GRAIN BIN FUMIGATION

Fumigation Service & Supply, Inc.

16950 Westfield Park Road
Westfield, Indiana 46074-9371 USA

products • service • education

www.FumigationZone.com

How to Keep Grain Free From Insects in Farm Bins

Start with the following storage conditions:

- Install a 5 foot gravel barrier around the storage bins.
- Keep all grass cut around bins.
- Spray the floor to wall junction at the outside, the area around the bins, and the tops of the bins with Cy-Kick CS™ or other environmentally stable insecticide.
- Immediately clean up all spillage.
- When storages are empty, you should clean and spray with a residual insecticide such as Tempo™ on the interior.

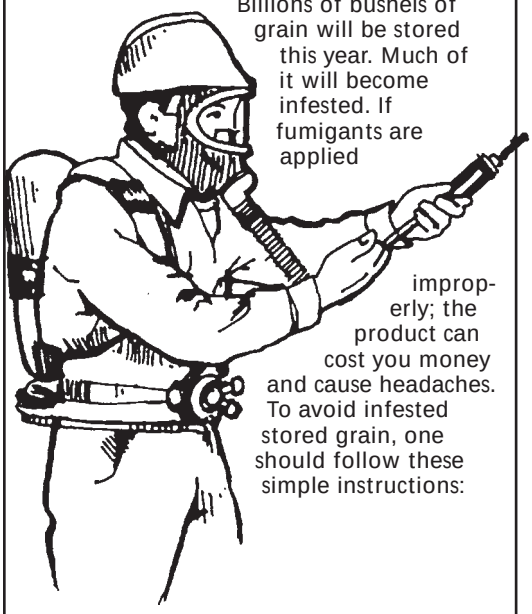
Only licensed applicators can apply grain fumigants.

Disclaimer: *OSHA safety rules apply to many aspects of fumigation. You are responsible for understanding these rules.*

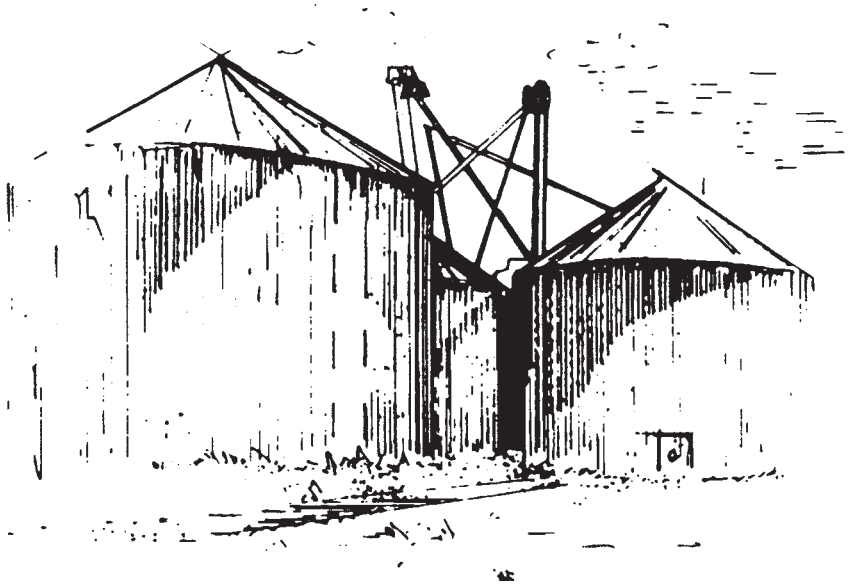
Empty Bin Preparation

Fumigant: Chloropicrin is an approved fumigant listed for empty grain bin fumigations. The bin floor should be covered with 4 mil polyethylene. Place metal pans with burlap cloth or rags under the poly tarp. Use 1 lb./ 1,000 cubic feet of Chloropicrin for 1-2 days. **(Note: Chloropicrin should not be used on processed food or on bulk commodities.)**

Fumigant: Phosphine—Phosphine is an excellent fumigant for empty bin treatment, but simply cleaning the bin thoroughly with a broom and air hose along with a residual insecticide such as Tempo should be sufficient.



Billions of bushels of grain will be stored this year. Much of it will become infested. If fumigants are applied improperly; the product can cost you money and cause headaches. To avoid infested stored grain, one should follow these simple instructions:



Fumigating Small Grain Bins With Phosphine Fumigant

Small bins: 3,000 to 25,000 bushels.

Assemble all of the necessary supplies:

a. Aluminum phosphide
b. Probe 1.25" diameter pvc ridged pipe
c. Cotton work gloves
d. Aluminum phosphide warning signs
e. Hand sprayer/approved insecticide
f. Polyethylene sheeting 4 mil.
g. Tape/adhesive
h. Approved gas mask for hydrogen phosphide or phosphine gas
i. Self contained breathing apparatus available (SCBA)
j. Phosphine Detection equipment

The applicator is responsible for reading and following labeled instruction. Familiarize yourself with the fumigant….

An instruction manual is available from your supplier for detailed information. Contact Fumigation Service & Supply Inc 800-992-1991 or FumigationZone.com if you have any further questions about how to fumigate grain bins. Remember to read the label on the container before using any pesticide.

Determine what your target pest is. Knowing the pest is half the battle in controlling it. Determine the volume to be treated. Remember that Phosphine gas is 1.18x heavier than air (for all practical purposes consider phosphine to be equal in density to air) it will fill the volume of the bin. The gas does not know the difference between the commodity and the headspace.

Safety Equipment

The following is a list of safety equipment needed to treat a grain bin with a fumigant.

1. Gas detection equipment
2. Fall protection
3. Dust mask
4. Respiratory Equipment: Minimum requirement are two full faced canister type gas mask with OSHA approved canister for phosphine gas. The canister gas mask must be worn when gas levels are between 0.3-15 ppm. On hot days, the gas levels in a grain storage will easily reach 5 to 10 ppm. The legal limit is 0.3 ppm. Attach the face mask to the 'd' ring on the gas mask strap and wear it through the entire fumigation. When the gas readings shows an excess of 0.3 ppm, put the gas mask on. It is best practice not to reuse the canister for any reason.

