Pesticide Employee Safety Training (2023) Script

1. Introduction

1.1 Introduction

Welcome to the University of California’s online Pesticide Employee Safety Training. This training was developed for non-research users of pesticides operating within the UC System.

This training will explore the safe and effective use of pesticides while following local, state, and federal laws. Also, there is a section for Applicator Supervisors outlining their role and responsibilities in managing others in the use of pesticides.

The course takes approximately 2 hours to complete and does not need to be done in one sitting.

Now let’s begin.
1.2 How to use

Notes:

Before we begin please note that you can read the information presented (without having to listen to the narrator) at anytime by clicking on the “Script” tab. To disable the audio click on the sound icon at the bottom.

Also, this is an interactive tutorial. You will often be prompted to click on an area, or make a decision, before proceeding to the next section of the course.

If you cannot access content or use features in this training due to a disability or other accessibility-related issue, please complete the Accessibility Needs Request form located in the “Resources” tab of your training player.
1.3 Objectives

By the end of this training, you should be able to:

1. Follow the laws and regulations related to pesticide use
2. Identify major pests
3. Understand how to use integrated pest management
4. Identify hazards
5. Use and calibrate equipment
6. Protect humans and the environment
7. Respond to emergencies

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6. Protect humans and the environment
7. Respond to emergencies
1.4 About Course

Notes:

To work with pesticides, it is necessary for you to receive training as a handler before being allowed or directed to do so. In addition, fieldworkers and handlers must be trained annually on several required areas which are covered in this course.

Also, while this course is not a substitute for obtaining the Qualified Applicator Certificate (QAC) or an acceptable equivalent license issued through the California Department of Pesticide Regulation (DPR), this online training:

Grants a UC equivalent applicator certification for work on any UC campus to employees who currently don’t hold a QAC or equivalent license from DPR (requires attendance at an in-person workshop).

Provides essential information for Application Supervisors in their management role

And, provides continuing education credits

To learn more about DPR's Licensing and Certification Program visit their website by clicking on their logo or accessing the link in the resource tab of this course.
1.5 Role

Notes:

To best customize this course for your learning needs, please indicate your role.

Are you an Application Supervisor? Select “Yes”. Otherwise, select “No.”
If you are unsure, click the “Learn more” button to determine your correct role.

Application Supervisor:

An Application Supervisor is a UC employee who exercises primary direction and control over the activities of a Pesticide Applicator and is responsible for the execution of any Pest control procedure, including compliance with applicable local, state, and federal laws and regulations, and UC Policy.
1.6 Menu

Notes:

Welcome to the main menu.

You can select any module to begin. However, it is best to take them in order from left to right starting with the top row and working your way to the bottom.

Also, while Supervisors only need to complete the supervisor section of this course to meet the requirement, to receive CEU credits, the entire course must be completed.

Choose any topic area to begin.
2. Intro to Pesticides

2.1 Module 1 Objectives

Notes:

Pesticides and Problem Diagnosis
By the end of this module you should be able to:

• Define what pests and pesticides are
• Describe pesticide formulations
• Identify the key factors in how pesticides control a target pest
2.2 Pests Defined

Notes:

Pests are any living organism that causes damage or economic loss or transmits or produces disease.

Pests can be animals (like insects or mice), unwanted plants (weeds), or microorganisms that cause plant diseases (like plant diseases, bacteria and viruses).
2.3 *Pesticides Defined*

**Pesticides**

Any substance or mixture of substances intended to be used for:

- Preventing, destroying, repelling, or mitigating any pest
- Defoliating plants
- Regulating plant growth
- Any spray adjuvant

FAC § 12753

**Notes:**

A pesticide is any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any pest; defoliating plants; regulating plant growth; and any spray adjuvant, as detailed in California Food and Agriculture Code Section 12753.
2.4 Common Pesticides

Notes:

The following groups of chemicals are all pesticides:

- Disinfectants are applied to non-living objects like countertops or pruning shears to destroy microorganisms such as fungi, viruses, and bacteria.
- Fungicides control fungi, mold, and mildew.
- Insecticides control insects
- Herbicides are used to kill plants.
- Rodenticides control rodents

Next let’s talk about formulations of pesticides.
2.5 Formulations

Notes:

Most pesticide products are formulations made of two primary components:
The active ingredient or the pesticide and the inert ingredients or the non-pesticide constituents.
2.6 Formulations: Inert Ingredients

Notes:

The inert ingredients are included in the formulation to improve product performance or usability. Common inert ingredients include water and solvents.

The following are some different types of pesticide formulations.
2.7 Types of Formulations

Notes:

Pesticide labels usually indicate formulation type by letters that follow or are a part of the brand name of the pesticide. Selecting the correct formulation among the many available can be difficult.

Click on each image below to learn more about these commonly encountered pesticide formulations.

When done, click the next button to continue.

Liquids (Slide Layer)

Liquids. Many pesticide products are liquids. They may be either water or oil soluble. While they generally mix easily with other pesticides and are easy to handle, spillage and splashing are common handling disadvantages.
**Wettable Powders (Slide Layer)**

**Wettable powders.** Wettable powder formulations do not dissolve in water. Wettable powder formulations consist of the pesticide and a finely ground dry carrier, usually mineral clay. Manufacturers combine these with other ingredients that enhance the ability of the powder to remain suspended in water.

Most wettable powder formulations contain from 15 to 75% active ingredient. Also they can be abrasive to spray equipment.

**Emulsifiable Concentrates (Slide Layer)**

**Emulsifiable concentrates.** These oil-based formulations include emulsifying agents to help them mix with water. Because they are easily absorbed through the skin, they can be more hazardous to applicators than other formulation types.
Soluble Powders (Slide Layer)

Soluble powders. Because they are more soluble in water, soluble powders generally require much less agitation and are less abrasive than the wettable powders.

Dry Flowables (Slide Layer)

Dry flowables. These products are similar to the wettable powders, but the active ingredient is combined with larger granules that must be mixed with water before use. The pesticide is suspended in water and does not dissolve. They require agitation to remain in solution.
**Flowables (Slide Layer)**

**Flowables.** These are concentrated emulsions made of finely-ground pesticide particles mixed with water and emulsifiers. Flowables require agitation to remain well-mixed in the spray tank.

**Bait (Slide Layer)**

**Bait.** A pesticide active ingredient manufactured with food or other attractive materials that pests consume. They are in gel or liquid form or can be solid blocks or granules. Baits are most often used for ants, cockroaches, snails and slugs, and rats.
Granules. These products are larger in particle size than dusts. Granular formulations are applied as dry materials that need to be incorporated into the soil by cultivation, irrigation, or rainfall shortly after application. Granular-type pesticides are unlikely to drift away from the target site during application.

Some of these formations are more abrasive to your equipment than others. For example, wettable powders are not entirely soluble and are the most abrasive formulation to application equipment.
2.8 Mode of Action

The term “mode of action” or MOA refers to the specific way that the pesticide controls a target pest.

Some examples include:

- **Central nervous system poisons.** Many insecticides have this mode of action such as organophosphates and carbamate insecticides.
- **Anticoagulants** are blood-thinners that cause rodent pests to bleed to death after they consume treated bait.
- **Amino acid synthesis inhibitors.** Some herbicides affect the synthesis (production) of essential amino acids that are used to produce proteins.
- **Auxin mimics** are herbicides that mimic the growth regulator hormone auxin.

Next let’s talk about some of the factors in pesticide use.
2.9 Resistance Development

Notes:

Pest populations can become resistant when pesticides with the same mode of action are used repeatedly.

Resistance occurs when individuals in the pest population have a pre-existing genetic resistance to the mode of action. Once most of the individuals susceptible to the pesticide are eliminated, the resistant individuals pass on their resistant genes to their offspring.
2.10 Selectivity

**Selectivity**

Selective pesticides have modes of action that are only effective on one or a limited number of pest species.

Notes:

Selective pesticides have modes of action that are only effective on one or a limited number of pest species.
2.11 Nonsystemic Insecticide

<table>
<thead>
<tr>
<th>Contact &amp; Systemic Pesticides</th>
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<tbody>
<tr>
<td><strong>Contact Pesticides</strong></td>
</tr>
<tr>
<td>Contact pesticides work only on pests that they contact directly</td>
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**Notes:**

Contact pesticides work only on pests that they contact directly. For instance, weeds die when a contact herbicide covers a sufficient surface area of the plant. Only insects that are sprayed directly or have traveled across treated surfaces are affected by contact pesticides.

Systemic pesticides move through an organism to kill either the plant itself or the insect that feeds on it, depending on the type of pesticide used. For example, systemic insecticides move through the organism the insect is feeding on, while for a herbicide, it moves through the plant to kill it.

The decision to use either a contact or systemic pesticide can have an impact on how pests are controlled. Now let’s take a look at a brief video on pesticide toxicity.
2.12 Pesticide Toxicity

Notes:

A pesticide’s relative toxicity is often described by its LD50 value. “LD” is an abbreviation for “lethal dose”. The LD50 is the dose that will kill 50% of a test population of animals; for example, laboratory rats. LD50 values are expressed as milligrams of the pesticide per kilogram of test animal body weight. Another way to describe milligrams per kilograms is parts per million or ppm.

LC50 values or Lethal concentrate tests are similar to LD50 test except they involve, “concentrates” instead of “doses”. LC 50 values are expressed as milligrams of the pesticide per liter of water or air. 1 milligram per liter is equal to 1 part per million.

Here’s an easy way to remember the difference between these two types of tests:

LD50 tests generally involve the test of animals ingesting the poison orally while LC50 tests often involve fish or aquatic invertebrates as the test species. In this case, the fish do not ingest the poison but are exposed to the pesticide after it has been applied to the aquaria water.

One of the most important things to remember about both the LD50 and LC50 tests is that smaller numbers mean higher toxicity. For example, a chemical with an LD50 of 3,000 milligrams per kilogram has lower toxicity because it will take 3,000 milligrams of the pesticide for each kilogram of body weight to kill the test organism. However, a chemical with an LD50 of 1
milligram per kilogram has higher toxicity because it only takes 1 milligram of the pesticide for each kilogram of body weight to be lethal.

Depending on the pesticide’s toxicity, human exposure may cause either acute or chronic illness. An acute exposure can cause immediate illness symptoms which may be brief or last for an extended period of time. An chronic exposure can cause illnesses which may take longer time-periods to develop and may be longer in duration. Wearing the proper personal protective equipment, following label instructions, and the Universities policies and procedures for handling pesticides will reduce your risk of exposure. These items will be covered in other sections of this course.
2.13 Performance Factors

Notes:

The following are some factors that can influence how well a pesticide will work:

**The life stage of the pest.** Most pesticides will be more effective if applied during the early life stages of target pests.

**Persistence.** How long will the pesticide last? Persistent pesticides can provide a longer control period than pesticides that are non-persistent. However, persistent pesticides have drawbacks too, like more impact on beneficial insects and when seeding for the next crop or new plants can be installed.

**Weather.** Rain can wash pesticides off target plants. Many herbicides will not work well if the weather is too hot or too cold. In general, most pesticides will work best when weather conditions are optimal for the pesticide to be absorbed into the target pest.

**Coverage.** Did the application provide good pesticide coverage or contact with the target pest? Nozzle type and tank pressure are two factors that can affect pesticide coverage.

Now let's take a few minutes to check your knowledge.
2.14 Practice Exercise 1

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following are pesticides?

- Disinfectants
- Herbicides
- Insecticides
- All of the above

Notes:

Which of the following are pesticides?

- Disinfectants
- Herbicides
- Insecticides
- All of the above
2.15 Practice Exercise 2

(Multiple Choice, 10 points, unlimited attempts permitted)

Which formulation is the most abrasive to application equipment?

- Emulsifiable concentrates
- Dry flowables
- Soluble powders
- Wettable powders

Notes:

Which formulation is the most abrasive to application equipment?

- Emulsifiable concentrates
- Dry flowables
- Soluble powders
- Wettable powders
2.16 Practice Exercise 3

(Multiple Choice, 10 points, unlimited attempts permitted)

Which term refers to a pesticide that moves through an organism to kill either the plant itself or the insect that feeds on it?

- Pesticide persistence
- Pesticide Toxicity
- Systemic Pesticide
- Selectivity

Notes:

Which term refers to a pesticide that moves through an organism to kill either the plant itself or the insect that feeds on it?

- Pesticide persistence
- Pesticide Toxicity
- Systemic Pesticide
- Selectivity
2.17 Practice Exercise 4

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following affect the way a pesticide may perform?

- Life stage of the pest
- Persistence of the pesticide
- The pesticide application coverage
- All of the above

Notes:

Which of the following affect the way a pesticide may perform?

- Life stage of the pest
- Persistence of the pesticide
- The pesticide application coverage
- All of the above
2.18 Section 1 Summary

Notes:

This completes this section.
You should now be able to:

• Define what pests and pesticides are
• Describe pesticide formulations
• Identify the key factors in how pesticides control a target pest
3. Laws & Regulations

3.1 Module 2 Objectives

Laws and Regulations

By the end of this module you should be able to:

1. Identify agencies and their roles in regulating pesticides in California
2. Use pesticide labels and Safety Data Sheets (SDS) to obtain relevant information

Notes:

Laws and Regulations

By the end of this module you should be able to:

1. Identify agencies and their roles in regulating pesticides in California
2. Use pesticide labels and Safety Data Sheets (SDS) to obtain relevant information
3.2 Regulatory Agencies

Notes:

Pesticides are regulated at the federal, state, and local levels by the following agencies:

Federal (Slide Layer)

The U.S. Environmental Protection Agency (USEPA) regulates and enforces pesticides at the federal level.
The USEPA allows states to have their own pesticide regulatory programs. In California, this is the Department of Pesticide Regulation (DPR).

In California, the local county agricultural commissioner's office (CACs) enforces DPR's regulations at the local level. CAC's may impose their own pesticide regulations in coordination with the state DPR. They may also have local regulations and/or pesticide or crop specific trainings that might need to be taken. Check with the local office where the application will occur.
UC Policy (Slide Layer)

UC policy requires that all pesticide use be performed in compliance with all applicable laws and regulations.
3.3 Practice Exercise 5

(Multiple Choice, 10 points, unlimited attempts permitted)

Which agency is responsible for enforcing pesticide laws and regulations at the local level?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner’s Office (CAC)
- All of the Above

Notes:

Which agency is responsible for enforcing pesticide laws and regulations at the local level?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner’s Office (CAC)
- All of the Above
3.4 Practice Exercise 6

(Multiple Choice, 10 points, unlimited attempts permitted)

Which agency is responsible for enforcing pesticide laws and regulations in California?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner’s Office (CAC)
- All of the Above

Notes:

Which agency is responsible for enforcing pesticide laws and regulations in California?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner’s Office (CAC)
- All of the Above
3.5 Finding Information

Notes:

As an employee, it can be tough to remember all the details about the pesticide applications that are made at your worksite. That’s why, under the California Pesticide Worker Safety Regulations, your employer is required to provide this information in writing at a central location on the establishment. This central location should be an area that you and your colleagues are likely to pass by or gather in, so that the information specific to you can be easily seen and read. Some employers choose to display this application-specific information on the wall of a lunchroom, on a display board outside of a central office, or in a binder inside the farm shop.
3.6 Finding Information

Notes:

The following documents must be displayed at a central location and the pesticide application records and SDSs retained on the establishment for two years after the expiration of the Re-entry Interval (REI).

- **Pesticide Safety Information Series (PSIS) A-8 and A-9 or N-8 leaflet(s).** These documents contain important emergency medical care information and the physical address of the nearest medical facility including its direct phone number.
- **Pesticide application-specific information,**
- **and Safety Data Sheets**

These documents, along with the information found on the pesticide label are designed to protect you, others, and the environment.

If you are unsure of where this information can be found at your location, contact your supervisor or your campus EH&S office immediately.
3.7 Labels & SDS General

Notes:

Pesticide labels and SDS are essential tools in ensuring the safe and effective use of pesticides. By following the instructions on pesticide labels and SDS, users can protect themselves and others from the hazards associated with pesticide use. In addition, pesticide labels and SDS help protect the environment by providing information about the potential impact of pesticides on wildlife, plants, and water sources.

