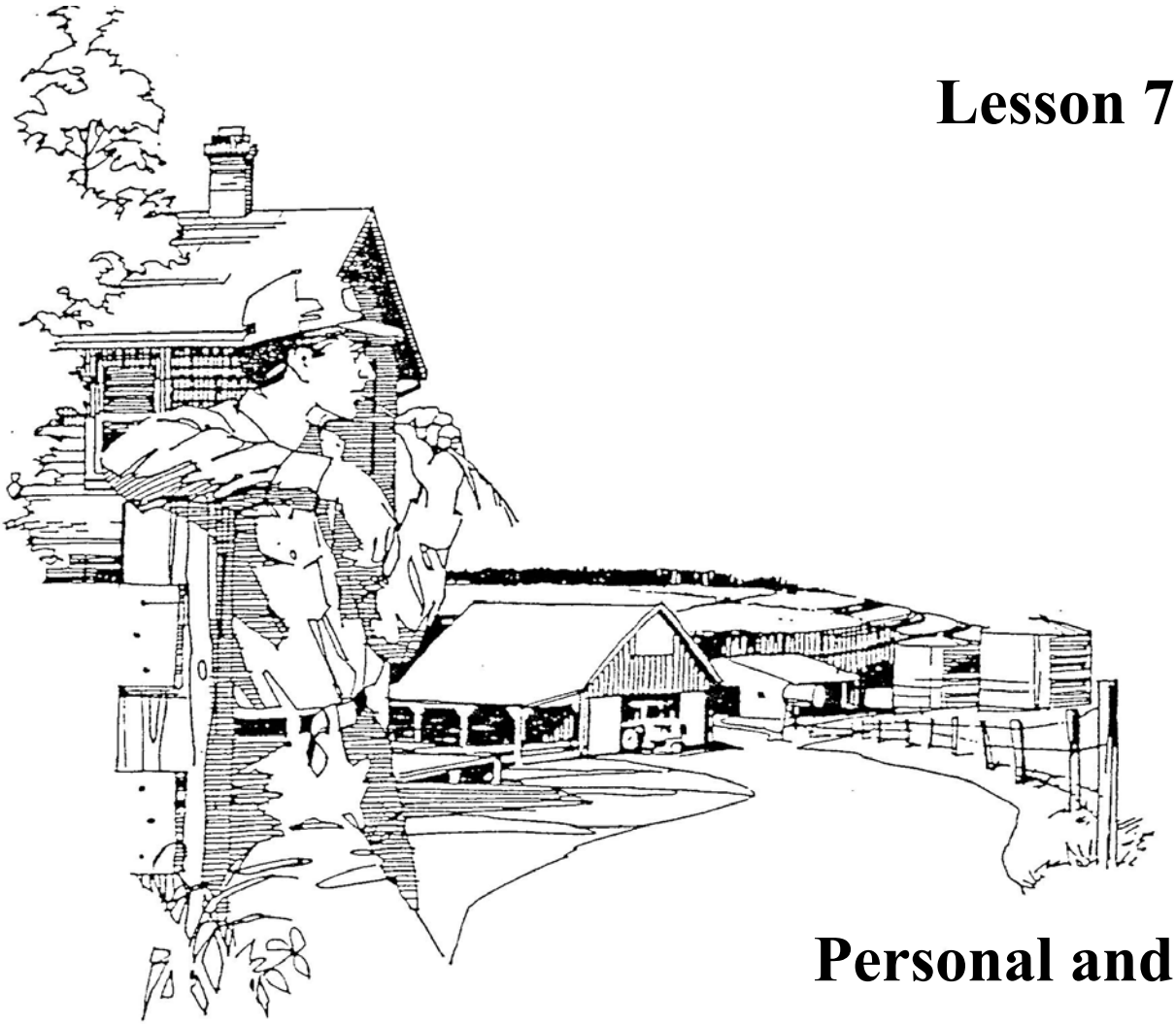
Pesticide Applicator Course for Agricultural Producers



Lesson 7

Personal and Environmental Safety

Table of Contents

Lesson 7

Personal and Environmental Safety

What You'll Learn!

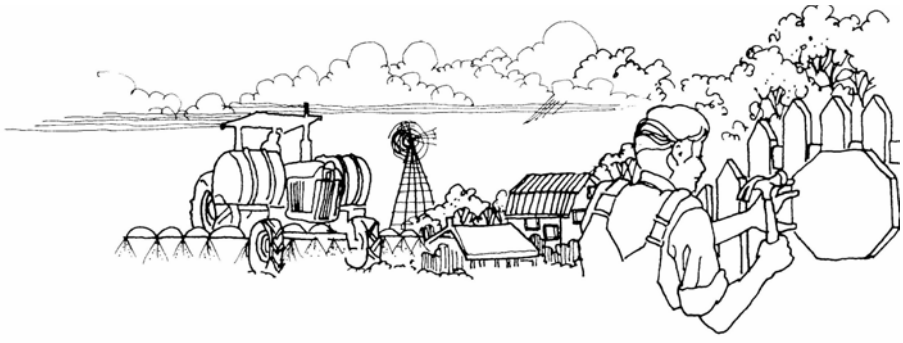
The purpose of Lesson 7 is to explain the guidelines you should follow when using pesticides to ensure personal and environmental safety.

By the time you complete this lesson you should be able to:

- **explain the importance of safe pesticide use;**
- **define the terms adsorption, volatilization, spray drift, runoff, leaching, absorption, microbial breakdown, chemical breakdown, and photodegradation;**
- **give examples of how each of the above processes can affect pesticide use;**
- **list general safety guidelines in the following stages of pesticide use:**
  - **purchase**
  - **transportation**
  - **storage**
  - **mixing**
  - **application**
  - **clean-up**
  - **disposal**
- **list safety measures you can take to protect:**
  - **fish and wildlife**
  - **bees and other beneficial insects**
  - **non-target plants**
  - **groundwater, wells, and bodies of water**

  state what steps to take in the case of a pesticide spill or fire.

You'll need to know all these things to qualify for certification.



Keeping Yourself and the Environment Safe

Safe pesticide use is your responsibility. When you use pesticides safely, you protect yourself, the consumer, and the environment. This lesson will provide you with safety guidelines and help you understand the safety information on pesticide labels. Your production guide also has directions on using pesticides safely.

The unsafe use of pesticides can:

- **poison the user;**
- **poison family or employees;**
- **harm crops;**
- **leave significant residues in food;**
- **injure non-target plants and animals;**
- **contaminate soil or water.**

Safety must be part of everything you do, from choosing the right pesticide to transporting, storing, mixing, loading, and applying pesticides, and disposing of pesticides.

Safety is everyone's concern. All adults should know poisoning symptoms and first aid. Children and adults should recognize poison symbols and know to stay away from the storage and mixing areas. The person doing laundry must be aware of special laundry practices for protective clothing. Employees must be aware of and respect reentry times.

The previous lessons on toxicity and poisoning told you how pesticides can affect you. Pesticides can also damage our environment. Understanding what happens to a pesticide once it is in the environment will help you make responsible decisions about pesticide use.