Dosage:

There is a labeled range of dosages that you can use to fumigate with Phosphine fumigant. As a certified fumigator, it is your responsibility to choose a dosage rate. The factors that play in this decision are:

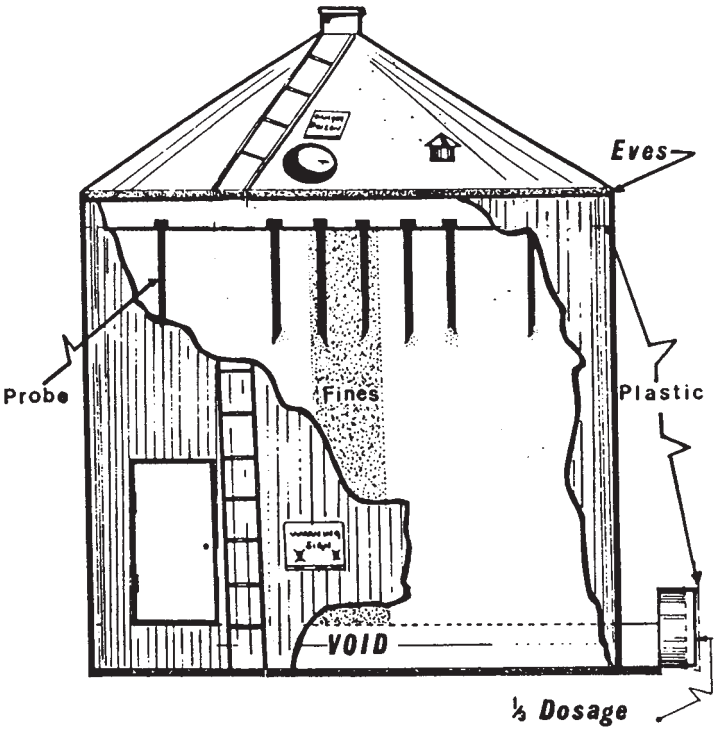
1. Temperature of the grain
2. Tightness of the bin / half loss time
3. Weather conditions, anticipated wind (wind is usually low in the late afternoon)
4. Targeted insects (weevils are harder to kill than flour beetles)
5. Review your historical monitoring data, and review the latest label—for applicable dosage rates. Sub lethal dosages have led to phosphine resistance in certain insect species.

Application:

Do not open the bin top and scatter fumigant on the surface. This will not give a

complete kill. By following these steps, you can successfully fumigate a grain bin with phosphine fumigant:

a. Always use at least 2 trained people to fumigate. Never fumigate alone!
b. Place warning signs on all doors and near ladders. When placing signs, take into consideration youth as well as adult.
c. Always tie off to a safety line.
d. Pre-cut a piece of polyethylene sheeting to fit over the surface of the grain. Allow for the peak of the grain and an extra 2 feet to tuck on the edges.
e. Plan your bin fumigation so that you are only in the bin for 15 minutes at the most. The headspace of the grain can reach 120 degrees Fahrenheit. Protect yourself against heat exhaustion.
f. One man should pull the poly to the farthest end of the bin and secure the poly by tucking it down between the grain and the metal side walls.
g. The other man should probe the phosphine tablets or pellets on 5' centers by starting at the farthest point from the escape hatch and working his way toward the ladder. Probe about 10-20 tablets or 50-100 pellets per probe. The probe should be pushed in as fast as possible.
h. If you suspect the gas concentration to be above 0.1ppm, take a gas reading. If a gas level of 0.3ppm is detected, proper respiratory equipment should be used.
i. After the last probe is made, pull the poly toward the bin opening and secure a piece of cord on the poly sheeting. Extend the cord out of the bin entry and then seal the hatch. This will allow you to remove the poly after the fumigation is complete without climbing into the bin.
j. To finish the fumigation, you need to place phosphine fumigant into the aeration fans and cover the ends of the fans with 4 mil polyethylene. The fans must be left off during the entire fumigation. **Note: Make sure the aeration duct is dry before you add phosphine. Not doing this will result in a fire.**
k. Lock bin securely after the gas has been added. Double check all possible entrances.
l. Spray the perimeter of the bin at ground level with an approved insecticide to help prevent re-infestation. Weeds and obsolete equipment should be removed.
m. Following the fumigation, it is important to remove the poly sheeting from the surface of the grain and the aeration fans. It can be reused. Warning signs must always be removed after the gas has been properly aerated. When entering the bin to remove the poly sheeting, remember to check gas levels and use the proper safety respiration devices. Before the signs are removed be sure to run aeration fans for at least 48 hours and monitor the gas levels inside the bin to ensure safety.
n. Remember after the gas is vented there is no residual insect control. For this reason it would be advised to apply an approved protectant to the surface of the commodity after the fumigation. Lock all possible accesses into the storage, post warning signs properly and notify the local authorities. Review the label for the length of the fumigation.



Grain Bin Fumigation with Phostoxin Fumigant

Fumigating a Large Corrugated Bin

A large corrugated bin is 25,000–460,000 bushels with 36–60 foot diameters. Anything larger than this will require a different fumigating technique.

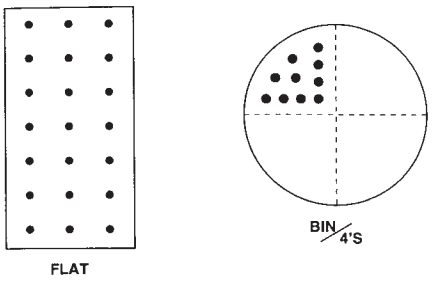
Assemble all the necessary supplies:

a. Aluminum phosphide
b. Probe 1.25" diameter pvc ridged pipe
c. Cotton work gloves
d. Aluminum phosphide warning signs
e. Hand sprayer / approved insecticide
f. Polyethylene sheeting 4 mil.
g. Tape/adhesive
h. Approved gas mask for hydrogen phosphide or phosphine gas
i. Self contained breathing apparatus available (SCBA)
j. Phosphine Detection equipment

The applicator is responsible for reading and following labeled instruction. Familiarize your self with the fumigant...

