



ACEAPP

ACEAPP TRAINING

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APPLICATOR
Test Prep – Manual

INTRODUCTION

Branch 1. Fumigation. The practice relating to the control of household and wood destroying pests or organisms by fumigation with poisonous or lethal gases.

Branch 2. General pest. The practice relating to the control of household pests, excluding fumigation with poisonous or lethal gases.

Branch 3. Termite. The practice relating to the control of wood destroying pests or organisms by the use of insecticides, or structural repairs and corrections, excluding fumigations with poisonous or lethal gases.

All applicator's licenses shall expire at 12 midnight three years from the date of issue. Every applicator shall pay a fee for renewal of his or her license. The board shall, on or before 60 days prior to the expiration of an applicator whose license will expire, addressed to him or her at his or her last known address, a notice that his or her renewal fee is due and payable and that, if not paid by the due date, a penalty will be added thereto. In no case shall the penalty be waived. Upon the receipt of the fee, the board shall cause the renewal certification to be issued.

SIGNAL WORDS

A signal word is displayed in large letters on the front of the label to indicate approximately how acutely toxic the pesticide is to humans. The signal word is based on the entire contents of the product, not the active ingredient alone. The signal word does not indicate the risk of delayed or allergic effects. All highly toxic pesticides that are very likely to cause acute illness through oral, dermal, or inhalation exposure have DANGER as their signal word and will carry the word POISON printed in red with skull and-crossbones symbol. Products that have the DANGER signal word due to skin and eye irritation potential will not carry the word POISON or the skull-and-crossbones symbol. Chemical substances labeled with DANGER tend to generally have an oral LD-50 of 1-50 g/kg. The signal word WARNING denotes a less toxic chemical with an oral LD-50 of 50-500 g/kg. Most chemicals used by pesticide applicators are in the third category of chemical toxicity and have the signal word CAUTION on their label. CAUTION is used for the least dangerous of chemicals and usually marks chemicals with a known oral LD-50 of 500-5,000 g/kg.

Signal word (category)	Toxicity	Approximate amount needed to kill the average person
DANGER (I)	Highly toxic	A taste to a teaspoon
WARNING (II)	Moderate toxic	A teaspoon to a tablespoon
CAUTION (III)	Slightly toxic	An ounce to more than a pint

THE LABEL

By law certain kinds of information must appear on a pesticide label. People who use pesticides have the LEGAL responsibility to read, understand and follow the label directions. Pest problems occur in many different settings from agricultural to commercial and residential. Many times a pesticide will be chosen as part of the management plan for the problem. If you choose to apply a pesticide, understanding the contents of the pesticide label is essential for the products safe and effective use. If the label is not complete due to the package size you should find a supplemental label or a notification of where to find the rest of the label. The California code of regulations specifies regulations of pesticides and pesticide use in California.

Familiarity with the pesticide label is crucial to selecting the most appropriate pesticide products for your use and therefore receiving maximum benefit from their use. While the label may seem overwhelming at first, it takes only a few minutes to understand the information once the general format is recognized. **You should read the pesticide label CAREFULLY:**

- Before purchasing the pesticide to ensure that it is the one you need.
- Before mixing the pesticide to ensure the proper pesticide concentration.
- Before applying the pesticide to ensure proper use.
- Before storing of excess chemical or disposal of the empty container.

Safety information

1. Child hazard warning. The front panel of every pesticide label must bear the statement, “KEEP OUT OF REACH OF CHILDREN”. Poisoning is a major cause of injuries to children. *The label must always contain this warning!*

2. Signal word. This section of the label contains any one of the three major terms (Danger, Warning, or Caution) associated with the specific pesticide’s level of toxicity. The signal word is prominently displayed on the label and allows an applicator to assess the relative dangers of the chemical and prepare accordingly.

3. Statement of practical treatment. The labels for all highly toxic pesticides (signal word DANGER) must provide information to medical personnel should a poisoning occur. Some examples: “if swallowed, call a physician or poison control center immediately;” “if on skin, wash skin with soap and water”. It is in this section that proper antidotes and treatment are recommended for medical personnel treating a victim. For this reason, 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. Often labels for less toxic pesticides will also provide first-aid instructions.

4. Hazard to humans and domestic animals. This part of the label includes precautionary statements indicating specific hazards, routes of exposure and precautions to be taken to avoid human and animal injury.

5. Personal protective equipment. Most pesticide labels contain specific instructions concerning the type of clothing that must be worn during the handling and mixing processes.

6. Environmental hazards. This section of the label explains the nature of potential hazards and the precautions needed to prevent injury or damage to non-target organisms or to the environment.

7. Use classification. EPA is required to classify pesticides for either general use or restricted use. In classification a pesticide, EPA considers

- The toxicity of the pesticide.
- The way in which the pesticide will be used.
- The effect of the pesticide on the environment.

8. Brand (trade) name. Each manufacturer has a brand name for each of its products.

9. Ingredient statement. Identifies the name and percentage by weight of each active ingredient.

10. Net contents. The front panel of the pesticide label tells you how much is in the container. This can be expressed as pounds or ounces for dry formulations and as gallons, quarts, pints, or fluid ounces for liquids.

11. EPA registration number. This number identifies a specific product and signifies that the product has met federal registration requirements.

12. EPA establishment number. This number identifies the facility that formulated the product. In the event of questions or concerns regarding a product, the facility that made the pesticide can be determined

13. Name and address of the manufacturer. The law requires the maker or distributor of a product to put the company name and address on the label. This enables consumers to know who made or sold product.

