

Unit 6. Public, Personal and Environmental Safety

Learning Objectives

After studying this unit, the learner will be able to:

- Understand the risks fumigation poses to people and the environment.
- Practice safe fumigation procedures that reduce or eliminate personal risk and risk to the public.
- Select appropriate tools and equipment to make fumigation safer and more effective.
- Use safety checklists before, during and after a fumigation operation.
- Recognize the signs and symptoms of fumigant exposure.
- Administer basic first aid in the event of fumigant exposure.

The Arkansas Core Manual, **Applying Pesticides Correctly**, is a comprehensive guide to pesticide safety. The Core Manual discusses basic safety considerations for all applicators.

This unit covers safety practices specific to raw commodity, structures and soil fumigation. By reading it, you will learn how to reduce or eliminate fumigant exposure to yourself and to the public. It will teach you about personal protective equipment (PPE), warning gases and exposure limits. You will discover the importance of posting warning signs and writing an application plan. At the end of this unit are several safety checklists. This unit will explain why it is critical to use these checklists before, during and after every fumigation.

Terms to Know

Aerate – To replace fumigant-containing air or water with fresh air and/or water that contains little or no fumigant. Aeration must follow all fumigation operations.

Antidote – A remedy that may counteract the effects of a pesticide.

Exposure – When a person or organism comes in contact with a pesticide by inhalation, ingestion, skin contact or any other method.

Overexposure – When a person or organism comes in contact with enough pesticide to cause harm.

Material Safety Data Sheet (MSDS) – A printed report that details information on the fumigant manufacturer, identity of hazardous ingredients, physical and chemical characteristics, fire and explosion hazard data, reactivity data, precautions for safe handling and use and control measures.

Permissible Exposure Limit (PEL) – An OSHA standard that designates the maximum exposure permitted as an 8-hour time-weighted average (TWA).

Personal Protective Equipment (PPE) – Clothing or devices used to protect the human body from exposure to pesticides and pesticide residues.

Rinsate – A pesticide-containing water (or other liquid) that results from rinsing a pesticide container, pesticide equipment or other pesticide-containing materials.

Threshold Limit Value-Short Term Exposure Limit (TLV-STEL) – The concentration of fumigant to which most workers can be exposed continuously for a short period without suffering from:

- Irritation
- Chronic or irreversible tissue damage
- Narcosis (drunkenness) that may increase the chance of accident or injury

Exposures to concentrations at the STEL should not be longer than 15 minutes and should not occur more than four times per day. The STEL is expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³).

Threshold Limit Value-Time Weighted Average (TLV-TWA) – The average concentration of fumigant to which most workers may be repeatedly exposed 8 hours a day, 40 hours a week without adverse effect. The TLV-TWA is expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³).

Volatility – The ability of a substance to turn into a gas (vapor) at relatively low temperatures.

Warning Gas – A chemical that can be added to an odorless fumigant to help workers detect the product. Warning gases give off strong smells or have an irritating effect.

Fumigants are the most hazardous of all pesticides. They are highly volatile, penetrating and poisonous. Even experienced fumigators can cause injuries or damage because of these hazards:

- Fumigants can kill humans.
- Fumigants can kill rodents, bats, birds, pets and other animals that are on site during treatment.
- Fumigants can cause severe burns and damage internal organs.
- Fumigants can cause fires and explosions.
- Improper fumigant use can result in illegal residues in/on foods.
- Some fumigants can inhibit the germination of seeds.
- Some fumigants can corrode metals.
- Some fumigants react with certain materials to produce bad odors and flavors.
- Most fumigants can kill plants.

Three agencies regulate the use of fumigant pesticides – the Environmental Protection Agency (EPA), the Arkansas State Plant Board (ASPB) and the Occupational Safety and Health Administration (OSHA). Each agency administers regulations that concern pesticide handling.

You must follow all directives issued by the EPA, ASPB and OSHA, and the instructions in the fumigant label information. These agencies may fine you for misusing a fumigant or for failing to properly use and maintain your protective equipment.

This unit discusses safety issues, general precautions and emergency procedures related to fumigation. It will describe how to protect the public, your coworkers and yourself from exposure. It will also provide safety checklists for all stages of fumigation. However, no publication can cover all situations for all products. Follow the instructions in the label information specific to each product that you use. Remember that there is no substitute for good common sense.

Unit 7 will cover safety equipment and its proper use.

