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## CHAPTER 2

# PRINCIPLES OF PEST MANAGEMENT

Pesticides are valuable tools for reducing the impact of pests in aquatic ecosystems. However, if used incorrectly or without full knowledge of the potential hazards they present, pesticides can cause great damage and injury to the applicator, the public, and the environment.

Pesticides are toxic materials. Applicators assume risk every time they choose to use a pesticide. You can minimize risk by having an understanding of:

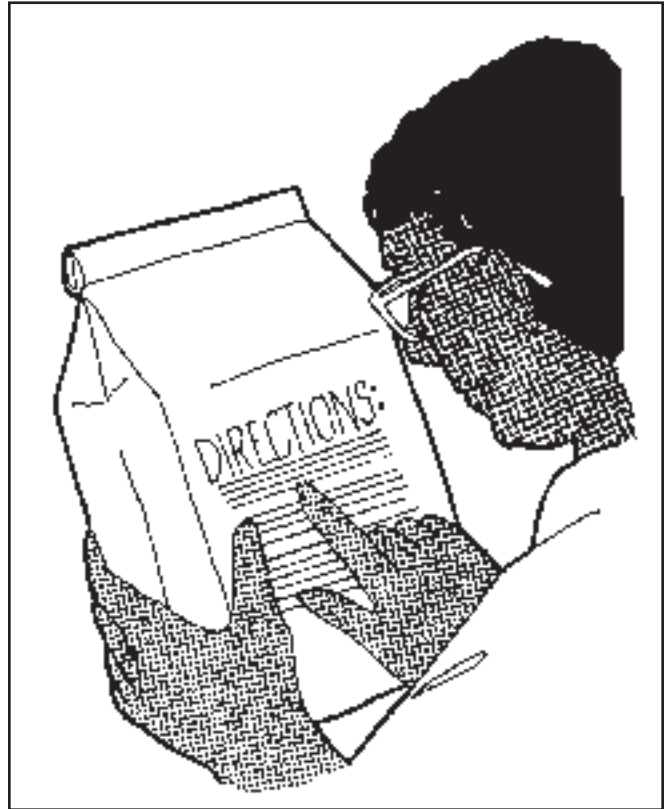
- How to select the best pesticide for controlling the pest you have identified.
- How to apply the pesticide at the proper time (when the pest is most vulnerable).
- How to protect yourself with appropriate personal protective equipment.
- How to properly mix, load and apply pesticides.
- How to dispose of the container and rinsates.
- How to store pesticides.
- The fate of the pesticides you apply.

Much of this information can be found on the product label. Become familiar with the components of a pesticide label so you can use the information for making decisions about pesticide use.

### Pesticide Labeling

Pesticide product labeling is the primary means of communication between a pesticide manufacturer and pesticide users. **Labeling** includes the label itself, plus all other information you receive from the manufacturer about the product when you buy it. **Pesticide users are required by law to comply with all the instructions and directions for use included in pesticide labeling.**

No pesticide may be sold in the United States until the U.S. Environmental Protection Agency (EPA) has reviewed the manufacturer's application for registration and determined that the use of the product will not present an unreasonable



**Read and follow all directions found on pesticide labels.**

risk to humans or the environment when it's used according to label directions. As part of this product registration process, the EPA has set certain labeling requirements and must approve all language that the manufacturer proposes to include in the product labeling. Parts of a label are listed and briefly explained below.

### Parts of Pesticide Labeling

Pesticide labeling contains basic information that helps users clearly identify the product.

**Brand name** — Each manufacturer has a brand name for each of its products. Different manufacturers may use different brand names for the same pesticide active ingredient. The brand or trade name is usually the one used in advertisements

and by company salespeople. Pesticide handlers must beware of choosing a pesticide product by brand name alone. Many companies use very similar names with only minor variations to designate entirely different pesticide chemicals. **Always** read the ingredient statement to verify the active ingredients that a product contains.

**Ingredient statement** — Each pesticide label must list the active ingredients and the amounts of each ingredient (as a percentage of the total product). The ingredient statement must list the official chemical name and/or common name for each active ingredient. Inert ingredients need not be named, but the label must indicate their percentage of the total contents.

The **chemical name** is a complex name that identifies the chemical components and structure of the pesticide. This name is almost always listed in the ingredient statement on the label. For example, the chemical name of Reward is 6,7-dihydrodipyrido(1,2-a:2',1-c)pyrazinedium dibromide.

Because pesticides have complex chemical names, many are given shorter common names. Only **common names** that are officially accepted by the U.S. Environmental Protection Agency may be used in the ingredient statement on the pesticide label. The official common name may be followed by the chemical name in the list of active ingredients. For example, a label with the brand name Sonar would read:

Active Ingredient:

Fluridone: 1-methyl-3-phenyl-5-[3-(trifluoromethyl) phenyl]-4(1H)-pyridinone 41.7%  
Inert ingredients..... 58.3 %

By purchasing pesticides according to the common or chemical names, you will always be sure to get the right active ingredient.

**Registration and establishment numbers** — These numbers are needed by the pesticide handler in case of poisoning, claims of misuse, product recalls or liability claims.

**Name and address of manufacturer** — The law requires the maker or distributor of a product to put the name and address of the company on the label. This is so you will know who made or sold the product.

**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. Liquid formulations also may list the pounds of active ingredient per gallon of product (see the above example).

**Type of pesticide** — The type of pesticide usually is listed on the front panel of the label. This short statement indicates in general terms what the product will control. Three types of pesticides that an aquatic pest manager may encounter include herbicides for weed management, algacides for algae management, and piscicides for fish management.

**Type of formulation** — The front panel of some pesticide labels will tell you what kind of formulation the product is, such as granular or liquid.

## Restricted Use Designation

When a pesticide is classified as restricted by the EPA, the label will state "Restricted Use Pesticide" (RUP) in a box at the top of the front panel. Below this heading may be a statement describing the reason for the restricted use classification.

