Lesson 4: Impacts on the Environment

When pesticides are applied, they can act in a number of ways. Pesticides can drift away from their targets, runoff in surface water, leach into the soil or make their way into our water system. This movement can harm non-target life forms in the environment.

This lesson will focus on best practices for preventing unwanted movement of pesticides and their resulting effects on the environment. Best practices may include leaving buffer zones or no-treatment zones beside sensitive areas such as water bodies.

Key Learning Points

- Describe how to prevent pesticides from harming water and organisms that depend on the water.
- Describe how to prevent pesticides from harming land environment and its inhabitants.
- Know the difference between a pesticide free zone and a no-treatment zone and a buffer zone.

Fate of Pesticides in the Environment: On land, in Air, and in Water

We depend on the natural environment (water, farming soils and forests). We use pesticides in some situations to enhance the environment's productivity and/or protect the health and safety of humans, livestock, and pets. However, when pesticides are used improperly, or they move to unintended locations, they can contaminate the environment and may harm organisms.

All pesticide applicators, including assistant applicators, have an important responsibility to the environment. Proper application technique and precautions can help keep our environment safe and protect our health.

How Pesticides Move in the Environment

Some pesticides interact with soil and plants by binding (sticking) to the soil particles or plants they were bound to. Other pesticides are absorbed by the particles. Pesticides can also be released from particles that they were bound to, or absorbed into.

- Soil drift – when soil is dry and there isn't a lot of plant cover, the soil is at risk of wind erosion – causing treated soil to drift away from the target area.
- Leaching – when pesticides are carried by water through the soil
- Degradation – when pesticide breaks down over time into other chemical components

What does this mean for soil?

Pesticide can leave residues in plants or in soil that can harm earthworms, soil bacteria, and other non-target organisms. It can also lead to contamination of drinking and irrigation water.

Pesticides move through the air in a variety of ways.

This movement can happen because of:

- Spray drift – droplets of pesticide become airborne and drift away from treatment site. The smaller the droplets, the easier they move—so it helps to use nozzles that produce larger droplets and to lower the spray pressure.
- Vapour drift – when pesticide changes into a gas or vapour, the wind can move the vapours away from the treatment site. To avoid vapour drift, do not apply pesticides when it's hot.
- Volatilization – a solid or liquid pesticide changes into a gas or vapour.

What does this mean for the air?

Assistant applicators should take precautions to minimize the movement of pesticides through the air. Once in the air, pesticide particles can be carried to nearby water bodies, non-target organisms, and other sensitive areas.

Pesticides move through the water in a variety of ways.

Pesticide can drift into water bodies, or leach into the soil and run off into water bodies.

- Drift – when pesticide blows away from the treatment site into a water body.
- Runoff – this is the movement of water down a slope. Pesticides dissolved in the water can be moved in this way.
- Leaching – when pesticides are carried by water through the soil.

What does this mean for water?

Even when water bodies are protected, pesticides can move from target areas into the soil and down into ground water. Rain can wash pesticides off plants and out of the soil into creeks and rivers. The impacts of pesticide contamination on water-borne life can be immediate and deadly.

Water Contamination

Water is classified as either surface water or ground water. **Surface water** is the water that you can see, such as ditches, streams, ponds, rivers, lakes and oceans. **Ground water** is found below the surface of the earth in zones of rock, sand or gravel saturated with water. The **water table** is the level below the ground's surface in which all the space between soil particles is filled with water. Where the water table starts, and the depth of the water table can vary according to soil conditions.

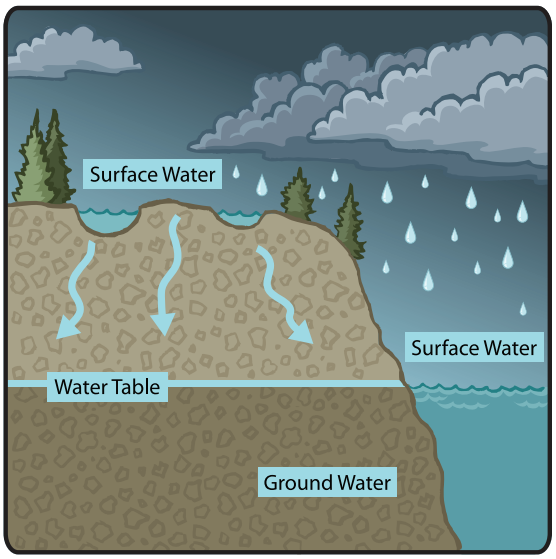
When a large amount of pesticide is released in a small area, water can become contaminated. This can happen via:

- Runoff from an accidental spill.
- A pesticide fire.
- Back siphoning of the pesticide into a water source.

- Leaks from storage containers.
- Improper disposal of surplus pesticide and containers.

When pesticide is applied over a large area, water can become contaminated. This can happen via:

- The use of too much pesticide.
- The application of an inappropriate pesticide for the site, soil and weather conditions.
- Pesticide runoff.
- Drift.
- Leaching.
- Failure to follow pesticide label directions.