Let’s take a look at the differences between each document and where they overlap.
3.8 Pesticide Labels

Notes:

Pesticide labels are legally required by the Environmental Protection Agency (EPA) and contain information such as the pesticide's application rate, directions for use, Restricted Entry Interval (REI), crops or site information, Pre-harvest interval (PHI), and required personal protective equipment (PPE). Pesticide labels are required to be attached to the product at all times.
3.9 Labeling

Notes:

A pesticide label provides information on legal application areas, amount, application methods, and precautions which are crucial for pesticide handlers to be aware of. Literally, the label represents the law that must be followed.

You may find it challenging to understand the label instructions due to various factors such as font size, language, and unfamiliar terms. If for any reason you are unable to read the label, it's important to contact your supervisor before using the pesticide to get a proper explanation of the health, safety, and directions for use information.
3.10 Labeling

**Pesticide Labeling: Usage**

It is critical that handlers read and refer to the label BEFORE:

- Buying the pesticide or taking it out of the storage area
- Mixing the pesticide
- Applying the pesticide
- Storing the pesticide or disposing of the container

**Notes:**

As a pesticide handler, you must read and refer to the label **BEFORE:**

**Buying the pesticide or taking it out of the storage area** to ensure the use of the correct product. Make sure to verify the type of pest the product controls and the crop or site to which it can be applied. This is also an opportunity to review the PPE information to ensure that you have all of the required PPE or protective clothing.

Now let's review where this and other important information can be found on a pesticide label.

**Mixing the pesticide** to understand the product labels mixing instructions. Keep in mind that mixing is the most hazardous task as you'll be working with the product in its most concentrated form. If the instructions and precautions are not clear, ask your employer or supervisor for clarification or assistance.

**Applying the pesticide** to become familiar with instructions on how to use the product safely (e.g., the environmental hazards, first aid information, and special precautions).

and, **Storing the pesticide or disposing of the container** to find specific instructions about temperature limits, potential fire hazards, environmental impacts, and guidelines for container cleaning and disposal.

Now let's take a look at the common sections of a pesticide label.
3.11 Pesticide Labeling

Here is a sample pesticide label that includes most sections you will commonly encounter.

Click on each number to learn about that label section.

When done, click the "next" button to continue.

1. **Product Classification**

When a pesticide is classified as restricted, the label will state "Restricted Use Pesticide" at the top of the front panel. To purchase and apply restricted-use pesticides, you must be certified and licensed through the appropriate department in your state.

2. **Trade Name**

A trade name is the name a manufacturer gives to the product. This is the name found in the DPR Product Label Database and used to advertise and promote the product.

3. **Formulation**

Pesticide labeling often lists the formulation type, such as emulsifiable concentrate, wettable powder, or soluble powder. Manufacturers may include this information as a suffix in the brand name of the pesticide. In this example, WP indicates that this product is a wettable powder formulation."
4. Mode of Action

This information is sometimes included on a label and provides the pesticide classification number. This is important to know because users should rotate among classes to prevent resistance.

5. Active Ingredient

The active ingredient, or A.I., is the material that is working to control the target pest. On a label, the percentage of the A.I. is provided. The A.I. is usually listed as a common name of the more complicated chemical name.

6. Other/Inert Ingredients

These ingredients do not work to control the target pest directly, but are sometimes added to the product to improve effectiveness (such as a dissolving agent or surfactant).

7. Net Contents

Pesticide labeling list the net contents, by the weight or liquid volume contained in the package.

8. Registration and Establishment Numbers

The U.S. EPA assigns registration numbers to each pesticide they register; DPR assigns registration numbers to products it registers. This registration number is needed for pesticide use records or pesticide use reporting. An establishment number identifies the unique site of manufacturing or repackaging and includes a two- or three-letter code designated to the state or country where the producer is located.

9. Manufacturer's Address

This section of the label identifies the name and address of the producer, registrant, or person for whom the product is produced.

10. Signal Word

An important part of pesticide labeling is the signal word. The signal word indicates to the user the pesticide product's toxicity level. It is determined by the acute (short-term) toxicity data conducted on the pesticide product. Part of the registration process is to assign each pesticide a toxicity category, based on acute toxicity to humans and noted by a signal word.

The words "DANGER/POISON" with skull and crossbones indicate that the pesticide is highly toxic.
The word “DANGER” used alone indicates that the pesticide poses a dangerous health hazard.

“WARNING” indicates moderate toxicity, and “CAUTION” means lower toxicity. The lowest toxicity pesticides may not include a signal word.

11. Keep Out of Reach of Children Warning

The child hazard warning statement, (“Keep Out of Reach of Children”) appears on almost all end-use pesticide products except those pesticides that are intended for use on children or where it is demonstrated that children will not come in contact with the products.

12. First Aid

This section recommends proper antidotes and treatment for individuals treating a victim. Always take the pesticide label with you if you need to visit an emergency medical facility. Products labeled DANGER also bear an 800 telephone number that physicians may call for further treatment advice.

13. Precautionary Statements

Precautionary statements are designed to provide the pesticide user with information regarding the toxicity, irritation, and sensitization hazards associated with the use of a pesticide, as well as treatment instructions and information to reduce exposure potential. It includes information on potential hazards to people and domestic animals and the type of personal protective equipment to wear while handling, mixing, and applying the product. In addition, it includes information on environmental hazards, such as the product’s toxicity to non-target organisms such as honeybees, fish, birds, and other wildlife.

14. Directions for Use

The Directions for Use are an important part of pesticide labeling that must be followed to keep the user from violating the law. It is illegal to use a product in a manner inconsistent with the Directions for Use except where federal or state laws specify acceptable deviations from the registered labeling. The Directions for Use list all the target pests that manufacturers claim their pesticides control. They also include the crops, plant species, animals, or other sites where the pesticide can be used. Here is where the applicator would find special restrictions that must be observed. They also include restrictions on feeding crop residues to livestock or grazing livestock on treated plants.
15. Storage and Disposal

Storage information such as temperature and light requirements, are provided to prevent the breakdown of the material. Most liquid or flowable formulations have minimum storage temperature requirements. This section also explains how to deal with the unused portion of the product and the container.
3.12 Labeling

**Pesticide Labeling: Reminders**

- **Read each label even if a similar product has been used in the past.** Each pesticide product is different, and you must read each label even if you have used a similar product in the past.

- **The registration number is essential during a pesticide exposure situation.** It gives medical personnel a way of identifying the product to find additional information on the health effects, ingredients, and first aid instructions.

- **Read the first aid section before exposure occurs.** By doing this, you will be ready to address any pesticide-related sickness or injury. First aid instructions may differ, particularly in cases of pesticide ingestion.

- **The necessary protective clothing and PPE may vary on the same label, depending on the handling task.** For example, you may have to wear a chemical-resistant apron during mixing, but not during application. Additionally, you may observe that a respirator is not necessary when applying the product outside, but it is necessary when applying it inside an enclosed space. Hence, you must review the complete PPE section before using the product.

- **Check with your local county agricultural commissioner for additional storage and disposal regulations.**

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**Notes:**

The following are some reminders about reading and understanding label instructions:

1. *Read each label even if a similar product has been used in the past.* Each pesticide product is different, and you must read each label even if you have used a similar product in the past.

2. *The registration number is essential during a pesticide exposure situation.* It gives medical personnel a way of identifying the product to find additional information on the health effects, ingredients, and first aid instructions.

3. *Read the first aid section before exposure occurs.* By doing this, you will be ready to address any pesticide-related sickness or injury. First aid instructions may differ, particularly in cases of pesticide ingestion.

4. *The necessary protective clothing and PPE may vary on the same label, depending on the handling task.* For example, you may have to wear a chemical-resistant apron during mixing, but not during application. Additionally, you may observe that a respirator is not necessary when applying the product outside, but it is necessary when applying it inside an enclosed space. Hence, you must review the complete PPE section before using the product.

5. *Check with your local county agricultural commissioner for additional storage and disposal regulations.*
Now that we have looked at pesticide labels, let's review Safety Data Sheets (SDS).
3.13 Safety Data Sheets (SDS)

Safety Data Sheets (SDS)

Required under OSHA Hazard Communication Standard
- \(LD_{50}\) value
- Boiling point
- Long term (chronic) human health hazards

Notes:

Safety Data Sheets are required under the OSHA Hazard Communication Standard and provide more detailed information about the hazards of a particular pesticide. SDS typically contain information such as the chemical's \(LD_{50}\) value, boiling point, and long term (chronic) human health hazards.

Also, while pesticide labels are required to be attached to the product, SDS are generally provided by the manufacturer to the purchaser or the user, and are required to be kept available in the workplace.
3.14 Labels & SDS Overlap

Notes:

While labels and SDSs differ in their purpose and format, there are areas where they overlap. Here are some examples of overlap areas:

Product Identity: Both pesticide labels and SDS provide information about the product's name, manufacturer, and product code or registration number.

Hazardous Ingredients: Both documents include a list of hazardous ingredients present in the pesticide product. The list includes the chemical name and common name, as well as the percentage of each hazardous ingredient in the product.

Physical and Chemical Properties: Both documents provide information on the physical and chemical properties of the pesticide, such as its appearance, odor, and solubility. This information helps users identify the product and understand how it behaves under different conditions.

Health Hazards: Both documents provide information about the health hazards associated with the pesticide. The information includes the potential routes of exposure, symptoms of exposure, and first aid measures.

Precautionary Statements: Both pesticide labels and SDS include precautionary statements that provide information on how to handle the product safely. The statements may include instructions for personal protective equipment (PPE), handling and storage, and disposal.

Emergency Information: Both documents provide emergency information, such as contact information for poison control centers and emergency responders, in case of accidental exposure.
While there are overlapping parts between these documents, both documents are critical to ensure the safe and effective use of pesticides, and should be consulted before any pesticide use.
3.15 Conflict with Labeling

Notes:

For the most part, it is illegal to use a pesticide in a manner that conflicts with its registered labeling.

Remember: The label is the law!

However, there are a few activities that are NOT considered to be “use in conflict with labeling”.
3.16 Conflict with Labeling

**Exceptions unless the label expressly forbids them**
- A decrease in the rate per acre
- A decrease in the concentration
- A decrease in use frequency
- Using the pesticide to control a pest that’s not specifically mentioned on the label
- Use of a different application method
- Mixing the pesticide with another pesticide or fertilizer

**Notes:**

Unless the label expressly forbids them, the following are legally allowed exceptions:
- a decrease in the rate per acre
- a decrease in the concentration
- a decrease in use frequency
- using the pesticide to control a pest that’s not specifically mentioned on the label
- use of a different application method
- and, mixing the pesticide with another pesticide or fertilizer.

Finally, while you can use the pesticide for a pest not on the label, it is important to note that the site must be on the label.

For example, an insecticide specifically for landscape use that does not have aphids on the label can be used to control aphids on landscape plants but not on tomatoes since tomatoes are not a listed site or crop.

Now we will look at pesticide signal words and their meanings.
3.17 Toxicity Categories

The EPA established four Toxicity Categories for acute hazards of pesticide products, with "Category I" being the highest toxicity category (or toxicity class). Most human hazard, precautionary statements, and human personal protective equipment statements are based upon the Toxicity Category of the pesticide product as sold or distributed.

The four toxicity categories, from one to four are:

- Toxicity category I is highly toxic and severely irritating
- Toxicity category II is moderately toxic and moderately irritating
- Toxicity category III is slightly toxic and slightly irritating
- Toxicity category IV is practically non-toxic and not an irritant.
3.18 Signal Words

**Notes:**

The USEPA generally uses acute LD50 values to establish pesticide toxicity categories. These categories are designated on pesticide labels by the following signal words.

**Danger (Slide Layer)**

**DANGER.** Category I pesticides are highly toxic and often include the word “Poison” along with a graphic of the skull and crossbones. They have acute oral LD50 values that are less than 50 ppm.

When a pesticide label only displays the “Danger” signal word and does not include the word “Poison” with the skull and crossbones, it means that the pesticide is an eye or skin hazard.
**Warning (Slide Layer)**

<table>
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<tr>
<th>Signal Words</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Danger" /></td>
</tr>
<tr>
<td>Category II pesticides are moderately toxic. They have acute oral LD50 values that are between 51-500 ppm</td>
</tr>
<tr>
<td><img src="image2" alt="Warning" /></td>
</tr>
<tr>
<td><img src="image3" alt="Caution" /></td>
</tr>
</tbody>
</table>

**WARNING.** Category II pesticides are moderately toxic and use the signal word, “Warning”. They have acute oral LD50 values that are between 51-500 ppm.

**Caution (Slide Layer)**

<table>
<thead>
<tr>
<th>Signal Words</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Danger" /></td>
</tr>
<tr>
<td>Category III pesticides are slightly toxic. They have acute oral LD50 values that are between 501-5,000 ppm</td>
</tr>
<tr>
<td><img src="image2" alt="Warning" /></td>
</tr>
<tr>
<td><img src="image3" alt="Caution" /></td>
</tr>
</tbody>
</table>

**CAUTION.** Category III pesticides are slightly toxic and use the signal word, “Caution”. They have acute oral LD50 values that are between 501-5,000 ppm.
No Signal Word. Category IV pesticides do not use signal words and are practically non-toxic. They have acute oral LD50 values that are greater than 5,000 ppm.

In addition to the signal words, ALL pesticide labels include the warning, “Keep out of Reach of Children”.
3.19 Practice Exercise 7

(Multiple Choice, 10 points, unlimited attempts permitted)

The precautionary statements section of the label contains information about the:

- Application rate
- Legal use sites
- Directions for use
- Hazards to people and domestic animals

Notes:

The precautionary statements section of the label contains information about the:

- Application rate
- Legal use sites
- Directions for use
- Hazards to people and domestic animals
3.20 Practice Exercise 8

(Multiple Response, 10 points, unlimited attempts permitted)

Which of the following is considered to be pesticide labeling or supplemental labeling?

Choose all that apply:

- Printed material that includes directions, requirements, or prohibitions
- Advertisements from the manufacturer
- Any direction or warning information that is encased in a plastic pouch attached to the primary container
- All of the above

Notes:

Which of the following is considered to be pesticide labeling or supplemental labeling?

- Printed material that includes directions, requirements, or prohibitions
- Advertisements from the manufacturer
- Any direction or warning information that is encased in a plastic pouch attached to the primary container
- All of the above
3.21 Section 2 Summary

Summary

✅ Identify agencies and their roles in regulating pesticides in California
✅ Use pesticide labels and Safety Data Sheets (SDS) to obtain relevant information

Notes:

This completes this section.

You should now be able to:

• Identify agencies and their roles in regulating pesticides in California

• Use pesticide labels and Safety Data Sheets (SDS) to obtain relevant information
4. Pest Management

4.1 Module 3 Objectives

By the end of this module you should be able to:

- Identify the major pest groups and the importance of accurate identification in pest management.
- Outline how pests are classified.
- Describe common pest monitoring and control strategies.
- Define IPM and identify its common components.
- Follow protocols when using pesticides that are harmful to bees.

Notes:

Pest Management

By the end of this module you should be able to:

- Identify the major pest groups and the importance of accurate identification in pest management.
- Outline how pests are classified.
- Describe common pest monitoring and control strategies.
- Define IPM and identify its common components.
- Follow protocols when using pesticides that are harmful to bees.
4.2 Pest Types

Notes:

There are four major pest groups:

- Invertebrates, such as insects, snails, and nematodes
- Plant Pathogens
- Vertebrates
- and Weeds

It’s important to note that not all species in these groups are pests. As an example, most spiders are considered beneficial species.
### 4.3 Pest Identification

Identifying a pest correctly is the first step in successful pest management. Misidentifying pests is one of the most common reasons that pest management programs are unsuccessful.

**Books & Websites (Slide Layer)**

There are many books and websites that can help pest management professionals identify organisms like weeds and invertebrate pests. Other resources like photographs, preserved specimens, or identification keys are also available. Many of these resources are available from the University of California, commercial pest control companies, or professional organizations.
Identifying smaller pest organisms like mites or other smaller invertebrates, nematodes, or plant pathogens generally requires the expertise of trained professionals. The local county agricultural commissioner’s office and the University of California Cooperative Extension office in each county may be able to assist with identifying these tough-to-identify pests.
4.4 Pest Classification

Notes:

There are many different ways to categorize or classify pests. One common method is based on prioritizing the pest into Key Pests, Secondary Pests, and Occasional Pests.

