

# 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 the manual.
- Define Integrated Pest Management (IPM).
- Select fumigants as one aspect of an IPM program.
- Describe the advantages and disadvantages of fumigants.

The introduction describes the importance of fumigation. While highly toxic, fumigants are often the best and only way to control pests in hard-to-reach areas. 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 explain the principles of Integrated Pest Management (IPM). You will discover how you can use fumigation as one aspect of a well-planned IPM program. This unit also outlines the scope and purpose of the manual. Finally, this unit will describe the advantages and disadvantages of fumigants.

## Terms to Know

**Aeration** – When fresh air is introduced to dilute and remove fumigant-filled air. Aeration must follow all fumigation operations.

**Commodities** – Items produced for trade or commerce.

**Fumigant** – 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.

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

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

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

**Pest** – Any living thing that is undesirable or causes harm to people, property, 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.

**Quarantine** – A period of time during which a vehicle, commodity, or other item is detained and isolated to prevent pests from entering an area, state, or country. Commodities are often quarantined at shipping ports before entering the United States.

The earliest use of fumigants as pesticides dates back to 2500 B.C. At this 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 processing plants, boxcars, and ships. Fumigation is one of the quickest and most effective ways to eliminate pests from processed food, wood, large buildings, and sometimes homes. We also use fumigation in quarantine. It helps to prevent pests from traveling from one location to another.

However, fumigants are some of the most toxic pesticides in the world. Even small amounts can kill nontarget insects, animals, and people. Fumigators require a great deal of specialized training, skill, and technical knowledge.

## What is Fumigation?

A fumigant is a gas with pesticide activity. 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 move into tiny gaps such as those in flour or through small openings in equipment. Fumigants can even penetrate 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 in food storage and commodities. Other times, you may need to fumigate as a last resort for a difficult infestation.

This manual covers fumigation of food and processed commodities. Structures include commodity storage areas such as warehouses, boxcars, and grain bins. Processed commodities and food include all types of processed goods such as flour, meal, candy, cereals, grain, and other products.

## The Food Related Fumigation Manual

The purpose of this manual is to help you fumigate food and processed commodities in a safe and effective way.

It starts by describing the major pests of food and stored commodities. While the list is long, it is by no means complete. Professional organizations, universities, industry, 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, fungi, birds, and rodents can all harm food and stored commodities. Fumigation is most often used to control insects. For this reason, insect pests are the focus of this manual. Rodent pests will be discussed briefly. You will learn how to identify these pests by sight and by their habits. 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, solubility, and flammability. External factors such as temperature and humidity can also affect performance. This manual will describe these factors and help you select the best fumigant for your situation.

This manual will introduce you to a range of fumigation materials and methods. You will learn the basic types of fumigation (vault, tarpaulin, and spot) used to treat food and commodities. Each method has its pros and cons. You will learn how to select a fumigation method based on the pest, the product or site infested, and the severity of the infestation. During fumigation, difficulties 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. Aeration introduces fresh air to dilute and remove fumigant-filled air. Proper aeration is key to safe fumigation. Procedures for aeration vary with the fumigant, the area, and the items fumigated. 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. Even 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, first-aid techniques, and protective clothing and equipment for fumigators.

Respirators and gas detectors are two of the most important safety tools used 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 four common fumigants used to treat food and commodities.

Read and study this manual carefully. This information and training in the field will help you become an effective and safe fumigator.

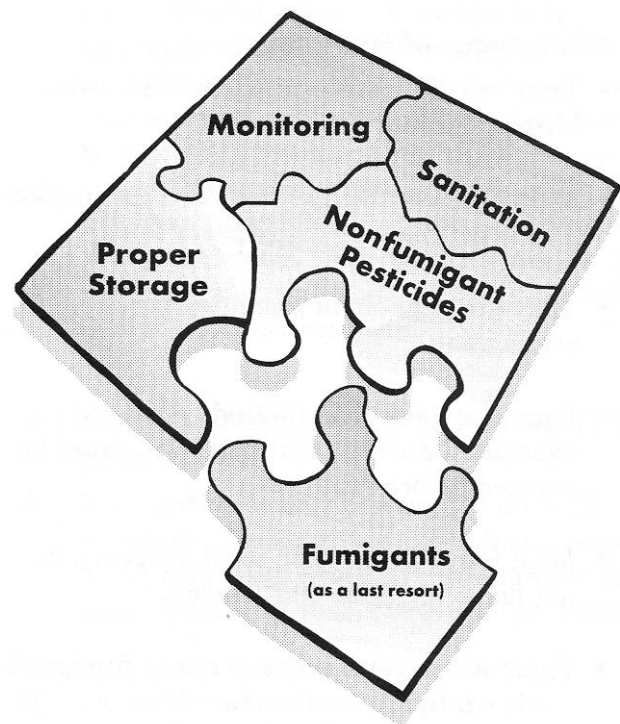
## IPM and Decision Making

There are many ways to control pests that infest food 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 re-treatment 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. In what situations are fumigants commonly used?**

A. We rely on fumigants to treat processing plants, boxcars, and ships. Fumigation is one of the quickest and most effective ways to eliminate pests from processed food and commodities. We also use fumigation 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 penetrate very small spaces where pests live, such as those in flour. Fumigants can even penetrate seemingly solid items like brick, concrete, and wood.

**Q. What is the first thing you should do when you detect a pest problem?**

A. Identify the pest.

**Q. Name two of the most important safety tools for fumigators.**

A. Respirators and gas detectors.

**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.