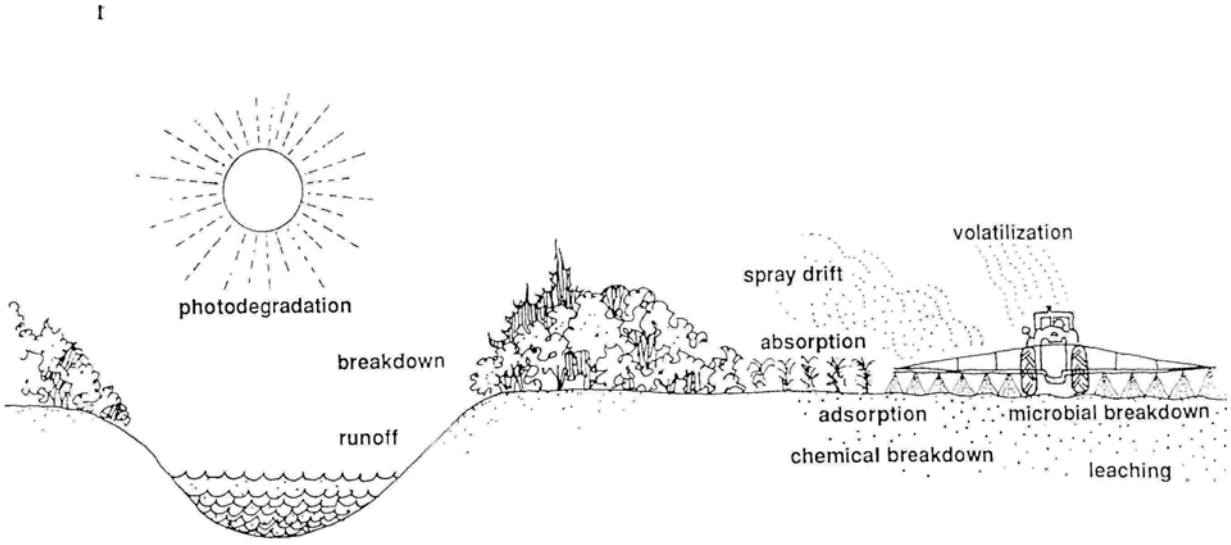
Pesticide Fate - What Happens to Pesticides

When a pesticide is released into the environment many things happen to it. Sometimes what happens is beneficial. For example, the leaching of some herbicides into the root zone can give you better weed control.

Sometimes, however, releasing pesticides into the environment can be harmful. For example, runoff can move a herbicide away from target weeds. The chemical is wasted, weed control is reduced, and there is more chance of damaging other plants and polluting soil and water.

Many processes affect what happens to pesticides in the environment. These processes include adsorption, volatilization, spray drift, runoff, leaching, absorption, and breakdown.

Each of these processes is explained in the following sections.



Absorption

Absorption is the movement of pesticides into plants and microorganisms. Most pesticides break down once they are absorbed. Pesticide residues may remain inside the plant or be released back into the environment as the plant decays.

Some pesticides stay in the soil long enough to be absorbed by plants grown in a field years later. They may damage or leave residues in future crops.

Adsorption

Adsorption is the binding of pesticides to soil particles. The amount a pesticide is adsorbed to the soil varies with the type of pesticide, soil moisture, soil pH, and soil texture. Pesticides are strongly adsorbed to soils that are high in clay or organic matter. They are not as strongly adsorbed to sandy soils.

Most soil-bound pesticides are less likely to give off vapors or leach through the soil. They are also less easily taken up by plants. For this reason you may require the higher rate listed on the pesticide label for soils high in clay or organic matter.

Volatilization

Volatilization is the process of solids or liquids turning into fumes. These fumes move in the air. This movement is called vapor drift. Vapor drift from some herbicides can damage nearby crops.

Pesticides volatilize most readily from sandy and wet soils. Hot, dry, or windy weather and small spray drops increase volatilization. Where recommended, incorporating the pesticide into the soil can help reduce volatilization.

Spray Drift

Spray Drift is the airborne movement of spray droplets away from a treatment site during application.

Spray drift is affected by:

- **spray droplet size - the smaller the droplets, the more likely they will drift;**
- **wind speed - the stronger the wind, the more pesticide spray will drift;**
- **distance between nozzle and target plant or ground - the greater the distance, the more the wind can affect the spray.**

Drift can damage nearby sensitive crops or can contaminate crops ready to harvest. Drift may also be a hazard to people, domestic animals, or pollinating insects. Drift can contaminate water in ponds, streams, and ditches and harm fish or other aquatic plants and animals. Excessive drift also reduces the pesticide applied to the target and can reduce the effectiveness of a treatment.

Ways to reduce spray drift are discussed in the section that follows on Safety Guidelines - When Applying Pesticides and in the section on Nozzles in Lesson 8.

Runoff

Runoff is the movement of pesticides in water over a sloping surface. The pesticides are either mixed in the water or bound to eroding soil.

The amount of pesticide runoff depends on:

- **the slope**
- **the texture of the soil**
- **the soil moisture content**
- **the amount and timing of irrigation or rainfall**
- **the type of pesticide used**

Runoff from areas treated with pesticides can pollute streams, ponds, lakes, and wells. Pesticide residues in surface water can harm plants and animals and contaminate groundwater. Water contamination can affect livestock and crops downstream.

Pesticide runoff can be reduced by:

- **using minimum tillage techniques to reduce soil erosion;**
- **grading surfaces to reduce slopes;**
- **diking to contain runoff;**
- **leaving border vegetation and plant cover to contain runoff.**

Pesticide losses from runoff are greatest when it rains heavily right after you spray. Reduce the chances of runoff by watching the weather forecast. If heavy rain is expected, delay spraying to avoid runoff.

Irrigate according to label instructions.

Leaching

Leaching is the movement of pesticides in water through the soil. Leaching occurs downward, upward, or sideways.

Leaching can be increased when:

- **the pesticide is water soluble;**
- **the soil is sandy;**
- **it rains or you irrigate shortly after spraying;**
- **the pesticide is not strongly adsorbed to the soil.**

Groundwater may be contaminated if pesticides leach from treated fields, mixing sites, washing sites, or waste disposal areas.

Breakdown

Pesticides are broken down by microbes, chemical reactions, and light. When most pesticides are broken down, they are no longer toxic. This is good for eliminating pesticide residues from soil or crops. However, when pesticides break down too rapidly, they may not control a pest or may provide only short-term control.

Microbial breakdown is the use of pesticides as food by microorganisms such as fungi and bacteria.

Microbial breakdown tends to increase when:

- **temperatures are warm;**
- **soil pH is favorable;**
- **soil moisture and oxygen are adequate;**
- **soil fertility is good.**

Microbial breakdown is one of the ways pesticides are more readily destroyed in soils. Sometimes you need to use the higher application rate on a pesticide label to make up for rapid microbial breakdown. In a few cases, certain pesticides are no longer useful because the microbes break them down so fast they don't have time to work.

Chemical breakdown is the breakdown of pesticides by chemical reactions in the soil. The rate and type of chemical reactions that occur are influenced by:

- **the binding of pesticides to the soil**
- **soil temperatures**
- **pH levels**
- **moisture**

Many pesticides, especially the organophosphate insecticides, break down more rapidly in alkaline soils or in spray tank water with a high pH level.

Photodegradation is the breakdown of pesticides by sunlight. Some pesticides are rapidly broken down by photodegradation. This is why some labels direct you to disc or water a pesticide into the soil.

Quiz 7.1

1. Below is a list of definitions which describe the different things that can happen to a pesticide after it has been released into the environment. Match each definition with its correct term from the Answer Box on the next page. The first one has been completed for you.

a) The process of solids or liquids turning into fumes.

ii) volatilization

b) The breakdown of pesticides by sunlight.

_____

c) The use of pesticides as food by microorganisms such as fungi and bacteria.

_____

d) The movement of pesticides in water through the soil.

_____

e) The binding of chemicals to soil particles.

_____

f) The movement of pesticides in water over a sloping surface.

_____

g) The breakdown of pesticides by chemical reactions in the soil.

_____

h) The movement of pesticides into plants and microorganisms.

_____

i) The movement of spray droplets out of a treatment area by wind.

_____

Answer Box

i) adsorption

ii) volatilization

iii) spray drift

iv) runoff

v) leaching

vi) absorption

vii) microbial breakdown

viii) chemical breakdown

ix) photodegradation

2. Using the terms in the Answer Box above, fill in the blanks in the sentences below.

a) If *heavy* rain is expected, delay spraying to avoid pesticide loss through _____.

b) _____ is likely to occur rapidly to organophosphate pesticides applied to alkaline soils.

c) Vapor drift damaging nearby crops could result from the _____ of a solid or liquid pesticide.

d) _____takes place more easily in soils high in clay or organic matter.

e) Groundwater may be contaminated through the _____ of pesticide from treated fields, mixing sites, washing sites, or waste disposal areas.