Protecting the Public and the Environment

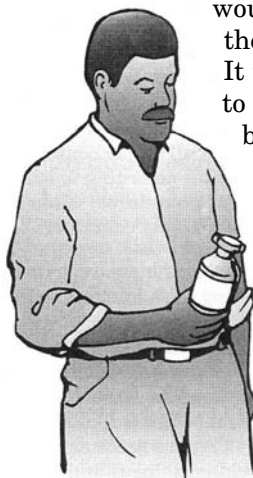
Fumigants are some of the most toxic pesticides available. Their safe use and handling requires skill and care. This manual discusses fumigants that control pests in structures, stored products, raw commodities and soil. Some commodities are edible-corn, wheat, rye, etc. Others are stored where people work and animals live, grain bins, silos, etc. Agricultural fields supply us with fruits, vegetables and animal feed. These fields may be located near homes, livestock facilities or water sources. In nearly all cases, fumigants control pests on items or in areas with which people and animals have direct contact. Your ability to apply fumigants safely is critical. You must protect the public and the environment from exposure.

There are several important ways to protect others from fumigant exposure. These include:

- Reading and following the label directions
- Posting warning signs
- Monitoring for the fumigant
- safely transporting, storing and disposing of fumigants and their containers
- Following tolerance levels, properly aerating the treatment area
- Preparing and planning well before application

Read the Label Information

The most important thing you can do to ensure personal and public safety is to read the label. Fumigant labels include both an abbreviated sticker label and an extended label, often in booklet form. Treat these two documents as you would any pesticide label. Follow their instructions to the letter. It is the law. This manual refers to the sticker label and the label booklet together as “label information.”

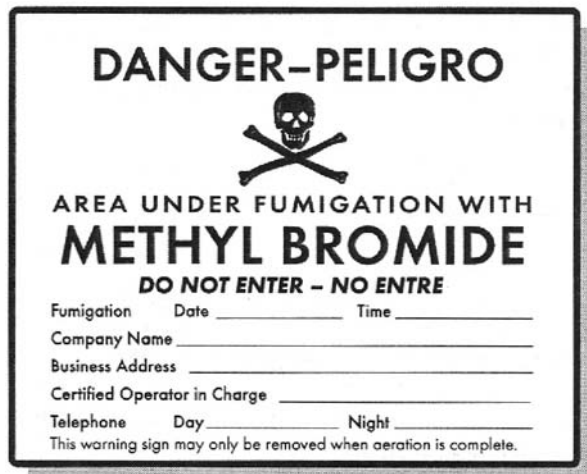


The label information will tell you how and where to use the product. It will give you detailed application and aeration instructions. You will discover how to store the chemical properly. The label information may

note specific sites that you should avoid or application methods that are not permitted. It will also describe specific safety precautions. Read all of the label information completely before using any fumigant for any purpose.

Signage for Fumigated Areas

Warning signs or “placards” protect the public during and after fumigation. They are also posted during transportation and storage of a fumigant. A warning sign provides a barrier between people and the fumigated site or item. Federal and state laws require you to post warning signs at all accesses leading to areas or commodities under fumigation. Only authorized fumigators wearing the proper personal protective equipment (PPE) may enter treated areas before and during aeration.



Follow label directions regarding posting warning signs before and during fumigation. Most fumigant labels have specific directions regarding signage:

- What the sign should say
- How many signs to use
- Where to post the signs
- How long to leave the signs in place

Posting warning signs will help to keep unauthorized persons away. Do not remove the signs until the treated equipment and surrounding area have been completely aerated.

Monitoring for the Fumigant

There is always a risk that fumigant gas will escape from a treatment area. Monitoring for these leaks is critical. When treating

commodities that are next to work areas, be sure to take air samples during treatment. Use appropriate gas detectors to verify that fumigants are not leaking. This is particularly important during indoor treatments. See Unit 7 for more information about gas detectors.

Transporting Fumigants

Transporting a fumigant is dangerous. Leaks and spills caused by accidents are sometimes beyond your control. However, by taking the following precautions and using common sense, you can prevent many accidents.

- Do not use public transportation (subways, buses, trains or taxis) to transport fumigants.
- Do not transport fumigants through tunnels unless you get permission from the Arkansas Department of Transportation (ADOT).
- Do not transport fumigants and people together in a closed vehicle.
- Be sure you have the required driver’s license with any appropriate endorsements for the specific fumigant you plan to transport.
- Read the label information and/or the Material Safety Data Sheet (MSDS) to determine the signage requirements for transporting each fumigant that you use. You can also contact the fumigant manufacturer for more information on placarding for transportation.
- Be sure cylinders are upright and secured during transport.
- Mount cylinders so they are protected from rear end collision.
- Do not remove protective valve covers until just before use.

NOTE: It is illegal to transport goods over public roads or highways if those goods are undergoing fumigation or have not been completely aerated.

Always follow federal and state department of transportation regulations when transporting fumigants and/or their containers. Contact your local Arkansas Department of Transportation office for further information.