The Michigan Department of Agriculture also restricts the use of some pesticides that are not classified as RUPs by EPA. The labels for these products may not bear the statement "Restricted Use Pesticide," e.g., Reward. Consult with your regional MDA office for a list of restricted use pesticides in Michigan.

## Front Panel Precautionary Statements

Signal words and symbols — The signal word — DANGER, WARNING or CAUTION — must appear in large letters on the front panel of the pesticide label. It indicates how acutely toxic the product is to humans.

The signal word is not based on the active ingredient alone, but on the contents of the formulated product. It reflects the hazard of any active ingredients, carriers, solvents or inert ingredients. The signal word indicates the risk of acute effects from the four routes of exposure to a pesticide product, oral, dermal, inhalation and eye, and is based on the one that is greatest. Use the signal word to help you decide what precautionary measures are needed for yourself, your workers and other persons who may be exposed.

- **DANGER** — This word signals you that the pesticide is highly toxic. The product is very likely to cause acute illness from oral, dermal or inhalation exposure, or to cause severe eye or skin irritation.
- **POISON/SKULL AND CROSSBONES** — All highly toxic pesticides that are very likely to cause acute illness through oral, dermal or inhalation exposure also will carry the word POISON printed in red and the skull and crossbones symbol. Products that have the signal word DANGER because of skin and eye

irritation potential will not carry the word POISON or the skull and crossbones symbol.

# DANGER



# POISON

- **WARNING** — This word signals you that the product is moderately likely to cause acute illness from oral, dermal or inhalation exposure, or that the product is likely to cause moderate skin or eye irritation.
- **CAUTION** — This word signals you that the product is slightly toxic or relatively nontoxic. The product has only slight potential to cause acute illness from oral, dermal or inhalation exposure. The skin or eye irritation it would cause, if any, is likely to be slight.

**Statement of practical treatment (first aid)** — Most pesticide products are required to include instructions on how to respond to an emergency exposure involving that product.

## Hazards to Humans and Domestic Animals

**Acute effects statements** — The label or labeling will contain statements that indicate which route of entry — mouth skin, eyes, lungs — you must particularly protect and what specific action you need to take to avoid acute effects from exposure to the pesticide. The statements will warn you if you may be harmed by swallowing or inhaling the product or getting it on your skin or in your eyes.

Many pesticides can cause acute effects by more than one route, so study these statements carefully. These precautionary statements tell you what parts of your body will need the most protection. “DANGER: Fatal if swallowed or inhaled” gives a far different indication than “DANGER: Corrosive — causes eye damage and severe skin burns.”

**Delayed effects statements** — The labeling of pesticides that the Environmental Protection Agency considers to have the potential to cause delayed effects must warn you of that fact. These statements will tell you whether the product has been shown to cause problems such as tumors or reproductive problems in laboratory animals.

**Allergic effects statement** — If tests or other data indicate that the pesticide product has the potential to cause allergic effects, such as skin irritation or asthma, the product labeling must state that fact. Sometimes the labeling refers to allergic effects as “sensitization.”

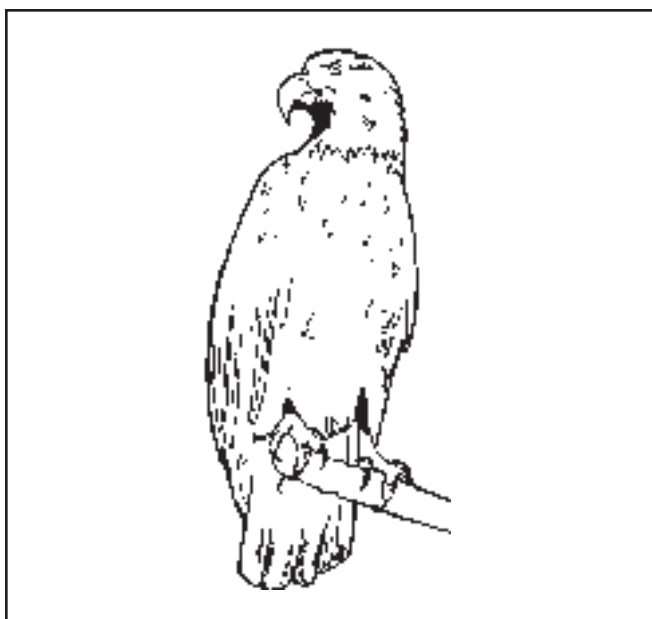
Personal protective equipment statements — Immediately following the statements about acute, delayed and allergic effects, the labeling usually lists personal protective equipment requirements. These statements tell you the minimum personal protective equipment that you must wear when using the pesticide. This includes handling, mixing, loading, working with equipment that contains a pesticide and handling the pesticide containers. Sometimes the statements will require different personal protective equipment for various pesticide handling activities. For example, an apron may be required only during mixing and loading or equipment cleaning.

## Environmental Hazards

This section of the pesticide labeling will indicate precautions for protecting the environment when you use the pesticide. The labeling will contain specific precautionary statements if the pesticide poses a specific hazard to the environment. For example, it may warn you that the product is highly toxic to bees, birds, fish or other wildlife.

## Directions for Use

Directly under the heading “Directions for Use” on every pesticide product labeling is the following statement: “It is a violation of Federal Law to



The pesticide label may require that special precautions be taken to protect endangered species.

use this product in a manner inconsistent with its labeling." The directions section also contains information on storage and disposal and may contain a section on entry into or use of treated areas/sites after a pesticide application. In addition, it will contain the specific directions for using the product.