14. Formulation. The front panel of some pesticide labels will tell what kind of formulation the product is. The formulation name may be either spelled out or designated by an abbreviation, such as WP for wettable powder, D for dust and EC for emulsifiable concentrate.

15. Limited warranty and disclaimer. This statement conveys the manufacture's assurance that the product conforms to the chemical description on the label and that it is fit for label purpose if used according to directions under normal conditions.

16. Directions for use. This section usually makes up the bulk of a pesticide label and begins with the wording: "It is a violation of federal law to use this product in any manner inconsistent with labeling." In this section you find directions and restrictions on the pesticides' application rates along with target sites & target pests.

17. Storage and disposal. Label information about storage generally includes temperature requirements. In many cases, minimum and maximum storage temperatures will be provided.

TOXICITY

Pesticides vary in their toxicity, from only slightly toxic to extremely toxic. Toxicity is the degree to which a substance is harmful or poisonous. Pesticides are toxic because they must be able to destroy the target pest.

Acute toxicity of pesticide *refers to the toxic response resulting from a single dose of, or exposure to pesticide.*

Chronic toxicity is the *toxic response resulting from repeated exposures to small doses of a pesticide over longer period of time.* Scientists measure the toxicity of a pesticide by determining its LD50. Lethal Dose 50% (LD50) The LD50 value is the statistical estimate of a chemical dose which when administered will kill 50% of the test animals within a stated period of observation (24 hour to seven days).

ROUTES OF ABSORPTION OF PESTICIDES

Oral *refers to the intake of substance by the mouth and digestive tract.* Poisoning may result from accidental ingestion, ingestion for suicidal reasons or contamination of foodstuffs. It is commonly due to carelessness, example blowing out of sprayer nozzles, smoking or eating prior to washing the hands. The most common occurrence of oral intake is when pesticides have been removed from their original containers and stored in liquor, soft drink or food bottles.

Dermal *is the intake of substance through contact with exposed skin.* It can occur easily through direct contact with the spray concentrate, spray solution or spray mist during spraying or through the wearing of contaminated clothing. Absorption depends on several conditions. Skin rashes, broken skin or abrasions may increase the rate of absorption. There is less absorption of powders than liquids. Oil solutions may be more readily absorbed than aqueous solutions. Fortunately intact skin is a very effective barrier against any substances. Dermal absorption is the most common route of poisoning from the exposure to pesticides. Absorption through the skin is the cause of more than 95% of all pesticide poisoning.

Inhalation is the absorption of airborne particles of a substance. It occurs when mixing and spraying and is increased when in confined or poorly ventilated areas.

- Chronic poisoning is usually caused by small exposures to pesticides over a long period of time.
- Symptoms of pesticide poisoning: MILD = dizziness, profuse, sweating, excessive salivation, throwing up; MODERATE = muscle pain or cramps, constricted pupils ; SERIOUS = difficult breathing

HAZARDS

Pesticide drift

It is the physical movement of spray particles through the air from the target site to any non-or-off-target site. Wind speed greatly influences the amount of drift. After wind speed and direction, spray droplet size is the most important factor influencing drift. Larger droplets are heavier and less likely to move off-target. One of the simplest methods to increase droplet size with any nozzle is to reduce nozzle pressure. If one is doing crack and crevice treatment with a hand sprayer it is important to use low pressure so as to have a fine pin stream generate the pesticide into the desired location.

How to Handle Pesticide Spills

First, do everything you can do to prevent a spill or pesticide accident. Never handle pesticides in a kitchen or high-traffic areas. Keep others away from where you are mixing and applying the pesticide, especially children and pets. Mix the pesticide outdoors or in a well-ventilated area.

BE PREPARED

The pesticide label may give you specific information on how to handle a spill. If it doesn't, here are some recommendations. You should be wearing the personal protective equipment and clothing before you open the pesticide to mix and apply it.

To be prepared for a spill, have rubber gloves, rubber or plastic foot coverings and protective eyewear ready to put on, if you are not already wearing them.

Have dry absorbent material available ahead of time to soak up spilled pesticide. This can be material such as cat litter (best), sawdust, sweeping compound, newspaper or paper towels. These materials can also be used to clean up other spills such as paints, solvents and fuels.

Have local emergency phone numbers near your telephone. Have these numbers written large enough so that you can see them with uncorrected vision. Pesticides have an emergency phone number(s) on the label. Write this number down ahead of time, along with the product name. If you need this information in an emergency and you need to read the label, they may be hard to find or too small to read in a hurry or may be obscured or otherwise unreadable.

If you spill formulated pesticide product on you, or a large amount of mixed spray, remove your clothes and shower immediately. If you have a pesticide spill, you should:

- 1) Control the spill. If a pesticide container, sprayer, bag or spreader tips over, quickly set it upright to keep more pesticide from spilling out.
- 2) Contain the spill. Keep spilled liquid material from spreading by covering it with absorbent material, such as soil, sand, sawdust, peat moss, rags, paper towels, newspaper, or cat litter.

3) Clean up the spill right away. Never leave a spill and finish the job first. Absorb liquids with cat litter, soil, peat moss, paper towels, newspaper, or sawdust.

Carefully sweep up or collect the absorbent material. Put these pesticide-contaminated materials in a plastic bag. To clean up the spill, wear chemical-resistant gloves to handle the spilled pesticide and clean-up materials. If you need to leave the spill to get help or if you have spilled a dust formulation, put absorbent materials on the spill or cover it. Block access to the spill.