Storage and Disposal of Fumigants

Storage of fumigants is hazardous. Whenever possible, buy them just before you need them to shorten the storage period. Store all fumigants on sturdy shelves in an area apart from feed or seed. A separate building that is well ventilated or has a mechanical exhaust system is best. Be sure that all fumigant storage areas are locked and posted as pesticide storages. Warning signs should indicate the presence of fumigants.

Fumigants can escape from faulty valves or damaged or corroded cans. Leaks can cause dangerous concentrations to build up in closed storerooms. Check valves and containers regularly for leaks. Before entering any storage area, run an exhaust fan to remove vapors that may have built up inside.

Do not risk contamination of water supplies. Dispose of all empty containers, residues and rinsates according to state waste management procedures. Keep all pesticides and their empty containers out of the reach of children.

Tolerance Levels

Fumigants should not change or impair treated material in any way. Nor should they leave any residues on raw agricultural products that could be hazardous during processing. The EPA has determined the amount of pesticide residue that may safely remain in or on agricultural products. This is called the “tolerance level.” Be sure fumigant residues never exceed these levels by following label directions to the letter. Consult the label information or the registrant for tolerance levels specific to the product(s) you use and commodity(ies) you treat. Tolerance levels come from the Code of Federal Regulations.

Proper Aeration

Proper aeration is important for your safety, the safety of your crew and the safety of your clients. Poor aeration is one of the most common problems associated with fumigation. Read and follow the instructions in the label information exactly. When treating raw agricultural products, be sure the rate of air exchange during the aeration phase will adequately remove the

fumigant. If necessary, use fans or other ventilation equipment. Also, check air temperatures. The treatment area should be warm enough to allow the fumigant to completely desorb from the treated agricultural product. Heat the area or increase the aeration time if necessary. Finally, check the sorptive capacity of the commodity you are treating. Highly sorptive materials require longer aeration periods. Adjust your aeration time as needed. See Unit 5 and Unit 8 for more information on aeration procedures.

Preparation and Planning

Preventing public and environmental exposure also relies on how well you prepare. How well have you sealed an area? Have you inspected all equipment thoroughly? Are you applying the fumigant at or below the label rate? Have you set aside enough time to completely aerate the site or item? Have you set up fences and posted warning signs to keep people, livestock and pets out of the treatment area? Details about proper application methods are described in Unit 5 and Unit 8. Use this information to develop a solid application plan. Review your plan several times. Then use the checklists at the end of this unit to be sure nothing has been overlooked. Appendix A contains safety checklists that you can copy and use.

Remember, you, the applicator, are the most important variable in fumigation. Your education and training will directly affect the safety and success of your operation.

Personal Safety

Safety is always a concern for you as a fumigant applicator. You must consider your own safety, as well as that of your coworkers, your clients and the people who will use the areas you treat.

Human safety is addressed throughout the Arkansas Core Manual, Applying Pesticides Correctly. Unit 7 (Harmful Effects and Emergency Response) and Unit 8 (Personal Protective Equipment) are devoted to human health and safety issues. Unit 7 describes the signs and symptoms of pesticide injury or illness. It also tells you how to respond to a poisoning emergency. Unit 8 discusses how to select, use and care for protective clothing and equipment. Review these sections of the Core Manual for basic pesticide safety information.

Besides taking the precautions outlined in the Arkansas Core Manual, you must also consider the specific risks associated with fumigants.

Always Work in Pairs

One of the most important things you can do to protect yourself during fumigation is to **always work with another person** when applying fumigants. This person can assist you immediately if you become injured or incapacitated while working around these products. In fact, many fumigant labels require fumigators to work in pairs during application or gas monitoring.

Routes of Exposure

As a fumigant applicator, you may be exposed to fumigants in several ways. Fumigants can enter your body through your lungs (inhalation), your eyes (ocular exposure), your mouth (ingestion) and even your skin (dermal exposure). The most dangerous and common type of fumigant exposure is inhalation. Most fumigants are highly toxic. Breathing even small amounts of some fumigants can cause serious illness or death. To protect yourself, read the label information. Find out what personal protective equipment (PPE) the manufacturer requires. Then, learn what to do in case of exposure. See “First Aid for Fumigant Poisoning” later in this unit for details about how to handle different types of fumigant exposure.

PPE

Personal protective equipment (PPE) is the name given to clothing and devices that minimize your exposure to pesticides. The label information for each product lists the minimum PPE required for using that pesticide. Federal and state laws require pesticide users to follow all instructions on the product label, including wearing the appropriate PPE.

