Chapter 5

PESTICIDE SAFETY

Safety is always an issue when using pesticides. Applicators, bystanders, and the environment can be harmed by exposure to pesticide concentrates or vapour drift. Those who work with pesticides must know and follow safe practices to reduce risk.

Pesticide safety begins with choosing the correct product. Safety is important in pesticide storage, transportation, mixing, and loading. Equipment cleanup and maintenance must be done safely. Unwanted pesticides and empty pesticide containers must be properly disposed.

Learning Objectives

Completing this chapter will help you to:

- **Know why pesticides must be handled with care and knowledge.**
- **Follow safety procedures when handling pesticides.**
- **Select the right pesticide.**
- **Buy the proper quantity of pesticide.**
- **Select personal protective clothing and equipment (PPE) for handling pesticides.**
- **Properly wear personal protective equipment for handling pesticides.**
- **Maintain personal protective equipment.**
- **Clean application equipment safely and effectively.**
- **Maintain application equipment**.

Learning Objectives, cont'd.

- **Know how to safely transport, store, mix, load, and apply pesticides.**
- **Dispose of excess pesticide and empty containers in a safe and legal way.**
- **Reduce bystander exposure to pesticides by limiting re-entry into treated areas.**
- **Keep full and accurate records of pesticide use.**

Attitude and General Precautions

Safe pesticide use begins with:

- Adopting a responsible attitude
- Following basic safety guidelines
- Providing the necessary training for anyone who will handle or apply pesticides

Employees, employers, and supervisors should understand each of these steps.

Attitude

Pesticides can be poisonous to humans, pets, and livestock. They can also harm beneficial organisms and the natural environment. Safe pesticide use reduces risk to applicators, the public, and the environment. The safe use and handling of pesticides is the applicator's responsibility. Work responsibly at all times.

Pesticide handlers should review safety procedures on a regular basis. These can be obtained from the pesticide label. Safety procedures should be checked because:

- Applicators can become careless with a product or process they have become used to.
- Pesticide information and safety procedures may have changed since last reviewed.
- Repetition can bring about poor safety practices.

General Precautions

Safe pesticide handling practices include:

- Reading and following label information and directions
- Wearing clean personal protective equipment (PPE)
- Removing contact lenses before handling pesticides
- Washing before eating, drinking, smoking, or using the toilet
- Not having food or smoking products on your body when handling pesticides
- Never eating, drinking or smoking when handling pesticides
- Immediately, washing any spilled pesticide off an affected person and removing contaminated clothing
- Showering and washing hair and cleaning under the fingernails at the end of each day

Employee Training

Employers, supervisors, and employees must co-operate to reduce workplace injuries and illnesses. The employer is mainly responsible for workplace health and safety. Supervisors and employees also have a role to play.

Employers must supply personal protective equipment (PPE). They must make sure that supervisors and employees are trained in its proper use. Employers must provide supervisors and employees with information on any pesticide to be handled. Pesticide labels must be on the containers. Material Safety Data Sheets (MSDSs) should be given when available. Supervisors and employees must be trained to work safely when handling pesticides.

Supervisors are responsible for ensuring that all employees wear proper personal protective equipment (PPE), and that they understand and follow correct procedures in order to provide a safe workplace. Employees should request information on the pesticides they will be handling if it is not provided.

In Review

There are basic safety precautions that employers, supervisors, and employees involved in using pesticides must learn and follow if they are to minimize risk to themselves, bystanders, pets and domestic livestock, and the natural environment. In particular, they must:

- **Know safety procedures.**
- **Make sure that proper personal protective equipment (PPE)is used.**
- **Ensure that people handling pesticides avoid all contact with product residues during and after application.**

Selecting and Buying Pesticides

Safe pesticide use begins with choosing and buying a pesticide. To ensure that a pesticide is safe to use, make sure that the:

- Pesticide is registered for the intended use
- Pesticide may be used in available application equipment
- Proper personal protective equipment (PPE)is on hand
- Label shows the pesticide as approved for the intended use
- Pesticide can be used safely under site conditions (Impact on non-target life, people, and the environment should be minimal.)
- Pesticide can be used in an integrated pest management program **(See Chapter 7: Integrated Pest Management)**
- Amount of product needed is calculated accurately
- Label restrictions are known

Amount of Pesticide to Buy

Careful planning of pesticide purchases can reduce the amount and duration of pesticides in storage. This reduces the risk of human or environmental exposure. Minimizing the amount of pesticide on site also minimizes the storage space needed. Order and purchase only the amount of pesticide that can be used within a short period of time, or for one application.

Bulk Containers

Some pesticides are sold in reusable mini-bulk or shuttle containers. These containers hold from 50 to 400 litres of pesticide. When empty, these containers can be returned as a sealed unit to the vendor. This eliminates container disposal problems. Pesticides should be bought in these containers, if possible, when large amounts are required. These containers pose less risk in handling and disposal.

Soluble Packaging

Some pesticides come in water-soluble packaging. These may be referred to as solu-packs. They reduce handling and disposal problems. However, care should be taken with this type of packaging. They must be kept in a dry location at all times to keep packages from leaking.

Total amount of pesticide to buy = Pesticide rate X Size of treatment area

Number of containers to buy = Total amount of pesticide needed ÷ Amount in each container

In Review

The proper selection of a pesticide is based on a number of factors:

- **Pest to be controlled**
- **Application equipment available**
- **Personal protective equipment needed**
- **Compatibility with integrated pest management programs**
- **Environmental conditions**

Personal Protective Equipment

Personal protective equipment (PPE) reduces the applicator's exposure to pesticides. To give effective protection, PPE should be chosen based on the information given on the pesticide label. This equipment should be able to handle the rigours of work and length of pesticide exposure. A pesticide applicator should know how to fit, use, clean, and maintain all PPE. This equipment should not be used for any other kind of work.

The personal protective equipment (PPE) needed for a given pesticide depends on the risk associated with its handling. Risk factors include:

- The pesticide's properties
- Type of exposure
- Length of exposure
- Application method

Pesticide Properties

The toxicity, volatility, formulation, and potential type of exposure to the pesticide determine the PPE that is needed. PPE must protect against all types of possible exposure (oral, ocular, dermal, or inhalation). (**See Chapter 4: Human Health)**.

Highly toxic pesticides pose a high risk of harm to applicators and require the most PPE. The more volatile a pesticide, the greater the risk of inhalation. This creates a greater need for a respirator. When smaller pesticide particles are created by application equipment, the need for PPE is increased. Smaller particles are more prone to be inhaled into the lungs. The eyes are very sensitive to toxic chemicals. Eye protection should always be used when mixing and applying pesticides with a 'corrosive' warning on the label.

The need for PPE varies with the type of application equipment being used.

Hazard symbols and label information statements are key to determining the toxicity of a pesticide. They may also tell what PPE is needed when handling or applying the pesticide.