After completing the quiz, check your answers against the Answer Key at the end of the lesson. If you understand these terms, continue with Lesson 7. If not, reread the section on Pesticide Fate and try the quiz again.

Safety Guidelines

Each stage of pesticide use has its own set of general safety guidelines. These guidelines are explained in this section.

When Buying Pesticides

Before you buy your pesticide, read the label to:

- **Make sure the product is registered for your specific use.**
- **Check what type of spray equipment and safety gear you'll need.**
- **See whether the pesticide can be used safely with the application conditions on your farm.**
- **Calculate how much pesticide you'll need to buy (see Lesson 9). Purchase only enough pesticide to use in a year.**

When Transporting Pesticides

Whether you're bringing pesticides home from the supplier or driving out to the field, remember: *you are responsible for their safe transport*. You must obey these legal requirements.

- **Pack containers securely. Prevent them from moving and being punctured or broken. Be especially careful with liquid pesticides.**

- **Prevent contamination. Never transport pesticides with food, animal feed, fertilizer, clothing, or household goods.**

- **Lock up the pesticides if you leave your vehicle. You are responsible if anyone is accidentally poisoned by pesticides you have left unattended.**

In addition to the above, always follow these safety guidelines:

- **Check containers before you move them. Make sure caps and plugs are tightly closed and each container is clearly labelled. Don't move broken bags and cartons or leaky containers. Safe handling of damaged containers is discussed later in this lesson.**

- **Never transport pesticides in the passenger section of any vehicle. Don't let people ride with the pesticides. Harmful fumes may be released; spills or residue from previous spills may cause injury.**

- **Don't transport pesticides on a wooden truck bed. The wood will absorb any spilled pesticides and contaminate future loads. Place all pesticide containers in a metal or plastic storage box, or on a waterproof tarp.**

- **Carry spill clean-up equipment. Know what to do in case of a spill. Spills are discussed later in this lesson.**

- **Protect paper or cardboard containers from rain.**

When you buy a pesticide the supplier should tell you if it is legally considered a dangerous good. If so, you may require shipping papers and vehicle warning signs to transport this product.

If you need a warning sign on your vehicle to bring your pesticides home, you may also need it on your sprayer when driving it on a public road while carrying those pesticides.

Transporting pesticides in a licensed farm vehicle is exempt from some of these requirements if you are carrying less than 500 kg of pesticide (except for fumigation). ***Ask your supplier which regulations apply to the purchase you have made.***

When Storing Pesticides

Proper storage of pesticides protects people, animals and the environment. It also lengthens the shelf life of your pesticides.

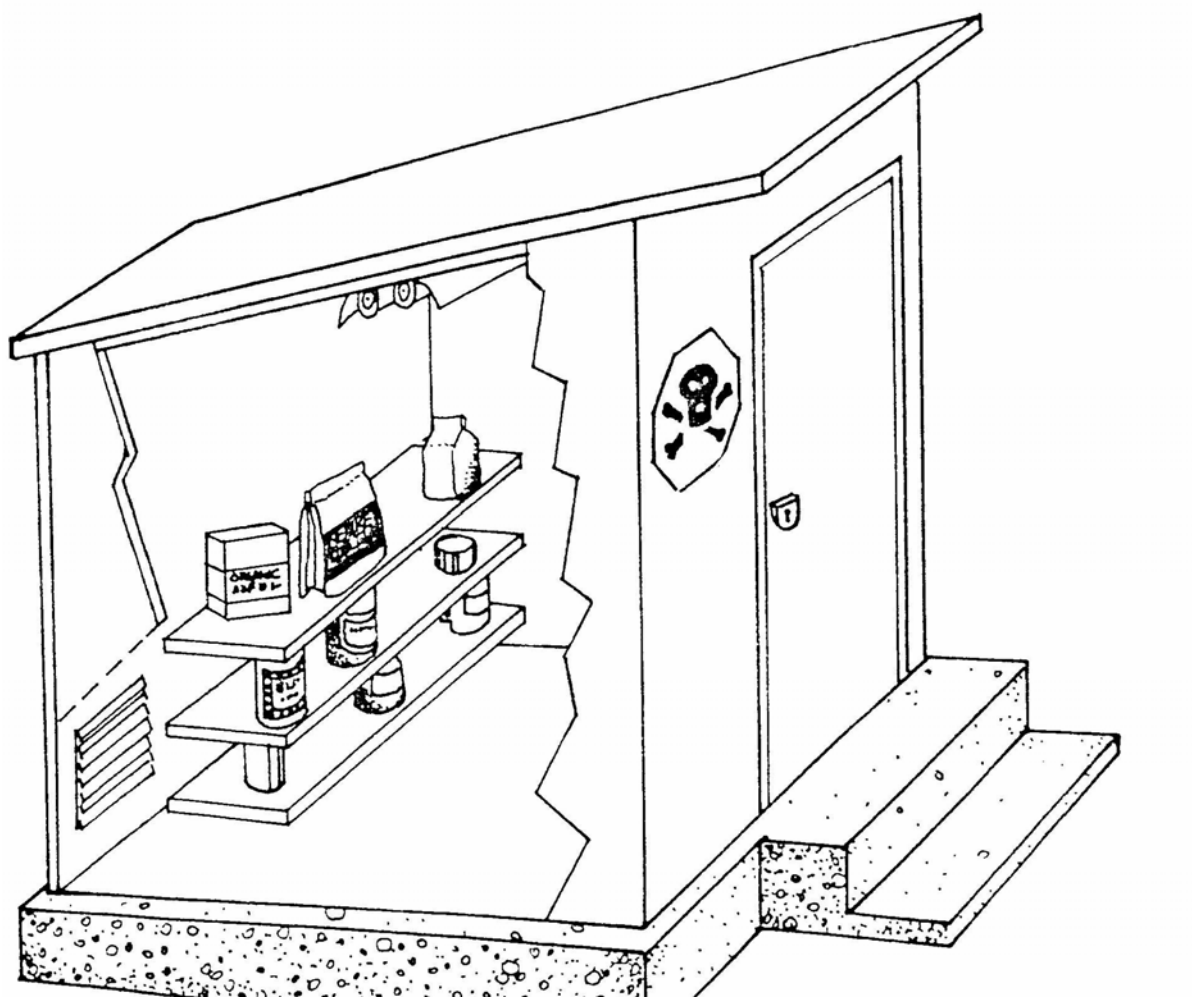
By law, all restricted and commercial pesticides (check your labels for the classification) must be stored in a shed, room or locker that:

- **is locked when left unattended;**
- **is ventilated to the outside;**
- **is entered only by authorized people;**
- **has a warning sign posted on each entrance;**
- **has a source of water in an area in or near the storage area.**

For your own safety, always follow the additional pesticide storage guidelines listed below:

- **Check labels for storage instructions for each pesticide.**
- **Store pesticides in their original containers with original labels. If you must use a different container, place a new label on it. You should be able to get one from your supplier.**
- **Never store pesticides in any bottles or containers which used to contain food or drink.**
- **Keep herbicides separate from other pesticides. Some herbicides can contaminate fungicides and insecticides. This could seriously damage your crop. If you can't keep herbicides in a separate storage area, at least keep them on different shelves at opposite ends of the room.**
- **Never store pesticides near livestock, food, animal feed, wells, or water supplies, or in your home. Pesticides and pesticide fumes can contaminate nearby food or water.**
- **Locate your storage area away from wells, ditches, or bodies of water. Avoid gravelly soil or areas where flooding may occur. This will help prevent water contamination in the event of a spill.**
- **Build your pesticide storage shed (or cupboard) out of fire-resistant material with a sealed concrete floor and metal shelves. Wooden surfaces and unsealed concrete floors absorb spilled pesticide and are impossible to clean properly. If you cannot replace wooden shelves, cover them with heavy plastic.**

Your storage shed should be well lit and insulated to protect the pesticides against extreme temperatures. Very hot or very cold weather may damage your pesticides. Some liquid pesticides are destroyed by freezing.