Keep children and pets away from the spill. If you spill a liquid, consider the need to dike the spill so that it will not turn off to other areas. *Do not wash down spills with water.* Spread absorbent materials on the spill. Sweep or scoop this material up and put it into a heavy-duty or doubled plastic bag.

Next, clean the area with heavy-duty detergent or bleach. Use as little liquid as possible. Don't rinse this away. Absorb this material also and place it into the plastic bag and seal it. Place the bag in the trash. Many pesticides, especially organophosphate insecticides (e.g. Malathion, Diazinon, chlorpyrifos), can be neutralized with household bleach.

Remember that bleach can be hazardous, and it is also a pesticide. If you use bleach, first absorb the spill, as explained above, and then use the bleach. Use only the amount of bleach you may need to cover the spill. Soak up the bleach with absorbent material also. Again don't wash down the spill area with water.

Any and all materials used to clean up the spill must be properly disposed of, including the broom. Small quantities of spilled homeowner pesticide and clean-up materials can be placed into a heavy-duty plastic bag and securely sealed and disposed of in household trash.

Don't forget to wash off or decontaminate any clothing or equipment that gets pesticide on it. After you clean up the spill, wash your hands and any exposed areas of your skin with soap and plenty of water. Shower if necessary. If you get a small amount of diluted pesticide on your clothing, you can wash this clothing separately from other family laundry with heavy duty detergent. If you spill formulated product on your clothing you may need to dispose of this clothing along with clean up materials. Wrap contaminated tools and empty pesticide containers in several layers of newspaper and place in the trash.

Mixing Pesticides

Mix pesticides carefully and accurately, using only the recommended amount. The stage of mixing and loading chemicals is when the handling of the chemicals is the most dangerous. Read the label carefully before mixing a pesticide on site and follow the directions exactly. Wear gloves, splash-proof goggles or face shield, and other required personal protective clothing. Keep hands away from face, head and neck when mixing. Open liquids on a level surface and below eye level to avoid spilling and splashing. Pour liquids below eye level as close to the ground as possible. Do not try to pour from container that is too heavy. Open powders with scissors to avoid dust. Use the proper measuring tools when mixing pesticides. Mix pesticides outside or in a well-lit and ventilated area. When mixing pesticides together, the toxicity, the mode of action, and its effectiveness change. Mode of action is the way pesticides destroy or control a target pest. Understanding the mode of action helps you select the proper pesticide and determine how to apply it. Ortho Boric Acid is an example of a pesticide that is inorganic.

Loading and mixing pesticides

Remember to check the weather conditions when loading and mixing pesticides. For example, if it is raining it may be best to mix in a covered area to have an accurate mix. Exposure to sunlight may effect mixing as well. Stand with your back to the wind so the pesticide will be blown away from you, not to you. Keep your head well above the tank opening to prevent pesticide from splashing in your face. Do not use your hands to stir pesticides or retrieve something that has fallen into the tank. Close all containers as you finish with them.

Select the right equipment, use it correctly and take good care of it. Install an approved anti-siphoning device to prevent back siphoning into the water supply. An air gap between the source and the spray tank should be maintained. Fill the spray tank with water and add the pesticide last. This way, the filling hose will not be contaminated. Add pesticide to the water-filled tank away from the water source. Preferably, pesticides should be added while the sprayer is in the field. If pesticide must be added first, secure the hose to the top of the tank out of the liquid so it is not drawn in. use check valves.

First Aid for Pesticide Poisoning

Step one in any poisoning emergency is to call an ambulance or doctor. The only exception is when you are all alone with the victim. Then you must see that he is breathing and that he is out of the exposure before leaving him to make your phone call. Always save the pesticide and the label for the doctor.

Poison on the skin: The faster the poison is washed off the patient, the less injury will result; Drench skin and clothing with water (shower, hose, faucet, pond); Remove clothing; Cleanse skin and hair thoroughly with soap and water; Detergent and commercial cleaners are better than soap; Dry and wrap in blanket.

Poison in the eye: It is most important to wash the eye out as quickly but gently as possible; Hold eyelids open, wash eyes with a gentle stream of clean water; Continue washing for 15 minutes or more; Do not use chemicals or drugs in water.

Inhales Poison (Dust, Vapors, Gases): If the victim is in an enclosed space, do not go in after him without an air-supplied respirator; Carry patient (do not let him walk) to fresh air immediately; Open all doors and windows; Loosen all tight clothing; Apply artificial respiration if breathing has stopped or is irregular; Keep patient as quiet as possible. If patient is convulsing watch his breathing and protect him from falling and striking his head.

Swallowed Poison: The most important choice you have to make when aiding a person who as swallowed a pesticide is to vomit or not to vomit. The decision must be made quickly and accurately; the victim's life may depend on it. Usually it is best to get rid of the swallowed poison fast. But: NEVER induce vomiting if the victim is unconscious or is in convulsions. The victim could choke to death on the vomit.

NEVER induce vomiting if the victim has swallowed a corrosive poison. Find out what poison the person has ingested. A corrosive poison is a strong acid or alkali such as dinoseb. The victim will complain of severe pain and have signs of severe mouth and throat burns. A corrosive poison will burn the throat and mouth as severely coming up as it did going down.