Instructions and Warnings on the Label

The pesticide label gives information on the personal protective equipment (PPE) needed for handling a pesticide. This information appears under the precautionary statement on the secondary panel of the label (**See Chapter 3: Labelling**). Always follow label directions.

A label may not mention each piece of PPE that is needed. It may just state the protection needed. Labels may have statements that indicate a potential problem (e.g., "avoid breathing dust or fumes", "avoid skin contact", or "keep product out of the eyes"). Use these statements to decide which PPE to wear.

Extra information on personal protective equipment (PPE) for a given pesticide can be found on its Material Safety Data Sheet (MSDS), or obtained from a pesticide company representative. Other sources of information on PPE include:

- Pesticide pamphlets
- Safety equipment vendors
- Applicator handbooks
- Training personnel

Dermal Protection

The skin is a major route for pesticides to enter the body.

Gloves

Most exposure of pesticides occurs to the hands. This is especially so during pesticide mixing and loading. By wearing gloves, an applicator can almost eliminate pesticide exposure to the hands. Wear gloves when:

- Handling or applying pesticides
- Rinsing or disposing of pesticide containers
- Repairing contaminated equipment
- Washing contaminated application or personal protective equipment

Gloves should be:

- In good condition (no holes or rips)
- Clean
- Unlined
- Made of proper chemical resistant material for the pesticide
- Long enough to cover the wrist and lower forearm
- Replaced regularly, as some gloves will breakdown over time.

There are several types of materials used to make gloves. No one material is likely to protect against all types of pesticides. Check the label or pesticide supplier for the glove type needed. Some pesticide labels call for certain glove types such as neoprene, nitrile, butyl rubber, or pvc-supported. **Leather or cloth gloves are not suited for handling pesticides.**

Figure 5-1: Proper way of wearing gloves when spraying overhead.

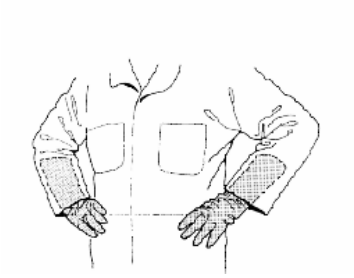


Figure 5-2: Gloves should be covered by coverall sleeves

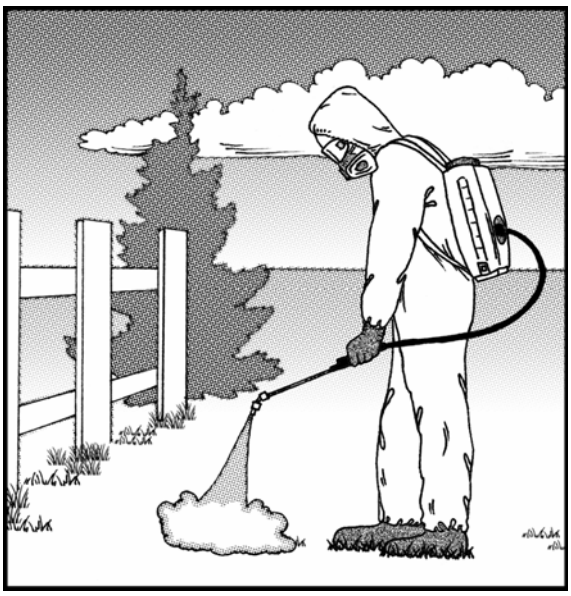
The top of the gloves should be folded to form a cuff. This keeps the pesticide from running down the glove and onto the arm when raised above the head. Sleeves of coveralls or shirts should be worn over the top of the gloves. This keeps pesticides from rolling down the sleeve and into the glove.

- **Gloves are the first piece of PPE to be put on and the last to be removed.**
- **Always use unlined gloves to reduce the risk of absorbing pesticides through the skin.**
- **Always wash gloves before taking them off. That way they will already be clean the next time they are needed. This avoids contaminating other equipment.**

Table 5-1: Minimum Safety equipment that should be worn, based on type of formulation and precautionary words on the pesticide label.

FORMULATION	CAUTION	WARNING	DANGER
Granular	Long-legged trousers and long-sleeved shirt, shoes and socks.	Coveralls, shoes and socks, hat, gloves.	Coveralls, boots, hat, gloves, and cartridge or canister respirator if dusts in air or if label says to avoid breathing dust or vapours.
Spray (where little exposure to spray exists)	Coveralls, boots, hat, and gloves.	Coveralls, boots, hat, and gloves. Goggles if advised by label. Cartridge or canister respirator if label says to avoid breathing vapours or spray mists.	Coveralls, boots, hat, gloves, and goggles. Cartridge or canister respirator if label says to avoid breathing vapours or spray mists.
Spray (where coveralls could be wet through or high exposure hazard exists)	Waterproof suit, boots, gloves, hat, and goggles.	Waterproof suit, boots, gloves, hat, goggles, cartridge or canister respirator.	Waterproof suit, boots, gloves, and waterproof hood. Full-face cartridge or canister respirator.

Body Covering



Once on the skin, pesticides can quickly be absorbed into the body. Skin should be covered to reduce the risk of poisoning from dermal exposure. Protective clothing should include:

- A long-sleeved shirt
- Long-legged trousers or coveralls
- Protective footwear
- Socks

Figure 5-3: Disposable coveralls are lightweight and cover regular work clothes. Hood should be up if head protection is required.

Disposable coveralls designed for pesticide use can be used in place of a long-sleeved shirt and long-legged trousers (e.g., TYVEK QC coverall, Saranex 23P coverall, or KleenGuard EP coverall).

Clothes should be pesticide-free and made of tightly woven fabric. They should be waterproof if the pesticides handled are likely to wet clothing. A liquid-proof, chemical-resistant apron should be worn over coveralls when measuring, mixing, or loading pesticides. This should cover the front of the body from chest to boots. It can be made of rubber or synthetic material. This will prevent absorption of any concentrated pesticide spilled.

Individuals are at highest risk when handling concentrated pesticides.

Boots/Protective Footwear

Applicators should wear unlined boots when mixing pesticides or walking through a treated area. These should be made of a chemical-resistant material (e.g., neoprene, nitrile, or polyvinyl chloride). The boots should reach above the ankle and be covered by the pant leg. This prevents liquid pesticides from running down into the boots and being absorbed through the skin.

Figure 5-4: Wear pant legs over boots

Head Protection

A wide brimmed hat should be worn when handling pesticides. This should be made of a non-absorbent material (e.g., rubber or plastic) for ease of cleaning. The head and neck area can absorb pesticide easier than other parts of the body. Every time cloth or straw hats are worn the head is exposed to the pesticide.

Figure 5-5: Never wear cloth or straw hats!

Cloth baseball caps or straw hats do not provide proper head protection when handling pesticides.