An instruction manual is available from your supplier for detailed information. Contact Fumigation Service & Supply Inc 800-992-1991 or FumigationZone.com if you have any further question about how to fumigate grain bins. Remember to read the label on the container before using any pesticide.

Determine what your target pest is. Knowing the pest is half the battle in controlling it. Determine the volume to be treated. Remember that phosphine gas is 1.18x heavier than air (for all practical purposes consider phosphine to be equal in density to air) it will fill the volume of the bin. The gas does not know the difference between the commodity and the headspace.



Determine # Probes (approx 4' apart)

$$\frac{\text{Total Tablets}}{\text{\# Probes}} = \text{Tablets per Probe}$$

Safety equipment:

1. Low range monitor phosphine monitor
2. Gas detection equipment
3. Dust masks
4. Fall Protection
5. Minimum respiratory equipment: full faced canister gas mask or SCBA.

Dosage rate:

Always consult the label of the product you are using. All corrugated bins need to be covered with polyethylene sheeting and your dosage rate should reflect the volume or bushel capacity under the polyethylene sheeting.

There is a labeled range of dosages that you can use to fumigate with phosphine fumigant. As a certified fumigator, it is your responsibility to choose a correct dosage rate. The factors that play in this decision are:

1. Temperature of the grain
2. Tightness of the bin/half loss
3. Weather conditions, anticipated wind
4. Targeted insects
5. Review your historic monitoring data and the latest label—for applicable dosage rates—sub lethal dosages have led to phosphine resistance in certain insect species

Application: Do not open the bin top and scatter fumigant on the surface. This will not give a complete kill. By following these steps, you can successfully fumigate a grain bin with phosphine fumigant.

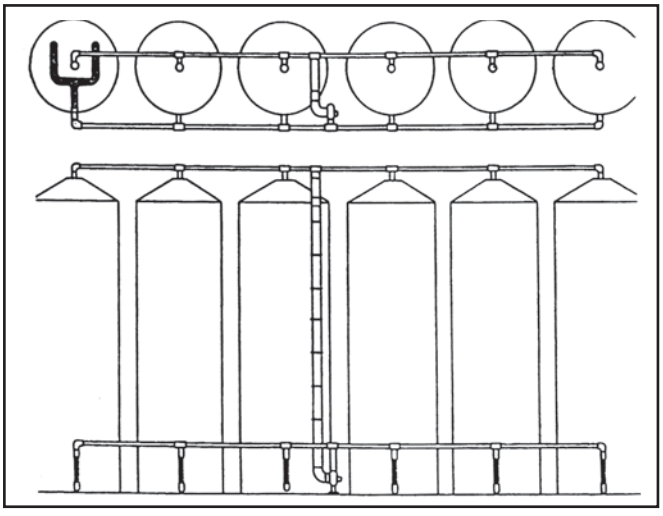
a. Always use at least 2 trained people to fumigate—3-4 would be more helpful. Never fumigate alone!
b. Place warning signs on all doors and near ladders. When placing signs take into consideration youth as well as adult.
c. Pre-cut a piece of polyethelyne sheeting to fit over the surface of the grain. Allow for the peak of the grain and an extra 2 feet to tuck on the edges.
d. Plan your bin fumigation so that you are only in the bin for 15 minutes at the most. The head space of the grain can reach 120 degrees Fahrenheit. Protect yourself against heat exhaustion.
e. One man should pull the poly to the farthest end of the bin and secure the poly to the furthest point of the bin. Depending on the diameter of the bin, the width of the poly, and the height of the cone, two pieces may be needed. You would place the plastic so that there is a seam in the middle. Also, you may need to cut into the plastic and tuck around temperature cables. Tuck the plastic between the grain and metal sidewalls of the bin.
f. Roll the plastic from the middle seam to the outside where the plastic is tucked into grain and sidewalls—for the pellet application.
g. Next, probe phosphine pellets or tablets on 5' centers. Probe about 10–20 tablets or 50–100 pellets per probe. The probe should be pushed in as far as possible.
h. Take gas readings with your phosphine detection equipment and use the proper respiratory equipment. If the gas concentrations are above 0.3 ppm and below 15 ppm use your full faced gas mask with phosphine canister. If the gas concentrations are above 15 ppm, use an SCBA.
i. After the last probe is made, one man should go to the opposite side of the bin and roll the two ends of the pieces of plastic together to meet in the middle and tuck them into the grain together.
j. To finish the fumigation, you need to place phosphine fumigant into the aeration fans and cover the ends of the fans with 4 mil. polyethylene. The fans must be left off during the entire fumigation. **Note: make sure the aeration duct is dry before you add phosphine. Not doing so will result in a fire.**
k. If the grain bin is taller than 40 ft. the J system will be more effective for applying gas into the bottom of the bin. **See J system.**
l. Lock all possible accesses into the storage, post warning signs properly and notify the local authorities. Review the label for the length of the fumigation.

Dosage:

Always consult the label of the product you are using. Partial bins need to be covered with polyethylene sheeting or treated like a full bin. (volume of a bin = 3.14 x radius x height of bin) (one bushel equals 1.25 cubic feet or 1 cubic foot = .8 bushels)

Fumigating Large Welded Steel Tanks with the J System

The J system is simply an accurate way to recirculate phosphine gas. The gas is evenly distributed using a simple system of tubing and a specially sized blower. The J system is used on all types of grain storages, specifically storages over 40' tall. On large bins with capacities of 250,000 to 1 million bushels, recirculation is the only way to achieve a "good kill." If you are interested in implementing the J system to any of your storages you must first establish pipe and blower sizing for the bin or bins to be treated. This can be done through Fumigation Service & Supply Inc.