EMPLOYMENT LAW

Employers are responsible for training and supervising employed applicators to ensure the proper use and disposal of pesticides. The employer must ensure that his or her employees have access to emergency medical care, should the need ever arise. For this reason the name, address, and phone number of a medical care facility must be kept posted at all times in the service vehicles used by such employees. Employers are also responsible for providing all necessary personal protection equipment to all hired pesticide handlers. It is required by the state that each individual pest control operation performed by a licensed company, other than fumigations, have a proper recording of certain information. This information must include the date of treatment, the address of the property treated, the name of the owner and the owner's agent, the address of the property treated, a description of the are treated, a naming of the target pests, the name of the pesticide used and how much was used, and the name of the person(s) involved in treating the area.

A safe work environment must be provided by the employer to all employees. If a safe working environment is not provided then it is the employee's right to file a confidential complaint concerning the presented working conditions. An employee must also be shown a copy of a completed written Hazard Communication Information sheet prior to handling pesticides. It is also required that an employer keep a record of pesticides used for their particular employees. A Materials Safety Data Sheet (MSDS) must also be maintained by a licensed employer and must be accessible. It is also the responsibility of the employer to make emergency medical care plans with a local medical facility in the event of an accident that occurs during work operations.

PERSONAL PROTECTION EQUIPMENT

Become familiar with types of pesticides used at your job. Knowing the types of pesticides used determines the protective clothing and equipment needed to handle them. Consider the nature of the pesticides and the proximity of the chemical to points of entry on your body – dermal (through the skin), oral (through the mouth) or inhalation (through the lungs). Any of these entry points may cause symptoms such as coughing, sneezing, and tightness of the chest.

Protective clothing can be divided into two groups: disposables and reusable. Reusables are usually made of laminated woven or non-woven fabric like rubberized rainwear. Research has shown that this type of equipment provides excellent protection against all types of pesticides, including spills of liquid concentrates. Advantages are that it is reusable and can be cleaned. However it is expensive, heavy and uncomfortable in warm weather. Disposable protective clothing is usually made of spun bonded (non-woven) fabrics that do not absorb pesticides as quickly as woven materials.

Respirators protect the lungs from chemicals. Respirators must be selected based on the chemicals used. Information detailing what type of respirator to use is located on the chemical label or should be listed in the farm's chemical logbook. They don't generate oxygen. Anyone going to work wearing a respirator first must have a medical check up. Some people may not be able to work wearing a respirator. Every respirator must be purchased to fit the person wearing it. Many things can affect how a respirator fits, and each person is different. Test your respirator before mixing or spraying chemicals. If it fails, stop your work immediately. Your employer should provide you with a training on the fitting and testing of the respiratory equipment. It is wise to use a respirator whenever applying pesticides (especially highly toxic ones), and whenever there is not ample air supply.

- Chemical cartridge respirators have a partial face mask fitted with one or two replaceable cartridges. These cartridges contain an absorbent material (often activated charcoal) that purifies inhaled air and filters dust particles. Cartridge respirators are effective against all but the most toxic vapors. They provide added protection when spraying toxic pesticides, using toxic chemicals in confined areas, or hand spraying certain crops. Always use NIOSH-approved respirators. Cartridges have a limited capacity of protection usually around 8 hours. Make sure to replace the filter and cartridges as needed and remember that a respirator will not protect you from all hazards. The respirator itself can be cleaned by soaking the gasket and valve parts in a solution of warm soapy water and remove any pesticides residue.
- Powered-air purifier may be preferred for excessive high concentrations of dust or pesticides. The devices use the same filter materials mentioned above, but have a motor-blower assembly that forces air through the filter and into the breathing zone of the wearer. Breathing is much easier because drawing air through the filter requires no effort. Supplied-air respirator delivers air through a breathing tube connected to the wearer's face piece, helmet or hood.

Protective eyewear should be carefully selected, fitted and cleaned. When handling and applying chemicals, wear splash goggles or full face shields. Never wear contact lenses when handling ammonia or other farm chemicals. Water may be needed to irrigate chemical spills occurring in the eyes. Special eye wash faucets should be installed in areas where chemicals are handled or wash for 15 minutes with gentle stream of water.

Hand Protection: Cuts and abrasions on the hands may allow toxic chemicals to enter the body. Use appropriate gloves, barrier creams, hand cleaners and lotions to protect hands. Wearing gloves that match the job provides good hand protection. Only sound, properly fitting gloves should be worn. Tight gloves limit dexterity and are uncomfortable. Overly large gloves can interfere with work. Gloves to protect the hands from chemicals can be made of rubber, plastic or other materials and should be unlined. Never use leather gloves. Gloves should be long enough to cover the entire hand and part of the forearm. Wearing long sleeves will provide an extra barrier for the skin along with the gloves. Wear your sleeve outside your gloves to prevent pesticides from getting into the gloves. After using chemicals and before removing your gloves, rinse and clean them thoroughly. After removing your gloves, wash your hands again. Make sure you have extra gloves on hand.

Foot Protection: Toes and feet can be injured when working with pesticides. Boots offer protection when splash hazards are present. When working with pesticides, wear neoprene or nitrile boots to prevent exposure. Do not wear leather boots. Wear your pant leg outside of your boots to prevent pesticides from splashing inside.

Pesticide-Contaminated Clothing: Never launder pesticide-contaminated clothing with family laundry. Change clothing after handling pesticides. Hang clothing outdoors if it not laundered immediately. Launder clothing daily when applying pesticides. All clothing worn while handling and applying pesticides should be considered contaminated and should be laundered before reuse.

APPLICATION EQUIPMENT

The formulation of today pesticides demand that proper equipment be used in order to disperse the pesticide at the prescribed rate, prevent drift, avoid over application and create spray patterns that leave no voids or excessive run off.