**Use inconsistent with the labeling** — It is illegal to use a pesticide in any way prohibited by the labeling. You may not use higher dosages, higher concentrations or more frequent applications. You must follow all directions for use, including directions concerning safety, mixing, diluting, storage and disposal. You must wear the specified personal protective equipment. **Use directions and instructions are not advice — they are requirements.** The following are situations that an aquatic applicator may encounter that are not considered uses inconsistent with the label:

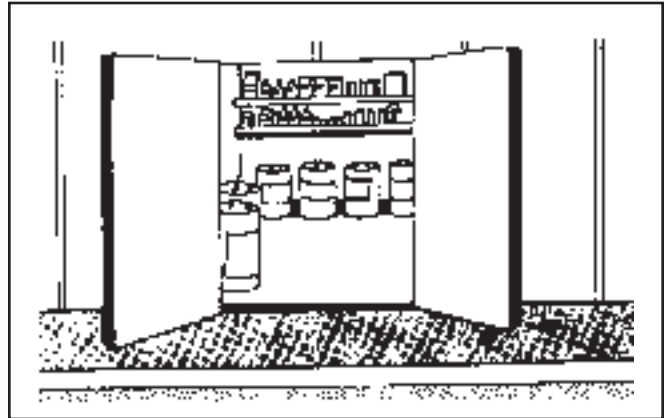
- Using the product at a lower rate than the label specifies.
- Mixing two or more pesticides together if it is not prohibited according to label directions.
- Applying the pesticide at the label rate to control a pest when the pest is not listed on the label but the site where the pest is located is on the label and the label does not specifically prohibit treating the pest. "Site" may represent many things, including a host plant or animal, a field, pond, foundation or structure.

**Entry statement or use of treated water** — Some pesticide labeling contains a precaution about entering a treated area or using treated water after application. This statement tells you how much time must pass before swimming or bathing in treated water or using the treated water for irrigation or consumption; e.g., "Do not use the treated water for animal consumption, spraying, irrigation or domestic purposes for 14 days after treatment."

Michigan applicators are responsible for making information on restricted water use available to water users by posting treated areas and surrounding areas. The permits required for any application of pesticides to Michigan waters may have additional or more stringent requirements than the product labeling. These permits also have posting and notification requirements. Read the "Laws and Regulation" chapter of this manual to learn more about your responsibilities.

**Storage and disposal** — All pesticide labeling contains some instructions for storing the pesti-

cide and how to dispose of excess pesticide and the pesticide container in ways that are acceptable under federal regulations. For acceptable practices in Michigan, consult pesticide-related laws. Appropriate storage and disposal practices are critical for preventing environmental damage.



**Store pesticides in a secured area to prevent human and animal exposure and to ensure the integrity of the products.**

**Other directions for use** — The instructions on how to use the pesticide are an important part of the labeling. Pesticide labels are the best source for determining the appropriate manner for handling the product.

The use instructions will tell you:

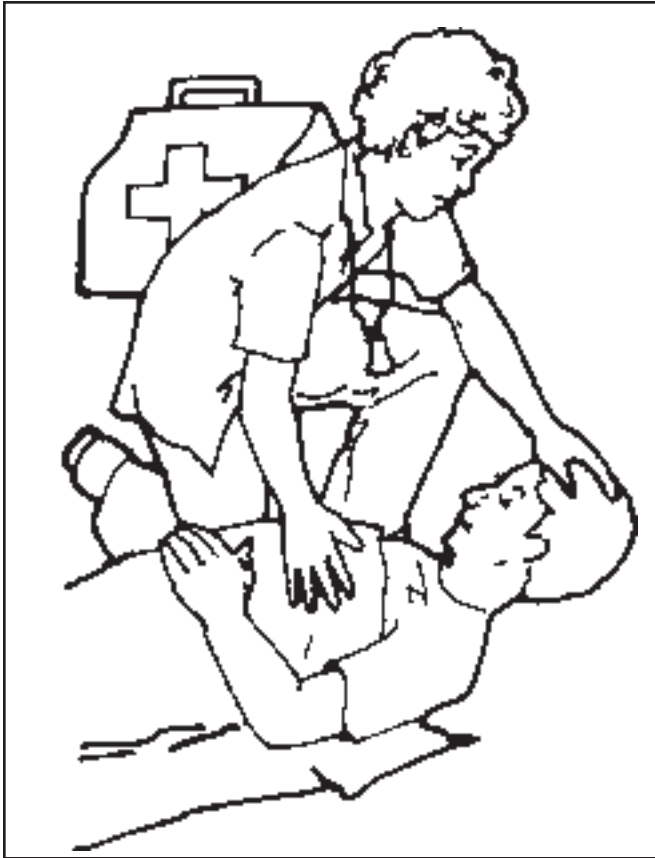
- The pests that the manufacturer claims the product will control.
- The correct equipment to use.
- How much pesticide to use.
- Mixing directions.
- Whether the product can be mixed with other often-used products.
- When, where and how often it should be applied.

## PESTICIDES AND HUMAN EFFECTS

Some pesticides are highly toxic to humans — only a few drops in the mouth or on the skin can cause extremely harmful effects, possibly death. Other pesticides are less toxic, but excessive exposure to them can cause harmful effects, too. A useful equation to remember is:

$$\text{HAZARD} = \text{TOXICITY} \times \text{EXPOSURE}$$

**Hazard** is the risk of harmful effects caused by pesticides. Hazard depends on both the **toxicity** of the pesticide and the **exposure** you receive in a given situation.



Know the potential effects of pesticides and how to obtain help if an emergency arises.

## Toxicity

Toxicity is a measure of the ability of a pesticide to cause harmful effects. Signal words listed on the labels of all pesticides indicate the relative toxicity of the ingredients. These signal words allow us to make informed decisions and take necessary precautions about how we handle, use and dispose of the product according to its toxicity.

**Acute toxicity** generally describes the immediate (usually within 24 hours) effects of a single short-term exposure to a material.