Respiratory protection is the most important piece of PPE for fumigators. When you are surrounded by toxic gas, respirators provide you with clean air to breathe or filter the contaminated air. There are several types of respirators. Each one has its pros and cons. Respirators must be “fit-tested” to each user to ensure that they are sized correctly and will work properly. Users must also pass the appropriate physical tests to ensure that they can wear and use a



Respiratory equipment

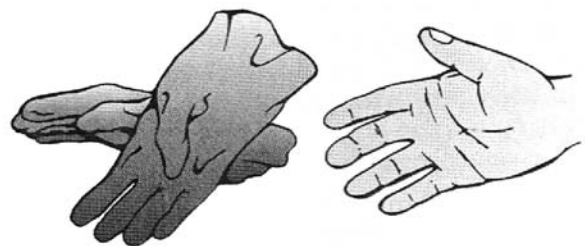
respirator safely. Read the label information to determine which type of respirator you will need. If you have questions about respirators, contact your county Extension agent. See Unit 7 to learn more about the selection, use and maintenance of respirators.

Fumigation also requires other types of PPE. These include protective clothing and gloves. Requirements vary with the fumigant. Read the label information carefully.

To protect your skin, some fumigants recommend that you wear loose-fitting clothes, long-sleeved shirts, long pants and socks. Other products say nothing about clothing.

The need for gloves also varies. For example, some solid fumigants require fumigators to wear gloves because of possible skin irritation. Read the label information to be sure you use the right kind of glove. Other fumigants, particularly liquid products, do not require gloves. Some may even prohibit you from wearing gloves.

Read the label information to learn which items are required for the product(s) you plan to use.



Some fumigants require you to wear gloves during fumigation. Others do not.

Other Tools for Personal Safety

Because inhalation exposure poses the greatest risk during fumigation, several tools are available to reduce or prevent this type of exposure. These include:

- Warning gases
- Exposure limits
- Gas detectors

NOTE: The safe and effective use of gas detectors is covered in Unit 7.

Warning Gases

It is often helpful to add warning chemicals to odorless fumigants. These products give off an odor that can help you detect the presence of harmful gas. However, you should never rely on warning gases alone. Keep the following facts in mind:

- Individuals vary in their ability to detect and quantify odors.
- Odors only indicate whether the fumigant is present. They do NOT tell you the concentration of the fumigant.
- You may suffer olfactory fatigue. Over time, you may lose the ability to smell a particular warning agent.

Warning gases serve a useful purpose, but they are not foolproof. Use them as one of many safety tools.

Exposure Limits

You can also reduce your risk of inhalation overexposure by monitoring fumigant concentrations during treatment and aeration. Be sure your exposure stays below established exposure limits such as the TWA, STEL and PEL.

An exposure limit is the highest level of fumigant that you may be exposed to without being required to use any controls to reduce your exposure. The American Conference of Governmental Industrial Hygienists (ACGIH), OSHA and the National Institute of Safety and Health (NIOSH) are all agencies that establish these limits. Each agency uses different terms to refer to long- and short-term exposure limits. Refer to the fumigant label information to find out what the different exposure limits are for each product you use.

The three most common terms used to express the exposure limit of a fumigant are the:

- Threshold limit value-time weighted average (TLV-TWA)
- Threshold limit value-short term exposure limit (TLV-STEL)
- The permissible exposure limit (PEL)

TLV-TWA or “TWA” is an ACGIH term that refers to the average concentration of a fumigant to which most workers may be repeatedly exposed 8 hours a day, 40 hours a week without adverse effects. Concentrations at or below the TWA represent conditions that you may be exposed to on a daily basis. These levels are considered safe. Concentrations above the TWA may lead to “overexposure” to a fumigant. This can cause discomfort, sickness or even death. These levels are considered unsafe. The TWA is usually expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³).

By monitoring fumigant levels throughout treatment and keeping your exposure level below the TWA, you can prevent injury and illness caused by overexposure. However, people’s susceptibility and response to fumigants varies widely. For example, a small number of workers may experience discomfort or minor irritation from fumigant concentrations at or below the TWA. Others may suffer more serious health effects – even death – due to a preexisting condition. Even when the TWA is low, observe yourself and your coworkers for any signs or symptoms of exposure.

For short-term exposure, look for the TLV-STEL on the product label. Like the TLV-TWA, this ACGIH term is often shortened to “STEL.” Specifically, STEL is the concentration of fumigant to which most workers can be exposed continuously for a short period without suffering from:

- Irritation
- Chronic or irreversible tissue damage
- Narcosis (drunkenness) that may increase the chance of accident or injury

Exposure to concentrations at the STEL should not be longer than 15 minutes and should not occur more than four times per day. The STEL is expressed in ppm or mg/m³.