Eye and Face Protection

GOGGLES

The eyes can absorb and be harmed by pesticides. To protect the eyes, wear clean goggles with a rubber or plastic headband. Goggles should fit so that they form a seal around the eyes and have no air vents. Because eyeglasses do not provide complete protection, always wear goggles that fit completely over glasses. Do not wear contact lenses when handling pesticides because they can absorb the pesticide and keep it in contact with the eyes.

FACE SHIELD

A face shield can protect the entire face from spills or splashes when mixing and loading pesticides. Goggles should be worn under the face shield to protect the eyes from mist and volatile pesticides.

Respiratory Protection

A respirator that covers the mouth and nose should be used to prevent pesticide exposure through inhalation. Pesticide spray droplets, particles, and vapours will be kept from entering the lungs when a properly fitted respirator (approved for pesticide use) is worn. Respiratory protection is important because pesticides can enter the bloodstream rapidly and fully through the lungs. If enough is inhaled, pesticides can damage the nose, throat, or lungs, or cause damage to other organs of the body.

Respirators must be approved for pesticide use by either:

- CSA (Canadian Standards Association)
- MSHA-NIOSH (Mines, Safety, Health Association - National Institute of Occupational Safety & Health)
- BHSE (British Health & Safety Executive)

Respirators should fit properly, be clean, and have cartridges that can remove pesticides from the air that passes through them. The cartridge or canister should be approved for pesticide use.

Respirators must be worn when called for on the label. They should also be worn if there is risk of exposure to harmful levels of pesticides in the air (e.g., during mixing, loading, or cleaning up a spill).

Fitting a Respirator

Respirators come in many shapes and sizes. Select one that fits properly. A proper fit may not be possible if the wearer has a beard, facial hair, scarring or ridges. Hair prevents direct contact between the face and the edge of the respirator.

Follow the manufacturer's guidelines for respirator fit. Use one of the two tests that follow:

1. Place the palm of the hand over the exhalation valve cover and exhale gently. The face piece should bulge slightly with no air leaks between the face and face piece. This indicates a proper fit. If an air leak is detected, reposition the respirator on the face and/or adjust the tension of the elastic straps. Repeat until a proper fit is obtained.

Figure 5-6: Exhalation fit test.

2. Place flat pieces of paper or palms of the hands (lightly) over the open area of the cartridge cap. Inhale gently, and hold your breath for 5 to 10 seconds. The face piece should collapse slightly. This indicates a proper fit. If air leakage is detected, reposition the respirator on the face and/or adjust the tension of the elastic straps. Repeat until a proper fit is obtained.

Figure 5-7: Inhalation fit test.

Do a fit test each time a respirator is worn.

Types of Respiratory Protection

Figure 5-8: Never wear a dust mask when using pesticides.

Types of respirators include:

- Cartridge respirators
- Canister respirators
- Air-powered purifying respirators
- Self-contained breathing equipment

Cartridge, canister, and air-powered purifying respirators do not supply oxygen. These should never be worn in places with little or no oxygen. Dust masks protect only from dust particles. They offer no protection from pesticide vapours. Use an approved respirator when there is a risk of exposure to pesticide. vapours.

CARTRIDGE RESPIRATORS

Cartridge respirators are the most common type of respirator used by pesticide applicators. Some of these respirators are now disposable. Cartridge respirators consist of either a half-face or a full-face mask. They provide protection by combining a pre-filter or particle filter to remove dust, small particles, and spray droplets together with one or two cartridges containing activated charcoal to remove hazardous vapours. Special cartridges and pre-filters are needed to protect against pesticide vapours.

Figure 5-9: Half-face cartridge respirator.

When buying or replacing cartridges and pre-filters, be sure they are designed to protect against the type of pesticide you are working with (e.g., organic). Always order cartridges and pre-filters that are made to be used with your respirator. Do not mix and match brands.

Cartridges should be changed at least once a year. Check respirator directions for usage times. If you can smell or taste a chemical when wearing a fitted respirator, you are not protected. Stop work, and leave the area immediately. Cartridge respirators are only good for short-term, outdoor use with low concentrations of pesticide vapour.

CANISTER RESPIRATORS

Canister respirators have a full face-piece and a canister of activated charcoal. The large volume canister allows for use where cartridge respirators may not be suited (e.g., high vapour concentrations). Canister respirators should **not be used** in confined spaces (e.g., fumigated structures) with little oxygen or high gas concentrations. Because air has to be drawn through more activated charcoal, it is sometimes more difficult to breathe comfortably when wearing a canister respirator.

Figure 5-10: Canister respirator.

AIR-POWERED PURIFYING RESPIRATORS

Air-powered purifying respirators use an electric pump to draw air through a charcoal cartridge and particle filter. Purified air is brought to a tightly fitted face mask, or a helmet. These are more comfortable than a half or full facemask respirator. This is especially so on hot days, when respiratory protection is needed for long periods.

Figure 5-11: Air powered respirator.

SELF-CONTAINED BREATHING EQUIPMENT

Self-contained breathing equipment supplies air through a tube on the headpiece. Air comes from a tank of compressed air on the applicator's back. Self-contained breathing equipment is often used when applying fumigants or dealing with emergencies (e.g., fire or major pesticide spill).

In Review

Pesticides can enter the body through skin, eyes, mouth and airways. The personal protective equipment (PPE) that will be needed when handling or applying a pesticide may be described on the pesticide label. PPE should be chosen by the type and formulation of pesticide, so all routes of exposure are blocked. This reduces risk to the applicator. Coveralls, unlined rubber gloves and boots, and certain types of hats will prevent absorption through the skin. Goggles or face shields will protect the eyes. A respirator designed to block pesticide vapours or particles will protect airways. Material Safety Data Sheets also provide information to help an applicator decide what personal protective equipment (PPE) to wear.

Cleanup and Maintenance of Equipment

Care of Personal Protective Equipment

Personal protective equipment protects against pesticide exposure only if it has been:

- Properly fitted
- Properly cleaned after use
- Maintained
- Replaced regularly

All personal protective clothing, (PPE), should be cleaned after each use or at the end of each day. Follow instructions given by the safety equipment manufacturer. Exposure to pesticide residues will be prevented the next time the PPE is handled or used. If specific instructions are not given, the following applies:

Gloves

Clean gloves as follows:

1. Leave gloves on while taking off and cleaning other personal protective equipment.

2. Wash gloves in soap and warm water before taking them off.

3. Check gloves for leaks. Roll the glove from the wrist to trap air in the fingers. Immerse the glove in water.

4. Discard leaky gloves.

5. Replace gloves on a regular basis.

Cleanup of personal protective equipment should be done at the application site, if possible.

Body Covering

Clean body covering as follows:

1. Wash off waterproof clothing before taking it off.
2. Discard heavily contaminated clothing.
3. Use disposable plastic garbage bags for storage of slightly contaminated clothes before washing.
4. Wash clothing after each day of use.