**Chronic toxicity** describes delayed effects from repeated exposures. This is determined by exposing test animals, usually rats or mice, to varying amounts of a material over a life span, or often several generations, and observing the results. Effects evaluated in this way include potential tumors, production of malignancy or cancer, and reproductive effects.

Scientists classify *exposure* to toxicity according to the way a material gets into our system. There are four primary ways that pesticides come in contact with your body:

- **Dermal exposure** — when you get a pesticide on your skin.

- **Oral exposure** — when you swallow a pesticide.
- **Inhalation exposure** — when you breathe in a pesticide.
- **Ocular exposure** — when you get a pesticide in your eyes.

## Managing Risk

Let's look at the hazard/risk equation again:

$$\text{HAZARD} = \text{TOXICITY} \times \text{EXPOSURE}$$

We can manage the level of hazard by making informed decisions and taking every precaution when working with pesticides. If we recognize that the most important factor that influences toxicity is the dose, or the amount of pesticide that enters the body, we can make decisions to limit the dose by limiting our exposure.

## Limiting Exposure

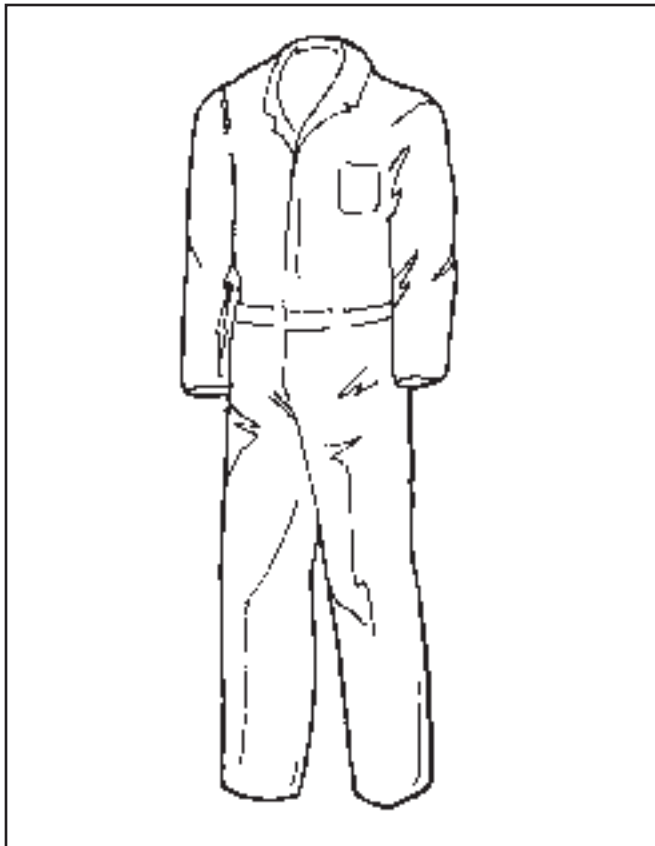
When working with pesticides, be alert, be prepared and exercise every precaution. Handling pesticides without proper protection and common sense can mean unintentional exposure. Consider the unique situations that may arise in your pesticide application because you are in a boat and operating on the water. Your working surface may not be stable when waters are not calm.

Boats may have seats covered in fabric that may absorb pesticides or solutions splashed or spilled on them. Proper and thorough clean-up procedures are vital to avoid accidental exposure to a person who may sit on this surface.

What would happen if a pesticide container is accidentally dropped overboard? If the container floats and has the lid securely attached, your situation is less critical than if a container was open or sinks to the bottom of the lake. Do not dive in after a pesticide that was in an opened or paper container. A person who made such a recovery was severely injured by exposure to the concentrated pesticide dissipating from the package. Avoid exposing yourself to the pesticide. Retrieve the container using proper protective equipment.

Unclothed parts of the body can be directly exposed to the pesticides. While working in warm temperatures and on the water, you may be tempted to wear shorts and a short-sleeved shirt. You are at risk of exposure when making your pesticide applications just as much as the person spraying an apple orchard, a field of corn or the neighbor's front lawn. As we have discussed, pesticides can enter your body through the skin, lungs, eyes and mouth. Dermal exposure accounts

for more than 80 percent of pesticide poisoning cases of pesticide applicators.



Coveralls help prevent dermal exposure.

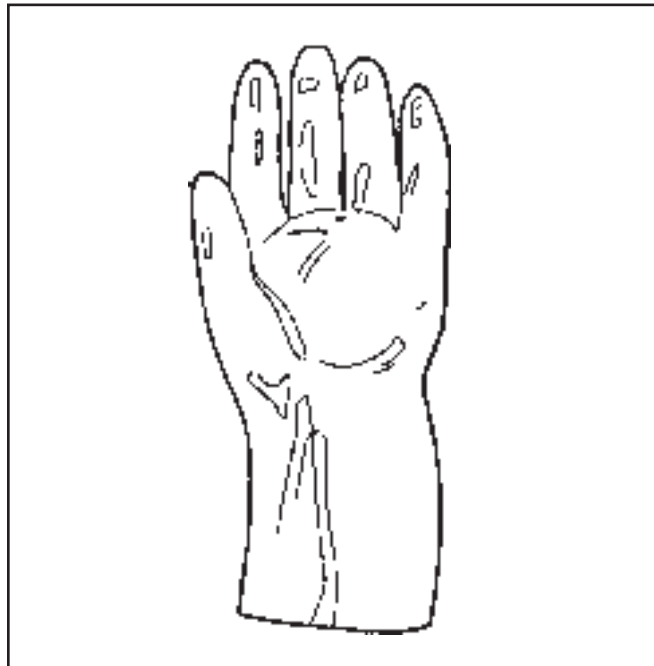
Some parts of the body absorb pesticides faster than others and need extra protection. Studies have shown that the head and scrotal areas are highly susceptible to pesticides. The hands are the culprits in the majority of reported pesticide poisonings. Hands can contaminate an individual through direct contact with the pesticide or by indirect contact such as rubbing the eyes. Proper use of gloves can reduce exposure to the hands by 80 percent. **Never** smoke, eat, drink or use the toilet after handling pesticides without first washing your hands.