- **Close containers when not in use. Dry formulations cake when wet. Put open bags of wettable and soluble powders, dusts, and granules in sealed plastic bags.**

- **Check containers for leaks, breaks, rust, and corrosion. If a leak or break occurs, place the damaged container inside another or transfer the contents to an empty container. Attach a temporary label with the trade name, common name, guarantee, and the P.C.P. Act Registration Number on it until you can get a replacement label.**

- **Keep an inventory of the pesticides in storage.**

- **Keep the following emergency supplies near, but not in your storage area.**

  - **fire extinguisher approved for chemical fires**
  - **broom and shovel**
  - **absorptive material**
  - **protective clothing and equipment**

- **Post emergency phone numbers for quick response.**

  - **ambulance**
  - **physician**
  - **fire department**
  - **police**
  - **poison control centre**

It's a good idea to tell your local fire department that you are storing pesticides on your property. They may ask for a list of your pesticides. That way, in case of a fire, they will be prepared to help you and protect themselves.

Exercise 7.1

How safe is your pesticide storage area? Keeping in mind the safe storage guidelines you have just studied, think of five ways you can improve your own storage area. List them in the space provided below.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Now make a note of when you'll make these improvements. Then continue with Lesson 7.

When Mixing Pesticides

Mixing is the most dangerous stage of pesticide use. You are working with concentrated chemicals. Even if you are very careful, spills may happen. Reduce the risks by following label directions and the safety guidelines listed below.

Before you start:

- **Put on protective clothing and safety equipment. You always need coveralls and waterproof gloves and boots. Also wear face protection and a waterproof hat when mixing and loading most pesticides. Wear a waterproof apron and a respirator for more toxic pesticides or if indicated by label warnings.**

- **Read the label to:**
  - **make sure the pesticide is registered for your crop and pest;**
  - **see what safety precautions you should follow;**
  - **review information on poisoning and first aid;**
  - **check mixing directions;**
  - **check your application rates;**
  - **check for harvest or grazing restrictions and reentry intervals.**

- **Calculate how much pesticide you need for mixing. Make sure your application equipment is working and properly calibrated. Lessons 8 and 9 discuss equipment, calibration, and application rates.**

- **Keep clean-up, disposal, and first aid equipment at hand.**

Choosing a mixing site:

- **Carefully choose the pesticide mixing and loading site. It should be outside, away from other people, livestock, and pets. Choose an area where a spill or overflow would not get into a water supply.**
- **Avoid mixing pesticides by a pond, stream, or ditch. If you have no alternative, make sure the area is graded to slope away from the water.**
- **If you must work indoors, make sure the area is well ventilated and well lit.**
- **Keep soap and an emergency water supply nearby.**

Mixing procedures:

- **Mix and weigh out pesticides on a sturdy level bench or table. It should be made of materials that will not absorb pesticides, or be covered with heavy plastic. Don't use the bench or table for any other purpose.**
- **Mix pesticides outside in still or low wind conditions. Stand up-wind of your mixing areas.**
- **Hold the container below eye level when pouring. This will reduce the chance of splashing pesticide in your eyes or face.**

- **Don't tear open bags. Cut the top of the bag with a sharp knife and wash the knife after use.**

- **Measure accurately. Don't guess. Mix only the amount you plan to use immediately.**

- **Label all weigh scales, measuring cups, pre-mixing pails, and knives for opening pesticide packages "for pesticide use only." Return them to the locked storage area when they are not in use.**

- **Pre-mix wettable powders with a small amount of water before adding to the spray tank. This will help prevent lumps and will reduce airborne dust. To pre-mix wettable powders, follow these steps:**

  1. **Put a little water in your pre-mix container (e.g., 20 litre plastic pail).**
  2. **Add the powder, stirring gently.**
  3. **Slowly add more water and mix.**
  4. **Put this slurry into your sprayer.**

- **When adding pesticides in your spray tank, follow these steps.**

  1. **Fill the sprayer half full with water.**
  2. **Turn on the agitator.**
  3. **Slowly add the pesticide.**
  4. **Finish filling the tank.**
  5. **Wash your gloved hands before getting onto the tractor, as your hands and forearms will have received the most exposure.**

- **Rinse pesticide containers as soon as they are empty. When residues dry they are difficult to remove. Triple rinse empty containers which held liquids and single rinse bags.**

- **Rinse measuring cups and mixing equipment. Pour all rinse water into your sprayer.**

- **Replace container caps and close bags. Return them to the storage area.**

- **If you splash or spill any pesticide, stop and clean up immediately. Remove any clothing which has been contaminated and wash your body thoroughly. Follow the first aid procedures and clean up any spilled pesticides.**

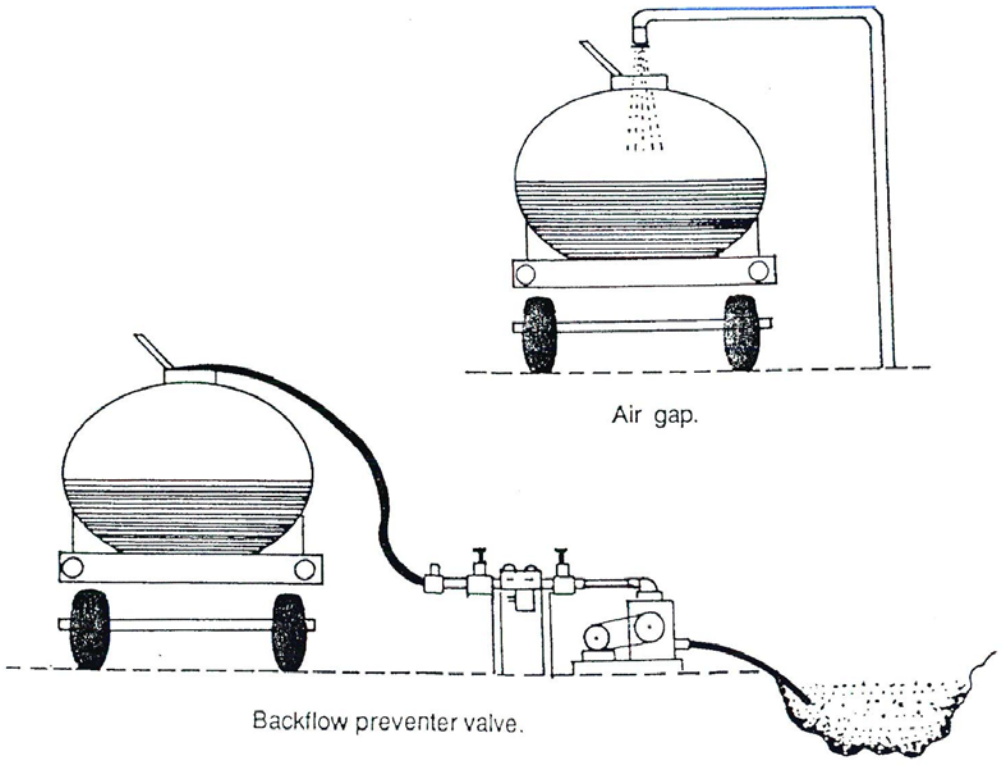
- **Use clean water. Sand, dirt, or algae cause excessive wear on pumps and nozzles and can reduce pesticide effectiveness.**

- **The pH of the water is also important. Alkaline spray water leads to chemical breakdown of many organophosphates and carbamates. The recommended water pH for mixing most pesticides is between 5.0 and 7.0. Buffers and acidifying agents can be used to adjust the pH of the water.**

- **Stand on a sturdy platform when you add the pesticide to the tank. Add the pesticide below face level to protect your eyes and face.**

- **Prevent overflow. Don't leave your tank unattended.**

- **Prevent contaminating your water supply by keeping the filler hose above the water line in the spray tank at all times. Contamination can occur if your hose is underwater in your tank and the pressure drops in the main water supply, or if your pump fails. Leave an air gap between the end of your filler hose and the water in your spray tank. You can also use a backflow preventer valve.**



When Applying Pesticides

Read the label before you apply a pesticide. Don't trust your memory - the label instructions may have changed.