PEL is an OSHA standard that designates the maximum exposure permitted as an 8-hour TWA. OSHA sets PELs to protect workers against the health effects of exposure to fumigants.

Usually, OSHA PELs are not as conservative as are ACGIH TLVs. With this in mind, it is

always wise to comply with the most stringent exposure limit. This will ensure the highest degree of safety and health. In the absence of any exposure limits, you should always strive to minimize your exposure.

Safety Checklists

Keep safety foremost in your mind when planning any fumigation operation. Focus on protecting lives and preventing fires. Plan ahead, especially when working in a remote location. Know how to get help if something goes wrong.

The following checklists will help you organize the many aspects of fumigation.

This information is general. It does not apply to all fumigants in all situations. Always read the label information first. Become familiar with the dangers of the product(s) you intend to use. Some manufacturers provide checklists specific to their products. Use these lists as well.

Safety Checklists – Raw Agricultural Product Fumigation

Preliminary Planning

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Draw or locate a sketch of the structure you plan to fumigate. Indicate the layout of the structure, connecting structures and escape routes above and below ground.
- ✓ Seal all spouts, conveyors, conduits, heating ducts, pipes, cracks, crevices, broken windows and other possible openings leading from the areas that you plan to treat.
- ✓ Record the number and names of everyone who routinely enters the area. Note the proximity of other nearby people and animals. Keep children, unauthorized persons and pets away from the application site.
- ✓ If you plan to treat a commodity, learn about it. Find out its mode of storage and its condition. If possible, get a previous treatment history.
- ✓ If you plan to treat a commodity within a structure, learn about the structure. What does it consist of: wood, brick, concrete? Note the locations of doors, windows and dividing walls. Check airflow patterns.
- ✓ Study the pest(s) you plan to control. When is it most vulnerable to fumigants? Where are its numbers the highest?
- ✓ Check and adjust all safety and application equipment. Be sure the components can withstand the corrosiveness of the fumigant(s). When applying compressed gas, use pressure-approved components. Seal them tightly.
- ✓ Locate connections and shut-offs for electricity, water and gas. Test these shut-offs to be sure they are working. Find the nearest telephone or communication device.
- ✓ Obtain and have handy telephone numbers for local health, fire, police and medical emergency services. Know how to contact the parties responsible for the structure and/or commodity you plan to fumigate.
- ✓ ONLY select a fumigant registered by the EPA and ASPB.
- ✓ Read and reread the label information. Study the directions and precautions. Make sure the fumigant is labeled for the required work (site, commodity, etc.).
- ✓ Notify the local health and fire departments, police and security personnel and hospital. Give them the following information: the location, the chemical name(s), the date and time of application, the type of gas mask and other safety equipment required, the fire hazard rating and literature about the safety measures you plan to use.
- ✓ Inform the occupants of the structure where treatment will occur. Also, notify the occupants of neighboring structures.
- ✓ Arrange for standby equipment and replacement parts for application equipment and PPE. Outline an alternate plan of action.
- ✓ Review your treatment plan with all workers. Explain the potential hazards to life and property. Identify the safety measures and emergency procedures that are required by the label.
- ✓ Prepare warning signs to post near treated areas. Arrange for someone to monitor all entrances and exits during treatment.
- ✓ Have first aid equipment (including antidotes and plenty of fresh water) handy.

- ✓ If possible, plan for application from outside the structure.
- ✓ When necessary, obtain fans to evenly distribute the fumigant.
- ✓ Preplan how you will aerate the area after treatment.
- ✓ Identify areas where you can store any excess fumigant(s). Be sure conditions in the storage area match those required by the label information.
- ✓ Make sure no open fires, motors or hot surfaces (heat pipes or electric fixtures) are within the space that you plan to treat.
- ✓ Know how to operate the gas detection devices.
- ✓ Have on hand all the PPE you would need to enter a treated area in an emergency. Check to be sure that this equipment is working properly.

Pre-Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Open all doors and drawers inside the area you plan to treat.
- ✓ Turn off pilot lights and gas lights. Disconnect electrical equipment.
- ✓ Make a final check. Be sure all occupants, pets and livestock have been removed from the structure.
- ✓ Place warning signs at all entrances and exits.
- ✓ Assign someone to observe all entrances and exits.

During Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Apply all fumigants according to the directions in the label information.
- ✓ Apply the fumigant from outside where appropriate.
- ✓ Consider the weather. You may need to delay or cancel outdoor treatments on windy or stormy days.
- ✓ Do not enter the area where fumigant gas is being discharged, except in extreme emergencies.