Clothing provides protection, but only if it's properly chosen, worn and maintained. Each pesticide situation is unique and requires an individual decision about appropriate **personal protective equipment (PPE)**.

Your choice of protective equipment is going to be based on the information from the pesticide label. Read the label! The label is the law. You must wear the recommended garments, but remember: it's ok to wear more!

To fully evaluate the potential hazard of a pesticide, competent applicators look first at its toxic-

ity by locating the signal words, as well as the formulation and route of entry, found on the label. The signal words indicate the general level of protection needed. For most pesticides labeled "Caution," appropriate work attire, gloves and goggles may be sufficient, while those labeled "Danger" require chemical-resistant clothing.



Proper use of gloves can reduce exposure to the hands by 80 percent.

*Route of entry* information listed under the "Hazards to Humans" section will help you select proper protective equipment. Think carefully and make your decisions. If the label reads "Causes eye irritation" or "Avoid contact with eyes," you should immediately think "Wear goggles and a face shield."

To properly protect yourself from exposure, it is important to understand the protective ability of various fabrics and how to wear the clothing or equipment correctly.

Begin with clean underwear and regular work clothing: long pants, a long-sleeved shirt or coveralls, plus socks and footwear. These garments provide minimum protection against granular pesticides and pesticides labeled "Caution." If these items become saturated with a pesticide concentrate or solution, remove them immediately so your skin does not remain in contact with the chemical. Wash with plenty of soap and water and put on a clean set of clothing.

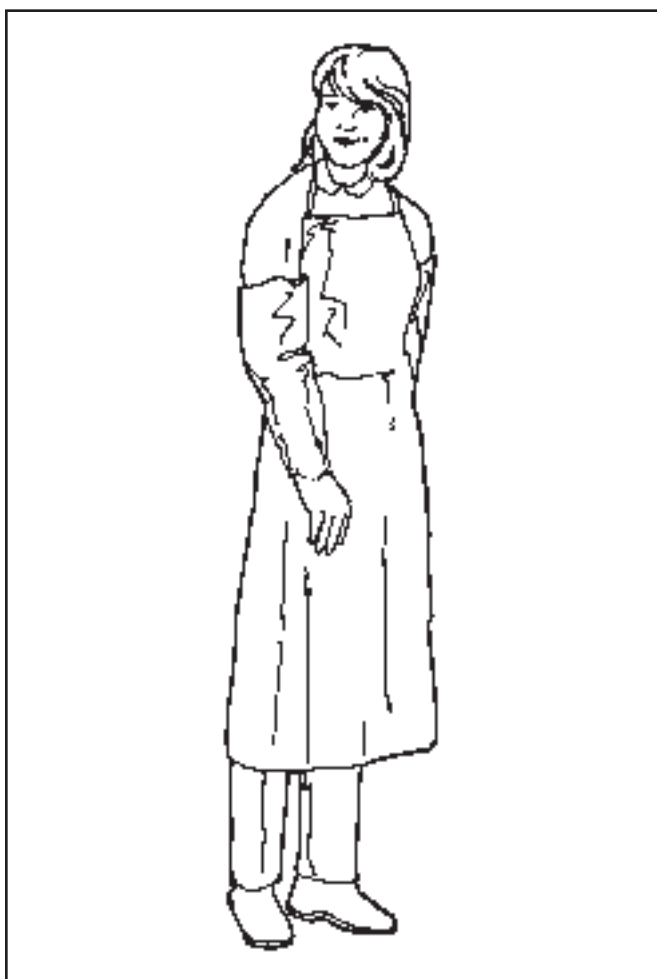
To get maximum protection with ordinary work clothes, choose fabrics made from 100 percent cotton. Select a twill fabric — one with a diagonal

weave such as denim. Select a heavy fabric. New denim will provide more protection than worn denim. Do not wear garments or shoes made of leather — leather absorbs pesticides and cannot be cleaned.

If you expect to be in a situation where a large amount of pesticide could be deposited on your clothing, and if you will be in that situation for a long time, consider wearing a chemical-resistant suit even if the pesticide labeling does not require you to do so.

When an applicator is layered in personal protective equipment, it is easy to become overheated when performing applicator duties. Be careful and monitor your work pace, keeping it moderate and consistent. Take frequent breaks to cool down. Drink plenty of water. Work with another person for safety.

The pesticide labeling may require you to wear a chemical-resistant apron while you are mixing and loading the pesticide and while you are cleaning pesticide equipment. Consider wearing an apron whenever you are handling pesticide concentrates.



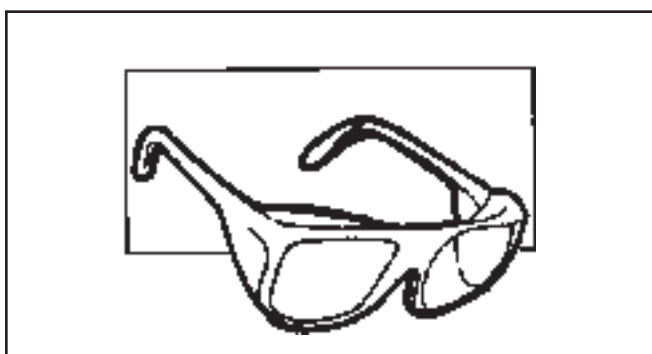
Some pesticide labels may require wearing an apron when mixing or handling pesticides.

It will protect you from splashes, spills and billowing dusts and will protect your coverall or other clothing. Wear an apron over the coverall or long-sleeved shirt and long-legged pants required for application or other handling activities.