The following system uses flexible tubing for a temporary recirculation system. Permanent systems can be designed using rigid piping.

Because you are moving the existing atmosphere and gas within the structure, thorough sealing is very important. Leaks will either pull fresh air in or push fumigant out depending on its location.

Assemble all of the necessary supplies:

a. Phosphine product
b. Probe 1.25' pvc pipe
c. Cotton work gloves
d. Warning signs
e. Polyethylene sheeting
f. Tape and adhesive
g. Approved gas mask for hydrogen phosphide and or SCBA
h. Gas detection equipment
i. 4, 6, or 8" corrugated non perforated drain tubing
j. J system blower sizing and availability through Fumigation Service & Supply

Safety Equipment:

1. Low range phosphine monitor
2. Gas detection equipment
3. Dust Masks
4. Minimum respiratory equipment: full faced canister gas mask or SCBA
5. Fall protection Equipment

Dosage:

Always consult the label of the product you are using. Partial bins need to be covered with polyethylene sheeting or treated like a full bin. (volume of a bin = 3.14 x radius x height of bin) (one bushel equals 1.25 cubic feet or 1 cubic foot = .8 bushels).

There is a labeled range of dosages that you can use to fumigate with phosphine fumigant. As a certified fumigator, it is your responsibility to choose a correct

dosage rate. The factors that play in this decision are:

1. Temperature of the grain
2. Tightness of the bin / half loss
3. Weather conditions, anticipated wind
4. Targeted insects
5. Review your historic monitoring data and the latest label for applicable dosage rates—sub lethal dosages have led to phosphine resistance in certain insect species

Application:

After acquiring the proper tubing and blower size, the recirculation system should be installed first.

1. The riser pipe is installed from the ground to the top of the bin. It must be secured at both ends.
2. Connect the riser pipe in the top of the bin, depending on the size of the bin you can run the riser pipe directly into the man hatch, temperature port or roof vent/ fan. If you are connecting the riser pipe to a covered corrugated bin, attach it to a 50 ft perforated piece of tubing laid on top of the grain in a horseshoe shape. Attach the riser pipe in the middle and tape both ends of the perforated pipe. Also, tuck the plastic around the solid risor and tape around so that only fumigated space is around the perforated pipe. For larger bins one should manifold into multiple roof entries.
3. The custom sized blower should be installed at the bottom of the riser pipe at the intake.
4. Attach the tubing to the outlet end of the blower and manifold to each aeration fan and ventilation duct accessible at the bottom of the bin. Seal each aeration duct/ fan thoroughly either before or after attaching the piping.
5. Seal all fans, drags, and conveyors on the top of the bin with 4 mil. plastic and tape.

After the J system is installed it is time to apply the fumigant. Evenly distribute the fumigant by probing directly into the grain surface. After the fumigant is probed within the commodity, the J system blower should be activated. Seal up the man hatch after you have exited the bin. Consult FSS for the length of time for the blowers to run. Lock all possible accesses into the storage, post warning signs properly and notify the local authorities. Review the label for the length of the fumigation.

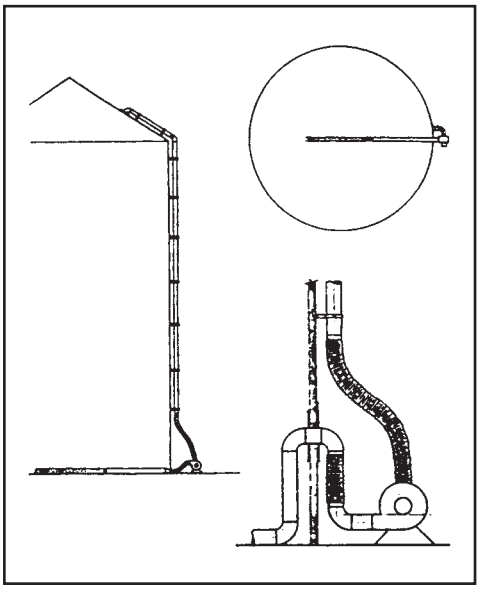
Ventilation:

When fumigation is complete, ventilate storage until gas detection equipment indicates the gas levels are below 0.3ppm throughout the commodity.

a. Place warning signs on all doors and near ladders. When placing signs take into consideration youth as well as adult.
b. Spray the exterior bin perimeter with an approved, environmentally stable insecticide to help prevent re-infestation. The weeds and obsolete equipment should also be removed.
c. Following the fumigation, it is important to remove the poly sheeting from the surface of the grain and aeration fans. Warning signs must always be removed after the gas has been aerated.
d. When entering the bin to remove the poly sheeting, remember to check gas levels and use the proper safety respiration devices. Before the signs are removed be sure to run aeration fans for at least 48 hours and monitor the gas levels inside the bin to ensure safety.
e. Remember after the gas is vented, there is no residual insect control. For this reason, it would be advised to apply an approved protectant to the surface of the commodity after the fumigation.