To wash clothes:

- Use chemical resistant gloves to handle contaminated clothing.
- Use a pre-wash treatment on contaminated areas.
- Pre-soak and launder separate from normal laundry.
- Avoid overloading the washing machine.
- Pre-rinse clothing using the pre-soak cycle.
- Use either heavy-duty detergent, bleach, or household ammonia. Do not mix these cleaners.
- Repeat wash cycles as needed for complete cleaning of contaminated clothing.
- Run the empty washing machine through a full cycle after use. Use hot water and detergent to rinse it.
- Set the machine for:
  - A normal wash cycle
  - A full water level
  - Hot water wash and rinse
- Hang clothes to dry. This prevents possible contamination of the dryer.

Throw out clothing that has been heavily contaminated. Place it in a plastic bag and dispose of it with empty pesticide containers.

Always follow the manufacturer's instructions for use/disposal of disposable coveralls.

Boots, Head Protection, Goggles, and Face Shields

Boots, head protection, goggles, and face shields should be washed with soap and warm water after each day of use. They should be checked regularly for leaks or damage. Discard them when they can no longer provide the protection needed.

Respirators

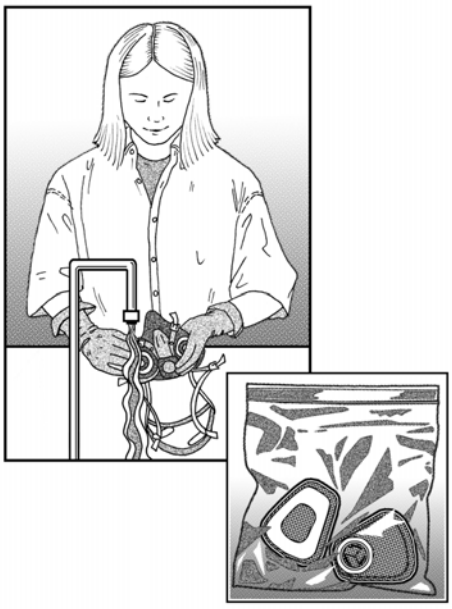


Figure 5-12: Wash face piece separately from cartridges and store cartridges in plastic bag.

Pre-filters and cartridges/canisters should be removed after each day of use. The respirator face piece should be washed in warm water and mild detergent, then rinsed well. Place cartridges in a clean, sealed plastic bag or in a clean airtight container. This prolongs cartridge life by stopping further uptake of vapours. Even moisture from the air can reduce the ability of a respirator cartridge to work properly.

Respirators should be checked regularly for damage. Make sure that all valves, mechanical pre-filters, and charcoal cartridges are positioned and sealed. Cartridges should be changed:

- At the start of each year (as a minimum)
- If breathing through the respirator becomes difficult
- Immediately if a smell or taste of pesticide is noted while wearing a fitted respirator
- When indicated in the respirator manufacturer's guidelines for changing pre-filters and cartridges/canisters

STORAGE OF PERSONAL PROTECTIVE EQUIPMENT

Do not store personal protective equipment in a pesticide storage area, or with regular clothing. A cool, dry storage area extends the life of personal protective clothing. Keep waterproof clothing (e.g., gloves, boots, splash apron, etc.) away from sunlight to extend its life. Keep charcoal cartridges/canisters in clean airtight containers.

After handling pesticides or washing PPE, take a shower before smoking or eating. Wash the body, hair, and under the fingernails.

Application Equipment

Proper maintenance of application equipment extends its life, saves on replacement costs, and promotes environmental and personal safety. Regularly inspect application equipment for wear and replace all worn or damaged parts. Lack of maintenance can cause accidents, spills, damage to non-target sites, or non-uniform pesticide application rates. Application equipment should be shut off before making repairs or adjustments.

Application equipment should be emptied and cleaned after each day of use, when changing pesticides, and before storage at the end of the use season. Do not leave pesticides in application equipment for a long time. This may:

- Allow pesticide to eat into hoses, gaskets, and plastic
- Cause corrosion
- Reduce pesticide effectiveness
- Allow suspensions to settle out (This can create mechanical problems.)
- Allow granules to absorb moisture and form lumps (often making them unusable)

Proper personal protective equipment (PPE) should be worn when cleaning application equipment. Clean application equipment away from wells, surface water, and groundwater. This avoids contamination.

Follow guidelines for taking off PPE. Shower before eating, drinking or smoking. Wash the body, hair, and under the fingernails. Cleaning under the fingernails removes pesticide residues that can pose a risk.

In Review

Proper care and cleaning of personal protective equipment is important to pesticide safety. Cleaning all PPE (coveralls, gloves, hats, boots, goggles and face shields, and respirators) is a must after each job or at the end of the day. Pre-filters and cartridges/canisters should be stored in containers separate from the respirator. Daily cleaning and proper care of application equipment ensures effective operation.

Transportation

Moving pesticides from one site to another requires care. Containers must be packaged and secured to prevent spillage during transport.

Transportation Guidelines

When transporting pesticides, pack pesticide containers securely to prevent movement or breakage. Follow federal and provincial transportation laws. (**See Chapter 2: Regulations.**) Take care when transporting liquid pesticides because a spill may contaminate other containers and the transport vehicle. Ensure that containers are stacked securely to reduce the chance of breaking or spilling. If a spill does occur, do not use the contaminated packages. Return them to the manufacturer for disposal or repackaging. Clean the vehicle to prevent further contamination.

To avoid cross contamination, never transport pesticides with:

- Human or pet food
- Livestock feed
- Fertilizer
- Clothing
- Household goods

The above commodities must be kept separate from pesticides. Never leave pesticides unattended in a vehicle, unless they are locked in a compartment separated from the passenger area.

Figure 5-13: Make sure pesticide containers are secure when transporting.

Pesticides should be transported in containers that are in good condition, with an approved and intact label. Never buy or off-load broken or leaky containers. Pesticides should be repackaged or disposed of if paper or plastic bags are broken (**See Chapter 9: Emergency Response**).

When transporting liquid formulations, make sure caps and plugs are tightly closed and containers are arranged in an upright position. Protect paper and cardboard containers from moisture (e.g., rain, snow, humidity).

Never transport pesticides in the passenger compartment of a vehicle or let people or animals ride in the same compartment with pesticides (e.g., the back of a truck). Harmful fumes can be released and spills can cause poisoning or vehicle contamination. Do not transport pesticides on a wooden truck bed because wood absorbs spilled pesticide and may contaminate future cargo loads. Pesticide containers should be placed in an enclosed metal or plastic storage box. If this is not possible, place pesticide containers on a waterproof tarp. Storage boxes or bulk pesticide containers must be secured to the transport vehicle. Carry personal protective equipment and spill clean-up equipment (e.g., a shovel and chemical neutralizer) to safely collect pesticide in case of a spill.

In Review

Safe transport of pesticides reduces the risk of spills.