After reading the label, follow the safety guidelines listed below.

- **Use a calibrated sprayer suited to your site.**
- **Wear the right protective clothing and equipment (see Lesson 6).**
- **Wash before eating, drinking, smoking, or using the toilet. Pesticides can be transferred from your hands to your mouth or skin.**
- **Watch the weather. Spray only when winds are between 2-15 km/h. Above 15 km/h pesticide may drift off target and below 2 km/h, pesticides may hang in the air and be subject to wind gusts afer application. Strong wind also causes uneven pesticide application. It is better to spray pesticides in the early morning or early evening. At these times wind speeds are usually lower.**
- **Don't apply pesticides just before a *heavy* rain. Rain can wash pesticides off treated surfaces or cause runoff from a treated area.**
- **Have fresh water as well as first aid and emergency spill supplies on hand.**
- **Post warning signs if necessary to keep people out of treated areas.**
- **Make sure the area to be treated is clear of people and animals. For example, don't spray along roadsides when children are going to school.**
- **Don't work alone when you are handling very toxic pesticides. If you have to work alone, make sure another person knows what you are doing, and when you plan to finish.**
- **If you feel ill, stop immediately and get help.**
- **Spray the pesticide at the rate recommended on the label.**

- **Wear gloves to replace or clean plugged nozzles. Use a soft brush or toothpick; wire or metal can damage nozzles. Replacement nozzles must be of the same pattern and size. Don't blow out clogged nozzles with your mouth.**

- **Shut off spray nozzles when you turn.**

- **Use and maintain the tractor speed chosen during calibration. Changing your speed changes the application rate.**

- **Plan the spray route through your field so you avoid passing through airborne spray or freshly treated areas.**

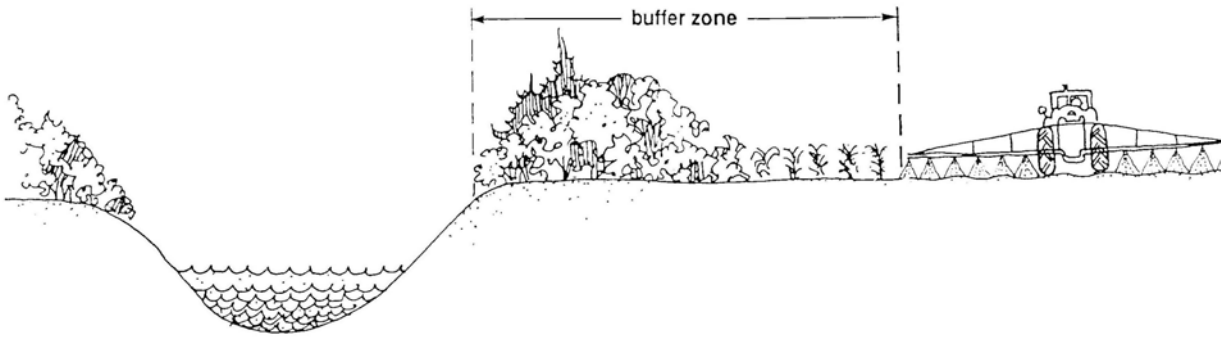
- **Prevent pesticides from contaminating non-target areas. Leave a buffer zone (untreated area) when the sprayed area is next to sensitive crops or other areas that may be harmed by exposure.**

- **A buffer zone must be left between a sprayed area and all bodies of water (lakes, streams, or ditches) to prevent contamination of water. The buffer zone receives no direct spray, but is used to contain all spray drift or pesticides that leach or run off from the treated area.**

- **The width of the buffer zone depends on the type of sprayer, the weather, the type of pesticide, the type of pest, and what type of area is being protected.**

  - **A 10-metre buffer zone is recommended for field boom sprayers along fish-bearing waters.**

  - **A 30-metre buffer zone is recommended around wells used for drinking.**



- **Minimize drift of airborne pesticides (particles, spray droplets, or gases) toward nearby water, crops, livestock, or residential areas. Drift increases when:**

  - **wind speeds and air temperatures increase;**
  - **relative humidity is low;**
  - **nozzle height and boom pressure are high;**
  - **spray droplets are small.**

- **Severe drift can also occur when the weather is calm but the air temperature at the ground or crop level is lower than that of the air above it. This is known as a temperature inversion. The warmer air does not allow the cooler air to rise, so it moves sideways instead. Small droplets can be carried in this layer of cool air and be deposited on a nearby crop or other non-target area.**

- **Minimize pesticide drift in the following ways:**

  - **Select the correct nozzle type and use a spray pressure low enough to produce the largest-sized droplets that will still cover the plants.**

  - **Replace worn nozzles.**

  - **Avoid spraying in windy conditions. In Newfoundland and Labrador, pesticides can only be applied when winds are between 2-15 km/h.**

  - **Set the boom only as high as necessary for good coverage.**

  - **Include a drift control agent in the spray mix.**

  - **Spray downwind from sensitive areas such as houses and beehives.**

  - **Don't spray when the temperature exceeds 25°C.**

  - **Don't spray if the relative humidity is below 50%.**

In addition to the safety guidelines described above, never apply pesticides through your irrigation system unless the label has specific instructions on chemigation. Follow all label precautions to prevent contaminating the water supply.

Use separate equipment for applying herbicides. If this isn't possible, clean application equipment well before switching pesticides.

When Applying Pesticides in Greenhouses and Enclosed Areas

Additional care and safety precautions are necessary when you use pesticides in greenhouses or other enclosed areas.

- **Prevent entry to treated greenhouses. Notify greenhouse staff and post warning signs before treatment. Lock doors after treatment.**
- **Wear protective clothing as required and use a respirator. A canister respirator should be worn for most greenhouse pesticide use.**
- **During application of very toxic or moderately toxic pesticides, two people should be present in case of an accident.**
- **When smoke fumigants are needed in more than one walkway of a greenhouse, a person should be assigned to light the fumigants in each walkway. They should start at the farthest distance from the exit and work in unison toward the exit.**
- **A treated greenhouse should remain sealed for the time specified on the label (e.g., overnight). Then, the greenhouse must be thoroughly ventilated (e.g., for an hour or more) before reentry of unprotected workers. During ventilation, keep workers away from exhaust fans.**
- **There are specific label precautions for applying the very toxic granular insecticide Temik (aldicarb). Make sure you follow label directions with extreme care.**

When Cleaning Up

- **Clean equipment away from water supplies. Wear protective gear. Remember that all exposed equipment, including pumps, tanks, hoses, etc., is probably contaminated with pesticide. Information on cleaning your equipment will be found in Lesson 8.**

- **Remove and clean personal protective gear. See the information in Lesson 6. Remember to wash your gloves first.**

- **Wash yourself.**

- **Keep records of every pesticide application. Write down the spray date, the type and rate of pesticide used, calibration settings, pest, stage of crop growth, weather, and anything that might affect the pesticide. This information should be included in a Growers Spray Record. Properly maintained, this record will provide a history of pest problems and control methods. It will be helpful for planning control programs, harvest dates, and future crops. It will also be very useful in solving any problems that come up after spraying.**

GROWER'S SPRAY RECORD							
Date Applied	**Crop Treated**	**Stage of Growth**	**Field ID #**	**Pest Controlled**	**Chemical Used**	**Rate Used**	**Remarks (weather, notes, etc.)**

When Disposing of Pesticide Containers, Concentrates, and Spray Tank Mixtures

After spraying you may find yourself having to dispose of empty pesticide containers or leftover concentrates and spray mixtures. Always follow the safety guidelines for disposal listed below.