Key Pests (Slide Layer)

A key pest is the most significant and perhaps the most common pest of a crop or site. For example, codling moths are a key pest in apple production and cockroaches are key pests in commercial kitchens.
Secondary Pests (Slide Layer)

Secondary pests are generally less important or prevalent than the key pest species but they may become a problem when key pests are controlled or eliminated. For example, some weed species become pests after more competitive weeds have been controlled. Also, particular species of fleas, ticks, and blood-feeding bugs attack people only after their natural hosts are eliminated.

Occasional Pests (Slide Layer)

Occasional pests are species that only become pests sporadically depending on influences such as weather or site-specific factors. For instance, ants become pests when sanitation practices change, providing them with food where none previously existed. Ants will also move into buildings after a rainfall destroys their outdoor food source.
4.5 Pest Monitoring

Notes:

Pest monitoring involves the systematic observation of pest activities like growth and development over time. It can also involve making observations of the level and extent of pest damage.

visual Inspection (Slide Layer)

Visual inspection is the most commonly used monitoring method. It involves inspecting plant foliage or soil for the presence of pest species or the damage they cause.

Some other commonly used pest monitoring methods include:
• Sticky traps for aphids, whiteflies, and thrips.
- pheromone traps for beetles and fruit flies.
- and sweet net collection for a wide variety of pests including weevils and caterpillars.

**Record Keeping (Slide Layer)**

Also, good recordkeeping is an important aspect of pest monitoring. The information gathered during monitoring plays a critical role in pest management decision-making.
4.6 Pest Management Methods

Notes:

Pest management methods include biological control, chemical control, mechanical and physical methods, and cultural controls.

Let’s take a closer look at each of these.

Biological (Slide Layer)

**Biological control** uses beneficial organisms or natural enemies such as insects or beneficial nematodes to control pests.

- Many are imported from other countries
- Generally used for pest suppression
- Most are host-specific

**Biological control** uses beneficial organisms or natural enemies such as insects or beneficial nematodes to control pests.

Some important facts about biological control agents include:

- Many are imported from other countries under strict government control. However, they can be purchased from vendors, and existing populations of natural enemies can be enhanced through habitat modification.
• They are generally used for pest suppression not eradication.
• Most are host-specific, meaning that they control only one or just a few pest species.

Chemical (Slide Layer)

Chemical control involves using natural or manmade (synthetic) chemicals. One of the major advantages of chemical pest control is it provides a quick means of killing pests. However, one major disadvantage is that chemical controls may affect other organisms in the surrounding area beyond the targeted species.

Mechanical (Slide Layer)

Mechanical and physical methods control pests directly or make the environment unsuitable for them. Some examples of mechanical controls include:
• disking
• mowing
• plowing
• trapping
• barriers
• hand-pulling or picking.

Cultural (Slide Layer)

Cultural control includes practices that reduce pest establishment, reproduction, dispersal, and survival. Some examples of cultural control include:

• Weed control to eliminate insect or rodent pest habitat
• Sanitation, such as removing garbage that may harbor cockroaches in a restaurant
• Modifying schedules for irrigation, pruning, or harvesting to discourage or eliminate pest species

Now, let's take a look at the Integrated Pest Management or IPM strategy.
4.7 Integrated Pest Management

Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on the long-term prevention of pests or their damage.
4.8 IPM Components

Notes:

There are six major components common to all IPM programs:

1. Pest identification
2. Pest prevention
3. Monitoring and assessing pest numbers and damage
4. Guidelines for when management action is needed
5. Taking action by using a combination of pest management techniques
6. Evaluation after action is taken to assess the effect of the pest management
**4.9 IPM Control Strategies**

IPM uses physical, mechanical, cultural, biological, and chemical control strategies. However, pesticides are typically used only after monitoring indicates they are needed.

Ideally, when pesticides are used, they will only affect the target species and will have limited impact on non-target species, people, and the environment. This is why establishing economic injury or treatment thresholds are an important aspect of IPM programs.
4.10 Beekeeper Notification

Notes:

Special procedures must be followed when using certain pesticides near beehives.

Pesticides that are toxic to honeybees will have a warning in the Precautionary Statements section of the label stating, “This pesticide is highly toxic to bees.”

Beekeepers that have registered with the County Agricultural Commissioner must be notified at least 48 hours before the scheduled application when all of the following happen:

• Pesticides toxic to bees are used
• The pesticides are applied to blossoming crops
• The pesticide is used within one mile of the hives

Finally, the person in charge of the pesticide application must check with the County Agricultural Commissioner to find out if any beekeeper has requested to be notified of any nearby pesticide applications.
4.11 Practice Exercise 9

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following are the four major pest groups?

- Biological, chemical, mechanical, and cultural
- Invertebrates, plant pathogens, vertebrates, and weeds
- Fungicides, insecticides, herbicides, and rodenticides
- None of the above

Notes:

Which of the following are the four major pest groups?

- Biological, chemical, mechanical, and cultural
- Invertebrates, plant pathogens, vertebrates, and weeds
- Fungicides, insecticides, herbicides, and rodenticides
- None of the above
4.12 Practice Exercise 10

(Multiple Choice, 10 points, unlimited attempts permitted)

Ants are an example of what classification of pests?

- Key pests
- Secondary pests
- Occasional pests
4.13 Practice Exercise 11

(Multiple Choice, 10 points, unlimited attempts permitted)

Modifying schedules for irrigation, pruning, or harvesting to discourage or eliminate pest species is an example of which type of control?

- Biological control
- Chemical control
- Cultural control
- Mechanical control

Notes:

Modifying schedules for irrigation, pruning, or harvesting to discourage or eliminate pest species is an example of which type of control?

- Biological control
- Chemical control
- Cultural control
- Mechanical control
4.14 Practice Exercise 12

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following is NOT one of the six major components common to all IPM programs?

- Pest identification
- Evaluation after action is taken
- Using pesticides as a first approach
- Monitoring and assessing pest numbers and damage

Notes:

Which of the following is NOT one of the six major components common to all IPM programs?

- Pest identification
- Evaluation after action is taken
- Using pesticides as a first approach
- Monitoring and assessing pest numbers and damage
4.15 Section 3 Summary

Summary
- Identify the major pest groups and the importance of accurate identification in pest management
- Outline how pests are classified
- Describe common pest monitoring and control strategies
- Define IPM and identify its common components
- Follow protocols when using pesticides that are harmful to bees

Notes:

This completes this section.
You should now be able to:

- Identify the major pest groups and the importance of accurate identification in pest management
- Outline how pests are classified
- Describe common pest monitoring and control strategies
- Define IPM and identify its common components
- Follow protocols when using pesticides that are harmful to bees
5. Problem Diagnosis

5.1 Module 4 Objectives

Notes:

Pest Problem Diagnosis

Knowing the cause of damage is important for determining whether or not a pesticide is required and, if one is needed, which one.

By the end of this module you should be able to apply pest management principles to:

• Weed control
• Vertebrate control
• Plant disease control
• Invertebrate control

Let's begin with weeds.
5.2 Weeds

Notes:

Controlling weeds is a major pest management activity in landscape maintenance, right-of-way sites, and plant agriculture.
5.3 Weed Impact

Notes:

Weeds compete with desirable plant species for water, nutrients, light, and space.

Weeds may also:
• Reduce road visibility
• Increase fire risk
• Damage infrastructure
• Contaminate crops
• Clog waterways
• Cause skin irritation
• Harbor other pests
• Cause aesthetic issues

Now, let's look at the characteristics of various types of weeds.
5.4 Gross Morphology

Notes:

When classified by their gross morphological features, weeds are broken into three major categories: grasses, sedges, and broadleaf weeds. When classified by their life cycle, they are broken into annual, biennial, and perennial. The latter classification method can have a profound impact on the effectiveness of control measures.

Weeds considered to be true grasses are monocotyledons having only one seed-leaf when they emerge from the soil. They have strap-like leaves (blades) with hollow stems and parallel leaves. Most have fibrous root systems. Some examples of weeds that are grasses include crabgrass, sandbur, and dallisgrass.

Weeds considered sedges are also monocotyledons, but not true grasses, though they exhibit a lot of the same characteristics as grasses. They are different from grasses in that their stems are solid, triangular, and have no nodes. Their leaves have a three-ranked arrangement (instead of an alternate arrangement) with each leaf one third the way around the stem from the one below it. The basal portion of each leaf forms a tube around the stem with no clear division between sheath and blade. Examples of weeds that are sedges are nutsedge and green kyllinga.

Broadleaf weeds are different from grasses and sedges in that their leaf blades are expanded. Their leaves have netted venation as they are dicotyledons. When broadleaf weed seedlings emerge from the soil, they have two seed-leaves. They often have tap roots or coarsely branched roots.
Some common broadleaf weeds include dandelion, clover, burdock, and thistle.

Correct identification is important because some herbicides work on some species of each group and not others.

Now we will look at plant growth stages and life cycles.
5.5 Plant Growth Stages

Notes:

Plants have four basic growth stages:

**Stage 1-Seedling.** This stage is characterized by the presence of the seed leaves. In general, the seedling stage is the easiest to control.

**Stage 2-Vegetative.** This is the stage where plants produce most of their leaves, stems, and roots. Like the seedling stage, this is also a good growth stage for weed control.

**Stage 3-Bud and Flowering.** This stage is when plants divert their resources from vegetative growth to the structures like flowers, fruits, and seeds.

and finally, **Stage 4-Maturity.** This is the growth stage when the plant has completed its vegetative growth and has produced seeds. Controlling mature plants is often very difficult.
5.6 Plant Life Cycles

Notes:

Most plants can be categorized into three life cycle types; Annuals, biennials, and perennials.

Annuals

Annuals complete their life cycle from seed germination to death in one year or less. There are two basic types of annuals:

Summer annuals germinate in the spring, grow vegetatively in the summer and set seeds and die in the fall to the early winter.

Examples of summer annuals include common lambsquarters and Russian thistle.

Winter annuals germinate in the fall and continue to grow and develop during the next spring and summer. They often die by the early or mid-summer. However, some may survive for a longer period, dying in the fall.

Redstem filaree and yellow starthistle are winter annual species.

Annuals are generally easiest to control in the seedling stage. Controlling annuals before seed production is critical.
**Biennials**

Biennials live for two growing seasons. The first season is primarily vegetative growth with flower and seed development occurring in the second. Some biennials may behave as annuals under certain environmental conditions such as growing in areas with longer growing seasons.

Biennials should be controlled in the first season during the seedling and vegetative stages because control during the second season is often less effective.

Bull thistle and poison hemlock are biennial species.

**Perennials**

Perennials live for more than two years. They may go dormant in the winter with new growth occurring the next spring. Perennials can be separated into the following groups based on reproduction:

1. *Simple*. Simple perennials are those that reproduce only by seed or when root segments are cut up. Examples of simple perennials include wild fennel and french broom.

2. *Creeping*. These species spread by seed or vegetatively by creeping stolons or rhizomes. Stolons are modified stems that grow along the ground surface and rhizomes grow underground. Examples of creeping perennials include Bermudagrass and field bindweed.

3. *Bulbous*. These species reproduce by seed or by underground bulbs or tubers. Like creeping perennials, the bulbous perennials can be spread by the soil disturbance occurring during cultivation. Purple and yellow nutsedge are bulbous perennials.

Perennial species are generally easiest to control during the seedling or vegetative stages. Control after these stages is usually not as effective.

Once perennial species become established, control generally requires either depleting the food storage reserves of the root system by repeatedly destroying the plant’s top growth.

Or by applying translocated herbicides at or after flowering, when food reserves are moving from the leaves down to the roots.
5.7 Non-Chemical Weed Control

Notes:

Both non-chemical and chemical methods are used for weed control. However, successful vegetation management programs often involve integrating these methods.

Non-Chemical Control Strategies include:

- **Mechanical control** uses equipment like mowers and tilling equipment. Mowing done too early in the season may need to be repeated because of weed regrowth. In some cases, the use of mechanical methods may cause sparks that can start fires.

- **Manual control** includes hand-pulling or the use of hand-held equipment like hoes or weed-eaters. While effective in small areas, these methods are often less effective once infestations grow in size or when target plants are in the later developmental stages.

- **Cultural control** methods include modifications in management activities that can provide pest control benefits. Establishing healthy, competitive landscape plants, selecting plant species that are well-adapted to the site, and proper irrigation and fertilization are some common cultural control strategies.

- **Structural control** involves using hardscapes like paved surfaces to prevent weed growth.

- **Biological control** involves the use of beneficial organisms such as insects, plant disease, and grazing animals that can be used to control weeds. While
this method is often effective against agricultural pests, the use of biological control in right-of-way or landscape settings may be limited due to difficulty establishing sustainable populations and the site having more than one weed species.

Other non-chemical controls include flaming, steaming, and tilling.
5.8 Chemical Weed Control

Notes:

Herbicides are pesticides designed to control undesirable plants and when used, you should follow label directions precisely. Here are a few things that you should know when using herbicides:

1. **Identify the weed and select the proper herbicide for the application site.**

Be sure the herbicide label lists the weed species you want to control. Also, a herbicide will kill all susceptible plants, not just weeds, so make sure the label says it's safe to apply on or around the other plants where you intend to use it. Finally, be sure the weeds are in a stage that is susceptible to the herbicide.

2. **Check the label for the herbicide type.**

Herbicides that kill most plants they contact are called non-selective. Weed-killers that control some kinds of plants but not others are called selective herbicides.

Pre-emergent herbicides control the germinating seeds before plants emerge from the soil. They won’t control weeds that have already emerged while post-emergent herbicides are used to control weeds that have already emerged. The younger the weed, the better a post-emergent herbicide will work. Finally, post-emergent herbicides may have either contact or translocated activity. Contact herbicides are primarily limited to the sprayed foliage of target plants while translocated herbicides are absorbed into sprayed foliar tissue and then move within the target plant’s vascular system.
5.9 Herbicide Performance Factors

Notes:

Foliar penetration and soil conditions can affect the performance of herbicide use.

Foliar (Slide Layer)

- Needs to penetrate the leaf to be effective
- Leaf shape, hairs, cuticle layer, and temperature may pose barriers to penetration
- Surfactants help herbicides penetrate leaf cuticles.
- Surface-active agents that allow better coverage on wax or hairy surfaces

Before a foliar-applied herbicide can work, it must first penetrate the leaf. Some barriers to penetration include leaf shape, hairs, cuticle layer, and temperature. However, the use of surfactants help herbicides penetrate leaf cuticles.

Surfactants are surface-active agents, also known as wetting agents or spreaders. They enhance spray coverage by reducing the surface tension of spray droplets. Surfactants allow better coverage on waxy or hairy surfaces, such as the leaves of many plants.
Soil (Slide Layer)

Also, soil conditions often have a strong influence on the performance of pre-emergent herbicides. Soil, silt, and clay are the three primary building blocks of soils. Herbicides can easily leach out of sandy soils or be too tightly bound to soils with high levels of organic matter or high clay content which can reduce herbicide effectiveness.

In order to be effective, pre-emergent herbicides need to move into the top 1-2 inches of the soil. This is where most of the seeds that can germinate are. Seeds in deeper layers are generally dormant or will struggle to get to the soil surface.

Now let’s test your knowledge on weeds and weed control
5.10 Practice Exercise 13

(Multiple Choice, 10 points, unlimited attempts permitted)

Which stage of weeds is often the easiest to control?

- Mature, post-flowering stage
- Vegetative stage
- Seedling stage
- Bud and flowering stage

Notes:

Which stage of weeds is often the easiest to control?

- Mature, post-flowering stage
- Vegetative stage
- Seedling stage
- Bud and flowering stage
5.11 Practice Exercise 14

(Multiple Choice, 10 points, unlimited attempts permitted)

Notes:

Which of the following are commonly used weed control strategies?

- Manual
- Chemical
- Cultural
- All of the above
5.12 Practice Exercise 15

(Multiple Choice, 10 points, unlimited attempts permitted)

What life cycle is shown below?

- Summer annual
- Winter annual
- Perennial

Notes:

What life cycle is shown below?