Post-Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Aerate according to structural limitations.
- ✓ Turn on ventilation fans where appropriate.
- ✓ Before reentering a treated area, use a suitable gas detector to determine the fumigant concentration. Some fumigants do not provide an adequate odor warning. Others aerate slowly.
- ✓ Remove warning signs only when aeration is complete.
- ✓ Dispose of or return empty containers per the manufacturer's instructions.
- ✓ When using metal phosphide fumigants, return any unused, solid chemicals to clearly labeled containers. Store them properly.

Personnel Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

To protect yourself and others, be sure you and your supervisor(s) always:

- ✓ Know the location of all entrances and exits.
- ✓ Know the location of all fumigant containers and aerating fans.
- ✓ Rehearse the fumigation plan so that each worker knows what to do.
- ✓ Remove all rings, jewelry and watches as required by the label.
- ✓ Have current health records for all employees. All workers that take part in fumigations must have a physical exam at least once a year. During fumigation, no worker should have a cold or other condition that may impair breathing. Nor should any worker be undergoing medical or dental treatment, unless a physician certifies that they may work with fumigants.
- ✓ Survey workers to make sure they have abstained from alcoholic beverages 24 hours before and will abstain 24 hours after a fumigation job.
- ✓ Instruct all workers about first aid, emergency procedures, antidotes and decontamination.
- ✓ Work in pairs, especially when entry into a fumigated area is necessary. Stay in sight of one another while inside a treatment area.

- ✓ Report any accidents to your employer or supervisor.
- ✓ Report any signs of illness or discomfort, regardless of how minor they may seem. This includes dizziness, diarrhea, nausea, headaches and lack of coordination.
- ✓ Teach all workers how to select, operate and maintain protection devices. Warn them about the hazards that they may encounter if the chemicals are misused.
- ✓ Have and use the necessary PPE. Inspect all PPE for defects. Know where emergency equipment is located.
- ✓ Make sure there is enough water on site to wash or flush skin and eyes if an accident should occur.

Safety Checklists – Soil Fumigation

Preliminary Planning

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Note the proximity of nearby people and animals. Keep children, unauthorized persons and pets away from the application site.
- ✓ Know the soil you plan to treat. What is its temperature, moisture level and texture? How much organic matter does it contain? Is it well aerated or compacted?
- ✓ Know the pest(s) you plan to control. When is it most vulnerable to fumigants? Which application methods are most effective and efficient?
- ✓ Check and adjust all safety and application equipment. Be sure the components can withstand the corrosiveness of the fumigant(s). When applying compressed gas, use pressure-approved components. Seal them tightly.
- ✓ Be sure that there is a properly-functioning check valve in the line between the cylinder of propellant and the fumigant cylinder.
- ✓ Find the nearest telephone or communication device.
- ✓ Obtain and have handy telephone numbers for local health, fire, police and medical emergency services.
- ✓ ONLY select a fumigant registered by the EPA and ASPB.

- ✓ Read and reread the label information. Study the directions and precautions. Make sure the fumigant is labeled for the desired use.
- ✓ Arrange for standby equipment and replacement parts. Outline an alternate plan of action.
- ✓ Review the fumigation plan with all workers. Explain the potential hazards to life and property, required safety measures and emergency procedures.
- ✓ Prepare warning signs to post near treated areas.
- ✓ Have first aid equipment (including antidotes and plenty of fresh water) handy.
- ✓ Identify areas where you can store any excess fumigant(s). Be sure conditions in the storage area match those required by the label information.
- ✓ Have on hand all the PPE you would need to enter a treated area in an emergency. Check to be sure that this equipment is working properly.

Pre-Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Place warning signs at all appropriate access points.

During Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Apply all fumigants according to the directions in the label information.
- ✓ Consider the weather. You may need to delay or cancel treatments on windy or stormy days.
- ✓ Do not enter the area where fumigant gas is being discharged, except in extreme emergencies.

Post-Application Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

- ✓ Observe all reentry period, PPE and waiting period specifications on the label for the fumigant that you use.
- ✓ Avoid reentering treated areas when you can still detect the fumigant odor. Although gas

detectors are rarely used with soil fumigation, they may be appropriate in some situations where fumigant concentrations may be high. You will need to use a gas detector when reentering an enclosed structure where soil or potting mixes have been fumigated. Remember that some fumigants do not provide an adequate odor warning. Others aerate slowly.

- ✓ Do not begin planting until after the “waiting period” is over. The waiting period is the number of days between when you apply a fumigant and when aeration is complete.
- ✓ Remove warning signs once the reentry interval has expired.
- ✓ Dispose of or return empty containers per the manufacturer’s instructions.

Personnel Safety

(Appendix A contains a version of this checklist that you can photocopy and use.)

