

Unit 1. Introduction

Learning Objectives

After reading this unit, the reader will be able to:

- Explain what fumigants are and how they work.
- Understand the scope of this manual.
- Summarize the contents of this manual.

The introduction describes the importance of fumigation. Although they are highly toxic, fumigants are often the best and only way to control pests in soil and raw commodities. They are also important for quarantine between states and between countries. By reading this unit, you will learn what fumigants are and how they work. This unit will outline the scope and purpose of this manual. It will also describe each unit and the type of information included.

Terms to Know

Aeration – The process of replacing fumigant-containing air or water with fresh air and/or water that contains little or no fumigant. Aeration must follow all fumigation operations.

Commodities – Items produced for trade or commerce.

Fumigant – A pesticide that is a gas, or forms a gas, when applied. In a high enough concentration, this gas (vapor) has pesticidal action.

Infestation – A pest population that grows so large it becomes harmful or unpleasant.

Integrated Pest Management – A pest management system that uses all appropriate strategies to reduce pest populations.

Molecules – The smallest particle of a substance that retains all the properties of that substance.

Pest – Any living thing that is undesirable or causes harm to people or the environment. An organism may be a pest in one place but not in another; for example, termites in a house vs. those that recycle dead trees in a forest.

Tilth – The physical condition of soil that determines the ease with which it can be tilled or cultivated and its suitability for seed germination and plant growth.

The earliest use of fumigants as pesticides dates back to 2500 BC. At that time, people burned sulfur to control insects and mites. Today, we use fumigants to control insects, rodents and other pests. We rely on these chemicals to treat grain bins, boxcars and even soil. Fumigation is one of the quickest and most effective ways to eliminate pests from stored grain, tobacco and sometimes homes. We also use fumigation in quarantine. It helps to prevent pests from traveling from one location to another.

Unfortunately, fumigants are some of the most toxic pesticides in the world. Even small amounts can kill nontarget insects, animals and people. Fumigants are often fast acting, odorless and invisible. Many are highly flammable. For these reasons, fumigators require more training and skill than do many other pest control operators. Skill and training are critical for safe application.

What Is a Fumigant?

A fumigant is a gas with pesticidal action. Fumigants are gases, or form gases, after application. In a high enough concentration, a fumigant can kill insects and other pests. Fumigants may be odorless, and usually cannot be seen.

People often mistake smokes, fogs, mists and other aerosols for fumigants. However, these pesticides produce relatively large particles or droplets that are very different from fumigants. They are not true fumigants because they are not gases.

As a gas, a fumigant consists of separate molecules that are much smaller than the droplets of a fog or mist. Fumigants can penetrate even seemingly solid items like brick, concrete and wood. However, these items are not as solid as they appear. In a magnified view, it is

possible to see the molecules of wood and the spaces between them. Fumigant molecules actually move between the wood molecules to reach the pests. Because fumigants penetrate so well, they must be confined in an enclosed space. As soon as a fumigant escapes from an enclosure, its effectiveness is lost.

NOTE: Fumigants provide no residual protection. Once a commodity has been treated and aerated, new pests can attack at any time.

Scope of This Manual

Fumigation is used to treat a wide range of pests in many locations. It is most often reserved for pests that live in hard-to-reach areas such as soil, stored grain or wood.

This manual, General Fumigation, covers fumigation of structures, soil and agricultural sites, such as crop fields, that are used for the production of agricultural products. It also deals with the fumigation of food and raw commodities. Raw commodities include whole grains, tobacco, nuts, raw logs and other unprocessed products.

The Fumigation Manual

The purpose of this manual is to provide basic information to help you fumigate safely and effectively. It starts by describing the major (the most common and the most damaging) pests of structures, soil, food and raw commodities in Arkansas. While the list is long, it is by no means complete. Professional organizations, universities, industries and government agencies produce detailed field guides and other pest identification references. These sources will help you learn more about the pests described here. They will also describe pests not included in this manual.

Many things can be pests. Insects, mites, nematodes, pathogens and rodents can all harm structures, soil-grown crops and stored commodities. This manual will focus on pests that are commonly controlled by fumigation. You will learn about their life cycles and what to look for when scouting. This manual also describes the most vulnerable stage (s) of common pests and the best time(s) for efficient and effective control.

You will also learn about fumigants. Fumigants have many characteristics that can affect how well they work. These include boiling point, molecular weight, water solubility and flammability. External factors such as temperature and humidity can also affect performance. When fumigating soil, application techniques and soil features such as tillage and texture can affect the success of your treatment. This manual will describe these factors and help you understand how different fumigants will perform in different situations.

This manual describes the principles of Integrated Pest Management (IPM). It explains when and how fumigation fits into a well-planned IPM program. You will also learn several ways to control pest and disease problems without fumigation. These alternatives to fumigation may be cultural, biological or chemical. By using a combination of methods, you may often achieve the best control.