- Summer annual
- Winter annual
- Perennial
5.13 Vertebrates

Notes:

A vertebrate is an animal with a backbone. It’s a diverse group including warm-blooded animals like squirrels and rats, crows and hummingbirds, and cold-blooded types like snakes and lizards.

This section will review basic pest management principles for vertebrate pests found in California.
5.14 Outdoor Vertebrates

Notes:

Ground squirrels, gophers, moles, and voles are some of the primary outdoor vertebrate pests found in California. Click on each image to learn more about them. When done, click the next button to continue. Other common vertebrate pests include rabbits, rats, and mice. To learn more about these and other vertebrate pests, visit the UC IPM website resource page.

Ground Squirrels (Slide Layer)

Ground Squirrels

These rodents are frequently found above ground near their burrow sites on warm, sunny days. Ground squirrels are active during the daylight hours and have both winter and summer hibernation periods.

Ground squirrels can cause significant feeding or chewing damage on landscape plants.
and plastic irrigation pipe, and cause burrow-building damage. Also, they can cause serious damage to earthen structures like dams and levees.

Strategies to control ground squirrels include:

- Removing preferred habitat sites
- Frequent tillage or mowing
- Trapping
- Burrow fumigants
- Poison grain baits

**Gophers (Slide Layer)**

Gophers

While gophers occasionally feed on plants near their burrow entrances, they are less likely to be seen above ground than are squirrels. They live and feed in extensive burrow systems. Except for females with young, there is rarely more than one gopher per burrow system. Also, they create crescent or c-shaped mounds which are usually plugged and made from the soil that is pushed to the surface during burrow construction.

Gophers feed primarily underground and can cause significant damage to the underground portions of landscape plants. They also cause chewing damage to underground cables or plastic waterlines and, burrow-building damage.

Control strategies for gophers include:

- Gassing with carbon monoxide
- Underground fencing
- Trapping
- Poison grain baits
Moles (Slide Layer)

Vertebrates: Moles

PEST DAMAGE:
Burrowing and mound-building activity can cause significant damage to turf areas or landscaped plantings.

ABOUT:
- Feed on earthworms and insects
- Live and feed in extensive burrow systems
- Active day and night and do not hibernate
- Create volcano-shaped mounds that are smaller than from a gopher

CONTROL STRATEGIES:
- Underground fencing
- Trapping
- Controlling the insect infestation
*Flooding and fumigation are often ineffective strategies

Moles
Smaller than gophers, moles feed on earthworms and underground insects. They’re rarely seen above ground and live and feed in extensive burrow systems. Moles are active during both the day and night, and they do not hibernate. Moles create volcano-shaped mounds of cloddy soil and may also produce raised ridges of soil to connect their mounds that they use for shallow feeding burrows. These mounds are smaller than those created by gophers.

The burrowing and mound-building activity of moles can cause significant damage to turf areas or landscaped plantings.

Common strategies for controlling moles include:

- Underground fencing with wire mesh
- Trapping
- Controlling the insect infestation.

Flooding and burrow fumigation are often unsuccessful because of the depth of the burrow system and because moles are adept at quickly plugging burrows.
Voles (Slide Layer)

Voles are small field or meadow mice; they are not the same species as the house mouse. They are generally found in areas with dense grass cover and construct shallow burrow systems with narrow raceways under the grass. Voles are active during both the day and night, and they do not hibernate.

Voles can cause significant feeding damage to landscape plants and may cause chewing damage on the stems of landscape shrubs or young trees. They are often cyclical with high populations typically declining as food resources become scarce.

Control strategies for Voles include:

- Habitat modification which is often successful by mowing grass areas down to 2 inches or lower.
- Poison grain baits which can be effective when placed along the raceways.
- Trapping which may be effective but labor intensive, especially when populations are high.

Flooding and fumigation are often ineffective strategies because voles use shallow tunnel systems.
5.15 Mound Comparisons

Notes:

The following are some of the characteristics of each type of mound for the pests just discussed:

- Ground squirrels. Their burrow openings are about 4 inches in diameter and never plugged.
- Pocket gophers. The mound at their burrow entrance is usually crescent shaped and opening is plugged.
- Moles. The mound at the burrow opening is circular in shape and the burrow opening in center is plugged.
- Voles. Their runways connect numerous, shallow burrows in grassy or weedy areas. Also, the burrow openings are 1 1/2 to 2 inches in diameter.
5.16 Residential Industrial, and Institutional Vertebrates

Notes:

Birds, rats and mice, and bats are vertebrate pests most commonly associated with residential, industrial, and institutional settings. Click on each image to learn more. When done, click the next button to continue.

Birds (Slide Layer)

Birds

While most bird species are considered to be beneficial and desirable for society; cliff swallows, house sparrows, pigeons, starlings, and woodpeckers are often considered pest species. Most birds are protected by state or federal law or international treaty. This means that permits from either federal or state wildlife agencies may be needed for control activities.

Birds can cause problems with noise, droppings, the consumption or contamination of products, physical damage to structures, and airport safety.

Control Strategies:
- Eliminating food and water supplies
- Eliminating or modifying roosting or nesting sites
- Blocking entrances to buildings
- Use of noise and frightening devices

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Strategies for controlling birds may include:

- Eliminating food and water supplies
- Eliminating or modifying roosting or nesting sites
- Blocking entrances to buildings to prevent entrance
- Use of noise and frightening devices such as recorded bird distress calls and plastic owls.

**Rats & Mice (Slide Layer)**

**Rats & Mice**

Rats and mice can be effectively controlled through:

- Exclusion which is the most important control method
- Elimination of habitat sites
- Sanitation strategies to keep sites free from easily obtainable food sources
- Trapping
• and the use of rodenticides.

This method should be used with caution as they could cause harm to children, pets, and other wildlife.

**Bats (Slide Layer)**

**Vertebrates: Bats**

**PEST DAMAGE:**
Create nuisance problems related to noise, odors, and disease transmission from their feces and urine. They may also attract other pests such as cockroaches.

**ABOUT:**
- It is illegal to kill bats in CA without a permit
- There are no approved pesticides to kill or repel bats

**CONTROL STRATEGIES:**
- Exclusion
- Contact your local Vector Control office for removal

**Bats**

Bats that are nesting in structures create nuisance problems related to noise, odors, and disease transmission from their feces and urine. They may also attract other pests such as cockroaches.

It is illegal to kill bats in California unless you have a permit from the California Department of Fish and Wildlife. Also, there are no pesticides approved for use in California to kill or repel bats.

The best strategy to control bats is exclusion. Dead bats can still transmit serious human diseases and a bite from a live bat can transmit rabies, a disease that is usually fatal to humans. You should contact your local Vector Control office for instructions for removal.

Now let's test your knowledge on vertebrate pests.
5.17 Practice Exercise 16

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following species eat and contaminate stored produce and reproduce at a rapid rate?

- Birds
- Rats and mice
- Bats
- None of the above

Notes:

Which of the following species eat and contaminate stored produce and reproduce at a rapid rate?

- Birds
- Rats and mice
- Bats
- None of the above
5.18 Practice Exercise 17

(Multiple Choice, 10 points, unlimited attempts permitted)

Which rodent pest constructs narrow raceways under grass cover and shallow tunnel systems?

- Moles
- Voles
- Gophers
- Squirrels

Notes:

Which rodent pest constructs narrow raceways under grass cover and shallow tunnel systems?

- Moles
- Voles
- Gophers
- Squirrels
5.19 Practice Exercise 18

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following species should not be handled dead or alive?

- Birds
- Rats and mice
- Bats
- None of the above

Notes:

Which of the following species should not be handled dead or alive?

- Birds
- Rats and mice
- Bats
- None of the above
5.20 Plant Diseases

Notes:

The majority of plant diseases are caused by bacteria, fungi, or viruses. Of the three types, fungal pathogens cause the majority of plant diseases. This section will review basic information about plant disease management.
5.21 *Plant Disease Triangle*

Notes:

There’s a close relationship between plant diseases and the three following factors:

- The pathogen.
- A favorable environment.
- A susceptible plant host.

This relationship is often referred to as the *Plant Disease Triangle*.

Reducing or eliminating any of the 3 factors of the triangle will tend to suppress the plant disease.
5.22 Fungal Plant Diseases

Notes:

There are lots of different types of fungi; most of them are not plant pathogens.

Fungal plant diseases:

• Are multicellular.
• Are made of thread-like materials known as hyphae that grows on or in the host.
• Are parasites.
• Produce spores or similar reproductive structures that can survive for years apart from host plants.
• Do best in warm, moist environments, but there are exceptions.
• Can spread by wind, people, animals, or on equipment.

Fungal Symptoms

Fungal-caused plant diseases can be separated into two groups; root and stem-infecting and foliar-infecting.

Some root and stem-infecting diseases invade the plant roots through the soil while others invade the stem by insect vectors or human activities.

Foliar-Infecting can infect foliage, stem, flowers, or fruit tissue. They destroy plant tissue via parasitic activity.

Symptoms of root and stem-infecting diseases include:

• Wilted leaves
• Leaf drop
• Darkened leaf veins
• Dead branches (flagging)
• Reduced new growth
• Dark streaks in wood

Foliar-infecting disease symptoms include:
• Spotting/d色ization
• Yellow/dying patches (turf)
• Premature leaf or fruit drop
• Stem death (flagging)

• Chemical and non-chemical strategies to control root and stem-infecting diseases include:
  • Proper plant species for site
  • Proper planting media
  • Proper drainage
  • Avoiding overwatering
  • Proper cultural care
  • Fungicides
  • Sanitation
  • Planting clean stock

Foliar-infecting control strategies include:
• Proper cultural care
• Planting resistant varieties
• Avoiding leaf wetting
• Leaf pulling
• Sanitation
• and the use of Fungicides as a preventative measure
5.23 Bacterial Plant Diseases

Bacterial plant diseases are simple, microscopic, single-celled microbes. They reproduce by simple cell division and they thrive in warm, moist environments. Bacterial plant diseases often require wounds or other openings to affect their hosts. They don’t overwinter apart from their hosts like fungi because they need closer contact with their hosts to survive.

They can spread during rainy or windy weather, by insects, or on equipment like pruning shears.

Symptoms of bacterial plant diseases include:
- Wilted leaves or flowers
- Leaf spotting
- Open wounds (cankers)
- Bacterial ooze
- Bent stem-tips

Bacterial plant diseases can be controlled by:
- Planting resistant varieties
- Proper cultural care
- Reducing plant wounding
- and in rare cases, the use of antibiotics.
5.24 Viral Plant Diseases

Notes:

Viral Plant Diseases are sub-microscopic particles of nucleic acid and protein which can multiply only inside living cells. A virus cannot replicate itself outside of a host’s cellular nucleus.

They disrupt normal cell functions and can affect the production of chlorophyll and starch.

Also, viral plant diseases rarely kill their host plants and many plant viruses are moved around (vectored) by insects, and/or human activity.

Virus diseases are recognized by several characteristic symptoms:

• Light and dark green mosaic patterns
• Mottles
• Ringspots
• Distortion of leaves and other plant parts
• Vein clearing and vein enations are some of the symptoms seen in the leaves.
• Deformed, yellow, stunted growth
• or overall stunting are other possible symptoms.

Control of virus diseases is a matter of prevention since no pesticide options are available.

• Purchasing clean (certified) plants
• Cleaning clippers and other tools
• Planting resistant varieties
• Removing infected plants
• Controlling insect vectors are all strategies to control viral diseases.
5.25 Practice Exercise 19

(Multiple Choice, 10 points, unlimited attempts permitted)

Most plant diseases are caused by what?

- Viruses
- Bacteria
- Fungi
- None of the above

Notes:

Most plant diseases are caused by what?

- Viruses
- Bacteria
- Fungi
- None of the above
5.26 Practice Exercise 20

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following are common control strategies for bacterial diseases?

- Heavy fertilization
- Good cultural practices
- Fungicides
- All of the above

Notes:

Which of the following are common control strategies for bacterial diseases?

- Heavy fertilization
- Good cultural practices
- Fungicides
- All of the above
5.27 Practice Exercise 21

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following is true about viruses?

- They frequently kill their hosts
- They can be seen with a microscope
- They can only multiply within living cells
- All of the above

Notes:

Which of the following is true about viruses?

- They frequently kill their hosts
- They can be seen with a microscope
- They can only multiply within living cells
- All of the above
5.28 Invertebrates

Invertebrates are animals that lack backbones. Pest invertebrates affect agricultural, landscape, and turf plants in many different ways. Typically, invertebrate pests in a landscape feed on growing plants. Some transmit disease organisms to the plants.
5.29 Anthropods and Non-Anthropods

Notes:

One of the most important invertebrate groups is the arthropods. Arthropods share a number of important characteristics including jointed appendages, a segmented body, and an exoskeleton that is periodically shed during growth.

The most important arthropod pest groups include insects, spiders, and mites.

Non-arthropod pest groups include snails, slugs, and nematodes.
5.30 Insects

Notes:

All mature insect species have three body parts (a head, thorax, and abdomen) and three pairs of legs.

Metamorphosis refers to the changes in body structure that many insect species go through. Complete metamorphosis and incomplete metamorphosis are two growth types of insects where the body form of insects changes during their lifecycle. Both complete and incomplete metamorphosis extend from the egg stage to the adult stage.

Complete metamorphosis consists of four stages: egg, larva, pupa, and adult.

The larval life stage is the most significant in terms of growth rate. Also, it is during this life stage where the most damage to crops and landscape plants occurs. Control during this stage is critical for successful pest management.

The following groups develop using complete metamorphosis:

• Ants
• Bees and Wasps
• Mosquitos
• Butterflies and moths
• Fleas
• Flies
Incomplete metamorphosis consists of three stages: egg, nymph, and adult. Nymphs often resemble the adult, but are smaller, lack wings, and may have different coloration. Both the nymph and adult life stages are very destructive to crops and landscape plants.

The following groups develop using incomplete metamorphosis:

- Aphids, scales, and whiteflies
- Cockroaches
- Crickets and grasshoppers
- Earwigs
- Leafhoppers
- and termites.
5.31 Spiders and Mites

Notes:

Spiders and mites have two body parts and 4 pairs of legs.

Spiders are beneficial in agricultural and landscape settings because they’re predators of a wide variety of pest species. However, in residential or similar indoor settings spiders may be considered pests.

Pest mites can cause considerable damage to crop and landscape plants by feeding damage. Mite damage symptoms may include:

- Small light-colored spots
- Yellowing of foliage
- Reddish-brown discoloration that may be rough to the touch
- Webbing
5.32 Nematodes

Notes:

Nematodes are microscopic, eel-shaped roundworms. There are thousands of different types of nematodes.

Some facts about plant pest nematodes include:

- They live in the soil and feed within or on plant roots.
- Some are pests and other species are beneficial
- They rarely kill their host plants, but are parasites that can substantially reduce crop yields or cause aesthetic damage to landscape plants.

Soil fumigants are frequently used as a control strategy in crop production, but less frequently used in landscape settings.
5.33 Practice Exercise 22

(Multiple Choice, 10 points, unlimited attempts permitted)

At what life stage does the majority of plant damage occur with 4-stage metamorphosis insect pests?

- Larval
- Egg
- Pupal
- Adult

Notes:

At what life stage does the majority of plant damage occur with 4-stage metamorphosis insect pests?

- Larval
- Egg
- Pupal
- Adult
5.34 Practice Exercise 23

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following are true about insects?

- They have 4 pairs of legs
- They have 2 body parts
- They have 3 body parts
- They do not metamorphosize

Notes:

Which of the following are true about insects?

- They have 4 pairs of legs
- They have 2 body parts
- They have 3 body parts
- They do not metamorphosize
5.35 Practice Exercise 24

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following statements are true about mites?

- They are not insects
- They are related to spiders
- They have 4 pairs of legs
- All of the above are true

Notes:

Which of the following statements are true about mites?