The greatest risk to the applicator is in handling and applying highly toxic materials and in mixing and loading pesticide concentrates. Do not tear paper containers to open them; use a sharp knife or scissors. When pouring from a container, keep the container at or below eye level and avoid splashing or spilling on your face or protective clothing. Do not use your mouth to siphon a pesticide from a container. Always stand upwind, or so the wind does not blow the pesticide toward your body.

It is not recommended to wear baseball caps when handling pesticides. They are not chemical-resistant and become a source of repeated contamination because they are worn for many occasions but rarely washed. An aquatic applicator who is exposed to direct sun, glare and reflection off the water, should wear a plastic hard hat or other non-absorbent hat to provide sun protection.

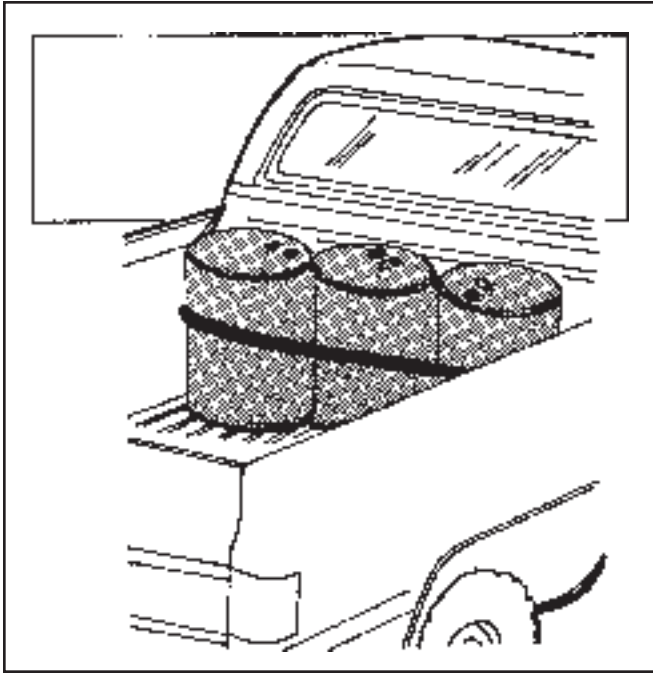
When the pesticide labeling requires you to wear protective eye wear, wear goggles, a face shield or safety glasses with shields at both the brow and sides. Eyes are very sensitive to chemicals in some pesticide formulations, especially concentrates, and temporary blindness caused by an accident may delay or prevent self-treatment. Eyes also readily absorb some pesticides. Do not wear contact lenses when handling pesticides. Instead, wear cover goggles that fit over prescription glasses.



Protect your eyes from pesticides.

## Transporting and Handling Pesticides: Be Prepared

Aquatic applicators travel to application sites and transport spray equipment and the pesticides for the job. They must use common sense and follow all safety precautions. Before leaving for a job site read and follow all pesticide label directions.



**Be sure pesticides are secure during transportation.**

Use the following checklist to make sure you are transporting your materials safely:

**Inspect the vehicle and trailer:**

- Remove sharp objects from the truck bed.
- Check lights, tires, mirrors, steering and brakes.

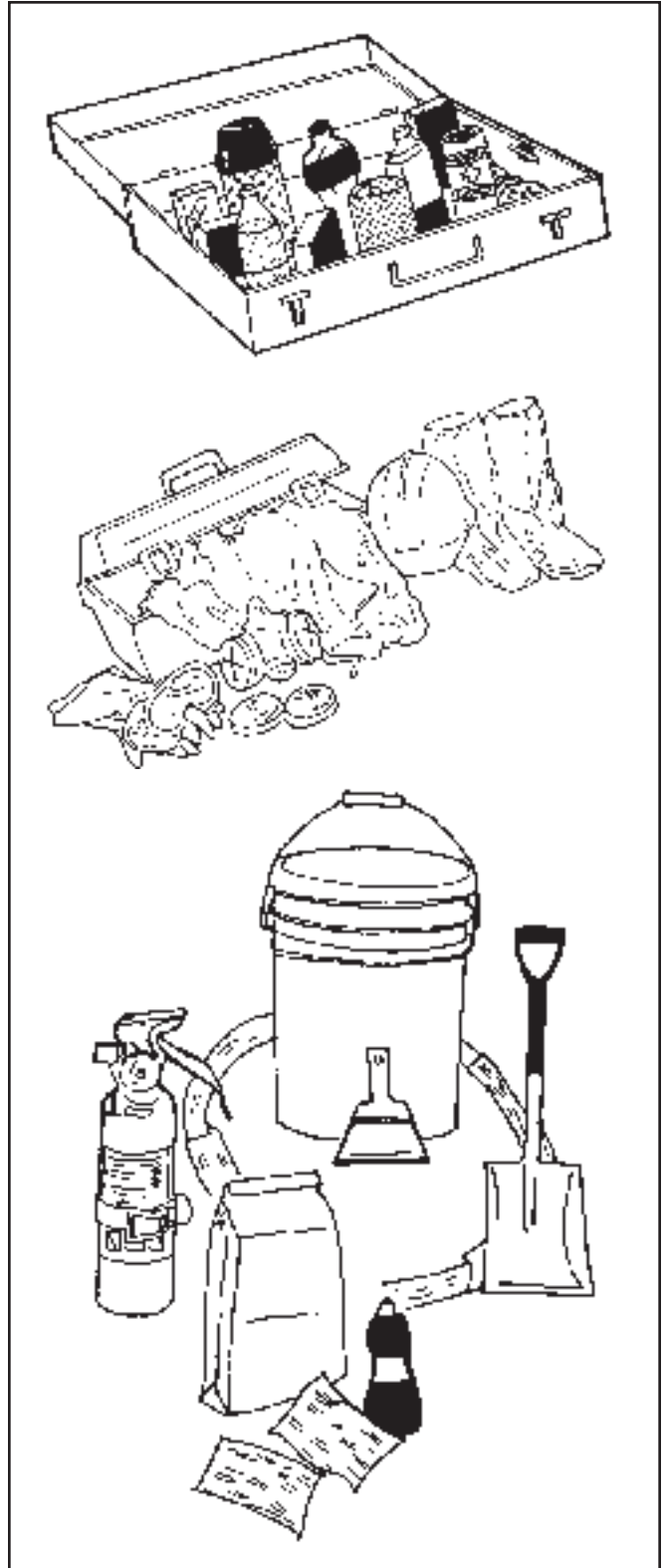
**Put safety equipment and spill kit components in the vehicle:**