- **Only transport containers that are in good condition.**
- **Check that all caps and plugs are tightly closed and containers are secured to prevent spills.**
- **To prevent theft, never leave pesticides unattended or in an unlocked compartment.**
- **Separate pesticide containers from other goods to prevent cross-contamination.**
- **Never transport pesticides in the same space as passengers.**
- **Prepare for emergency spills by having PPE and spill cleanup equipment on hand.**

Storage

Correct storage of pesticides can reduce the risk to humans, animals, and the environment. Some provinces have laws dealing with pesticide storage. Consult the provincial pesticide regulatory body for requirements in your area.

Storage Location

A storage facility should be:

- Separate from work areas, living areas, and areas where animals are kept
- Away from wells, ditches, or water bodies

- Away from porous soil and areas where flooding can occur
- Away from areas used by the public, children, and animals
- Ideally located 50 metres away from homes, hospitals, schools, and occupied buildings
- Accessible by road to emergency personnel

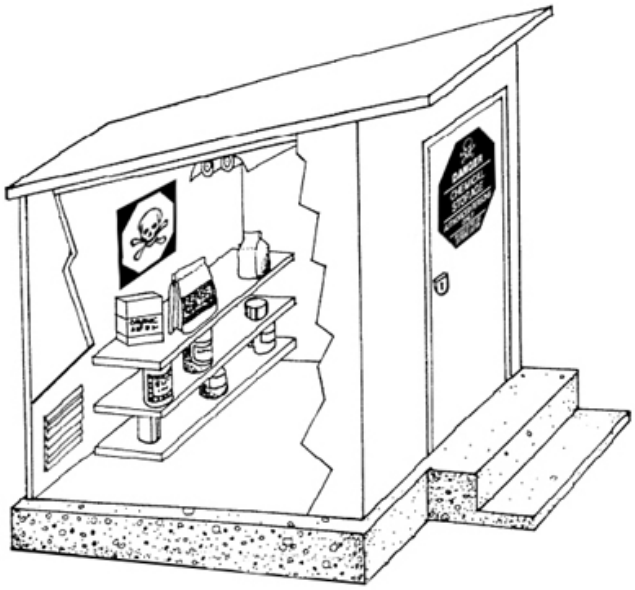


Figure 5-14: Storage Facility

Storage Facility

The storage facility should:

- Be used only for storing pesticides
- Be locked to prevent entry by unauthorized persons
- Be built to protect against adverse weather
- Be made of fire resistant materials
- Have a floor that does not allow seepage (with a curb to retain spills)
- Not have floor drains, unless self-contained (e.g., leading to a holding tank)
- Be well ventilated in all weather conditions
- Be well lit
- Have shelves made of materials that do not absorb pesticides
- Have proper electrical wiring
- Have proper fire extinguishers outside the storage facility

- Have easy access to emergency equipment and personal protective clothing outside the storage facility
- Have a warning sign on the entrance that indicates:
  - Pesticides are stored there
  - Flammable materials are present
  - No smoking

Temporary Pesticide Storage

Large weatherproof bulk containers and transport trailers can be used for temporary outdoor storage, but principles that apply to permanent storage still apply. Ensure that security measures are in place and only allow access to authorized persons. Post proper warning signs.

Storage Guidelines

Container Storage

Read and follow label instructions when storing pesticides. Pesticides must be stored in original containers with original labels intact to ensure that the pesticide is used for its intended purpose. Containers should be stored in areas set aside for pesticides. Never store them with other items. Containers should be checked regularly for leaks, tears, rust, or loose lids. Defective containers should be returned to the vendor or disposed of according to provincial laws (*see* section on **Disposal**). Close containers when not in use and store them in a dry area.

Store pesticides in their original containers.

Good Housekeeping Practices

Store a minimal amount of pesticides. Make careful estimates of amounts needed. This will reduce the need for disposal of excess and unwanted pesticides at the end of the use season. To prevent possible cross-contamination, never store pesticides with or near food, animal feed, seed, veterinary supplies, or in the home. Do not smoke or eat in or around the storage facility.

Storage Area Design

Pesticide storage areas should be located away from wells and water supplies. Store pesticide containers away from direct sunlight to prevent losses to heat or photo degradation. Store combustible materials away from heating systems to prevent fire hazards.

Store herbicides away from insecticides and fungicides. This prevents cross-contamination. Herbicide vapours can be absorbed into other pesticides. This can cause phytotoxicity and unwanted residues.

Keep pesticides separate from other materials that could be hazardous should they contact each other. Pesticides such as dazomet, maneb, and mancozeb produce flammable vapours when wet. Other pesticides, such as difenzoquat, methyl bromide, and paraquat, produce flammable hydrogen gas on contact with aluminum. Glyphosate produces hydrogen gas on contact with galvanized metal.

Keep pesticide containers upright and off the floor. Allow enough space between rows to permit inspection of containers for corrosion and leakage. Follow manufacturer's suggested stacking heights and make sure that tiers are stable and secure.

Keep a list of the quantity, type, and age of pesticides in storage. This allows you to plan purchases. In case of emergencies such as fires or floods it is important to have such a list. This list should be kept handy, but away from the storage site to allow access in case of an emergency.

To minimize handling, only remove the number of containers required for immediate use. Return containers to the storage area when not in use. Inform the local fire department of the location and contents of the storage facility. Keep proper personal protective equipment and a first aid kit near, but not in, the storage facility. Keep pesticide-mixing equipment in the locked pesticide storage. Allow clear access to emergency equipment at all times. Keep a list of emergency telephone numbers (e.g., fire department, medical personnel, and poison control centers) posted in a proper

location. Keep pesticides from freezing if stated on the label. Follow all provincial and/or municipal building, fire, and electrical codes.

In Review

Safe storage of pesticides requires attention to location and features of the storage facility (whether permanent or temporary). The pesticide storage should be located where it will not threaten people, animals, or the environment, and be made of fire-resistant materials. Restrict entry to only authorized persons. Keep the pesticide storage well ventilated, and keep emergency and spill cleanup equipment on hand.

Pesticides should be stored in their original containers. Herbicides should be separated from other pesticides to prevent cross-contamination. Inform the local fire department of the location and contents of a pesticide storage facility. Adhere to all provincial and/or municipal building, fire, and electrical codes.

Mixing and Loading

Mixing and loading pesticides is one of the most hazardous aspects of pesticide use because the mixer or loader will be exposed to concentrated product. Proper personal protective equipment (PPE) must be chosen and used. A site must be chosen for pesticide mixing and loading that will not harm the environment. Care must be taken to prevent pesticide spills and contamination of surface and groundwater.

Wear personal protective equipment when mixing and loading pesticides. Refer to provincial laws.