Power Sprayers. There are several variations of the sprayer, but most have common components. The major components are as follows:

1. The Tank

2. Pumps

- Roller Pump: provide volumes at low moderate pressure. They used best with non-abrasive formulations.
- Diaphragm Pump: They are used to deliver low or high volumes. They can be used also with high pressure application.
- Piston Pump. Is by far the most efficient pump and has the capability of performing over a wide range of use in the application of chemical used in structural pest control. It has the ability to produce large volumes at high pressures yet can be regulated to deliver at lower rates and pressures.

3. Agitation: There are jet agitation and mechanical agitation.

4. Pressure Regulations

- The purposes of pressure are twofold. They regulate the operating pressure and serve as a relief valve. It is installed at point between the flow from the tank and the flow to the nozzle and the regulator body provides for a by pass or return flow to the tank. The pressure in the tank must be correct to match the nozzle tip in use. Increasing the pressure in the tank will increase the probability of spray drift and the

contamination of non-target areas. If the nozzle is leaking it can be fixed by cleaning the seat gasket. The pressure regulator valve controls the pressure entering the hose.

5. **Strainers:** Strainers and screens are designed to prevent foreign particles from entering system. If the strainers are not properly serviced they may cause severe pump damage. Make sure the strainers and the nozzles are clean. Use soft bristle brush to clear the sprayer nozzle. Before leaving your shop to do a pesticide application, make sure that you have all the PPE, the label of the pesticide you are planning to use, and that your equipments are in good repair.

6. **Compressed air Hand Sprayers:**

Parts of a compressed air hand sprayer consist of Plunger rod, siphon tube, check valve, air pump handle, and others. The check valve keeps liquids from entering the pump in a compressed air sprayer. The most important aspect of a compressed air sprayer is make sure you have the correct tip and the correct pressure for the treatment.

6. **Dusters:**

A- **Rotary duster:** *Is powered by electricity which is not always available. They are good for applications with a large area that needs to be dusted.*

B. **Compressed air duster:** *Is converted from fire extinguisher. They will operate efficiently and will distribute large volumes of dust in short period.*

C. **Getz duster:** *Is used to apply small amounts of insecticide into cracks. Same with a bulb duster*

SPRAY TECHNIQUES

Applying pesticides

Set application equipment for the correct delivery rate and operate at the recommended speed for proper coverage. Check the sprayer for any loose connections or worn hoses. Know and maintain the proper pressure and speed to avoid damage.

Check the weather conditions when applying pesticides. It is against the law to apply pesticides on windy days when they might drift on to near by fields. Turn the sprayer off when turning around at row ends. Shut off the sprayer when you are moving from field to field. Don't apply pesticide when heavy rain is likely because they could be washed into non target areas. Should the equipment become clogged or not work properly when spraying, take the necessary precautions to fix it. Protect yourself with gloves and eye protection. Use a brush or soft copper wire to clean out clogged nozzles. Never use your mouth. After spraying fields, obey re-entry periods. Post warning around the treated areas and verbally warn others to stay out until it is safe to re-enter.

Before treating an area you should set up a treatment pattern to avoid contaminating yourself. It is important to be mindful of the fact that when you combine chemicals the level of toxicity may actually increase. Before treating a home by fogging, fish in a fish tank should be removed and pilot lights should be turned off. An ultra-low volume generator (ULV) is very helpful when doing space treatments in a warehouse. A ULV machine is used to apply small amounts of highly concentrated solutions. Depending on the type of surface being treated a pesticide may leave unsightly residue, cause staining, and/or be rendered ineffective. Therefore, it is very important that the application of pesticide be selected carefully by following the application directions on the label.

TRANSPORTATION AND STORING PESTICIDES

HANDLING PESTICIDES

Whenever pesticide are transported, stored, mixed, loaded or applied, several things needed to be kept in mind. Keep unauthorized people away, especially children, when handling pesticides. Be safety conscious, and always read pesticide labels. All pesticide labels must include a precautionary statement (which discusses the hazards to humans, domestic pets, and the environment), directions for use, and instructions for disposal.

Storing Pesticides

Proper storage of pesticide can greatly reduce accidents. Store pesticide in well ventilated, dry areas. Post storage areas and buildings with signs reading "Danger – Pesticides". The signs will also inform fire fighters that pesticide are present. Keep the storage are locked. Pesticides can be very harmful when in the wrong hands. Always keep children, animals and unauthorized persons away from pesticides. Don't keep large amounts of pesticides on hand. Only purchase them as you need them. Keep an inventory of pesticides and chemicals in storage. Keep the pesticide in their original containers. Never put them in unmarked or food containers. Never store pesticides with food products, livestock feed or fertilizer. Also, store personal protective equipment in a clean area away from pesticides. Periodically check pesticide containers for leaks or corrosion.

Transporting Pesticides

Transport pesticides carefully. Inspect the vehicle being used to transport the pesticides. Make sure it is functioning properly. Transport the pesticides in the back of the truck bed. During loading, check for leakage, make caps are secured, read the labels and count the number of containers. Make sure pesticide containers cannot roll around or fall out. Prevent the containers from moving by tying down, blocking and bracing them. Never transport pesticides with food or feed. Never allow anyone to ride with the pesticides. Never carry pesticides in the passenger seating area. Be prepared for a spill during transportation. Carry a safety kit for use during clean up. The kit should contain an index card with emergency numbers, duct tape, a shovel, a respirator, goggles, rubber gloves, protective clothing, soap, and wood dowels to plug leaks. Also carry kitty litter or sand as an absorbent material. If a spill happens, control and contain it. Put on safety equipment and secure the area. Contact the proper authorities for help. In case of a vehicle accident involving spilled pesticides you should call the highway patrol.