1. Pesticide Containers

Pesticide residues in unrinsed containers are hazardous to people and the environment. Rinse all pesticide containers to reduce hazards, save money, and to comply with provincial regulations. Read the label for special directions.

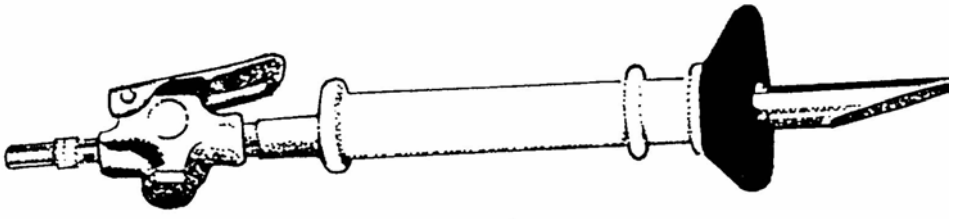
When you empty a container:

- **Immediately drain the container into the spray tank for at least 30 seconds or shake out the bag. Residues become dried and difficult to remove later.**
- **Rinse the package. You are legally required to triple rinse or pressure rinse drums, glass bottles, and plastic or metal containers; paper or plastic bags must have a single rinse.**

To properly triple rinse a pesticide container:

a) fill the empty container one-fifth full of water;
b) shake or roll the closed container;
c) pour the rinse water into the spray tank;
d) repeat this procedure two more times.

You can also pressure rinse your empty pesticide containers. Using a special pressure rinser thrust through the bottom of a plastic or metal container with the pressure rinser attached to a pressurized hose. Rinse the container for at least 30 seconds and put the rinse water into the spray tank.



Pressure rinser

Rinse water that cannot be added to the spray tank (e.g., water from rinsing out your sprayer) may be applied to a non - crop area. The requirements of such a site are:

- **flat, not boggy, not gravel or sand**
- **on your own property**
- **at least 200 metres from wells, lakes, rivers, streams, and ponds**

- **Crush, puncture, or damage empty rinsed containers so they cannot be reused.**

- **Dispose of the rinsed and damaged containers at a sanitary landfill site or by burying them on private property. The burial site must be:**

  - **flat**
  - **not boggy, gravel, or sand**
  - **at least 200 metres from wells, lakes, rivers, streams, or ponds**

  The containers must be buried at least 0.5 m below ground level.

- **Don't burn pesticide packages as residues may not be destroyed and toxic fumes may be released.**

- **If you cannot dispose of your containers immediately return them to locked storage until you are able to do so.**

2. Pesticide Concentrates

Disposing of pesticide concentrates is complicated and expensive. Plan your purchases carefully so you do not have to waste pesticides. Only buy enough for one season.

The safest way to dispose of pesticide concentrates is to use the product according to label directions. If this is not possible, return unopened containers to the manufacturer or dealer. Don't put unwanted pesticides into sewers, down drains, or on the land.

3. Pesticide Spray Tank Mixtures

Avoid mixing surplus spray by carefully calculating rates and calibrating your sprayer. If you do mix too much, use that material according to label directions on another crop or site listed on the label. If no such area can be found, spray the mixture over an area on your property where it will cause no damage.

If there is a small amount of spray mix left in the tank, dilute it with water (or other carrier) and re-spray the treated field with the diluted spray mixture. Once the mixture has been diluted, the additional amount of product applied to the entire field should not cause crop damage or high residues in the crop or soil.

Never re-spray the treated field with extra tank mix that has not been greatly diluted. Spraying an area twice will double the rate and may result in high residues in the crop or soil.

Reentry, Grazing, and Harvest Restrictions

There are a number of safety guidelines related to reentry, grazing, and harvest restrictions. These guidelines are described below.

- **Wait the proper time before entering or allowing employees to reenter treated fields. Sometimes the label will specify a reentry period. Follow the label. Where there are no warnings, wait at least 48 hours for very toxic and moderately toxic (dermal) pesticides. This is especially important when wettable powder formulations are used on crops that must be handled (e.g., hand thinning, hand weeding). Wait 24 hours before reentering fields treated with less toxic pesticides.**
  If you need to enter a treated area before the reentry period is over, wear protective gear.

- **Wait the required interval before allowing livestock to graze in a treated field. Check the label for grazing restrictions.**

- **Wait the required pre-harvest interval (days-to-harvest) before harvesting to avoid illegal pesticide residues on the crop. Pre-harvest intervals or days before harvest will be shown on pesticide labels and in your production guide.**

Exercise 7.2

In the space provided below list three pesticides you commonly use.

1. _____

2. _____

3. _____

Now check your production guide or product labels to find out how long you should wait before reentering an area treated with these pesticides.

1. _____**hours**

2. _____**hours**

3. _____**hours**

Next, check your production guide or labels to determine the pre-harvest interval.

1. _____**days**

2. _____**days**

3. _____**days**

When you've completed this exercise, try Quiz 7.2.

Quiz 7.2

When you feel you are familiar with the safety guidelines for the different stages of pesticide use, try answering the questions below.

1. List three legal requirements you must follow when transporting pesticides, even if they are not legally considered dangerous goods.

a) _____

_____

b) _____

_____

c) _____

_____

2. By law, all restricted and commercial pesticides must be stored in a shed, room, or locker that meets five conditions. List these conditions in the space provided below.

a) _____

_____

b) _____

_____

c) _____

_____

d) _____

_____

e) _____

3. List three important structural considerations for your pesticide storage building or shed.

a) _____

_____

b) _____

_____

c) _____

_____

4. There are four steps involved in pre-mixing a wettable powder formulation. List these steps in the space provided below.

a) _____

_____

b) _____

_____

c) _____

_____

d) _____

5. List seven items that should be recorded in your Grower's Spray Record.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

6. List three safety precautions to prevent unprotected workers from entering a greenhouse before it has been aired out (ventilated).

a) _____

b) _____

c) _____

7. List the four steps you should follow to triple rinse an empty pesticide container made of metal, plastic or glass.

a) _____

b) _____

c) _____

d) _____

After finishing the quiz, check your answers against the Answer Key at the end of the lesson. If most of your answers are correct, go on to the next section. If not, review the last section and try the quiz again.

Special Environmental Precautions

Protecting Fish and Other Wildlife

The improper use of pesticides can accidentally harm all kinds of animals. For example, fish kills can result from pesticides getting into the water. This can happen through drift, surface runoff, soil erosion, leaching, or in some cases, through the deliberate or careless release of pesticides directly into the water.

Birds can be killed by pesticides in several ways. Birds can eat granules, bait, or treated seed; they may be directly exposed to pesticide spray; they may eat a treated crop; they may drink contaminated water; or they may feed on pesticide-contaminated prey. Birds and other animals often mistake pesticide granules or baits for food.

Most insecticides, as well as some fungicides and herbicides, are very toxic to fish. Insecticides are toxic to birds and wildlife. Check pesticide labels for warning statements such as "Toxic to Fish" or "Toxic to Birds."