- They are not insects
- They are related to spiders
- They have 4 pairs of legs
- All of the above are true
5.36 Section 4 Summary

Summary
✓ Weed control
✓ Vertebrate control
✓ Plant disease control
✓ Invertebrate control

Notes:

This completes this section.
You should now be able to apply pest management principles to:

• Weed control
• Vertebrate control
• Plant disease control
• Invertebrate control
6. Hazards

6.1 Module 5 Objectives

Hazard: Human and Environmental

By the end of this module you should be able to:

• Identify human risk factors in the use of pesticides
• Identify the key factors that contribute to pesticide environmental safety concerns

Notes:

Hazard: Human and Environmental

For all pesticides to be effective against the pests they are intended to control, they must be biologically active, or toxic. Because pesticides are toxic, they are also potentially hazardous to humans, animals, other organisms, and the environment.

By the end of this module you should be able to:

• Identify human risk factors in the use of pesticides
• Identify the key factors that contribute to pesticide environmental safety concerns

Let’s begin with human hazards.
6.2 Human Hazards

Notes:

The risk a pesticide poses to people depends on two factors: toxicity and exposure. This can be described using the formula: \( \text{Risk} = \text{Toxicity} \times \text{Exposure} \).

In order to reduce pesticide risk, you must reduce either toxicity or exposure. Unfortunately, there’s no way to reduce a pesticide’s toxicity. However, you can reduce exposure!

Reducing exposure is the most effective way to reduce the risks associated with using pesticides.
6.3 Pesticide Residues

Notes:

Once you understand where pesticides and their residues occur, it is easier to discuss the health hazards, routes for pesticide entry into the body, and symptoms that may result from exposure to pesticides.

Pesticide residues may be found in or on:

• treated surfaces, such as plants and soil,

• tractors, sprayers, and other application equipment,

• work clothing, shoes, and PPE (personal protective equipment), especially gloves,

• pesticide mixing and loading areas,

• air that drifts from a nearby pesticide application,

• irrigation water as a result of pesticide runoff or chemigation, and

• the air inside pesticide storage areas, pesticide containers, and shelves

Now let's take a look at the four routes of pesticide exposure and situations that can lead to increase risk.
6.4 Human Hazards

Notes:

There are four routes of pesticide exposure:

1. Dermal or through the skin.
2. Oral or by ingestion.
3. Inhalation or by breathing it in.
4. Ocular or by the pesticide entering the eyes.

Dermal (Slide Layer)

Dermal Exposure

The majority of pesticide exposures occur via the dermal route. Dermal exposure occurs by:
- Not washing hands after handling pesticides
- Splashing or spraying on to unprotected skin
- Wearing pesticide-contaminated clothing
- Wearing inadequate PPE
- Touching, rubbing, or handling pesticide-treated surfaces, or foliage

**Oral (Slide Layer)**

**Human Hazards: Routes of Exposure**

- Not washing hands before eating, drinking, or smoking
- Splashing into mouth through carelessness or accident
- Eating produce with pesticide residues

**Oral Exposure**

Oral pesticide exposure is caused by:

- Not washing hands before eating, drinking or smoking
- Splashing pesticides into the mouth through carelessness or accident
- Eating produce with pesticide residues
Inhalation (Slide Layer)

Inhalation Exposure

Inhalation exposure is caused by:

• Breathing pesticides in enclosed or poorly ventilated spaces

• Breathing vapors, dust, or mist while handling pesticides without appropriate PPE

• Using an old or inadequate filter, cartridge, or canister in respirator.

• Poorly fitted respirator. Check with your campus’ respiratory protection program for fit test information.
Ocular (Slide Layer)

Human Hazards: Routes of Exposure

Ocular Exposure

Ocular exposure is when pesticides come in contact with the eyes. This type of exposure is caused by:

- Splashing or accidentally spraying pesticides in the eyes
- Mixing or applying pesticides without eye protection
- Rubbing the eyes or forehead with contaminated gloves or hands.
6.5 Routine Decontamination

Routine decontamination procedures can minimize fieldworker and handler exposure to pesticides and their residues. Routine decontamination procedures include the following:

- Employees should not use irrigation water to wash their hands as it may contain pesticides or their residues.
- Employees should use the decontamination supplies to wash their hands before eating, drinking, smoking, chewing gum or tobacco, or using the restroom while at work.
- Before changing into clean clothes, employees should shower or bathe with soap, shampooing their hair immediately after working with pesticides, or in areas where pesticides have been used.
As mentioned earlier, you may come into contact with pesticide residues that remain on work clothing or PPE. There are some ways for you to reduce your risk to exposure and the subsequent risk to family members by taking the following preventative actions:

- wear work clothing that protects your body,
- do not take used or contaminated PPE home at the end of the workday (if unavoidable, then the PPE should be stored in a sealed container outside of the home),
- wear work clothes only once before washing them,
- keep work clothes that may contain residues separate from other clothing by placing them in a clean plastic bag, and
- wash work clothes separately from other clothing
Routine Decontamination - Protecting Family Members (Slide Layer)

<table>
<thead>
<tr>
<th>Routine Decontamination: Protecting Family Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional steps to help reduce the likelihood of exposing to your family members to pesticides</td>
</tr>
<tr>
<td>Keep all children and non-working family members away from pesticide-treated areas</td>
</tr>
<tr>
<td>Never take pesticides or pesticide containers home</td>
</tr>
<tr>
<td>Never pour pesticides from their original containers into food or beverage containers</td>
</tr>
<tr>
<td>Remove work boots or shoes before entering homes</td>
</tr>
<tr>
<td>Remove work clothes and shower with soap and water before physical contact</td>
</tr>
</tbody>
</table>

The following are additional steps to help reduce the likelihood of exposing your family members to pesticides used at work:

- Keep all children and non-working family members away from pesticide-treated areas. Even if children do not come into direct contact with pesticides, they may still be at risk for exposure to residues if they play in or near treated areas or irrigation ditches, live in labor camps, or play with empty pesticide containers.

- Never take pesticides or pesticide containers home. Even empty and rinsed pesticide containers can contain pesticide residues.

- Never pour pesticides from their original containers into food or beverage containers. This action is illegal and dangerous. An unsuspecting person may mistake the pesticide for something edible and swallow it.

- Remove work boots or shoes before entering homes.

- Remove work clothes and shower with soap and water before physical contact with children or family members.
6.6 Signs & Symptoms

**Notes:**

Short-term pesticide poisoning symptoms can be mild, moderate, or severe. Poisoning symptoms depend on the type of pesticide, the amount of pesticide, the way you were exposed, and your physical characteristics.

If an employee feels sick while working in a pesticide-treated area or handling a pesticide, common pesticide symptoms can mimic those of a cold, the flu, heat stress, food poisoning, or other ailments; this may present challenges when determining if the symptoms are related to pesticide exposure. For this reason, it is important to assist the employee in seeking medical attention immediately for proper treatment.

Let's take a look at some of the symptoms of short-term pesticide poisoning.
**6.7 Start**

**Signs and Symptoms: Activity**

**Instructions:**
Review each flash card and determine its correct symptom level by click on it’s bucket.

**Notes:**

**Instructions:**
Review each flash card and determine its correct symptom level by click on it’s bucket. An “X” will indicate the incorrect answer and a checkmark will indicate the correct one.

Also, you can access assistance by clicking on the Question Mark Icon throughout the activity.

Now, click the start button to begin the activity when you’re ready.
6.8 Cards

Notes:

• Example #1: Nose, eye, throat, or skin irritation
• Example #2: Violent shaking
• Example #3: Coughing
• Example #4: Difficulty breathing
• Example #5: Diarrhea
• Example #6: Vomiting
• Example #7: Trembling
• Example #8: Chest pain
• Example #9: Excessive sweating
• Example #10: Excessive phlegm or mucus
• Example #11: Headache
• Example #12: Stomach ache

Click “continue” to move to the next section of this course.
As we’ve just seen,

**Examples of mild poisoning symptoms include:**

- Irritation in the nose, throat, eyes, or skin
- Headache
- Dizziness
- Nausea
- Diarrhea
- Excessive sweating
- Feeling weak and tired

**Examples of moderate poisoning symptoms include:**

- Vomiting
- Excessive salivating
- Coughing
- Stomach ache
- Blurry vision
- Rapid blinking
- Trembling
Examples of severe poisoning symptoms include:

- Difficulty breathing
- Pain in chest
- Excessive phlegm or mucus
- Violent shaking
- Fainting
- Death

Signs & Symptoms - Acute Health Effects (Slide Layer)

Signs and Symptoms: Acute Health Effects

*When the effects of pesticide are noticeable in seconds or hours, they are called "acute".*

Delayed effects are when the it takes several hours (24-48 hours) for acute symptoms to take effect

Sensitization to pesticides is not the same as overexposure and presents itself as a skin or respiratory problem over time

Acute Health Effects

Most short-term poisoning are due to errors or oversights. When the effects of pesticide noticeable in seconds or hours, they are called "acute".

In some cases, the effects may take several hours (24-48 hours) for acute symptoms to take effect. This is a delayed or delayed effect.

You may not react to pesticides right away but over time may feel an allergic reaction which may take months or years. This sensitivity to pesticides is presented as skin problems or respiratory problems. Sensitization to pesticides is not the same as overexposure to pesticides. It is important that workers know the difference.
Chronic Health Effects

Pesticide exposure can be hazardous for pregnant women and may result in miscarriage or harm to an unborn child. Also, while it’s common for symptoms of pesticide exposure to occur immediately following an incident. Less often, chronic symptoms may occur.

Chronic health effects are illnesses or injuries that persist for a long period of time (months to years). These chronic illnesses or injuries may result from a single exposure incident and occur immediately, such as blindness from a chemical spill to the eyes—or, they may appear later in life—days, weeks, or years, after repeat, low levels of overlooked exposure to a pesticide, such as lung disease, nerve damage, or cancer. These long-lasting symptoms that do not appear until days, weeks, or years later are delayed chronic health effects.
6.10 Environmental Hazards

Even when pesticides are used carefully, they have the potential to cause unwanted impacts on surface water, ground water, air, soil, and domestic animals and wildlife.

These potential environmental impacts are largely based on how and where the pesticide is applied and the following factors.
6.11 Factors

**Factors**

Water solubility, soil adsorption, environmental persistence, and volatility are all factors affecting environmental impacts. Click on each image to learn more. When done, click the next button to continue.

**Water Solubility (Slide Layer)**

Water solubility. The more soluble a pesticide is, the more likely it will move with surface water or move into groundwater.

*Water Solubility.* The more soluble a pesticide is, the more likely it will move with surface water or move into groundwater.
Soil Adsorption (Slide Layer)

Soil Adsorption. Adsorption is the process whereby a pesticide binds to soil particles. Pesticides that are weakly adsorbed to soil are more likely to move offshore into surface or groundwater.

Environmental Persistence (Slide Layer)

Environmental Persistence. Pesticides that break down slowly in soil or water have the potential to cause greater environmental effects compared to less persistent pesticides.
Volatile pesticides are more likely to move offsite as vapors, especially when air temperatures are warm.
6.12 Drift

Notes:

According to DPR regulations, no pesticide application can be made if there’s the potential to:

• Create a human health hazard
• Damage non-target crops, animals, or property
• Contaminate non-target public or private property
• Contaminate people not involved in the application

The Application Exclusion Zone (AEZ) establishes a safety perimeter for workers and the public not involved in the pesticide application.
Pesticide drift is influenced by several factors including:

**Wind speed and direction.**
Wind speeds between 2-8 miles-per-hour are ideal. No wind is not ideal because of the possibility of inversion and wind conditions of 10 miles-per-hour or greater will cause pesticides to drift too far. Both of these situations should be avoided for pesticide applications.

**Droplet size.**
Larger droplets are less likely to drift.

**Release height.**
- Spray droplets that are released closer to the target site are less likely to drift.
Drift Strategies (Slide Layer)

The most effective ways to prevent pesticide drift problems include:

- Avoid spraying when wind speeds are excessive
- Use nozzles that produce larger droplets
- Decrease tank pressure
- Add drift control agents to the spray tank to make droplets larger and heavier
- Be mindful of warm weather because increased evaporation will cause pesticide spray droplets to become smaller
- Use of buffer zones.
6.13 Volatilization

Volatilization occurs when pesticides evaporate from treated foliage into the air. Some pesticides can volatilize rapidly when air temperatures are high. For example, the ester formulation of the herbicide “Triclopyr” can volatilize when air temperatures exceed 85 degrees Fahrenheit.
6.14 Temperature Inversions

Notes:

Under typical weather conditions, warmer air is closer to the ground and air gets cooler as you go up in elevation.

Temperature Inversions 2 (Slide Layer)

A temperature inversion occurs when the typical situation is reversed and the cooler air is near the ground, and a layer of warmer air, like a lid, lays above it.
Temperature Inversions 3 (Slide Layer)

In general, a temperature inversion is formed:
- At night, before dawn
- When the weather is cold
- When there is no cloud cover
- When wind speeds are less than 3 miles per hour

The lack of air mixing and generally stagnant nature of the air mass prevent the very small spray droplets from falling to the ground which can result in the formation of a potentially large pesticide “cloud” that can move offsite and contaminate non-target sites.
6.15 Surface Water Contamination

Surface water contamination occurs when pesticides are applied directly to, or drift onto, impervious surfaces and is then washed into storm drains soon after the application by rainfall or irrigation.

Eventually, these pesticide residues may be transported into creeks where they pose a risk to aquatic life.

Ways to protect surface water areas from pesticide contamination include:

- Limiting the use of certain pesticides during the winter season
- Not applying pesticides within 24 hours of rainfall or irrigation
- Limiting application to sites that don’t produce run-off that can flow to nearby water bodies
- Requiring run-off water to be held on-site to allow for pesticide breakdown
6.16 Groundwater Contamination

Notes:

Pesticides can enter groundwater two ways, through direct leaching down through the soil profile, and through soil openings.

A pesticide's tendency to contaminate groundwater is based on water-solubility, soil-adsorption potential, and persistence.

Groundwater Contamination DPR (Slide Layer)

Pesticides that are known and suspected groundwater contaminants are regulated by DPR in California.

Pre-emergent herbicides have the greatest tendency to become groundwater contaminants
6.17 Practice Exercise 25

(Multiple Choice, 10 points, unlimited attempts permitted)

What's the most common route of pesticide exposure?

- Dermal
- Ocular
- Inhalation
- Oral Ingestion

Notes:

What's the most common route of pesticide exposure?
6.18 Practice Exercise 26

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following conditions is ideal for spray applications of pesticides?

- Wind speeds greater than 10 mph
- Wind speeds between 2-8 mph
- No wind speed
- None of the above

Notes:

Which of the following conditions is ideal for spray applications of pesticides?

- Wind speeds greater than 10 mph
- Wind speeds between 2-8 mph
- No wind speed
- None of the above
6.19 Practice Exercise 27

(Multiple Choice, 10 points, unlimited attempts permitted)

Which of the following is the most effective way to reduce the risks associated with using pesticides?

- Reduce pesticide toxicity
- Reduce pesticide exposure
- Reduce pesticide toxicity and pesticide exposure

Notes:

Which of the following is the most effective way to reduce the risks associated with using pesticides?

- Reduce pesticide toxicity
- Reduce pesticide exposure
- Reduce pesticide toxicity and pesticide exposure
6.20 Section 5 Summary

Summary

✓ Identify human risk factors in the use of pesticides
✓ Identify the key factors that contribute to pesticide environmental safety concerns

Notes:

This completes this section.
You should now be able to:
• Identify human risk factors in the use of pesticides
• Identify the key factors that contribute to pesticide environmental safety concerns
7. Protection

7.1 Module 6 Objectives

Notes:

Worker Protection

Agricultural Worker Protection Standard (WPS) aims to reduce pesticide poisonings and injuries among agricultural workers and pesticide handlers.

By the end of this module you should be able to:

• Describe strategies to protect fieldworkers while using pesticides
• Describe strategies to protect students, staff, and the public when using pesticides
• Demonstrate proficiency in determining the needed signage for a pesticide intervention
• Identify the correct procedures for cleanup, storage, and disposal of pesticides
7.2 Protecting Fieldworkers

Agricultural workers maintain crops and tend livestock. Although fieldworkers may be exposed to pesticides applied on crops or plants, they can be protected from pesticide exposure by:

- Not allowing workers to enter areas where pesticides are being applied or have been applied
- Not applying pesticides while workers are in the surrounding area. For example within a 1/4 mile of the treated area.
- Providing oral and written warning notices to workers that will be within 1/4 mile of a pesticide treatment area
7.3 Restricted Entry Intervals

Notes:

The restricted-entry interval (REI) is the time immediately after a pesticide application when entry into the treated area is restricted.