This manual will introduce you to a range of fumigation methods and equipment. You will learn basic techniques used to treat soil and raw commodities. Each method has its pros and cons. You will learn how to select a treatment method based on the pest, the item or type of soil infested and the severity of the infestation. During fumigation, problems often arise. You will learn how to prevent these problems, and how to handle them if they do develop.

Aeration must follow all types of fumigation. For indoor treatments, aeration introduces fresh air to dilute and remove fumigant-filled air. For soil treatments, aeration allows the fumigant to escape from the soil and/or water in the soil, until little or no fumigant is left. Proper aeration is key to safe fumigation. Procedures for aeration vary with the fumigant, the item or type of soil treated and the conditions in the treatment area. This manual will describe aeration techniques for a variety of situations.

Pest control decision-making will be addressed throughout this manual. Before fumigating, answer the following questions:

- Is the problem actually caused by a pest?
- If so, what pest?
- What effective and affordable control options are available?

- Is the problem severe enough to warrant fumigation?
- Is the pest in a vulnerable stage in its life cycle?

A good planner makes careful records of pest problems: when and where the problem occurred, solutions and results. He or she also learns how to prevent future problems.

Fumigants are the most hazardous of all pesticides. Small amounts of many fumigants can cause serious illness or death. This manual describes ways to protect the public, your co-workers and yourself from exposure. It provides safety checklists for all stages of fumigation. You will learn about special tools and first aid techniques.

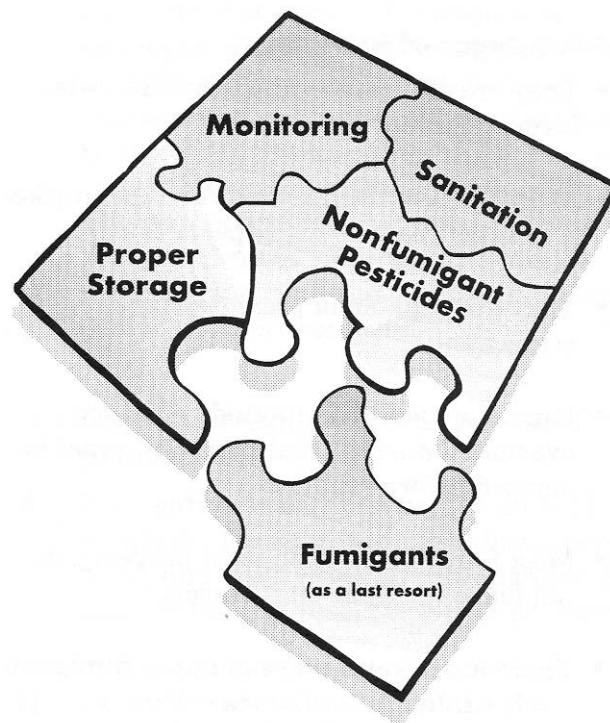
Respirators and gas detectors are two of the most important safety tools in fumigation. Respirators provide clean air to workers during fumigation and aeration. Gas detectors monitor and record gas levels before, during and after treatment. This manual will describe several models of each device. You will learn how to select the best model for your situation. You will also learn how to inspect, maintain and use this equipment properly.

Finally, this manual will discuss common fumigants used to treat structures, soil, food products and raw commodities.

Integrated Pest Management (IPM) and Decision-Making

There are many ways to control pests that infest structures, wood and stored products. Your job is to select the best method for the situation at hand. Pesticides and other control methods often provide good to excellent control temporarily. However, if you want consistent, reliable, long-term control, you need Integrated Pest Management (IPM).

IPM is an ecological approach to pest control. It is based on the habitat and life cycle of the pest. It combines all of the most appropriate pest control strategies into a unified, site-specific plan. IPM plans may include both nonchemical and



chemical management methods. IPM is dedicated to removing causes rather than simply treating symptoms. The goals of an IPM program are to reduce pest numbers to an acceptable level in a way that is practical, cost-effective and safe for people and the environment.

The first strategy of an IPM program is prevention. Prevention relies on sanitation, proper storage and the condition of the commodity before and after it is placed into storage. You may be able to exclude pests or provide them with unsuitable living conditions. Preventing a pest problem before it occurs saves time and money.

IPM also relies on scouting and sampling. Scouting and sampling will help you determine if treatment is needed and/or if previous control measures were effective. Check structures and commodity storage areas regularly. Look for signs of new infestations. Sample commodities to check their physical condition. Determine what pests are present, how many of each kind are in the area and how much damage they are causing.