Flat Storage of Grain with Phosphine Gas Fumigant

This is a very physical, difficult, dangerous, labor intensive and hot job. If you read these directions carefully, you will understand why this is true and how to



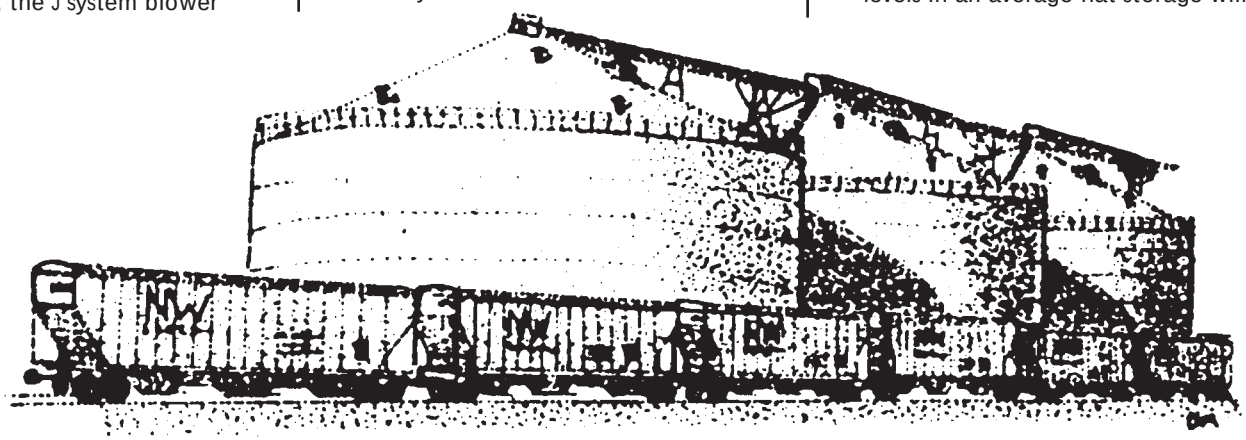
effectively treat large flat storages using phosphine gas fumigant.

Assemble all of the necessary supplies:

1. Phosphine product
2. 2 in. or 3 in. pvc probes—5 ft.
3. Duffel bag and 50' of rope
4. Approved respiratory equipment
5. Ladders or lifts
6. Fall protection
7. Gas detection equipment
8. Plenty of drinking water or other hydrating fluids
9. 4 mil polyethylene sheeting.
10. Strapping tape or big rubber bands
11. Masking tape
12. WARNING SIGNS

Safety equipment:

1. Low range detection equipment
2. Dust mask
3. "Respiratory equipment" minimum requirement are two full faced canister type gas masks with OSHA approved canister for phosphine gas. The canister gas mask must be worn when gas levels reach 0.3ppm and do not exceed 15ppm. On hot days, the gas levels in an average flat storage will



easily reach 5 to 10ppm. The legal limit is 0.3ppm. Attach the face mask to the "d" ring on the gas mask strap and carry it though the entire fumigation. When the gas reading with your gas detection device shows excess of 0.3ppm, put the gas mask on.

If the gas concentration is unknown or above 15ppm, a self contained breathing apparatus is required to be in a phosphine gas environment. In many cases, the 15 ppm level is reached. A SCBA will provide, fresh air to the applicator. The 2500 psi of air supply (varies with user) will deplete more quickly with increased activity.

Put your masks in a duffel bag and pull them into the grain storage with an attached rope. Don't put your mask on first and enter a bin hatch (unless there is already gas present).

Dosage:

There are a variety of dosages that may be used to fumigate large flat storages. Consult the product label or applicators manual for the specific product you are using to get the ranges available. Essentially, you are fumigating a building rather than a grain bin when you fumigate a flat storage. Phosphine gas does not know the difference between commodity and air space. Phosphine's weight is 1.18 x heavier compared to air at 1.0. One needs to compensate for empty headspace in a flat storage. Granted, the gas will go down if the air is completely still. However, air currents in grain bins can go up.

Application:

1. Seal all vents and end doors excluding entry and exit points using tape, adhesive, and 4 mil. polyethylene.
2. The appropriate number of applicators can probe phosphine tablets every 5 feet into the grain surface. A general guide is 2-3 people per 100,000 bu.
3. Place 20 to 30 tablets per probe.
4. 1 or 2 men should lag behind the probe and open flasks of tablets for the probe and gather up empty aluminum flasks and lids discard containers in the duffel bag that are carried along.
5. Check the gas concentration continuously with your gas detection device. If it reaches 0.3ppm alert the other applicators, and put gas masks on.
6. After exiting the flat at the opposite end, take a rest and perform a head count! Drink some liquids and check each man for symptoms of heat exhaustion and poisoning. Heat exhaustion and heat strokes can be serious. "I worry about heat illness more so than poisoning. We have the proper equipment to protect us from poisoning, but we only have common sense to protect us from the heat."
7. Aeration fans: apply 75 to 150 pellets or 15 to 30 tablets into each aeration fan. Be absolutely sure there is no water in the area that you will be placing fumigant. The fumigant you place in the aeration system should penetrate the bottom 15 to 20 feet of the flat. Cylinderized phosphine would also be helpful in these situations.
8. Lastly, lock all doors, complete sealing entry and exit points, and fill out and place phosphine warning signs on all four sides of the fumigated flat storage buildings along with all entry points.

   Allow the building to stay under gas for the full amount of time according to the label. Remember the duration of the fumigation varies according to the temperature. Ventilate the flat until all levels within the bin are below 0.3ppm. You must use your detection equipment to make this determination. Lock all possible accesses into the storage, post warning signs properly and notify the local authorities. Review the label for the length of the fumigation.

If these steps are followed, you can safely and effectively fumigate a flat storage building.

Fumigating Tall Concrete Silos

The J system is simply an accurate way to recirculate phosphine gas. The gas evenly distributedusing a simple system of tubing and a specially sized blower. The J system is used on all types of grain storages, specifically storages over 40' tall. On tall silos with heights of 40–120 feet, recirculation is the only way to achieve a "good kill."

If you are interested in implementing the J system to any of your storages you must first establish pipe and blower sizing for the bin or bins to be treated. This can be done through Fumigation Service & Supply Inc.

The following system uses flexible tubing for a temporary recirculation system. Permanent systems can be designed using rigid piping.