Restricted Entry Intervals-DPR (Slide Layer)

DPR regulations prevent fieldworkers from entering pesticide-treated areas until the REI expires. An employer cannot direct a fieldworker to enter a field if the field posting sign is posted even when the REI has expired. The REI is listed on the pesticide labeling under the heading "Agricultural Use Requirements" in the "Directions for Use" section of the pesticide labeling, or next to the crop or application method to which it applies.
Some pesticides have one REI, such as 4 hours, for all crops and uses. Other pesticides have different REIs depending on the crop, method of application, or the post-application activity to be performed. When two or more pesticides are applied at the same time and have different REIs, the longer REI must be followed.

**Restricted Entry - Early Entry (Slide Layer)**

- **An early-entry employee** is a worker who enters an area after the pesticide application is complete but before the REI has expired. **Early-entry** only after employee has been trained as an early entry employee to perform a necessary work task.

The early entry employee training must be provided **BEFORE** directing them to enter an area before the REI expires and include the following:
PPE specific to early entry and understand possible limitations of PPE and first aid,
Additional information about the pesticide product such as how the product can make you sick, heat stress, and decontamination supplies.

Also, agricultural and non-agricultural pesticide handlers and early-entry employees must be at least 18 years old.
### 7.4 Field Posting Signs

<table>
<thead>
<tr>
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<th>ONE</th>
<th>TWO</th>
<th>THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Required by pesticide labeling</td>
<td>Pesticides are used within an enclosed space</td>
<td>Re-entry period is 48 hours or longer</td>
</tr>
</tbody>
</table>

**Notes:**

According to DPR, field posting signs must be posted when:

- Product labels require it.
- Pesticides are used within an enclosed space (unless entry can be prevented)
- Pesticide labels require a re-entry period of 48 hours or longer

However, in almost all cases, UC policy requires that posting signs be posted around areas where pesticides have been applied and may have more stringent notification guidelines.
Field Posting Signs: Federal vs. State

The federal posting sign depicts the picture of angry ranger with a hand telling not to enter. This signage is not allowed to be used in the state of California. The allowable posting sign for California has the Skull & Crossbones, and the English and Spanish warning.

Field Posting Signs: Posting Rules

Some important things to remember about field posting include:

- The signs must be posted at the usual points of entry or at the field corners
- If the field is next to a road, the signs must be posted every 600 feet
The signs must be legible for the entire reentry interval

The word “Danger” and two skull and crossbones symbols must be visible from 25 feet

The signs must be in English and any other language spoken by the majority of workers

The sign must be posted before the application begins, but no earlier than 24 hours before the application

The signs cannot be removed during the reentry interval

The signs must be removed within 3 days after the end of the reentry interval.

Non-Farming (Slide Layer)

Posting signs for Non-Farming Areas

Posting signs may also be required for non-farming public areas. In these situations, posting is required when pesticide product labels have re-entry periods of 24 hours or longer for non-farming settings and the public area cannot be locked to prevent entry.

Non-farming posting signs must be removed within 24 hours of the expiration of the re-entry period.
Field Posting Sign Information (Slide Layer)

Field Posting Signs: **Information to Include**

<table>
<thead>
<tr>
<th>POSTING SIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Product name and active ingredient</td>
</tr>
<tr>
<td>2. EPA Registration Number</td>
</tr>
<tr>
<td>3. Target Pest</td>
</tr>
<tr>
<td>4. Date of proposed Pesticide use</td>
</tr>
<tr>
<td>5. Area to be treated</td>
</tr>
<tr>
<td>6. Signal word indicating the toxicity category of the Pesticide</td>
</tr>
<tr>
<td>7. The Systemwide Pesticide Oversight Committee or SPOC, hazard tier rating of the Pesticide (Click here for copy)</td>
</tr>
<tr>
<td>8. UC contact details for more information</td>
</tr>
<tr>
<td>9. The location of additional information available from the IPMC</td>
</tr>
</tbody>
</table>

Posting sign information

Posting signs should include the following information:

1. Product name and active ingredient
2. EPA Registration Number
3. Target Pest
4. Date of proposed Pesticide use
5. Area to be treated
6. Signal word indicating the toxicity category of the Pesticide
7. The Systemwide Pesticide Oversight Committee or SPOC, hazard tier rating of the Pesticide
8. University of California contact details for more information

and 9. The location of additional information available from the Integrated Pest Management Committee or IPMC.
K-12 & Childcare Centers

DPR's School IPM Program promotes the adoption of integrated pest management in schools and childcare centers and provides support for Healthy Schools Act compliance. Some specific requirements for K-12 schools and childcare centers include:

- Posting signs in the area where a pesticide will be applied, at least 24 hours before and 72 hours after the application
- Sending an annual notification to all parents, guardians, and staff of all pesticides expected to be applied during the year
- Giving parents, guardians, and staff the opportunity to register to be notified 72 hours in advance of individual pesticide applications
- Keeping records of pesticide applications, and file these records for at least 4 years
- Submitting annual pesticide use reports to DPR by January 30 for the previous year's applications. You only report pesticide use by school personnel
### 7.5 Protecting the Public

You can protect the public during non-farming pesticide applications by:

- Not making pesticide applications when people are present in the treatment or surrounding area
- Notifying people who live or work in the area of the planned application
- Preventing off-target pesticide movement by carefully observing site conditions such as the weather.

**Notes:**
### 7.6 Proper Storage

**Notes:**

Pesticides are poisonous and must be stored, moved, and disposed of with caution and concern for others.

Also, it is illegal to leave a pesticide container unattended. It must either be under the immediate control of a responsible person or be placed in a locked enclosure.

All pesticides must be in containers that are properly labeled. Storage areas with Category I & II pesticides (signal words "Danger" or "Warning"), must have signs in English & Spanish, and be legible to view from a distance of 25 ft.

Finally, never store a pesticide in any food or drink container, (event mason jars or ziplock bags), or with food, animal feed, or pesticide PPE.
7.7 Transporting Pesticides

**Transporting Pesticides**

- **NEVER CARRY PESTICIDES IN THE PASSENGER COMPARTMENT OF A VEHICLE**
- **CAREFULLY SECURE PESTICIDE CONTAINERS**
- **NEVER LEAVE PESTICIDES UNATTENDED IN AN OPEN TRUCK BED**
- **TRANSPORTING PESTICIDES IS A HANDLING ACTIVITY WHICH MEANS PROPER PPE IS REQUIRED.**

**Notes:**

When transporting pesticides remember to:

- Never carry pesticides in the passenger compartment of a vehicle
- Carefully secure pesticide containers so they're not punctured or damaged during transport
- Never leave pesticides unattended in an open truck bed. They must be kept in a locked enclosure if unattended!

Finally, remember that transporting pesticides is a handling activity which means proper PPE is required.
7.8 Cleanup and Disposal

Notes:

When cleaning and disposing of pesticides you should:

- Make sure that you wear the proper personal protective equipment
- Clean equipment and PPE after each use. Disposable PPE should be discarded after the application.
- Clean up pesticide spills immediately
- Properly dispose of empty containers
Equipment

Clean your equipment after each use to avoid contamination and assist in keeping it properly maintained. The following are some basic maintenance requirements:

- Use clean water
- Use and maintain screens to remove foreign materials
- **Clean plugged nozzles using a toothpick, small brush, or compressed air**
- Flush and clean the system after use. It is best to do this at the application site.
PPE (Slide Layer)

**Cleanup and Disposal: PPE**

- Wash gloves with soap and water immediately after use.
- Wash all of your chemical-resistant PPE with a soft brush, and soap and water.
- Store it in clean plastic bags.
- Inspected for wear and damage daily.

**PPE that is damaged or heavily contaminated SHOULD NOT be reused**

**Personal Protective Equipment (PPE)**

PPE that is damaged or contaminated with pesticide residue cannot provide adequate protection. Here are some important factors related to cleaning and maintaining PPE:

- Wash gloves with soap and water immediately after you've finished handling pesticides. A soft scrub brush will help remove any residues.
- Wash all of your chemical-resistant PPE with a soft brush, and soap and water.
- After your PPE has air-dried, store it in clean plastic bags.
- Also, PPE should be inspected for wear and damage on a daily basis. PPE that is damaged or heavily contaminated should not be reused.


7.9 Cleanup and Disposal

Notes:

Handling Dry Pesticides.

DPR does not have specific regulations regarding the disposal of containers that have held dry pesticides. You should follow label instructions and DPR's guidelines for bag disposal. The pesticide can be shaken onto a tarp or other container and then applied to a site on the label. Don't shake it into a trash can or the street.

Here is a summary of DPR's bag disposal guidelines:

• Open and empty the bag as completely as possible for at least 5 seconds
• Pour out any remaining contents for another 5 seconds by straightening the seams so that the bag is in its original, “flat” condition.
• Shake the bag twice and hold for another 5 seconds.
Liquid Containers

DPR regulations require that liquid pesticide containers that have held 28 gallons or less, must be triple rinsed. Triple rinsed pesticide containers are not hazardous waste and can be placed in a dumpster or other trash management receptacle.

Click the video icon to watch a short video on how to perform the triple rinse procedure. When done, click the next button to continue.
When I prepare a mixture, I always wear my personal protective equipment and I verify that it is in good condition.

I always make sure that my sprayer is calibrated and check for damages or leaks.

When the pesticide is over, I never forget to triple rinse its empty container. The triple rinse helps me to use almost 100% of the product. In addition, it cleans the empty container making its handling safer.

An empty, properly triple rinse container is not a hazardous residue. It can be recycled into more than 30 approved and recommended uses. This way we give the rigid plastic a second chance to be useful again.

The triple rinse technique consists of adding clean water into the empty container to 1/4 full recap the container. And continuously shake it during 30 seconds. Carefully, drain the rinse water into the spray tank to avoid any spilling outside the sprayer. I repeat this step two more times. Once the third rinsing is done, I drain the water rinse into the spray tank to maximize its use. I turned the empty container upside-down and let it dry.

Remember that the triple rinse also includes puncturing the empty container. This guarantees no one will reuse it. This way, we promote its recycling.

It is very important to return all triple rinsed empty containers to the nearest collection center to have them disposed responsibly.

Now let’s check your knowledge on worker prevention.
7.10 Practice Exercise 28

(Multiple Choice, 10 points, unlimited attempts permitted)

Under what conditions must field posting signs be posted around fields where pesticides have been applied?

- Product labels require it
- Pesticides are used within an enclosed space (unless entry can be prevented)
- Pesticide labels require a re-entry period of 48 hours or longer
- All of the above

Notes:

Under what conditions must field posting signs be posted around fields where pesticides have been applied?

- Product labels require it
- Pesticides are used within an enclosed space (unless entry can be prevented)
- Pesticide labels require a re-entry period of 48 hours or longer
- All of the above
### 7.11 Practice Exercise 29

*(Multiple Choice, 10 points, unlimited attempts permitted)*

**Warning signs are required for storage areas for which pesticides?**

- Category I and II pesticides
- All pesticides
- Only restricted pesticides
- Only Category I pesticides

**Notes:**

**Warning signs are required for storage areas for which pesticides?**

- Category I and II pesticides
- All pesticides
- Only restricted pesticides
- Only Category I pesticides
7.12 Section 6 Summary

Summary

✓ Describe strategies to protect fieldworkers while using pesticides
✓ Describe strategies to protect students, staff, and the public when using pesticides
✓ Determine when and where pesticide signage is required
✓ Identify the correct procedures for cleanup, storage, and disposal

Notes:

This completes this section.

You should now be able to:

• Describe strategies to protect fieldworkers while using pesticides
• Describe strategies to protect students, staff, and the public when using pesticides
• Determine when and where pesticide signage is required
• Identify the correct procedures for cleanup, storage, and disposal of pesticides
8. Emergencies

8.1 Module 7 Objectives

**Emergency Response**

Accidents may occur while you are handling or applying pesticides, even if you are working under the most careful conditions.

By the end of this module you should be able to:

- Outline the correct procedure for handling a pesticide emergency
- Identify the appropriate agencies and individuals to contact when a pesticide emergency incident occurs.
8.2 Emergency Preparedness

Notes:

Whenever you use pesticides, carry with you the names and locations of nearby medical facilities capable of treating pesticide-related injuries. If an accident happens and you have been exposed, seek medical care. Be prepared to offer first aid to accident victims who get exposed to pesticides. Then, insist they receive prompt medical attention.
8.3 First Aid

Notes:

First aid is the help you give a person exposed to pesticides before they receive emergency help from a medical professional. However, first aid is not a substitute for professional medical care.

First Aid-Product Labeling (Slide Layer)

The Precautionary Statements and Statement of Practical Treatment sections of each pesticide label provides specific first aid information. The precautionary statements section describe the hazards to people and domestic animals, environmental hazards, and physical and chemical hazards. The statement of practical treatment section describes what to do in the event someone is accidentally exposed to the pesticide. Poisoning or exposure can occur if pesticides get onto your skin or into your
eyes, if you accidentally swallow them, or if you inhale vapors, dusts, or fumes. The type of exposure determines what first aid and medical treatments are required. Serious pesticide poisoning may stop breathing or cause convulsions, paralysis, skin burns, or blindness. Applying the proper first aid treatment for pesticide exposure may reduce the extent of injury and even save lives.

First Aid-Product Symptoms (Slide Layer)

Protect yourself when administering first aid to a person suffering from pesticide exposure. Avoid getting pesticides onto your skin. Do not inhale vapors. Do not enter a confined area to rescue a person overcome by toxic pesticide fumes unless you have the proper PPE, including respiratory equipment. Remember, the pesticide that affected the injured person can also injure you.
First Aid—Protecting Self (Slide Layer)

Pesticide Emergencies: First Aid

1. Avoid getting on skin
2. Do not inhale vapors
3. Don’t enter confined areas without proper equipment

Pesticides that AFFECT the injured can also INJURE you

In addition to providing first aid, speed in obtaining medical care often controls the extent of injury. Get professional medical care at once for anyone who was exposed to a highly toxic pesticide or who shows signs of pesticide poisoning.

First Aid—Action Steps (Slide Layer)

Pesticide Emergencies: First Aid

1. Call for an ambulance
2. Provide complete information

Call an ambulance or transport the injured person to a medical facility for treatment. Also, provide medical personnel with complete information about the pesticide suspected of causing the injury. The law requires that a copy of the pesticide label or data sheet be brought to the medical facility with the injured or ill employee.
8.4 Heat Illness-Symptoms

Heat illness symptoms can be confused with pesticide poisoning symptoms, or symptoms of a cold or flu. Recognize, prevent, and provide first aid treatment for heat-related illness. Heat illness symptoms can vary depending on severity.

Look for signs of heat illness in your co-workers as they may not realize something is wrong.
Symptoms of heat exhaustion (moderate heat illness) include:

- Dizziness
- Headache
- Sweaty skin
- Fast heart beat
- Nausea, vomiting
- Weakness
- Muscle cramps
Severe heat illness can cause a person to act confused, get angry easily, or behave strangely. Without prompt first aid, the person could die.

Symptoms of heat stroke (severe heat illness) include:

- Red, hot, dry skin
- High temperature
- Confusion
- Fainting
- Convulsions

If you suspect that someone has severe heat illness, it is very important to cool the person down as quickly as possible and then get the person to the doctor right away. To cool a person down, take off their outer clothing, pour water on them, fan them vigorously, and wrap them loosely in wet clothes or towels. Keep pouring water on and fanning the person while taking the person to the doctor.
8.5 Heat Illness-Prevention

**Notes:**

It is important to know the three easy steps to reduce the risk of heat illness: water, shade and rest. Click each step to learn more. When done, click the “next” button to continue.

**Water**

One of the most critical steps to prevent heat illness is to stay hydrated. Drinking plenty of fluids, such as water and sports drinks, can help replace fluids lost through sweating and prevent dehydration. It is important to drink fluids before, during, and after any physical activity, especially when the temperature is high.
Shade

Another crucial step in preventing heat illness is to stay cool. When the temperature rises, it is important to seek out cool, shaded areas or air-conditioned spaces to rest and recover. Wearing light, loose-fitting clothing and using fans or other cooling devices can also help keep the body cool and prevent heat-related illnesses.