- Soap and water for cleaning hands, plenty of fresh water for flushing eyes or skin.
- Protective clothing, boots and chemical-resistant gloves.
- Respirator for toxic fumes.
- Goggles/face shield to protect eyes.
- Shovel to build dirt dikes.
- Adsorbent material for small spills.

**Make sure you have:**

- Your pesticide certification card.
- A tarpaulin to protect containers in case of rain.
- Emergency telephone numbers.
- A first aid kit.

Never transport pesticides in the passenger compartment of any vehicle. Do not stack heavy pesticide containers on top of light ones. Remain alert when driving and handling pesticides. Drive with extreme caution and check with state regulations to determine if your pesticide load requires your vehicle to be labelled with a placard. Be familiar with pesticide label directions and follow them precisely.



**These things should be readily available when transporting or working with pesticides.**

**What to do if a spill occurs:**

- 1) Secure the area — keep people at a safe distance.
- 2) Put on safety equipment to protect yourself from exposure.

- 3) If possible, stop the leak without endangering yourself or others. To stop a small spill on the ground, use adsorbent material and contain it with a dirt dike. Do not use water it will only spread the spill.
- 4) Notify the local fire department.



Use an adsorbent material to clean up liquid spills.

## Maintaining and Washing Personal Protective Equipment

Protective clothing is useless, and may even be harmful, if not properly used and maintained. Check each garment for defects before each use.

Shower as soon as possible after using a pesticide and before changing into clean clothes. Be sure to use plenty of soap and water. Wash your hair thoroughly and scrub your fingernails.

The best procedure for washing nonchemical-resistant items — such as cotton, cotton/polyester, denim, canvas and other absorbent materials and most chemical-resistant items is:

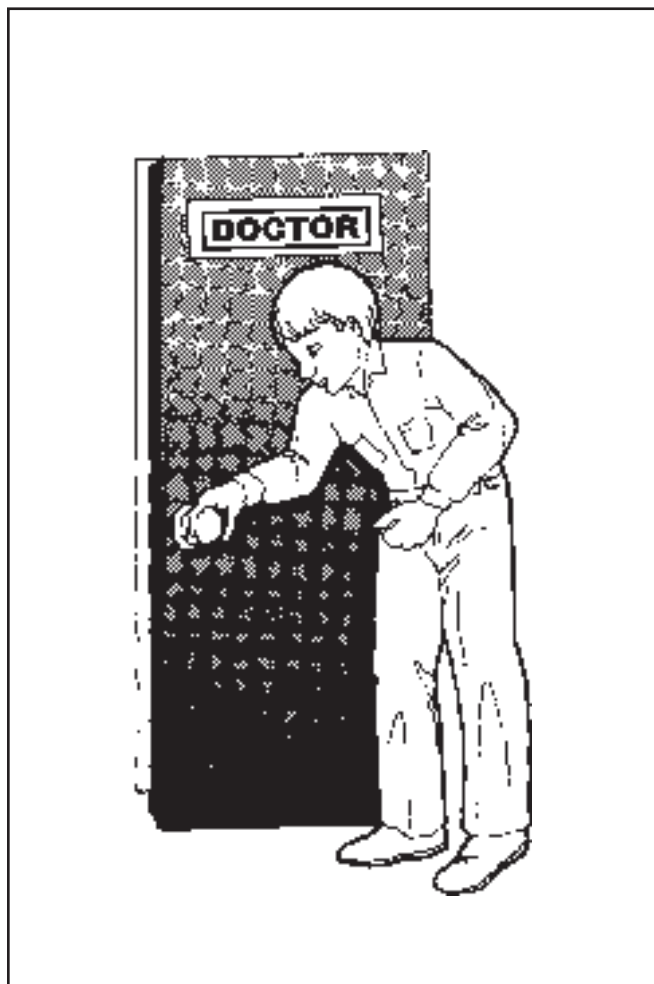
1. Wash clothing **daily** and **separately** from family wash.
2. **Prerinse, presoak** or **pretreat** with a stain remover.
3. Use **hot** water and the highest water level.
4. **Wash in a washing machine**, using a heavy-duty liquid detergent and use the longest wash cycle.
5. **Rinse twice** using two entire rinse cycles and warm water.