When an infestation does occur, identify the pest. Learn how it causes damage and when it is most vulnerable. Then, develop a control plan. Consider all appropriate control options. Your strategy should be economical and safe for the

environment. Follow-up site inspections are critical. Did the control tactic work? Is retreatment needed? Continue to monitor areas for long-term control.

Fumigation is only one option of an IPM program. Because it is specialized, very toxic and often expensive, fumigation should be the last resort to a pest problem. When deciding whether to fumigate, weigh these advantages and disadvantages.

Advantages of Fumigants

- They are effective against insects, rats, birds, mammals and fungi.
- Most are fast acting. They are the quickest way of controlling many pests.
- They are capable of providing total eradication.
- Human exposure is limited. Areas are evacuated during treatment and must be aerated before reentry.
- Most fumigants, when used properly, do not leave residues on surfaces.
- There are several ways to apply fumigants.
- They penetrate and treat cracks, crevices, burrows, partitions, commodities and equipment that cannot otherwise be reached.
- You can apply them without disturbing the commodity.
- They are usually readily available.
- You can use some fumigants in or near food without leaving harmful residues, tastes or odors.

Disadvantages of Fumigants

- They are highly toxic to most living things, including humans. Breathing even small amounts of some fumigants can be fatal.
- They require special protective equipment, such as a Self-Contained Breathing Apparatus (SCBA) and gas detectors.
- They require highly trained applicators.
- They offer no residual control. Once an area or item is aerated, traces of fumigant do not remain to help control future pests.
- They must be confined in a tightly sealed area to be effective.
- Some may injure seeds and reduce germination. Others may leave toxic residues, tastes or odors.
- Because they are fast acting, response to problems and emergencies must be quick. Spills, leaks and equipment failures usually call for immediate action.
- They often require warm temperatures to be effective. Temperature requirements may be hard to meet, especially in the winter.
- Some are expensive.
- Some are corrosive.
- They usually require a special license(s) or permit(s). This is because most are classified as restricted-use. Only properly certified applicators can purchase and use restricted-use pesticides.
- Some fumigants are hard to remove from fumigated material (ex. methyl bromide).

Test Your Knowledge

Q. What is Integrated Pest Management (IPM)?

- A. IPM is an ecological approach to pest control. It is based on the habitat and life cycle of the pest. It combines all appropriate pest control strategies, including nonchemical and chemical management methods. IPM is dedicated to removing causes rather than simply treating symptoms. Prevention is key. The goal of an IPM program is to reduce pest numbers to an acceptable level in a way that is practical, cost effective and safe for the environment.

Q. How does fumigation fit into an IPM program?

- A. Fumigation is only one part of an IPM program. Because it is specialized, very toxic and often expensive, fumigation is usually the last resort to a pest problem.

Q. Describe scouting. Explain its importance in effective pest management.

- A. Scouting is checking or monitoring for pests in an area to determine what pests are present, how many of each kind are in the area and how much damage they are causing. Scouting will help you determine if treatment is needed and/or if previous control measures were effective.

Q. List some of the advantages of fumigants.

- A. They are effective against insects, rats, birds, mammals and fungi.
- Most are fast acting.
 - They are capable of providing total eradication.
 - Human exposure is limited.
 - Most fumigants, when used properly, do not leave residues on surfaces.
 - There are several ways to apply fumigants.
 - They penetrate and treat hard-to-reach areas.
 - You can apply them without disturbing the commodity.
 - They are usually readily available.
 - You can use some fumigants in or near food without leaving harmful residues, tastes or odors.

Q. List some problems with fumigants.

- A. They are highly toxic to most living things, including humans.
- They require special protective equipment.
 - They require highly trained applicators.
 - They offer no residual control.
 - They must be confined in a tightly sealed area to be effective.
 - Some may injure seeds and reduce germination. Others may leave toxic residues, tastes or odors.
 - Response to problems and emergencies must be quick.
 - Temperature requirements may be hard to meet.
 - Some are expensive.
 - Some are corrosive.
 - They usually require a special license(s) or permit(s).
 - Some fumigants are hard to remove from fumigated material.

Q. In what situations are fumigants commonly used?

- A. We rely on fumigants to treat structures, grain bins, boxcars and soil. Fumigation is one of the quickest and most effective ways to eliminate pests from stored grain, tobacco and sometimes in quarantine. It helps to prevent pests from traveling from one location to another.

Q. What is a fumigant?

- A. A fumigant is a pesticide that is a gas, or forms a gas, when applied. In a high enough concentration, this gas (vapor) has pesticidal action.

Q. How does being a gas contribute to a fumigant's effectiveness?

- A. As a gas, a fumigant consists of separate molecules that are much smaller than the droplets of a fog or mist. Fumigants can move into tiny gaps, such as between kernels of grain, or through small spaces in soil. Fumigants can penetrate even seemingly solid items like brick, concrete and wood.