Rest

Finally, it is important to take breaks and pace oneself when working in hot weather. It is recommended to take frequent rest breaks in cool or shaded areas, and to avoid over-exertion during the hottest parts of the day. This can
help prevent the body from becoming overheated and reduce the risk of heat-related illnesses.
By following these three simple steps - water, shade, and rest - it is possible to prevent heat illness and stay healthy during periods of hot weather.
8.6 Heat Illness-Prevention

Notes:

If the ambient temperature exceeds 80°F during daylight hours or 85°F during nighttime hours (sunset to sunrise), employees required to wear a chemical-resistant suit must not handle the pesticide(s) unless the pesticide is handled pursuant to subsections 6738.4(c) or (e); or employees use cooled chemical-resistant suits, or engineering controls, to reduce temperatures to an effective working environment of 80°F during daylight hours or 85°F during nighttime hours (sunset to sunrise).
8.7 Leaks and Spills

Notes:

When pesticide spills occur, there is a risk of injury to yourself or others, damage to property, and potential environmental damage. Even small spills can have significant consequences if not taken care of promptly and properly. California Code of Regulations 8 CCR 5194(h) requires employers to provide effective information and training on hazardous substances in the workplace, including appropriate work practices, emergency procedures, and protective equipment to be used. Any employee who works with chemicals or may be expected to respond to a spill should be trained on the procedures.
Preparing for Spills
Keep a spill cleanup kit readily available whenever you handle pesticides or their containers. Also maintain a spill kit at the business location where pesticides are mixed, loaded, and stored, and on each vehicle that transports pesticides. If a spill occurs, you will not have the time or the opportunity to find all of the items needed to respond to the situation.
Spill Kits (Slide Layer)

Pesticide Emergencies: Spill Kits

Spill Kits
Spill kits should contain the following:

- The PPE equipment that's appropriate for the pesticide
- Pads or other similar items for spill containment
- Absorbent material such as clay, sawdust, or kitty litter
- A broom and dustpan or shovel
- Liquid detergent
- A heavy plastic storage container for the spilled material
- Emergency phone numbers

Store spill kit items in a plastic container, replace items that have been used or discarded, and keep the contents clean and in working order until needed.
Assessing a Spill (Slide Layer)

Assessing a Spill

Before responding or beginning to clean up a pesticide spill, consider your own safety and the safety of others. Make sure you have the proper supplies and protective equipment. If the spill is too large for you to manage safely, evacuate the area, call 911 and wait for emergency personnel.

If the spilled material requires a respirator for normal use and you are trained and fitted for respirator, then you should wear the respirator for cleanup. If you are not trained and fit tested for using a respirator and the label states that respiratory protection is required, then evacuate the area immediately and call 911.
Procedures for Spill Cleanup

If spilled material is flammable, turn off any ignition sources.
Wear gloves, safety goggles and any other personal protective equipment required by the pesticide label.
Cover spilled material with absorbent pads or dry powder absorbent.
When using dry powder absorbent, begin at the outer edges of the spill and sweep toward the center and pick up material with dustpan.
Or, when using absorbent pads, pick up the saturated pads.

Remember, absorbed materials must be bagged for disposal as Hazardous Waste.
8.8 Emergency Response

Notes:

A pesticide emergency may be caused by severe weather or, more likely, an accident or fire. Serious public health and environmental consequences can occur when a tank truck overturns or a hose ruptures, spilling pesticides. An explosion and subsequent fire in a pesticide storage facility could result in serious injuries and environmental contamination, requiring the evacuation of persons downwind from the site of the fire. How you respond to a pesticide emergency may determine whether the incident becomes nothing more than a minor mishap or results in a major chemical release.

You should always contact your campus or local EH&S office in addition to taking the following steps.
The Three Cs (Slide Layer)

The Three C's of Pesticide Spills

In an emergency involving pesticides, it is important to remember the three Cs of spill management.

Control is the first step because the goal is to stop the release of the pesticide. For example, if a five-gallon jug leaks liquid pesticide from a crack in the bottom, place the jug inside a larger container to catch, or "contain," the pesticide.

After controlling the spill, turn your attention to containing it (i.e., keeping the pesticide from spreading). When a liquid spill occurs in the field, you can prevent it from spreading by creating a dam using soil and a liquid shovel. When the spill is on a hard surface, use an absorbent material like cat litter or an absorbent pillow to contain the spill. If the spill occurs with a dry formulation, prevent spreading by lightly misting it with water, or covering the spill with a plastic tarp. Do not allow the spilled material to get into any body of water, including storm sewers or drains.

After the spill has been contained, the absorbent material and pesticide need to be properly disposed, and the area cleaned. For spills on concrete or similar materials, sweep up the absorbent material and place it in a fiber or steel drum lined with a heavy-duty plastic bag. The area can then be cleaned using a commercial cleaning product made for this purpose as recommended on the product label. Use additional absorbent material to soak up the cleaning solution and dispose of it in the heavy-duty plastic bag. When the spill occurs on soil, the only effective way to decontaminate the
area is to remove the top 2-3 inches of soil.

In either of these situations, the next step is to follow California guidelines for disposing of the pesticide waste material, now considered hazardous waste.

Emergency Response-People (Slide Layer)

When people have been exposed to pesticides:

What you should do in an emergency depends on the type of pesticide incident and how serious it is. Taking the right action is as important as taking action right away. Here are some basic steps to take when a person has been exposed to a pesticide.

- If you or anyone else is seriously ill, Dial 9-1-1 for help. Be sure to tell emergency responders that there has been a pesticide exposure.
- If the victim is unconscious, immediately remove them from the source of exposure, if you can do so without putting yourself or the victim in further danger.
- Assess the type of exposure and respond accordingly. DPR’s Recognizing and Reporting Pesticide Problems Guide gives instructions for specific situations which can be downloaded from the resource tab of this course.
- Contact the local agricultural commissioner’s office and your EH&S office to report the incident.
For pesticide spills on State or Federal Highways:

- Notify the local office of the California Highway Patrol and your local fire department (dial 9-1-1). Inform the emergency operator that a pesticide spill has occurred, provide an accurate location, and information on the type of pesticide involved.

- Contact CHEMTREC at 800-424-9300 for assistance in cleaning up a pesticide spill.

- Contact the California Office of Emergency Services. Usually a written report will need to be filed.

- Contact your local agricultural commissioner’s office for the county where the accident occurred.
Emergency Response - Local, Rural, Private (Slide Layer)

For pesticide spills on local city or rural roads, and on private land:

- You should also try to contain the spill if you can do it safely

For anything beyond a minor spill,

- Contact the local police or sheriff and fire department by dialing 9-1-1. Inform the emergency operator that a pesticide spill has occurred, provide an accurate location, and information on the type of pesticide involved.

- Contact CHEMTREC at 800-424-9300 for assistance in cleaning up a pesticide spill.

- Report the spill to the California Office of Emergency Services.

- Contact the agricultural commissioner’s office for the county where the accident occurred and the locations EH&S Department.
8.9 Practice Exercise 30

(Multiple Choice, 10 points, unlimited attempts permitted)

Which label section provides information on risks to people and domestic animals?

- Use Directions
- Statements of Practical Treatment
- Precautionary Statements
- Signal Words

Notes:

Which label section provides information on risks to people and domestic animals?

- Use Directions
- Statements of Practical Treatment
- Precautionary Statements
- Signal Words
8.10 Practice Exercise 31

*Multiple Choice, 10 points, unlimited attempts permitted*

Which of the following should not be part of a spill kit?

- Shovel, broom, and dustpan
- Wash and rinse buckets
- Absorbent clay, sawdust, or cat litter
- PPE as required by the pesticide label

**Notes:**

Which of the following should not be part of a spill kit?

- Shovel, broom, and dustpan
- Soiled materials from a previous spill
- Absorbent clay, sawdust, or cat litter
- PPE as required by the pesticide label
8.11 Section 7 Summary

Notes:

This completes this section.

You should now be able to:

• Follow the correct procedure for handling a pesticide emergency

• Identify the appropriate agencies and individuals to contact when a pesticide emergency incident occurs
9. Equipment

9.1 Module 8 Objectives

Equipment and Calibration

By the end of this module you should be able to:

• Identify the various types of pesticide equipment and PPE and their appropriate use
• Demonstrate the correct way to calibrate pesticide equipment

Notes:

Equipment and Calibration

By the end of this module you should be able to:

• Identify the various types of pesticide equipment and PPE and their appropriate use
• Demonstrate the correct way to calibrate pesticide equipment
9.2 PPE Overview

Notes:

Your employer is responsible for providing personal protective equipment (PPE) as required by pesticide labeling, regulation, and restricted material permit condition.

Also, they are responsible for its daily inspection and cleaning along with repairing replacing it when necessary.

Your employer must ensure that:

• Clean PPE is kept separate from personal clothing and in a designated pesticide-free area

• PPE is used correctly for its intended purpose

• Kept separate from other laundry, and either thoroughly dried before storage or stored in a well-ventilated area.

• The employer keeps ownership of PPE, and employees cannot take contaminated PPE home. If employees do not return to headquarters, they should store contaminated coveralls in a sealable container outside their living quarters.
Personal Protective Equipment or PPE and engineering controls can protect a person from hazards associated with pesticides. All pesticide handlers—applicators, mixers, loaders, flaggers, and early-entry agricultural workers are legally required to follow all PPE instructions from the product label and California laws and regulations. A pesticide label lists the PPE that you must wear while performing handling or early-entry activities, and California regulations often require more than what appears on the label.

In California, the minimum requirement for PPE use includes wearing a long sleeve shirt, long pants, closed toe shoes, socks, eye protection, and chemical resistant gloves.

Let's take a look at the types of PPE designed for pesticide use.
9.3 Coveralls

Notes:

DPR regulations define “coveralls” as clothing, either one or two-piece, that covers the entire body except the head, hands, and feet.

Coveralls:

- Must be worn if pesticide label specifies
- Signal word is “DANGER” or “WARNING”
- Should be worn if making backpack, fogger, or airblast applications because contact with spray is more likely in those application scenarios
9.4 Eye Protection

Notes:

DPR regulations require eye protection for most employee-made pesticide applications, even if the pesticide label doesn’t require it.

Unless the pesticide label requires a particular type of eye protection; goggles, a face shield, or safety glasses must be worn.

All must provide front, side, and brow protection and meet the American National Standards Institute (ANSI) Z87.1 standard **for impact resistance.**
9.5 Chemical Resistant Gloves

Notes:

DPR regulations require the use of chemical-resistant gloves for nearly all pesticide use situations, even if gloves are not specifically required by the pesticide product label.

You should:

• Wear the chemical resistant material stated on the label
• Make sure they are 14 mils or thicker

Remember, you can always choose a more protective PPE but never less protective.
### Glove Category Selection Key

DPR's simplified glove key code card can help you select the right glove for your situation. It fits easily into a wallet or pocket and also contains respirator restrictions. You can get one at your local county agricultural commissioner's office or order one from DPR directly.

<table>
<thead>
<tr>
<th>Label Code</th>
<th>Materials Required by Law</th>
<th>Material Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,2,3,4,5,6,7,8</td>
<td>1: Laminate</td>
</tr>
<tr>
<td>B</td>
<td>1,2</td>
<td>2: Butyl</td>
</tr>
<tr>
<td>C</td>
<td>1,2,3,4,7,8</td>
<td>3: Nitrile</td>
</tr>
<tr>
<td>D</td>
<td>1,2</td>
<td>4: Neoprene</td>
</tr>
<tr>
<td>E</td>
<td>1,3,4,8</td>
<td>5: Natural</td>
</tr>
<tr>
<td>F</td>
<td>1,2,3,8</td>
<td>6: Polyethylene</td>
</tr>
<tr>
<td>G</td>
<td>1,8</td>
<td>7: PVC</td>
</tr>
<tr>
<td>H</td>
<td>1,8</td>
<td>8: Viton</td>
</tr>
</tbody>
</table>

All but Laminate and Polyethylene must be 14 mils or thicker.
9.6 Other Types of PPE

There are no specific DPR regulations that address the following types of PPE. There use is only required when specified by the product labeling:

Chemical-resistant headgear.

Chemical-resistant footwear. The pant legs should be worn outside of the boots to keep pesticides from running down into the footwear.

Chemical-resistant aprons. These should be made of durable waterproof material, and be long enough to cover the chest and reach below the tops of boots.

Respiratory protection. There are several different types of respiratory protection including:

- Filtering facepiece respirators
- Cartridge respirators
- Powered air cartridge respirators
- Air-supplied respirators

Employees must have a medical evaluation and be fit tested before they use respiratory protection.

For more information on how to work safely with pesticides in non-
agricultural settings, download DPR's “Pesticide Safety Information Sheet” from the resource tab of this course.
9.7 Practice Exercise 32

(Multiple Response, 10 points, unlimited attempts permitted)

In California, employees must wear a coverall when handling pesticides with which of the following label signal words? Choose all that apply.

- Caution
- Warning
- Danger

Notes:

In California, employees must wear a coverall when handling pesticides with which of the following label signal words? Choose all that apply.

- Caution
- Warning
- Danger
9.8 Application Equipment

Notes:

Using the proper equipment is essential to safe and effective pesticide applications. Here are some different types of application equipment and their uses.

Liquid (Slide Layer)

Liquid Application Equipment

Liquid application equipment usually includes a tank for mixing and holding pesticides (often equipped with an agitator) and a pump for creating hydraulic pressure. It may also include a pressure regulator, pressure gauge, control valve, and several types of strainers. Spray is emitted through nozzles on a spray boom, manifold, or hand spray gun, and may be dispersed by a fan.
Granule & Dust (Slide Layer)

Application Equipment: Dust and Granule Application

Used to apply dry materials

Granular Materials
Used in a wide variety of outdoor settings

Dust Materials
Often limited to indoor settings

Granule and Dust Applicators
Dust and Granule Applicators are used to apply dry materials. Granular materials are used in a variety of outdoor settings while the use of pesticides dusts is often limited to indoor settings due to their drift potential.
9.9 Nozzles

How effective a pesticide application is, or how much drift might be produced, is strongly influenced by the spray nozzles that are used. Nozzles influence application rate, droplet size, and spray pattern. Here’s some important information about nozzle type:
Nozzle Selection (Slide Layer)

Nozzles: Selection

**NOZZLE SELECTION CRITERIA**

- Nozzle material
- Nozzle design
- Orifice size
- Pesticide formulation
- Droplet size, pattern, distribution
- Drift risk

**Nozzle Type**

You should base your nozzle selection on several criteria, including the

- Material the nozzle is made of
- Type of nozzle design
- Nozzle orifice size
- Pesticide formulation
- Droplet size, pattern, or distribution
- Drift risk
Different applications require nozzles adapted to specific requirements. Nozzles used to apply herbicides in a field may be unsuitable for applying insecticides or fungicides to foliage. Orchard sprayers have different nozzle requirements than row crop sprayers. Residential, industrial, and institutional applications need nozzles suitable for confined spaces.

For more information on nozzle types and selection, download the “Guide for Selecting Nozzles” from the Resource tab of this course.
9.10 Sprayer Maintenance

Notes:

Effective pesticide application depends on properly maintained and adjusted application equipment. Regular inspections and periodic maintenance programs help you avoid accidents or spills caused by ruptured hoses, faulty fittings, damaged tanks, or other problems. Inspect application equipment for wear, corrosion, or damage before each use. Replace or repair faulty components. Thoroughly clean equipment after every application. Wear PPE, including rubber gloves and eye protection, when cleaning or repairing the equipment. When not in use, store equipment in a way that prevents deterioration or damage.
9.11 Calibration

Notes:

Calibration is determining the correct amount of pesticide that should be applied to a given area. Proper calibration involves:

• Spray tank volume
• The size of the area to be treated
• Pesticide application rate
• Pesticide dilution rate
• Flow rate
• and Equipment speed.
9.12 Calibration

Notes:

Click on each button to learn more about that calibration element. When done, click the next button to continue.