Never transport pesticides with food, clothing or other things meant to be eaten by or in contact with people or animals. The risk of contamination is too high. Even small amounts of pesticide could contaminate these highly sensitive items.

Never leave your vehicle unattended when transporting pesticides in an unlocked trunk compartment or open-bed truck. You are responsible and liable if curious children or careless adults are accidentally poisoned by the pesticide. Whenever possible, transport pesticide in a locked compartment. Chemicals should always be secured by the likes of sand bags, straps, blocks, or any such device to keep the pesticide from spilling when being transported.

PESTICIDES - GENERAL

WHAT IS A PESTICIDE?

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Pests can be insects, mice, and other animals, unwanted plants (weed), fungi, or microorganisms like bacteria and viruses. Though often misunderstood to refer only to insecticides the term pesticide also applies to herbicides, fungicides and various substance used to control pests. By their very nature, most pesticides create some risk of harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms. At the same time, pesticides are useful to society because of their ability to kill potential disease-causing organisms and control insects, weeds, and other pests.

PESTICIDE FORMULATIONS

Sprays: While sprays may be a very popular means of applying pesticides, only a few pesticides are very soluble in water and can be supplied as aqueous solution or water-soluble powders. Most pesticide compounds are effectively insoluble in water and need organic solvent or very specialized formulation to enable them to be mixed with water for spraying.

Emulsifiable concentrates: Concentrated solutions of this active ingredient in oil with an emulsifier to allow the concentrate to mix readily with water. The emulsifier is detergent-like material that allows microscopically-small oil droplets to be suspended in water to form an emulsion. The concentrate disperses uniformly in water and will usually remain evenly suspended for at least a day.

Water miscible liquids/powders: Liquids or finely ground solids that mix readily with water. The active ingredient is miscible with water or alcohol and so produces true, clear solutions that don't precipitate out.

Wettable powders (WP) or water-dispersible powders: The active ingredient is mixed with a fine dust (usually clay or talc) and wetting agent (usually dry soap or detergent) this allows the pesticide to be dispersed in water before spraying. The active ingredient is insoluble in water and so without the wetting agent the powder would simply float on the water and be impossible to mix. These formulations tend to 'settle' quite quickly and need to be used quickly or agitated regularly if the concentration of the pesticide in the spray liquid is not to vary during spraying.

Flowable/spraying suspensions or suspension concentrates: Pesticides that are not soluble in water can also be formulated as suspension concentrates, which is as a suspension of very finely ground dust dilutant and a.i. in non-solvent liquid (usually water). This suspension will then mix well with water and can be sprayed in the same way as wettable powders. These formulations have a tendency to sediment out if stored for long periods of time but this can be reduced by 'thickening' the liquid concentrate with polymers that tend to fix the solid in suspension.

Oil solutions: The active ingredient is dispersed in oil-based spray. Many 'ready -to-use' pesticide come in this form. They are more likely to cause damage to the finish of an asphalt tile floor covering.

Dust: The a.i. is mixed with solid, particulate dilutant (usually with size range of 50-100 microns) that is then mixed with the air with the aid of a dusting machine. Scoops, brushes, or bellows duster are used to apply dust. To keep dust from clumping in the duster when shaken put a ball bearing or nut in it. Historically, dusts have been the simplest to make and easier to apply.

Granules: as small pellets (usually 0.3mm -1.3mm) of inert carrier (often clay) mixed with the pesticide a.i. to give the desired concentration. Granules can be formulated to allow either rapid release of the pesticide or slow, controlled release over time. Granules can also be particularly useful when dealing with very toxic pesticides which can be 'shut away' in the granule, allowing them to be handled more safely. Hand operated spreader will be used for granule applications. The granules are mostly used to treat soil insects.

Aerosols: must be soluble in a volatile, petroleum solvent when pressurized. When the aerosol is sprayed and atomized the solvent evaporates rapidly leaving micro-droplets of toxicant suspended in air. Usually used for indoor application of insecticides, repellents and disinfectants. They have low toxicity and short residual.

Fumigants: must be vaporous liquids or gases with a relatively high vapor pressure so that they can exist as a gas in high enough concentrations to kill pest in soil or enclosed spaces. The toxicity of the fumigants is proportional to its concentrations and the exposure time.

Baits: The bait may either be food which is then eaten by the target animal (as in vegetables and mollusks) or an attractant which is used to lure the target to the bait where the pesticide is transferred by contact (as in many insects). One of the main advantages of baits is that, used properly there is practically no release of pesticide into the environment.

PESTICIDE MEASUREMENTS

1 Gallon = 4 quarts or 8 pints or 128 ounces
1 Pound = 16 ounces
1 Cup = 8 ounces

1 Yard = 3 Feet
1 Sq-yard = 9 Square-feet
1 Cubic-yard = 27 Cubic-feet

1 Liter = 1,000 mL
1 mL = 1 cc
1 Gallon = 3.8 Liters

INSECTS

TERMITES

The subterranean and drywood are the two types of termites that cause damage to buildings in southern California. The homeowners can help prevent infestation to his buildings and can save a great deal of unnecessary expense by familiarizing himself with these insects and their habits.

Drywood termites *live inside wood and do not make contact with soil.* They get the moisture they need to live from humid air. For this reason, drywood termites are most common along humid coastal areas.