6. Use **two entire machine cycles** to wash items that are moderately to heavily contaminated.

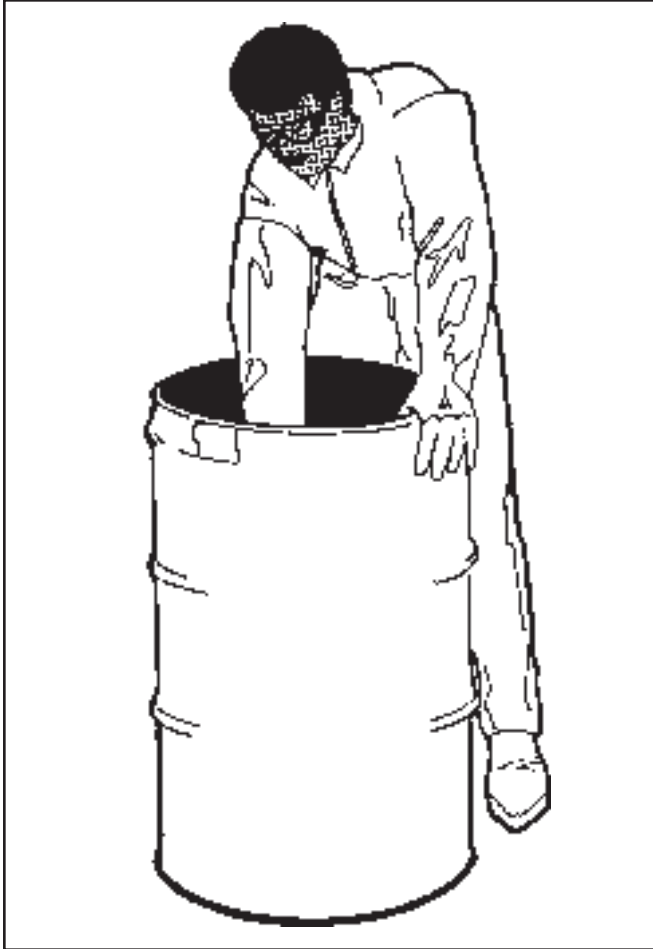
7. **Run the washer through at least one additional entire cycle** without clothing, using detergent and hot water, to clean the machine after each batch of pesticide-contaminated items and before any other laundry is washed.

8. **Hang the items to dry, if possible.** It is best to let them hang for at least 24 hours in an area with plenty of fresh air. When the items are hung outdoors and exposed to clean air and sunlight, any remaining pesticide residues may evaporate or photodegrade (breakdown because of exposure to sunlight). You may wish to have two or more sets of equipment at a time so you can leave one set airing in a clean place while you are using the other set.

Even with the proper equipment and care, accidents happen. Always follow the first aid instructions on the label in case of exposure. If you feel dizzy or strange in any way, get to fresh air and rest. If you must go to a medical facility for treatment, **ALWAYS TAKE A LABEL OR EMPTY CONTAINER WITH YOU.**

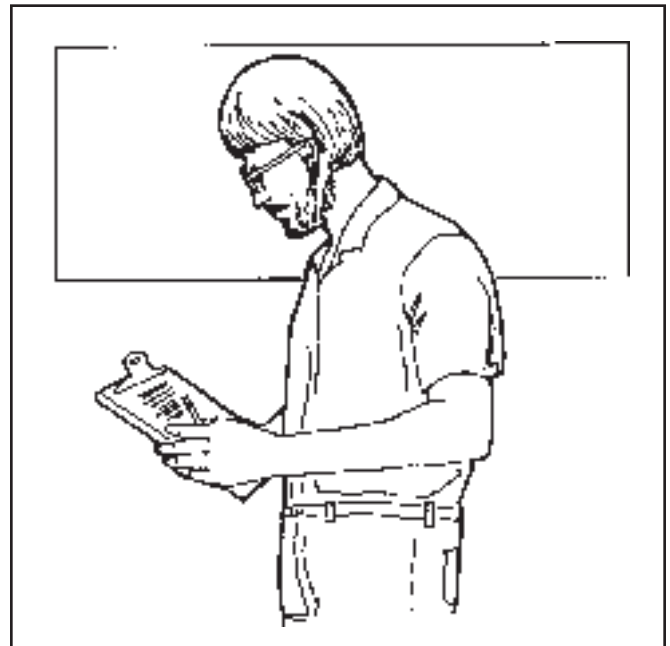


When finishing an application, place all properly rinsed, empty containers securely (tied down, stabilized, out of reach of children, etc.) in the vehicle. Follow container and equipment rinsing procedures explained in the core manual "Pesticide Handling, Storage and Disposal" chapter. All equipment should be cleaned and washed before leaving the site.



Used, protective clothing should be placed in a clearly identifiable bag. Wash your hands with soap and water or other specialized hand cleanser that will neutralize any pesticide residue on the skin. Once the boat is empty and washed out, put it on the trailer, be sure your posted informational signs are securely in place, fill out your treatment report and go to the next site.

Record the events of the day after completing each scheduled job. Include all pesticide information as required by Regulation 636. Your records should include weather, water conditions such as temperature and wave activity, target species condition, abundance, size, life stage, persons encountered and any other notable events.



**Record information about your applications and events of the day.**

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## Chapter 2 – Pesticide Safety Review Questions

**Write the answers to the following questions, and then check your answers with those in the back of this manual.**

1. What pesticide information must an applicator understand to minimize risk, and where can this information be found?
  - a. Active ingredients.
  - b. Amount of inert ingredients.
  - c. The percentage of each component.
  - d. All of the above.
2. What is the primary means of communication between pesticide manufacturers and pesticide users?
  - a. Sales representatives.
  - b. University researchers.
  - c. Sales brochures.
  - d. The product label.
3. List seven or more parts of a pesticide label.
4. What information is included in the ingredient statement?
  - a. Active ingredients.
  - b. Amount of inert ingredients.
  - c. The percentage of each component.
  - d. All of the above.
5. List the signal words and symbols used on pesticides labels.
6. What does a personal protective equipment statement tell a pesticide applicator?

7. Pesticides should not be used:
  - a. At less than label rates.
  - b. At longer intervals than stated on the label.
  - c. At rates higher than directed by the label.
  - d. None of the above.
8. What uses are **not** considered inconsistent with the label?
9. What is the equation for determining the hazard associated with a pesticide?
10. What is hazard, and what does it depend upon?
11. How does one choose personal protective equipment (PPE)?
12. What garments are required for minimum protection, and what pesticide signal words are associated with minimum protection?
13. When should an applicator wear a chemical-resistant apron?
  - a. While mixing and loading pesticides.
  - b. While cleaning pesticide equipment.
  - c. When the label requires the applicator to wear one.
  - d. All of the above.
14. What should be done if a spill occurs?