Application Rate (Slide Layer)

Application Rate. Application rate is the amount of product per area and is usually expressed as pounds or gallons per acre or ounces or pints per 1000 square feet.
Dilution Rate (Slide Layer)

Dilution Rate. Dilution rate or spray rate is the amount of product plus water in the tank. This is different from application rate, which is just the amount of pesticide. Sometimes the label may use Spray volume instead of Spray rate.

Flow Rate (Slide Layer)

Flow Rate. Flow rates are in gallons per minute (gpm). This rate can be for one nozzle or the entire spray system. Flow rate calibration must include all nozzles on the boom at the time of application.
**Speed (Slide Layer)**

*Speed.* Speed is given in miles per hour (mph).

**Pesticide Amount Equation (Slide Layer)**

*Pesticide Amount Equation.* The total amount of pesticide needed is determined by multiplying the application rate by the number of acres or square feet.
9.13 Practice Exercise 33

(Multiple Response, 10 points, unlimited attempts permitted)

When choosing chemical resistant gloves, what must you do? Choose all that apply.

- Follow the label and wear the chemical resistant material stated on the label
- Always wear liners underneath the glove
- Make sure they are 14 mils or thicker
- Never wear disposable gloves

Notes:

When choosing chemical resistant gloves, what must you do?
Choose all that apply.

• Follow the label and wear the chemical resistant material stated on the label
• Always wear liners underneath the glove
• Make sure they are 14 mils or thicker
• Never wear disposable gloves
9.14 Section 8 Summary

Notes:

This completes this section.

You should now be able to:

- Identify the various types of pesticide equipment and PPE and their appropriate use
- Demonstrate the correct way to calibrate pesticide equipment
10. Supervisors

10.1 Module 9 Objectives

**Notes:**

**Supervisor Responsibilities**
By the end of this module you should be able to ensure the application of pesticides in a safe manner. As a supervisor, you are responsible to ensure that all pesticide applicators and handlers use pesticides in accordance with all federal, state, local, and university requirements. This includes obtaining the necessary certifications for you and your employees, providing your employees with training, and the appropriate PPE. Additionally, you must ensure that affected UC community members are notified ahead of all proposed Pesticide applications under your supervision when potential for exposure to the applied areas exist. Finally, make sure that all Pesticide applications are requested and receive approval prior to use and ensure that the actual Pesticide quantities applied, are recorded. Let’s take a look at each of these areas a little more closely.
10.2 Compliance

Notes:

Compliance.

You are responsible for ensuring that the execution of any Pest control procedures under your supervision are completed in compliance with applicable local, state, and federal laws and regulations. In addition, you must comply with the University's Integrated Pest Management Policy and the local IPM plan.

You can download a copy of the University's IPM Policy by clicking on the download button or by accessing it through the resource section of this course.
10.3 Certification

Notes:

Certifications.

As an Application Supervisor, you are required to acquire and maintain at least the Qualified Applicator Certificate (QAC). Reimbursement funds may be available at your local campus to maintain your QAC, please check with your supervisor for possible options.

Pesticide Applicators or Handlers are required to complete the University’s PEST Certification which includes this online course plus a 4-hour in-person workshop. Workshops will be offered annually and at various locations throughout the state.

While the online course needs to be completed annually, participants need to attend the workshop only once.

Your role is to support all Pesticide Applicators and Handlers under your supervision in obtaining their required training by providing time during work hours to complete the requirements and educational materials to properly prepare for their certification.
10.4 Training

Notes:

Employee Safety Training.

You must ensure that all Pesticide Applicators and Handlers under your supervision receive initial and annual safety training before they’re allowed to handle pesticides on the job.

Minimum requirements 1 (Slide Layer)

At a minimum, pesticide safety training programs must include the following topics for each pesticide that’s handled:

- The format and meaning of pesticide label warning statements
- Both acute and chronic Pesticide use hazards
- The four routes by which pesticides enter the body
• The symptoms of pesticide overexposure
• Emergency first aid for over exposure
• How to obtain emergency medical care
• Routine and emergency decontamination
• Personal protective equipment

Minimum requirements 2 (Slide Layer)

- Heat-related illness
- Safety procedures
- Environmental concerns
- Warnings not to take pesticide containers home
- Medical supervision (such as blood tests), when required
- Location of hazard communication program information
- Employee rights, including the right to pesticide information, physician’s records and other similar information
Training Resources (Slide Layer)

Resources:
There are many resources available to support your work as an Application Supervisor.

The resource tab of this course has:
Sample Handler Pesticide Safety Training Record sheets and a link to the UC IPM website which provides information and courses for continuing education credits to keep your QAC current.

Finally, for respirator fit testing, contact your campus Environmental Health and Safety Office.
10.5 Personal Protective Equipment

Notes:

As an Applicator Supervisor, it is your responsibility to provide the employees under your care with the required PPE and instruct them in its proper use, cleaning, and storage.

This includes:

• Providing employees with coveralls, eye protection, chemical resistant gloves, and respiratory protection when required. Protection must meet the requirements for the pesticides being used.

• An extra pair of coveralls must be available at the mixing and loading site and the employer, not the employee are responsible for washing the coveralls.

• In addition, you must provide an initial and annual training on the respiratory equipment they are required to use. Also, users must be fit tested for their respiratory protection and must receive a medical evaluation before fit testing or use.
10.6 Notifications

Notes:

Notifications.

You must ensure that the contact information for a doctor, hospital, or clinic is at the pesticide use site.

Also, you must ensure that affected UC community members are notified ahead of all proposed Pesticide applications under your supervision, when potential for exposure exists. Posting requirements can be found in the Integrated Pest Management Policy Guide.
10.7 Reporting

**Supervisor Responsibilities: Reporting**

Ensure all pesticide applications are requested and receive Pesticide Use Authorization (PUA) approval prior to use.

Ensure the actual pesticide quantities applied are recorded electronically through the PUA Software.

**Notes:**

Reporting.

Your role as a Application Supervisor includes ensuring that all pesticide applications under your supervision are requested and receive Pesticide Use Authorization (PUA) approval prior to use.

Also, you must ensure the actual pesticide quantities applied under your supervision are recorded electronically through the PUA Software.

**PUA Software (Slide Layer)**

**Pesticide Use Authorization Software**

Systemwide tool for Pesticide Applicators and Supervisors

Used to request and receive approval for proposed Pesticide use

Used to report Pesticide use after a completed application

Integrates the Pesticide Hazard Tiering System

**PUA Software**

The Pesticide Use Authorization Software is a systemwide tool designed for Pesticide Applicators or Application Supervisors used to request and receive
approval for proposed Pesticide use. The tool is also used to report Pesticide use after completion of an application. This software integrates the Pesticide Hazard Tiering System and its use is required for all Pesticide applications.

Now let's check your knowledge on your supervisory responsibilities.
Which of the following topics must be covered in the annual Pesticide Safety Training? Choose all that apply.

- Performance factors
- Symptoms of pesticide overexposure
- Routine and emergency decontamination instructions

Notes:

Which of the following topics must be covered in the annual Pesticide Safety Training? Choose all that apply.

- Performance factors
- Symptoms of pesticide overexposure
- Routine and emergency decontamination instructions
10.9 Practice Exercise 35

(Multiple Response, 10 points, unlimited attempts permitted)

Choose all that apply to the following statement.
Employees who use respiratory equipment:

- Receive initial training only
- Must receive a medical evaluation before fit testing
- Must be fit tested
- Can use without being fit tested

Notes:

Choose all that apply to the following statement.
Employees who use respiratory equipment:

- Receive initial training only
- Must receive a medical evaluation before fit testing
- Must be fit tested
- Can use without being fit tested
### 10.10 Section 9 Summary

#### Summary
- Ensure the application of pesticides in a safe manner
- Ensure all pesticide applicators and handlers use pesticides in accordance with all federal, state, local, and university requirements
- Properly notify affected UC community members ahead of all proposed Pesticide applications under your supervision
- All Pesticide applications are requested, approved, and recorded using the PUA tool

#### Notes:

This completes this section.

You should now be able to ensure:

- The application of pesticides in a safe manner
- All pesticide applicators and handlers use pesticides in accordance with all federal, state, local, and university requirements
- Proper notification of affected UC community members ahead of all proposed Pesticide applications under your supervision
- All Pesticide applications are requested, approved, and recorded using the PUA tool
10.11 *For more information*

Notes:

Application Supervisors are only required to complete this section of the course to fulfill their annual training requirement. However, to obtain DPR CEUs, you must complete the entire course.

Click Return to Menu to go back and complete any sections of the course that you have not yet completed to receive your CEUs or Click Proceed to Test to complete a basic knowledge exam of the information from the entire course and exit the training without obtaining CEUs.
11. Test

11.1 Rights

Notes:

You have a right to a safe workplace. Specifically, each individual has the right to:

• Receive information regarding pesticides to which you may be exposed (personally).
• Receive information regarding pesticides to which you may be exposed (for their physician or collective bargaining agent).
• Report suspected use violations to the Department or county agricultural commissioner
• Not be discharged or discriminated against for exercising these rights.

If you have a complaint about a pesticide safety problem, call the County Agricultural Commissioner's Office. Any report of safety problems must be immediately investigated by the county commissioner for possible use violations.

You can look up the number for a local office by calling DPR's information line at 877-378-5463
11.2 Role and Responsibilities

Roles and Responsibilities

Workers
- Identify and recognize hazards of chemicals before beginning work
- Review labels and Safety Data Sheets
- Protect yourself from hazards (by implementing hazard controls, including safe work practices)
- Review the regulatory and program requirements
- Know your rights

Supervisors
- Determine hazards of substances (and their mixtures)
- Provide lists of hazardous substances
- Provide information and training
- Ensure containers are labeled, and that labels are not removed or defaced
- Ensure Safety Data Sheets are available

Notes:

In addition, there are several roles and responsibilities of workers and supervisors to maintain safety. After reviewing these regulations, click on “Next”.
11.3 For more information

Notes:

For more information

For more information, contact the University of California Statewide Integrated Pest Management Program. Their website has resources for:

- Pest identification and management
- Research materials
- Publications including newsletters, print publications and media resources.
- Training and events.

To receive credit for this course, you must complete the test. When you are ready, proceed to take test.
11.4 Q1

(Multiple Choice, 10 points, 1 attempt permitted)

Which agency is responsible for enforcing pesticide laws and regulations in California?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner's Office (CAC)
- All of the Above

Notes:

Which agency is responsible for enforcing pesticide laws and regulations in California?

- Environmental Protection Agency (USEPA)
- Department of Pesticide Regulation (DPR)
- County Agricultural Commissioner's Office (CAC)
- All of the Above

Feedback when correct:

That's right! In CA, DPR enforces pesticide laws and regulations.

Feedback when incorrect:

That's incorrect! In CA, DPR enforces pesticide laws and regulations.
11.5 Q2

(Multiple Response, 10 points, 1 attempt permitted)

Which of the following is considered to be pesticide labeling or supplemental labeling?

- Printed material that includes directions, requirements, or prohibitions
- Advertisements from the manufacturer
- Any direction or warning information that is encased in a plastic pouch attached to the primary container
- All of the above

Notes:

Feedback when correct:

Printed material that includes directions, requirements, or prohibitions and any direction or warning information that is encased in a plastic pouch attached to the primary container are considered to be pesticide labeling or supplemental labeling

Feedback when incorrect:

Printed material that includes directions, requirements, or prohibitions and any direction or warning information that is encased in a plastic pouch attached to the primary container are considered to be pesticide labeling or supplemental labeling
11.6 Q3

(Multiple Choice, 10 points, 1 attempt permitted)

Which formulation is the most abrasive to application equipment?

- Emulsifiable concentrates
- Dry flowables
- Soluble powders
- Wettable powders

Notes:

**Which formulation is the most abrasive to application equipment?**

- Emulsifiable concentrates
- Dry flowables
- Soluble powders
- Wettable powders

**Feedback when correct:**

Wettable powders are the most abrasive to application equipment.

**Feedback when incorrect:**

Wettable powders are the most abrasive to application equipment.
11.7 Q4

(Multiple Choice, 10 points, 1 attempt permitted)

Which type of pest control includes practices that reduce pest establishment, reproduction, dispersal, and survival?

- Biological control
- Chemical control
- Cultural control
- Mechanical control

Feedback when correct:

Cultural control includes practices that reduce pest establishment, reproduction, dispersal, and survival.

Feedback when incorrect:

Cultural control includes practices that reduce pest establishment, reproduction, dispersal, and survival.
11.8 Q5

(Multiple Choice, 10 points, 1 attempt permitted)

Which of the following is NOT one of the six major components common to all IPM programs?

- Pest identification
- Evaluation after action is taken
- Using pesticides as a first approach
- Monitoring and assessing pest numbers and damage

Feedback when correct:
With IPM, pesticides are typically used only when needed.

Feedback when incorrect:
With IPM, pesticides are typically used only when needed.

Notes:

Which of the following is NOT one of the six major components common to all IPM programs?

- Pest identification
- Evaluation after action is taken
- Using pesticides as a first approach
- Monitoring and assessing pest numbers and damage
11.9 Q6

(Multiple Choice, 10 points, 1 attempt permitted)

What life cycle is shown below?

- Summer annual
- Winter annual
- Perennial

Notes:

What life cycle is shown below?

- Summer annual
- Winter annual
- Perennial

Feedback when correct:

Perennials are the life cycles shown.

Feedback when incorrect:

Perennials are the life cycles shown.
**11.10 Q7**

*Multiple Choice, 10 points, 1 attempt permitted*

**Notes:**

**What's the most common route of pesticide exposure?**

- Dermal
- Ocular
- Inhalation
- Oral Ingestion

**Feedback when correct:**

Dermal is the most common route of pesticide exposure

**Feedback when incorrect:**

Dermal is the most common route of pesticide exposure
11.11 Q8

(Multiple Choice, 10 points, unlimited attempts permitted)

Under what conditions must field posting signs be posted around fields where pesticides have been applied?

- Product labels require it
- Pesticides are used within an enclosed space (unless entry can be prevented)
- Pesticide labels require a re-entry period of 48 hours or longer
- All of the above

Notes:

Under what conditions must field posting signs be posted around fields where pesticides have been applied?

- Product labels require it
- Pesticides are used within an enclosed space (unless entry can be prevented)
- Pesticide labels require a re-entry period of 48 hours or longer
- All of the above

Feedback when correct:

Field posting signs must be posted when a product label requires it, the pesticide is used within an enclosed space, and if the re-entry period is 48 hours or greater

Feedback when incorrect:

Field posting signs must be posted when a product label requires it, the pesticide is used within an enclosed space, or if the re-entry period is 48 hours or greater
**11.12 Q9**

*(Multiple Choice, 10 points, unlimited attempts permitted)*

Which of the following should not be part of a spill kit?

- Shovel, broom, and dustpan
- Soiled materials from a previous spill
- Absorbent clay, sawdust, or cat litter
- PPE as required by the pesticide label

**Notes:**

Which of the following should not be part of a spill kit?

- Shovel, broom, and dustpan
- Soiled materials from a previous spill
- Absorbent clay, sawdust, or cat litter
- PPE as required by the pesticide label

**Feedback when correct:**

Used items from your spill kit should be disposed of in a compliant manner during the spill response process as they will contain chemicals and residues that could potentially cause harm

**Feedback when incorrect:**

Used items from your spill kit should be disposed of in a compliant manner during the spill response process as they will contain chemicals and residues that could potentially cause harm
11.13 Q10

(Multiple Response, 10 points, 1 attempt permitted)

When choosing chemical resistant gloves, what must you do?
Choose all that apply.

- Follow the label and wear the chemical resistant material stated on the label
- Always wear liners underneath the glove
- Make sure they are 14 mils or thicker
- Never wear disposable gloves

Notes:

When choosing chemical resistant gloves, what must you do?
Choose all that apply.

- Follow the label and wear the chemical resistant material stated on the label
- Always wear liners underneath the glove
- Make sure they are 14 mils or thicker
- Never wear disposable gloves

Feedback when correct:

When choosing chemical resistant gloves, follow the label and make sure the gloves are 14 mils or thicker.

Feedback when incorrect:

When choosing chemical resistant gloves, follow the label and make sure the gloves are 14 mils or thicker.
11.14 Results

(Results Slide, 0 points, 1 attempt permitted)

Success (Slide Layer)

Failure (Slide Layer)