Subterranean termites *live in the soil and must maintain contact with the ground or some other moisture source to survive.* They build earthen tubes from the ground into the structure for protection from predators and help maintain a moist environment. In some rare situations, if water and wood are available from a source other than the soil, subterranean termites can establish a colony with no ground contact. After a trench application for subterranean termites is completed, you should put clean untreated soil back into the entire trench.

For an existing building, the perimeter of the foundation is trenched and drilled then treated with the termiticides. The goal of the treatment is to put a chemical barrier between the termites in the soil and the structure above. The chemical barrier can also affect those termites inside a building by preventing their return to the soil. In most cases these termites will die of dehydration.

Subterranean Applications:

To treat subterranean termites the pesticide will be injected into the soil. The sub-slab injector is designed to inject chemicals through holes drilled through concrete slabs. You insert the nozzle through the concrete slab and inject the pesticide with pressure (about 40 pounds). The repellent termiticides are all pyrethroids are fast acting nerve poisons that are highly toxic to termites but have low toxicity to mammals.

Flying ants and swarming termites are often difficult to tell apart. Termites have relatively straight antennae while ants have elbowed antennae. Termites have two pair of wings that are equal in length. Ants fore wings are much longer than the hind wings. The abdomen of the termite is broadly jointed to the thorax while the abdomen and the thorax of the ants are jointed by a narrow waist.

CARPENTER ANTS

Most carpenter ants can be easily distinguished from other species of ants by their large size, up to ½ inch long. Common species are dark, often black. Winged ants, which leave the nest to mate and establish new colonies, are sometimes confused with termites. Although ants do not eat wood, they bore into wood to make their nests, which consists of extensive networks of galleries usually begun in areas soft from decay. Indoor carpenter ants nests are bored into wooden parts of the building, sometimes causing serious structural damage. They also nest in wall voids, hollow doors, cracks and crevices, furniture and termite galleries. Infestation can occur in new buildings when land clearing in the area disturbs existing native colonies. Around the exterior of structures, carpenter ants nest in soil and beneath rocks; they bore into living and dead trees and stumps.

Some of the best ways to treat carpenter ants upon finding their entrance hole:

- Apply dust to entrance holes and drill holes into galleries and apply more dust
- Apply liquid pesticide into entrance holes and drill holes into galleries and apply more liquid pesticide
- Use a slow acting formulation applied to galleries to allow the ants to carry it back to the nest

COCKROACHES

- Cockroaches are unwanted by humans due to the fact that they devour food, which it is believed they discover primarily through their sense of smell. They are of extreme importance in bakeries, butcher shops, hotels, private homes, ships, and various localities where humans live and work. They live in or near drains, cracks or wooden store fixtures, hot water pipes, moist kitchen sinks, behind stoves and refrigerators, and under meat chopping blocks.
- All cockroaches are *omnivorous*. They mainly feed on starchy foods such as cereals, meat products, and sweetened or sugary substances. Some of the common substances upon which they feed include beer, cheese, leather (such as that found in upholstered furniture), hair, wallpaper, and dead animals. They eat books; especially those soiled with perspiration, and may feed on the binding of books in order to get to the paste behind the binding. Interestingly enough, they may even be found in greenhouses where they will feed on various plants.

COCKROACH BIOLOGY:

- Humans have what is known as an *endo-skeleton*, or simply a skeleton on the inside of the body. Humans are equipped with arm bones, head bones, leg bones, and backbones that are covered with a layer of muscles, a layer of fat, and a layer of skin. Insects, on the other hand, have what's called an *exo-skeleton*, or simply a skeleton on the outside of its body. The skeleton of an insect resembles a suit of armor which covers the entire insect. The exo-skeleton is made of a substance known as chitin. Chitin is a hard material covered with a wax-like layer which helps conserve the water inside the insects' body.

ANTS

- The two most numerous terrestrial animals on the planet are **ants** in the order *Hymenoptera* (including bees and wasps) and **aphids** (*plant lice*). Ants are extremely successful animals and range from the tropics into the arctic regions and from the dry desert areas down to sea level and moist regions.
- Part of the **success of the ant** is its *social and communal nature* and the fact that ant nests are usually terrestrial and are adapted to a great variety of climatic and soil conditions.
- One of the most **outstanding survival characteristics** of the ant is its *ability to adapt itself to a varying environment*.
- Another important factor in the survival of ants is their *division of labor among the division of labor among colony members*.
- Ants (as well as all insects in the order Hymenoptera) have a *complete life cycle* (metamorphosis).