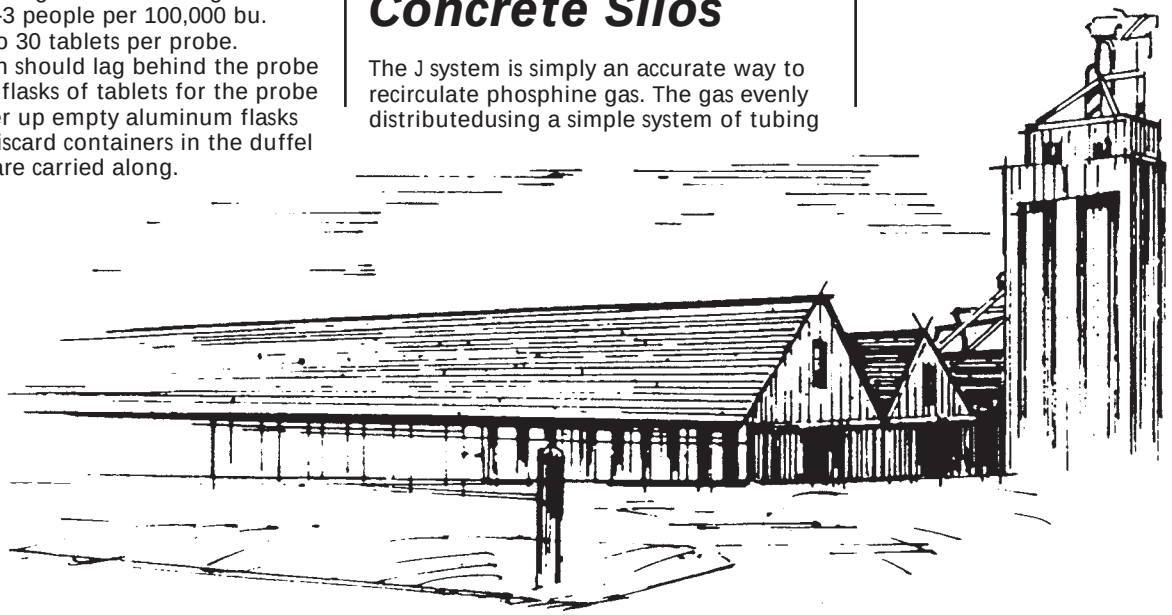
Because you are moving the existing atmosphere and gas within the structure, thorough sealing is very important. Leaks will either pull fresh air in or push fumigant out depending on its location.

Assemble all of the necessary supplies:

a. Phosphine product
b. Probe 1.25' pvc pipe
c. Cotton work gloves
d. Warning signs
e. Polyethylene sheeting
f. Tape and adhesive
g. Approved gas mask for hydrogen phosphide and or SCBA
h. Gas detection equipment
i. 4, 6, or 8" corrugated non perforated drain tubing
j. J system blower sizing and availability through Fumigation Service & Supply

Safety Equipment:

1. Low range phosphine monitor
2. Gas detection equipment
3. Dust masks
4. Minimum respiratory equipment: full faced canister gas mask or SCBA
5. Fall protection equipment



Dosage:

Always consult the label of the product you are using. Partial bins need to be covered with polyethylene sheeting or treated like a full bin. (volume of a bin = 3.14 x radius x height of bin) (one bushel equals 1.25 cubic feet or 1 cubic foot = .8 bushels).

There is a labeled range of dosages that you can use to fumigate with phosphine fumigant. As a certified fumigator, it is your responsibility to choose a correct dosage rate. The factors that play in this decision are:

1. Temperature of the grain
2. Tightness of the bin/half loss
3. Weather conditions, anticipated wind
4. Targeted insects
5. Review your historic monitoring data and the latest label for applicable dosage rates—sub lethal dosages have led to phosphine resistance in certain insect species.

Application:

After acquiring the proper tubing and blower size, the recirculation system should be installed first.

1. The riser pipe is installed from the ground to the top of the bin. It must be secured at both ends.
2. Connect the riser pipe in the top of the bin, depending on the size of the bin you can run the riser pipe directly into the man hatch, temperature port or roof vent / fan.
   If you are connecting the riser pipe to a covered corrugated bin, attach it to a 50 ft perforated piece of tubing laid on top of the grain in a horseshoe shape. Attach the riser pipe in the middle and tape both ends of the perforated pipe. Also, tuck the plastic around the solid risor and tape around so that only fumigated space is around the perforated pipe. For larger bins one should manifold into multiple roof entries.
3. The custom sized blower should be installed at the bottom of the riser pipe at the intake.
4. Attach the tubing to the outlet end of the blower and manifold to each aeration fan and ventilation duct accessible at the bottom of the bin. Seal each aeration duct/fan thoroughly either before or after attaching the piping.
5. Seal all fans, drags, and conveyors on the top of the bin with 4 mil. plastic and tape.
   After the J system is installed it is time to apply the fumigant. Evenly distribute the fumigant by probing directly into the grain surface. After the fumigant is probed within the commodity the J system blower should be activated. Seal up the man hatch after you have exited the bin. Consult FSS for the length of time for the blowers to run. Lock all possible accesses into the storage, post warning signs properly and notify the local authorities. Review the label for the length of the fumigation.

Ventilation:

When fumigation is complete, ventilate storage until gas detection equipment indicates the gas levels are below 0.3ppm throughout the commodity.