To protect yourself and others, always:

- ✓ Rehearse the fumigation plan so that each worker knows what to do.
- ✓ Remove all rings, jewelry and watches as required by the label.
- ✓ Have current health records for all employees. During fumigation, no worker should have a cold or other condition that may impair breathing. Nor should any worker be undergoing medical or dental treatment, unless a physician certifies that they may work with fumigants.
- ✓ Survey workers to make sure they have abstained from alcoholic beverages 24 hours before and will abstain 24 hours after a fumigation job.
- ✓ Instruct all workers about first aid, emergency procedures, antidotes and decontamination.
- ✓ Work in pairs, especially when entry into a fumigated area is necessary. Stay in sight of one another while inside a treatment area.
- ✓ Report any accidents to your employer or supervisor.
- ✓ Report any signs of illness or physical discomfort, regardless of how minor they may seem. This includes dizziness, diarrhea, nausea, headaches and lack of coordination.

- ✓ Teach all workers how to select, operate and maintain protection devices. Warn them about the hazards that they may encounter if the chemicals are misused.
- ✓ Have and use the necessary PPE. Inspect all PPE for defects. Know where emergency equipment is located.
- ✓ Make sure there is enough water on site to wash or flush skin and eyes if an accident should occur.

First Aid for Fumigant Poisoning

Even when you take all of the proper precautions, human exposure can still occur. Be prepared. Know what to do for all types of fumigant poisonings.

First, read the label information. The label information is often your best source of first aid information. Federal regulations require that first aid information appear in the label information if a particular hazard exists. Because most fumigants are highly toxic, first aid information is usually listed. Additional first aid information appears on the product’s MSDS.

First aid information in the label information is usually specific to the product. Therefore, you must also be familiar with basic first aid procedures for fumigant exposure.

Basic First Aid

First aid is just that: it is your first response to fumigant exposure. First aid is not a substitute for medical help. To protect yourself and your coworkers, know when medical attention is needed and seek it right away.

How you respond to a fumigant poisoning depends, to some extent, on whether you or someone else is the victim. In either case, however, you must follow the same basic principles.

If you have been exposed to a fumigant or if you begin to feel ill, remain calm. Get to a doctor right away. Even when the fumigant is less toxic than others are, you may need medical attention, particularly if you were exposed to a large amount of the chemical.

Do not go alone. Have someone take you to the doctor. Be sure to give the label information to the doctor. Keep an extra copy of the label

and MSDS on file for each fumigant that you use. You can take this information to the hospital in case of an emergency without risking container transport.

If you are with someone who has been exposed to a fumigant, begin first aid right away. When possible, get help. First, decontaminate the victim. Take him or her to fresh air. Remove any contaminated clothing. Be careful not to contaminate yourself in the process. If the victim needs medical attention, either call a doctor or take the victim directly to a doctor.

Before, during and after the fumigation process, watch for unusual behavior of yourself and others. It could be a sign of exposure. If you feel sick, do not stay to finish the job. Get to fresh air immediately and get help. If you are with someone who has been exposed to a fumigant, and if his or her breathing stops or is labored, give artificial respiration. Never give anything besides air by mouth to an unconscious person.

Specific first aid treatment varies according to the type of exposure. Learn all of the appropriate procedures. You will not have time or the opportunity to look them up during an emergency.

The two main types of fumigant exposure are inhalation and skin contact.

Inhalation Exposure

The greatest risk during fumigation is inhalation exposure. Inhalation exposure occurs when someone breathes fumigant gas. Mild exposure by inhalation can cause malaise (a feeling of sickness), ringing in the ears, fatigue, nausea and tightness in the chest. Exposure to fresh air will usually relieve these symptoms. Moderate inhalation poisoning can cause weakness, vomiting, chest pain, diarrhea, difficulty breathing and pain just above the stomach. Symptoms of severe poisoning may occur within a few hours to several days after exposure. Severe poisoning may result in pulmonary edema (fluid in the lungs). This can lead to dizziness, cyanosis (blue or purple skin color), unconsciousness and even death.

Do not attempt to rescue someone in an enclosed area if you are not wearing the proper respiratory protection. If you are with someone who is suffering from inhalation exposure, carry

him or her to fresh air immediately. Do not let the victim walk. Then do the following:

- Call for help – 911.
- Loosen all tight clothing.
- If breathing has stopped or is irregular, give artificial respiration.
- Keep the victim as quiet as possible.
- Prevent chilling by wrapping the victim in blankets. Take care not to overheat the victim.
- If the victim is convulsing, protect his or her head from striking the floor or wall.
- Watch for breathing irregularities that may require CPR. Keep the victim's chin up so that the air passage remains free. Do not put anything in the mouth of an unconscious person.
- Do not give alcohol in any form to the victim.
- Get medical attention right away. Take the victim to a doctor or emergency facility. Take the fumigant's label information with you.