Anatomy of Ants

- Ants come in a variety of sizes and colors. Ants are typically either, blackish, brownish, yellowish, or reddish in coloration, or any combinational mixes of the aforementioned. The largest ant is the female of *Dorylus wilverthi* and attains a length of up to 4 cm. The smallest ant is 0.8 mm long.
- **Antennae:** One of the distinguishing elements of the ant from other insects is primarily by the **narrow pedicel**, consisting of one or two joints, situated between the thorax and the abdomen. Ants also manifest a noticeable **elbowed antennae**. The discernible pest control operator will notice that the narrow pedicel of the ant is distinguishable from that of the broad connection of the thorax and abdomen in termites.
- The antennae harbors the many sensory cells of the ant and enable the ant in the primary areas of touch and smell. It is made up of a **scape** and **funiculus** (whip), the latter being much more mobile than the former. The funiculus has a tendency to rapidly vibrate and this vibration is associated with the high development of the olfactory sense in ants. An ant losing its antennae would be the equivalent to a man losing his hearing, speech, and eye sight, due to the fact that it is primarily through the antennae that they are aware of their environment and adjust themselves accordingly.
- The sense of smell in ants is radically different to that of humans. Ants can smell with their antennae and even recall smells that are elongated, hard, soft, round, square, and even in a certain direction.
- Ants use their antennae to follow the trails laid down earlier by a lead ant that has dropped a drop of perfume-like chemical (pheromone) along the trail at certain intervals. The ants follow the trail left behind through “smelling” the perfume left behind by the lead ants. If one were to cut off the insects antennae, it would be the equivalent of cutting off a human’s nose and plucking out his eyes. It would lead to great confusion and handicap the insect severely.
- Their eye sight on the other hand is much poorer than that of humans. They have lateral compound eyes; the queen, male and workers of some species have three simple eyes (ocelli). **Ocelli** are adapted only for seeing light or dark. Ants are not believed to be able to see things clearly and distinctly.
- **Head:** Ant heads come in a variety of forms: long, short, wide, thin, protruding, etc. One of the chief components of the ant head consists of the mandibles. The mandibles are used for a variety of endeavors: biting, building, carrying, cutting, gnawing, leaping, and sawing, but strangely enough, never for eating.
- **Legs:** Spurs are usually present on the legs of ants and those on the forelegs are especially large and comb-like. The ant removes dust from the antennae and legs by drawing these through the comb of the tarsus and the spur of the tibia. Moreover, the tarsal hairs are lubricated by the tarsal glands. In this regard, the comb and brush are never absent from the fore-legs. The secretion of the glands of the tarsus causes the grains of dust and other impurities to stick to each other, and this makes it easier for the ant to dispose of them with its comb and brush.

Ant Biology and Habits:

- The ant egg is virtually microscopic in size. It hatches, producing a soft legless larva. After several molts, the larva pupates. In some ants, the pupa is inside a silk, smooth-surfaced, light colored cocoon, while in others the pupa is “naked” (not in a cocoon). The cocoon resembles a large capsule-shaped egg, about the size of the ant itself (a good example of this is the common *Argentine ant*). Sometimes these pupae are mistakenly thought to be ant eggs. Indeed, the pupae of some of the larger species of ants are sold in pet stores as “ant eggs”. A good method in which to see this more clearly is by moving a board under where the ants are living and you will see the adults ants carrying off the pupae (or “ant eggs”) and larvae. By looking more closely, you can see that they also are carrying away the actual very tiny eggs.
- The adult ant may require a few days to become completely mature after emergence from the pupa. During this period, the body hardens and darkens. From egg to adult takes 6 weeks to 2 months or more, depending on the season, temperature, and species.
- As with bees and termites, the ant colony is composed of individuals called **castes**. The ants have three distinct castes: (1) the *workers*; (2) the *males*; and (3) the *females*. All three of these castes go through the same process of egg, larva, and pupa stages of development.

FLEAS

- Small, wingless, brown to black, blood-sucking insects. They belong to the Order “Siphonaptera”. “Siphonaptera” means that they have piercing-sucking mouthparts that are somewhat like a “siphon”; and that they do not have wings (“a” = without; and “pteron” = wing). Fleas are distinctly flattened laterally, and have spines on the body that are aimed backwards. This enables them to move rapidly and efficiently through the body hair of an animal. Their maximum jumping ability is 7”-8” vertically and 14”-16” horizontally.

Life Cycle:

- Metamorphosis is *complete*: egg, larvae, pupae, adult. The time required to complete a cycle depends on temperature, humidity, and the food available to the developing insect.
- Mating takes place on the host animal. The female must have a blood meal before she can lay fertile eggs. The female mates only once, and lays her light colored eggs loose on the host animal. They immediately fall from the pet’s body onto its bedding, onto the ground, or wherever else inside or outside the building where the pet is located at the time. The flea lays her eggs after each blood meal, but not all at once. They have between 1 to 12 days.
- The larvae are worm-like, white, blind, without legs, and have chewing mouthparts. They feed on all types of organic debris as well as flea feces, animal feces, and dried blood. They are rarely seen, but are quite active and can be found in floor cracks, rugs, dog kennels, and in and around the pet’s quarters. The larval stage lasts from a week or two in the summer when the temperature and other conditions are right, to several months at other times.
- The pupa is formed by the larva during its last *instar*. The larva spins a cocoon around itself, and then encrusts itself with various types of debris, including sand if it’s available. This camouflages the cocoon and makes it hard to find. The pupal stage lasts from 1 to 2 weeks. But sometimes a new adult will remain inside the pupal case awaiting a proper stimulus – staying in the pupal stage as long as several months. For example, most fleas that infest buildings are very sensitive to vibration.

The Main Kinds of Fleas Attacking Man:

- Each species of flea usually has its own preferred host. But many will suck a blood meal from a variety of hosts, including man, even when the preferred host is present. For example, the **cat flea** (*Ctenocephalides felis*), and the **dog flea** (*C. canis*) are the two fleas most commonly associated with man in the U.S. However, they must have access to a dog or cat or other animal for the infestation to be maintained. And the **human flea** (*Pulex irritans*) also feeds on ground squirrels, dogs, and other animals in addition to people. This flea is known for its rapid blood sucking on humans and leaving blood spots. These blood spots are used by flea larvae for food. A fourth important flea is the **Oriental rat flea** (*Xenopsylla cheopis*). It is the principal vector of bubonic plague from rat to man.