Personal Protection

Individuals should wear the following PPE when mixing and loading pesticides:

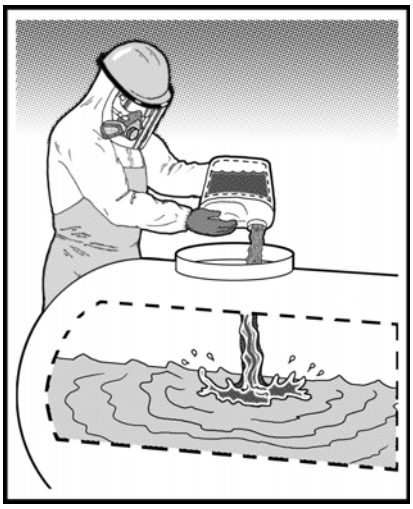
- Long sleeve shirt and pants, or coveralls
- Water repellent head protection
- Unlined chemical resistant gloves and boots
- Face shield and/or goggles
- Chemical resistant apron
- Respirator (for highly toxic or volatile pesticides)

Preparation for Mixing/Loading

Before mixing and loading a pesticide:

- Read the label to confirm that the pesticide is registered for the intended use.

- Review safety precautions, first aid information, mixing directions and pesticide rates. This information will also be found on the pesticide label.



- Ensure that first aid equipment and emergency phone numbers are within reach.
- Calculate how much pesticide is required for each tank or application site.
- Put on personal protective equipment before you begin.
- Prepare only the needed amount of spray mixture.

Figure 5-15: Mixing and loading requires the most PPE as this is the time the pesticide is most concentrated and poses the most risk to the handler, mixer or loader.

Selection of a Mixing/Loading Site

To protect applicators and the environment, the mixing and loading site should:

- Be outside or well-lit and well-ventilated
- Be close to the application site
- Be away from other people, livestock, and pets
- Be in an area where a spill or overflow will not get into a water supply
- Have an emergency water supply, soap, and spill cleanup equipment nearby

Mixing/Loading of Pesticide

Mix and measure pesticides on a sturdy, level surface. The mixing surface should be made of material that does not absorb pesticides, or it should be covered with heavy-duty plastic. Prevent pesticide contamination by not using this surface for any other purpose. Do not mix pesticides in wind or in situations that can increase the risk of exposure. Hold the pesticide container below eye level when pouring to

prevent pesticide from splashing into the eyes. Do not tear open bags. Cut them carefully with a sharp knife to prevent exposure or spills.

Measure the pesticide accurately to ensure the proper application rate.

When mixing and loading a pesticide in a spray tank, follow label directions. If not stated on the label, the following guidelines should be used:

1. Use clean water.
2. Make sure the spray tank is level while it is being filled. Add roughly half of the required water to the tank.
3. Turn on the agitator (if indicated on the label).
4. Stand on the ground or on a sturdy platform when adding pesticides to application equipment.
5. Add the pesticide slowly, holding the container below eye level.
6. Triple rinse or pressure rinse any empty containers and measuring equipment. Add the rinse water to the spray tank.
7. Add water to the tank until it reaches the required level. Do not overfill.
8. Prevent tank overflow. Never leave a tank unattended while filling.
9. Close and return pesticide containers and measuring equipment to locked storage.
10. Wash gloved hands.

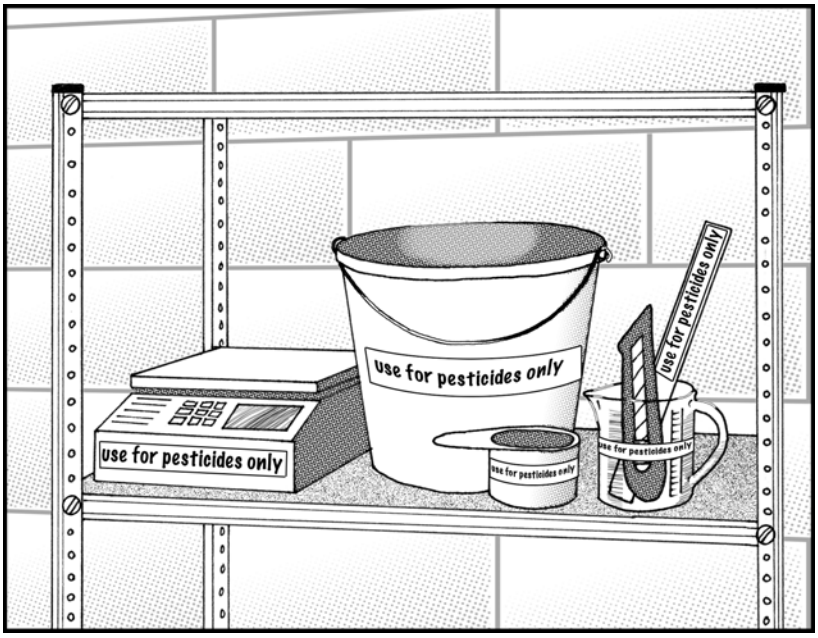


Figure 5-16: Make sure scales, measuring cups, pre-mixing pails, and knives are used only for pesticides. After use, wash these with soap and water, triple rinse, and return them to the locked storage.

Stop and clean up a pesticide at once if it is splashed or spilled.

When working with pesticides, care is required to prevent contamination of surface or groundwater. To reduce the risk of water contamination:

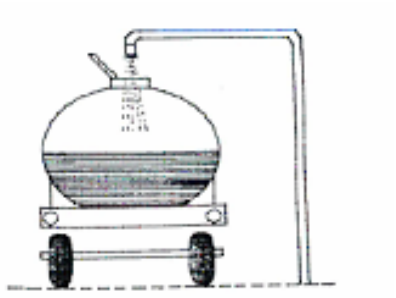


Figure 5-17: Air gap prevents back-siphoning

- Fill the sprayer away from the water source.
- Use a nurse tank to bring the water to the sprayer.
- Keep the filler hose above the water line in the spray tank to prevent back-siphoning of the spray mixture into the water supply. Use an anti-backflow device.
- Clean application equipment and PPE at the application site, when possible.

Bring the water to the sprayer. Do not bring the sprayer to the water.

In Review

Ensure the safety of applicators, bystanders, and the environment during mixing and loading of pesticides by:

- **Using proper personal protective equipment (PPE) as stated on the pesticide label**
- **Properly locating the mixing and loading site**
- **Adding pesticide properly to the application equipment**
- **Reducing the risk of groundwater and surface water contamination**

Application

The careless or improper application of pesticides may risk exposing people or nearby property. Exceeding label rates or applying pesticides in unsuitable weather can contaminate surface or groundwater. Failure to handle pesticides safely can put the applicator at risk from spills and exposure.

Before and during a pesticide application, applicators should practice the following:

- Read the label
- Wear proper personal protective equipment (PPE)
- Use clean water
- Prevent contamination
- Mix and apply safely
- Never work alone
- Calibrate equipment
- Plan the pesticide application
- Apply granular pesticides correctly
- Repair equipment malfunctions safely

Read the Label

The most important thing to do before applying a pesticide is to read and understand the pesticide's label information.

Wear Proper Personal Protective Equipment (PPE)

Wear proper PPE for the specific pesticide and method of application.

Use Clean Water

Have a supply of clean water at the application site for personal clean up. This water can also be used in an emergency. Clean water tanks should be nearby or attached to application equipment.