Skin Exposure

Skin exposure occurs when a pesticide contacts the skin. Liquid and solid pesticides are most often the cause of this type of contamination. However, some fumigant gases can also injure the skin. Skin exposure usually occurs when clothing or jewelry holds the gas tight against the skin. This can cause skin to burn or blister. Fumigants may also be absorbed through the skin and pass into the bloodstream, causing systemic effects.



Blisters caused by fumigant exposure

To prevent skin exposure, most fumigant labels suggest that you remove all jewelry and wear loose-fitting clothes. Some labels prohibit the use of gloves. Always consult the label to determine what precautions you should take.

If skin exposure does occur, take the following steps:

- Get to fresh air.
- Remove contaminated items (clothing, jewelry, gloves, shoes, bandages, etc.) immediately.
- Drench the skin with water.
- Wash the skin, hair and fingernails with soap and water.
- Rinse thoroughly and wash again.

- Dry and wrap the affected skin in a blanket.
- If exposure causes a burn, cover the area loosely with a clean, soft cloth. Avoid using ointments, powders and other medications.
- Do not wear contaminated clothes again until you wash them and air them out for several days.

You can never entirely eliminate the risks associated with fumigation. However, if you take precautions, you can significantly reduce them. Take steps to protect the public, yourself and your coworkers. Use the checklists from this manual. Read the label information. Learn about the specific risks of each product you use. Find out what PPE your product requires. Unit 7 will teach you how to select, use and maintain respiratory and gas detection equipment.

Test Your Knowledge

Q. Name three agencies that regulate the use of fumigants.

A. The Environmental Protection Agency (EPA), the Arkansas State Plant Board (ASPB) and the Occupational Safety and Health Administration (OSHA).

Q. List several things you can learn from reading the label information of a fumigant.

A. The label information will tell you how and where to use the product. It will give you detailed application and aeration instructions. It may note specific sites that should not be treated, or application methods that are not permitted. The label information also describes specific safety precautions including what PPE to wear and basic first aid procedures.

Q. How long should warning signs remain posted?

A. Do not remove warning signs until the treated materials and surrounding area have been completely aerated.

Q. Name several precautions you must take when transporting a fumigant.

- A.
1. Do not transport fumigants and people together in a closed vehicle.
 2. Make sure fumigant containers are upright, secured and protected against rear end collision.
 3. Read the label information and/or the MSDS or contact the fumigant manufacturer to determine the signage requirement for transporting each fumigant to you use.
 4. Do not use public transportation to transport fumigants.
 5. Do not transport fumigants through tunnels unless you get permission from ADOT.
 6. Do not remove valve protective covers until just before use.

Q. What are the two main routes of fumigation exposure?

A. Inhalation and skin contact.

Q. What PPE protects you from inhalation exposure to fumigants?

A. A respirator.

Q. True or False: You should always wear gloves when working with fumigants.

A. False. Gloves are not recommended with some fumigants. Others require gloves made of specific materials.

Q. What are some problems with warning gases?

A. Individuals vary in their ability to detect odors and levels of odors. Odors only indicate whether the fumigant is present. They do NOT tell you the concentration of fumigant. You may suffer odor fatigue. Over time, you may lose the ability to smell a particular warning agent.

Q. Explain the difference between TLV-STEL and TLV-TWA.

- A. TLV-STEL stands for “threshold limit value-short term exposure limit.” It is the concentration of fumigant to which most workers can be exposed continuously for a short period without suffering from:
- Irritation
 - Chronic or irreversible tissue damage, or narcosis (drunkenness) sufficient to increase the chance of accident or injury

Exposures to concentrations at the STEL should not be longer than 15 minutes and should not occur more than four times per day. The STEL is used to monitor short-term exposure.

TLV-TWA stands for “threshold limit value-time weighted average.” It is the average concentration of fumigant for a normal 8-hour workday and a 40-hour workweek to which workers may be repeatedly exposed without adverse effect. The TWA is used to monitor long-term exposure.

Q. Describe some symptoms of mild inhalation exposure to a fumigant. What should you do if you or a coworker is experiencing any of these symptoms?

A. Mild exposure by inhalation can cause malaise (a feeling of sickness), ringing in the ears, fatigue, nausea and pressure in the chest. Exposure to fresh air will usually relieve these symptoms.

Q. Why do some fumigant labels recommend that you remove jewelry and wear loose-fitting clothes during application?

A. Jewelry and tight clothing can trap fumigant gas next to the skin, causing irritation or a burn.