Coring

Assemble all of the necessary supplies:

1. Phosphine product
2. 4 mil polyethylene sheeting or large poly bags for vents
3. Strapping tape or large rubber bands
4. Sealing tape/adhesive
5. Warning signs

Safety Equipment:

1. Low range phosphine monitor
2. Gas detection equipment
3. Dust masks
4. Minimum respiratory equipment:full faced canister mask or SCBA

Dosage:

Always consult the label of the product you are using. There is a labeled range of dosages that you can use to fumigate with phosphine fumigant. As a certified fumigator, it is your responsibility to choose a dosage rate. The factors that play in this decision are:

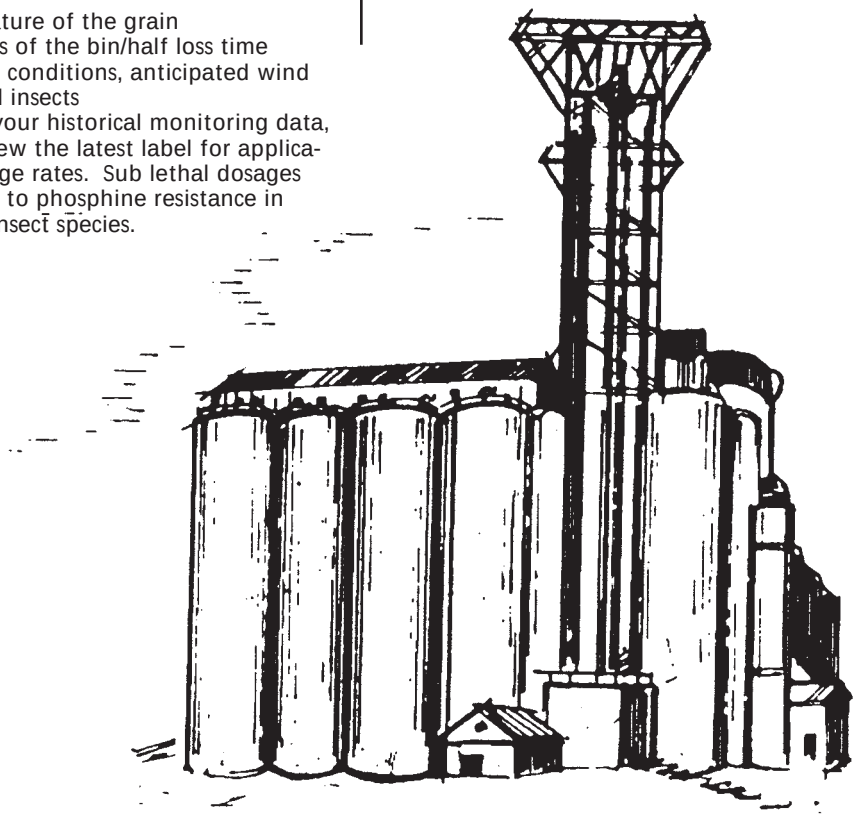
1. Temperature of the grain
2. Tightness of the bin/half loss time
3. Weather conditions, anticipated wind
4. Targeted insects
5. Review your historical monitoring data, and review the latest label for applicable dosage rates. Sub lethal dosages have led to phosphine resistance in certain insect species.

Application:

1. Start with an inverted cone on the grain surface
2. You will be pulling the core out of the bin and turning it around on top of this inverted cone.
3. While the core is being rotated, phosphine will periodically be placed preferably in the top drag or belt. Avoid placing the fumigant in the bottom portion of the transfer system

Warning: If phosphine is administered into the dump or bottom of the transfer system, the pellets/tablets can become lodged in voids and emit gas into the tunnel or other occupied areas.

4. You don't have to turn the entire bin to effectively fumigate with this solid form fumigant. However, you need to pull the center of the bin and rotate it around so that the pellets/tablets will be pulled down the middle of the bin to the bottom (within 20 feet of the bottom)
5. 3/4 of the entire dosage rate goes into the core
6. Find out the turning speed of the leg that will transfer this grain (bushels/hour)
7. There are several ways to determine when you have pulled the fumigant to the bottom or near the bottom. The following is a list of some options:
   a) Take gas readings at the bottom of the grain transfer system as you are applying the gas.
   b) Place a large amount of confetti or ping-pong balls in the bottom of the



inverted cone. Start the coring process, when these materials exit the bin they will immediately surface in the lower transfer system. Take careful note of the exact time that it takes to turn the bin.

8. How far will phosphine gas travel? A good rule of thumb is 25-30 feet in any direction vertically or horizontally. Remember that phosphine is about the same weight as air.
9. If you have used the confetti/ping pong ball method to determine the exact length of time. You divide the length of time to turn the bin by the number of flasks required to fumigate the bin. The sum of these two figures will provide the number of minutes between the dispensing of each flask.

Note: *if you do not know the coring time and time does not allow the above method then you must use your best judgment. In most cases if you have a center draw, a center drop and you start with and inverted cone, it usually take 30-60 minutes to core the average size silo. If you have further questions in determining rotation time, call FSS and review your situation with one of our service technicians.*

10. Finally, after all is turned off, you should hold back 1 or 2 flasks and administer this gas through the man hatch without entering the bin. Most of the gas loss comes from the headspace. This additional gas is to compensate for this loss.
11. Sealing the roof vent: If you can safely cover the roof vents with poly sheeting or plastic bags - do it. Occasionally it is too dangerous and other measures must be taken. One way to seal these tough to reach vents is to seal them prior to administering the gas from the inside of the bin. If the grain level is down then take a ladder inside the bin to help. Thorough sealing is important but not worth a life.
12. Consult the phosphine label to determine the required duration of the fumigation according to the ambient temperature of the storage.
13. Lock and secure the bin. Fill out proper warning signs and place them on all storage entry ways and ladders. Mark the bin fumigated on black boards and bin charts in controller rooms and scale houses. Let every employee know that the storage is under gas and the hazards involved with the fumigation.
14. Aerate bin until gas levels are below .3ppm using your gas detection equipment.
15. After the fumigation, grain insects can immediately take to the bin like bees to honey. It is best to apply top dress grain protectant to combat any reoccurrence.

Cylinderized Phosphine

Cyinderized phosphine can be used effectively for grain fumigations. There are two different cylinderized phohine formulations: ECO2FUME™ and VaporPhos. ECO2FUME is 98% CO2 and 2% Phosphine—this formulation is non-flammable. VaporPhos is another formulation of cylinderized phosphine. Vaporphos is pulled through a generator which mixes it with air. Contact Fumigation Service & Supply for the application methodology of these newer fumigants for your specific site.