Prevent Contamination

Before a pesticide application begins, cover or remove all items that may become contaminated (e.g., animal feed, water containers, toys, food utensils, etc.). Remove livestock and pets from the area if there is a risk of exposure. Make sure that proper warning signs are posted at points of entry to the treatment area. Before application, consult provincial laws/municipal by-laws for specific signage regulations. Prevent contamination by following buffer zones and re-entry times, as indicated on the label and/or provincial laws.

QUIZ # 5-1: PREVENTING CONTAMINATION

Answers are located in Appendix A of this manual.

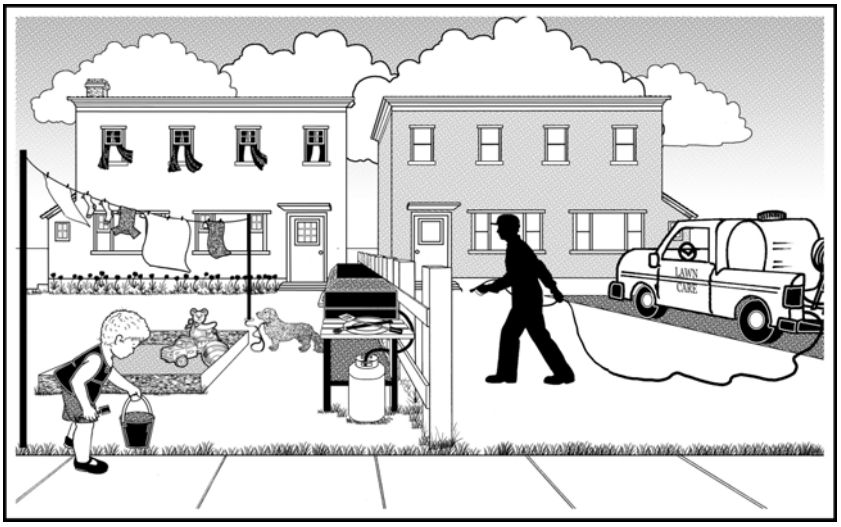


Figure 5-18: List the precautions that should be taken before pesticide application.

Mix and Apply Safely

Pesticides should be mixed and used at rates called for on the pesticide label. Only use outdoor pesticides under favourable weather conditions.

Never Work Alone

Avoid working alone with pesticides. This is especially important when you are working in hazardous conditions. If you must work alone, make sure that someone else knows what pesticide you are using and its *Pest Control Products Act* Registration Number. They should also know where you are working, and when you plan to finish.

Calibrate Equipment

Use calibrated application equipment that is suited to the type of application, as stated on the label. Make sure that the equipment is in good working order. Use and maintain the settings (speed, pressure) chosen during calibration.

Plan the Pesticide Application

Plan a travel route that will avoid passing through airborne spray or freshly treated areas. Stop the pesticide application when passing through an area that does not require treatment. For example, shut off spray nozzles on a boom when turning or crossing a grassed waterway.

Apply Granular Pesticides Correctly

Soil-incorporated granules should be properly mixed into the soil and covered during their application (even at the ends of rows).

Repair Equipment Malfunctions Safely

If application equipment breaks down, shut it off and put on proper personal protective equipment (PPE) before fixing it. When repairs are complete, wash your hands before continuing the application. Wear gloves and goggles when replacing or cleaning plugged nozzles. Use a soft brush and clean water, or compressed air, for blocked nozzles.

Never blow out a nozzle with your mouth. Never use sharp, metal objects or wire to remove a blockage. This can damage the nozzle.

Pesticide Drift

Pesticide drift can damage non-target crops, landscape ornamentals, and lawns. It can pose a health hazard to people and damage the environment (e.g., water, wildlife, aquatic habitat, etc.). To reduce pesticide drift:

- Use the lowest possible application rate.
- Deliver the spray as close to the target area as possible.
- Select the slowest speed possible for motorized application equipment.
- Use nozzles that reduce fine droplets (e.g., large nozzle orifice, low pressure).

When working with sprays:

- Use an anemometer (wind meter) to measure wind speed and direction. Keep a record of this.
- Do not apply when wind speeds exceed provincial regulatory requirements or the label maximum. (**See Chapter 6: Protecting the Environment** and **Chapter 8: Application Technology.**)
- Do not apply pesticides when the temperature exceeds 25^0 C. The release of vapours by pesticides increases as the temperature rises.

In Review

Follow safety guidelines before and during pesticide application. This avoids human exposure and environmental damage. The pesticide label is an important source of information for application rates, acceptable weather conditions for pesticide use, and buffer zone requirements.

In addition, provincial legislation may indicate the type of weather conditions and buffer zone requirements that are permitted for certain types of pesticide use. Choosing and using proper personal protective equipment (PPE) can reduce the risk of exposure to the applicator. Items should be covered or removed to protect them from exposure. Signs can help to notify people of a pesticide application. Application equipment should be calibrated and kept in good working order.

Disposal

Risk of human exposure or environmental contamination must be minimized when cleaning and disposing of empty pesticide containers and excess pesticides.

Container Cleaning and Disposal

Containers should be cleaned when emptied. This removes pesticide residues before they dry. When emptying a pesticide container:

- For liquids, drain the pesticide into the spray tank or mixing tank until no drips are visible.
- For solids, gently shake the bag into the tank or hopper until no loose pesticide remains.
- Triple rinse or pressure rinse metal, plastic, or glass containers, unless otherwise indicated on the label.
- Gently single rinse bags if possible, unless otherwise indicated on the label.

Empty pesticide containers should be properly cleaned and disposed of because:

- Improperly rinsed containers cannot be recycled.
- Pesticide residues can be hazardous to humans. Children playing around containers could be poisoned.
- Pesticide residues can contaminate the environment. For example, rain could wash residues into a stream and kill fish.
- Poor container disposal creates a bad public image. Customers who see poor disposal may refuse future business.
- Poor disposal practices waste pesticides and money.

To Triple Rinse an Empty Pesticide Container:

1. Fill the empty container to at least 10% of its volume with a diluent (usually water) and recap. The amount of rinse water required may vary.
2. Shake or roll the container, and make sure that inside surfaces are well rinsed. Pour the rinse water into the spray tank. Repeat the process twice more. If pressure-rinsing equipment is used, rinse the container for 60 seconds. Pour the rinse water into the spray tank.
3. After cleaning, make the empty container unusable by cutting, puncturing, and/or crushing plastic, metal, or paper containers. Break glass containers in a plastic bag. This prevents future uses such as for water buckets, harvesting containers, or sand pails.
4. Cap and properly dispose of the container. Plastic containers can often be returned to vendors or depots for recycling/disposal. Check the provincial regulatory body to find out how to dispose of paper or plastic bag containers, large drums (refillable and non-refillable) and glass bottles. If you cannot dispose of cleaned, empty containers immediately, return them to locked storage.