Protect fish and wildlife from pesticide poisoning by following these guidelines:

- **Use pesticides only when necessary. Select the least toxic and least persistent.**
- **Leave a buffer zone along all bodies of water (lakes, streams, ditches) to prevent contamination of water with spray drift, leaching, or runoff. A 10-metre buffer zone is recommended between field sprayers and fish-bearing waters.**
- **Don't destroy vegetation along fish-bearing waters. Streamside vegetation is an important source of food and shelter for fish and wildlife.**
- **Incorporate granular insecticides.**
- **Minimize pesticide drift, leaching, and runoff.**
- **Store treated seed where it cannot be consumed by animals.**
- **Place baits in covered bait stations.**
- **Follow all precautions on pesticide labels as well as all safety guidelines in this lesson.**

Protecting Bees

Bees and other pollinating insects are essential for the production of many crops. Many pesticides, particularly insecticides, are very toxic to pollinating honey bees and wild bees.

Protect bees from pesticide poisoning by following the safety guidelines listed below:

- **Talk to beekeepers on or near your farm about your spray program. Let them know when you will be using pesticides hazardous to bees. They may have to protect or move their hives.**
- **Don't apply pesticides near hives.**
- **Don't apply pesticides that are toxic to bees while plants are in bloom. Bees attracted to the flowers of treated plants, either crops or weeds, may come in contact with pesticides. Mow cover crops and weeds to remove blooms prior to spraying. Pesticide labels may indicate if the product is toxic to bees.**
- **Select the pesticide and formulation least harmful to bees. Microencapsulated formulations are very hazardous to bees as they can be carried back to hives like pollen. Dusts are more hazardous than sprays. Wettable powder formulations are more hazardous than emulsifiable concentrate or liquid formulations. Granular insecticide formulations are generally the least hazardous to bees.**
- **Reduce spray drift. Spray only in light winds; do not spray when winds are greater than 15 km/hr.**
- **Time your pesticide sprays carefully. Evening sprays are less hazardous than early morning sprays; both are safer than midday sprays.**

Protecting Other Beneficial Insects

Pesticides can kill beneficial insects as well as pests. Reduce this damage by using as little pesticide as possible and by selecting chemicals known to be less harmful to insect predators.

Protecting Non-Target Plants

Pesticides that injure plants are said to be phytotoxic. All kinds of pesticides can injure or kill plants. However, most non-target damage is caused by herbicides. They can drift, run off, or leach from treated areas as well as from mixing, disposal, and storage sites.

Protect non-target plants by taking steps to prevent the movement of pesticides onto non-target areas.

Protecting Groundwater, Wells, and Bodies of Water

Groundwater is found in zones of rock, sand, gravel, or limestone that are saturated with water. These zones are known as aquifers. Groundwater moves through aquifers and reaches the surface through springs or drilled wells.

Surface water is water we can see: lakes, rivers, and oceans.

Both surface water and groundwater are easily contaminated by pesticides.

Groundwater contamination is most likely where:

- **soils are gravelly or sandy;**
- **the water table is close to the soil surface;**
- **there is high rainfall or excess irrigation;**
- **pesticides are broken down slowly;**
- **pesticides are weakly adsorbed to the soil and leach quickly.**

It is very difficult to clean contaminated groundwater. The best solution to groundwater contamination is prevention.

Be particularly cautious about how you store and apply pesticides, and avoid rinsing off equipment where there is a possibility of groundwater contamination.

Emergency Response

Pesticide Spills

Pesticide spills can involve anything from a leaking container to the contents of a fully loaded spray tank. To prevent spills, keep your sprayer in good condition, fix leaks and drips, drive carefully, and follow the safety guidelines in this lesson.

Reducing the Effects of Spills and Fires

Prompt action to minimize the spread of accidentally released pesticides can significantly reduce the impact of a spill or fire - particularly, the environmental impact. The cost and magnitude of the cleanup operation will often be substantially reduced, also.

- **act quickly to control the spill but before taking action, make sure you know what product you are dealing with and what precautions are necessary. Use the recommended personal protective equipment.**

- **prevent liquid materials from flowing into water bodies, sewers and water-filled ditches by dyking the area. Prevent powdered materials from blowing away by covering them with a tarpaulin or plastic sheet.**

- **do whatever possible to keep the spill contained. Place leaking containers upright and close valves.**

- **never wash down a spill. Try and prevent rain and run-off from spreading the spill by covering and dyking until it can be cleaned up.**

Be prepared for accidental spills. Always keep the following on hand:

- **a list of emergency telephone numbers, including:**
  - **Poison Control Centre**
  - **doctor**
  - **ambulance**
  - **the 24-hour Federal Environmental Spill Response Number: 772-2083. Call this number to report spills of more than one litre or one kilogram of pesticide. Ask for spill clean-up advice or assistance if required. (The Pesticide Control Section may also be of assistance to you at 729-3395 or 1-800-563-6181, during Provincial Government office hours.)**

- **emergency protective gear and equipment**
- **absorptive material (e.g., kitty litter or clay)**
- **a container for contaminated waste (e.g., garbage bag or can)**
- **tools to pick up contaminated material (e.g., broom, shovel)**
- **bleach and hydrated lime to decontaminate spill areas**

Spill Cleanup

If a spill occurs, follow the ten steps listed below.

1. **If you need help, call the Emergency Numbers listed above.**
2. **Protect yourself from exposure. Wear protective gear and ventilate the area. Lesson 6 covers protective gear.**
3. **Keep bystanders away from the accident.**
4. **Don't smoke, drink, eat or use washroom facilities during cleanup operations unless protective clothing has been removed and arms, hands and face are washed beforehand with soap and water.**
5. **Work upwind of the spill.**
6. **Separate damaged or leaking containers from intact ones. Place them or pump their contents into sound 205 L drums. Sturdy plastic bags may be used for dry products. Clearly label the new containers and ensure that the pesticide label stays with the repackaged material.**
7. **Clean up the spill. Small amounts of spilled liquids may be soaked up in clay, sawdust or other suitable absorbent, then swept towards the centre and shoveled into drums or bags.**

   Don't use absorbent materials for dry spills. Dry formulations can be swept up and reused. If dry materials have become wet or contaminated with soil and other debris, sweep them up and place them in a waste container.

8. Decontaminate the spill area.

- **Build a dyke of soil around the area to contain all liquids used in the cleanup.**

- **After removing the spilled material and absorbent it is necessary to decontaminate the area. The following method may be employed on hard surfaces such as concrete and asphalt. Use an appropriate decontamination solution. Check with the manufacturer if you are not sure what to use. A common mixture is made from equal parts of laundry bleach and water. Alternatively, caustic soda or lye may be used instead of bleach. Workers should be aware of the corrosive nature of these solutions and take precautions against inhalation and burns to skin and eyes. A filter respirator and eye protection may be necessary. Begin by soaking the contaminated area with the solution. Use a coarse broom to work into the surface. Then spread hydrated lime over the entire area and let it react for one to two hours before sweeping up as before.**

- **Absorb the excess liquid with more absorbent material and then sweep it up into the disposal container. Repeat this procedure several times to ensure the area has been decontaminated. Don't hose down the area with water.**

- **The drums containing the cleanup material should be covered and labeled "spilled pesticide - DANGER" and the name of the product, if known. Drums should be transported to the disposal site designated by the provincial Department of Environment, Pesticides Control Section. Do not take these drums to the municipal landfill unless authorized to do so.**

To decontaminate soil saturated with a pesticide:

- **remove the top two to three inches of soil;**
- **cover the area with at least two inches of lime;**
- **cover the lime with fresh topsoil;**
- **safely dispose of the contaminated soil.**

9. Remove and wash all protective gear (see Lesson 6). Change clothing immediately. Launder clothing as soon as possible. Discard any badly contaminated clothing or equipment (e.g., broom). Shower using lots of soap and water.

10. Contact the Pesticides Control Section, Department of Environment, 729-3395 or 1-800-563-6181, for information on the disposal of the contaminated material.

If the spill takes place in a public area like a highway, call the local police. If the spill has released pesticide into the environment, contact the Pesticides Control Section. After hours, call the 24-hour Federal Environmental Spill Response Number at 772-2083.