Quality Assurance Measures for Grain

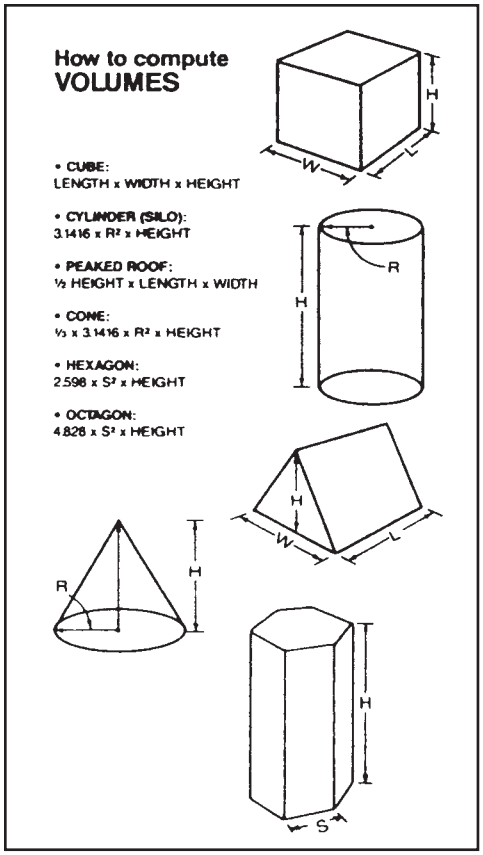
There are a couple of things you can do for quality assurance purposes during grain fumigations. The use of high range phosphine readings and test insect cages or (bio-assays) ensure effective fumigations.

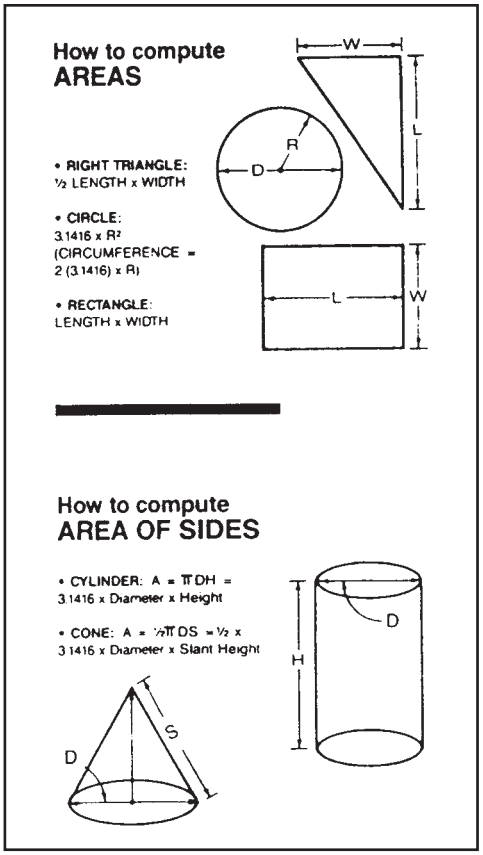
High range phospine readings give much useful information regarding a fumigation.

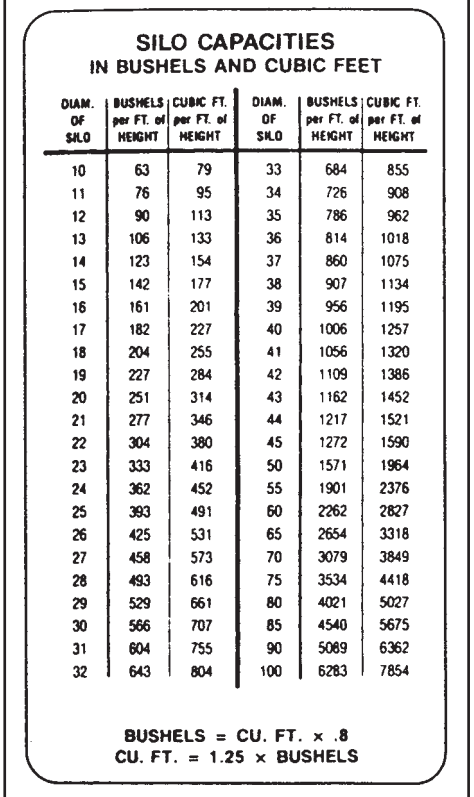
High range gas readings:

1. Ensure proper dosage rates
2. Ensure excess money is not spent on fumigant
3. Lower bystander safety issues
4. Prevent the need for re-treatment
5. Prevent the promotion of insect resistance

Insect bio-assays should be placed in the fumigated grain mass and tied to a string for easy retrieval. Pull them out of the grain mass after the ventilation is complete to ensure that quality fumigations are being performed.







SILO CAPACITIES
IN BUSHELS AND CUBIC FEET

DIAM. OF SILO	BUSHELS per FT. of HEIGHT	CUBIC FT. per FT. of HEIGHT	DIAM. OF SILO	BUSHELS per FT. of HEIGHT	CUBIC FT. per FT. of HEIGHT
10	63	79	33	684	855
11	76	95	34	726	908
12	90	113	35	786	962
13	106	133	36	814	1018
14	123	154	37	860	1075
15	142	177	38	907	1134
16	161	201	39	956	1195
17	182	227	40	1006	1257
18	204	255	41	1056	1320
19	227	284	42	1109	1386
20	251	314	43	1162	1452
21	277	346	44	1217	1521
22	304	380	45	1272	1590
23	333	416	50	1571	1964
24	362	452	55	1901	2376
25	393	491	60	2262	2827
26	425	531	65	2654	3318
27	458	573	70	3079	3849
28	493	616	75	3534	4418
29	529	661	80	4021	5027
30	566	707	85	4540	5675
31	604	755	90	5089	6362
32	643	804	100	6283	7854

BUSHELS = CU. FT. x .8
CU. FT. = 1.25 x BUSHELS