Domestic pesticide containers can be discarded with household garbage once they have been cleaned.

Pesticide Disposal

Disposal of Concentrated Pesticide

Planning your pesticide purchases will minimize excess pesticide concentrates left over after an application or use season. Review records of prior applications. Use the pesticide that is on hand before buying more. Contact the pesticide manufacturer or a local vendor to be sure that old stocks are still effective.

The safest way to dispose of pesticide concentrates is to use them according to label directions. If this is not possible, unopened containers may sometimes be returned to the manufacturer or local dealer. Applicators can also contact the provincial pesticide regulatory body for advice on proper disposal of unused pesticides.

Disposal of Surplus Tank Mixture

Applicators can avoid large amounts of surplus tank mixture before mixing by:

- Accurately measuring the area to be treated
- Confirming application rates
- Calibrating application equipment

If there is tank mix remaining at the end of an application, use it according to label directions on another area that requires the same pesticide. If this is not possible, contact the provincial pesticide regulatory body for advice.

Never apply surplus tank mixture a second time to the treatment area.

In Review

You must properly dispose of empty pesticide containers and excess mixed pesticide. This reduces the risk of human exposure or environmental contamination. Empty plastic containers should be triple rinsed and returned for recycling. Dispose of non-plastic containers (glass bottles, paper or plastic bags, drums, etc.) according to label directions or provincial laws. Planning can minimize excess tank mix. If excess pesticide remains, use it on a similar treatment area or dispose of it according to label directions.

Re-Entry

Humans risk being exposed to pesticides if they enter treated areas too soon after an application without wearing proper personal protective equipment (PPE). Levels of exposure in freshly treated areas can be as high as during application.

Re-entry times are stated on some pesticide labels. If these times are not given, exposure can be minimized by following provincial re-entry guidelines or waiting until liquid pesticides dry. Observe the re-entry time before going into a treated area without wearing proper PPE. If you need to re-enter a treated area before the re-entry time has passed, wear appropriate PPE. Make sure that all who may enter a treated area are aware of the re-entry time by posting signs.

Figure 5-19: Wear appropriate PPE if you need to re-enter an area before the re-entry time has passed.

The re-entry time, or re-entry interval, is the minimum time required to stay out of the treated area unless proper PPE is worn.

Application Records

Record keeping provides a history of pest problems and control methods for a given area. Good records are useful for planning pesticide applications, re-entry times, harvest dates, and grazing times. Records provide details on application and equipment settings. Records can answer questions or address problems that arise after application. Problems can include poor applications, crop or property damage, complaints and law suits.

Application records may include:

- Date and time of application
- Location of application
- Pest
- Target site
- Pesticide (Product name and P.C.P. Act Registration Number)
- Rate of application
- Applicator's name and license/certificate number
- Type of application equipment and settings (e.g., nozzles used, pressure, acing, speed, boom height, etc.)
- Weather (e.g., rain, wind, temperature)
- Preharvest interval (if it applies)
- Nearby areas (e.g., crops, sensitive areas, such as schools, daycares, water bodies, protected habitat)
- Environmental effects of pesticide use
- Evaluation of the application
- Amount of pesticide used
- Monitoring results (if used)
- Other information that might affect the application

Some provinces require that pesticide application records be kept. Check with the provincial regulatory body for legal requirements.

Summary

Pesticide handlers or applicators should be familiar with safety procedures. This involves:

- **Choosing the most suitable pesticide available**
- **Choosing and using proper personal protective equipment (PPE)**
- **Cleaning and maintaining application equipment**
- **Proper transport, storage, mixing, loading, and application**
- **Proper disposal of excess pesticides and empty pesticide containers**

Choose a pesticide according to:

- **The pest to be controlled**
- **Application equipment available**
- **Personal protective equipment needed**
- **Compatibility with integrated pest management**
- **Environmental conditions**

The pesticide application rate and the size of the treatment area will dictate the amount of pesticide to buy.

PPE should be chosen by the type and formulation of pesticide and all routes of exposure (skin, eyes, and airways) should be protected. Coveralls, gloves, boots, and hats will minimize skin absorption. Using goggles or face shields can protect the eyes. Cartridge respirators, canister respirators, air-powered purifying respirators, or self-contained breathing equipment can protect airways. These should be chosen by the type of pesticide being used, the amount of time it will take to complete the pesticide application, and any other hazards associated with the application (such as an application in an enclosed space). PPE must be correctly worn, kept in good order, and replaced regularly.

Good personal hygiene is important to pesticide safety. Proper care and cleaning of PPE and application equipment is a must. All PPE (coveralls, gloves, hats, boots, goggles, face shields, and respirators) must be cleaned after each job or at the end of the day.

Summary, cont'd.

The safe transport of pesticides can help reduce spills. Only transport containers that are in good order. Make sure caps and plugs are tightly closed. Containers should be secured to prevent spills. Vehicles should be locked to prevent theft. Pesticides should be transported separate from non-pesticides and never in the passenger compartment of a vehicle.

Safe storage of pesticides is a must. Pesticides should be stored where they will not threaten people, animals, or the environment. A good storage facility will:

- Be made of fire-resistant materials
- Prevent entry by unauthorized persons
- Be well ventilated
- Have emergency and spill clean-up equipment nearby

Applicators, the public, and the environment must be protected during mixing and loading of pesticides. Locate the mixing and loading site to reduce environmental contamination, especially the contamination of surface water or groundwater.

Humans and the environment must be protected before and during pesticide application:

- Read product labels. Follow label recommendations on pesticde application rates, weather conditions, and buffer zones.

- Application equipment must be calibrated and kept in good order.

- Applicators must prevent spray drift onto non-target areas.

Safety is a concern when:

- Cleaning and disposing of empty pesticide containers
- Disposing of excess mixed pesticide
- Going back into freshly treated areas

Self-test Questions

Answers located in Appendix A of this manual.

QUIZ # 5-2

1. List eight (8) safety practices common to all types of pesticide use.

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2. Given a rate of application, and the size of the treatment areas, how would you calculate the amount of pesticide to buy?

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3. What risk factors can affect the type of personal protective equipment needed for handling a pesticide?

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4. List the characteristics of a glove that would allow it to provide protection from pesticides.

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5. Why is it important to wear a face shield when mixing and loading pesticides?

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6. List the characteristics of a respirator that is suited to provide protection from pesticides.

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7. List the types of respirators available.

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8. Describe six ways to transport pesticides safely.

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9. List four characteristics of a good site for storing pesticides.

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10. What safety procedures should be followed before mixing and loading pesticides?

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11. List three ways to safely clean a blocked spray nozzle.

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12. Describe the process for washing pesticide-contaminated clothes.

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13. Name four steps for safe pesticide container disposal.

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14. What should you do with excess tank mixture?

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15. What should never be done with excess tank mix?

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16. Define re-entry time.

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17. List three reasons why it is important to record pesticide applications.

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