Personnel

Workers involved in applying pesticides or accident cleanup operations will need to protect themselves from possible harmful effects by using the appropriate personal protective equipment for the job and adopting good hygiene practices. Recommended equipment and procedures for routine handling of pesticides is contained in Chapter 3.

The same principles apply to workers engaged in cleanup operations. These are briefly:

- **at the end of the day's work of application or when crossing a decontamination line around a cleanup site, workers must remove all protective clothing, shower thoroughly and wash their hair using large amounts of soap and water. They should change to clean clothing.**
- **before eating, smoking or using the restroom, they should remove their contaminated protective clothing and thoroughly wash their arms, hands, and faces.**
- **protective clothing, after it has been removed should be kept in isolation and decontaminated at the end of the day.**
- **inner clothing should be washed by itself in detergent and bleach before reusing.**
- **watches and jewellery (especially rings) should not be worn, if possible.**
- **protective equipment and clothing have to be discarded if they cannot be adequately decontaminated. Porous articles such as leather boots are unsuitable for use for this reason.**

Pesticide Fires

Pesticide fires are extremely dangerous because of the highly toxic fumes. Reduce the dangers by following these safety guidelines:

- **Let your fire department know ahead of time where you store your pesticides.**
- **Always post a warning sign on all entrance doors to the storage facility.**
- **Keep emergency phone numbers handy.**
- **Keep the storage area locked.**
- **Don't store glass containers in the sunlight.**
- **Keep a fire extinguisher approved for chemical fires near the storage area.**
- **Store combustible materials away from heating systems.**

If a fire does occur, call the fire department and keep people away from the area. Warn the firefighters that pesticides are in the building.

Quiz 7.3

1. List eight safety guidelines you should follow to protect fish and other wildlife from pesticide poisoning.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____

2. List six safety guidelines you should follow to protect bees from pesticide poisoning.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

3. Name two safety guidelines that will help reduce damage by pesticides to beneficial insects.

a) _____

b) _____

4. How can you protect non-target plants from damage caused by pesticides?

_____

_____

5. What is the best solution to groundwater contamination by pesticides?

_____

6. Name six items you should keep on hand to be prepared for accidental pesticide spills.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

7. List the ten steps to follow in case of an accidental pesticide spill.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____

j) _____

8. List the seven safety guidelines you should follow to reduce the danger from pesticide fires.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

After completing the quiz, check your answers against the Answer Key at the end of the lesson. Then finish Lesson 7.

Looking Ahead

Lesson 7 has given you a great deal of important information on safe pesticide use. You have learned what happens to pesticides when they are released into the environment. You have become familiar with safety guidelines for every aspect of pesticide use, from purchase to application to disposal. You have also learned special precautions to take to protect fish, wildlife, non-target plants, and the environment, as well as how to deal with emergency situations such as pesticide spills and fires.

Lesson 8 examines the different kinds of pesticide application equipment.

Answer Key

Quiz 7.1

1.a) The process of solids or liquids turning into fumes.

ii) volatilization

b) The breakdown of pesticides by sunlight.

ix) photodegradation

c) The use of pesticides as food by microorganisms such as fungi and bacteria.

vii) microbial breakdown

d) The movement of pesticides in water through the soil.

v) leaching

e) The binding of chemicals to soil particles.

i) adsorption

f) The movement of pesticides in water over a sloping surface.

iv) runoff

g) The breakdown of pesticides by chemical reactions in the soil.

viii) chemical breakdown

h) The movement of pesticides into plants and microorganisms.

vi) absorption

i) The movement of spray droplets out of a treatment area by wind.

iii) spray drift

2.a) If a *heavy* rain is expected, delay spraying to avoid pesticide loss through iv) runoff.

b) viii) Chemical breakdown is likely to occur rapidly to organophosphate pesticides applied to alkaline soils.

c) Vapor drift damaging nearby crops could result from the ii) volatilization of a solid or liquid pesticide.

d) i) Adsorption takes place more easily in soils high in clay or organic matter.

e) Groundwater may be contaminated through the v) leaching of pesticides from treated fields, mixing sites, washing sites, or waste disposal areas.

Quiz 7.2

1. When you are transporting pesticides you are legally required to:

- **a) pack containers securely;**
- **b) never transport pesticides with food, animal feed, fertilizer, clothing, or household goods;**
- **c) lock up pesticides if you leave your vehicle.**

2. Your storage area for commercial or restricted pesticides must, by law, meet the following conditions. It must:

- **a) be locked when unattended;**
- **b) be ventilated to the outside;**
- **c) be entered only by authorized people;**
- **d) have a warning sign posted at each entrance.**

3. Your storage shed must be:

- **a) built out of fire resistant materials;**
- **b) located away from work and living areas, and wells, ditches, and other water supplies;**
- **c) equipped with shelving that won't absorb spilled pesticides.**

4. To pre-mix a wettable powder formulation:

a) put a little water in your pre-mix container;
b) add the powder, stirring gently;
c) slowly add more water and mix;
d) put this slurry into your sprayer.

5. Seven items that should be recorded in your Grower's Spray Record are:

a) spray date
b) type of pesticide used
c) rate of pesticide used
d) calibration setting
e) pest controlled
f) stage of crop growth
g) weather

6. Three precautions to prevent unprotected workers from entering a greenhouse before it has been aired out are:

a) notify greenhouse staff;
b) post warning signs;
c) lock doors after treatment.

7. To triple rinse an empty pesticide container made of metal or glass:

a) fill the container one-fifth full;
b) shake or roll the closed container;
c) pour the rinse water into the spray tank;
d) repeat this procedure two more times.

Quiz 7.3

1. Eight safety guidelines you should follow to protect fish and other wildlife from pesticide poisoning are:

a) use the least toxic and least persistent pesticide, and then only when necessary;
b) leave a buffer zone along all bodies of water;
c) don't destroy vegetation along fish-bearing waters;
d) incorporate granular insecticides;
e) minimize pesticide drift, leaching, and runoff;
f) store treated seed in protected areas;
g) place baits in covered bait stations;
h) follow all precautions on pesticide labels.

2. Six safety guidelines you should follow to protect bees from pesticide poisoning are:

a) talk to beekeepers on or near your farm about your spray program;
b) don't apply pesticides near hives;
c) don't apply pesticides that are toxic to bees while plants are in bloom;
d) select the pesticide and formulation least harmful to bees;
e) reduce spray drift;
f) time your pesticide sprays carefully.

3. Two safety guidelines that will help reduce damage by pesticides to beneficial insects are:

a) use as little pesticide as possible;
b) select chemicals known to be less harmful to insect predators.

4. Non-target plants can be protected from damage caused by pesticides by:

taking steps to prevent the movement of pesticides onto non-target areas.

5. The best solution to groundwater contamination by pesticides is: prevention

6. Six items you should keep on hand to be prepared for accidental pesticide spills are:

a) a list of emergency telephone numbers;
b) emergency protective gear and equipment;
c) absorptive material;
d) a container for contaminated waste;
e) tools to pick up contaminated material;
f) bleach and hydrated lime.

7. Ten steps to follow in case of an accidental pesticide spill are:

a) call for help if necessary;
b) protect yourself from exposure;
c) keep bystanders away from the accident;
d) don't smoke, drink, or eat during clean-up;
e) work upwind of the spill;
f) contain the spilled material as much as possible;
g) clean up the spill;
h) decontaminate the spilled area;
i) remove and wash all protective gear;
j) contact the Department of Environment, Pesticides Control Section.

8. Seven safety guidelines you should follow to reduce the danger from pesticide fires are:

a) let your fire department know ahead of time where you store your pesticides;
b) post warning signs on all entrance doors of the storage facility;
c) keep emergency phone numbers handy;
d) keep the storage area locked;
e) don't store glass containers in the sunlight;
f) keep a fire extinguisher approved for chemical fires near the storage area;
g) store combustible materials away from heating systems.