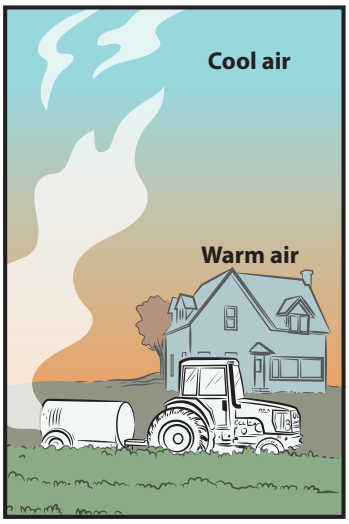


Surface and ground water

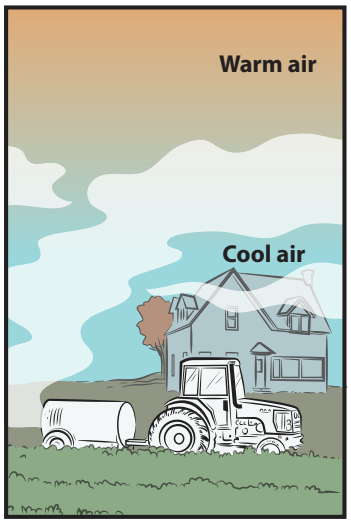
Temperature Inversions

Don't apply pesticides when air is dead calm. This often indicates a temperature inversion, which creates the risk that pesticides will will be trapped close to the ground. Pesticide droplets may then drift off target.

If you're not sure if it's safe to apply a pesticide, ask your supervisor.



Normal Condition
Mist rises and disperses



Inversion Condition
Mist concentrates or moves sideways

What to look for

Your supervisor will assess the environment and determine how the pesticide will behave during the application. This is a key step in the prevention of environmental contamination.

Buffer Zones and Pesticide-Free Zones

As an assistant applicator, your supervisor may have set up areas near water bodies or other sensitive areas where you cannot apply pesticides.

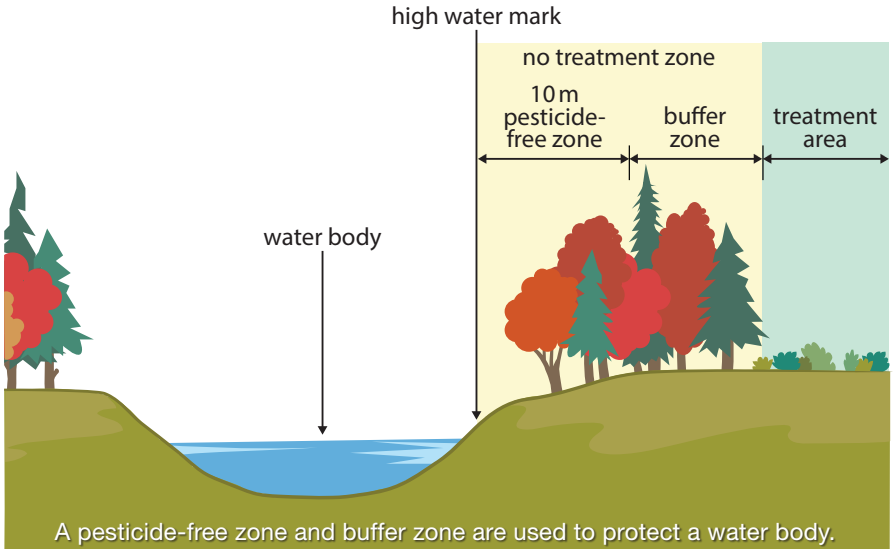
You might see these types of areas mentioned on a pesticide label as "buffer zones." In addition, there are laws in BC that refer to Pesticide-free zones (PFZs) and no-treatment zones (NTZs). Your supervisor may refer to any of these terms, so it's good to be familiar with them.

A **pesticide-free zone (PFZ)** is an area of land that must not be treated with pesticide and must be protected from pesticide moving onto it. A PFZ helps ensure that pesticides do not reach a sensitive feature to be protected, and may also hold other environmental benefits or values, such as riparian habitat and wildlife corridors. A PFZ may be required by the Integrated Pest Management Regulation for certain pesticide uses. Ask your supervisor if a there is a PFZ in the treatment area.

Be aware that there may be a **buffer zone** set up to protect a pesticide-free zone. Often this area is marked off with flagging tape. Ask your supervisor for clarification.

No-treatment zones, or **NTZs**, are areas that must not be treated with pesticide. Where pesticide-free zone is required to protect a feature, the no-treatment zone includes the pesticide-free zone and a buffer if one is required.

The following diagram shows the setup of buffer zone next to the pesticide-free zone—which together make up the **no-treatment zone (NTZ)**.



A pesticide-free zone and buffer zone are used to protect a water body.

If there is any confusion or doubt about where to apply pesticides, ask your supervisor. Always check before you treat.

People, Plants and Animals

Anyone who applies pesticides has the responsibility of ensuring the safety of people, plants and animals in the areas in and around where they apply pesticides.

In consideration of non-target organisms, assistant applicators must:

- Be aware of areas of high human use such as schools, hospitals, daycares, senior housing facilities and recreational areas such as parks and playgrounds.
- Be aware of whether the area is habitat to any non-target animals.
- Know whether there are food crops or gardens in the vicinity.
- Watch out for apiaries (place where bee hives are kept) and bee boxes.

It's important to know that all plants can be injured by pesticides. Most damage is caused by herbicides; however, insecticides and **fungicides** might also harm non-target plants.

In the news

Most pesticide disasters don't make the news. Here are a few that have.

Wildlife at risk after consuming pesticides through the food chain.

Surrey, B.C.
December, 2010

A 2009 study found a number of dead owls contained varying levels of rodenticide. The owls are dying a gruesome death, bleeding over a period of days from stomach hemorrhages. Scientists are investigating the suspicion that a new extra-potent class of rat poison in the market may be making its way through the food chain to kill wildlife.

Inattention to label directions leads to poisoning deaths of two girls.

Utah, U.S.A.
February, 2010

Two girls, ages one and a half and four, died after inhaling fumes from tablets of rat poison placed at their home. The applicator did not comply with the label directions, which gave specific guidelines against placing the tablets too close to a house. The pest control worker will be charged with two counts of negligent homicide. The manufacturer of the product says the deaths could easily have been avoided if only the applicator had followed the label directions.

Soil runoff leads to massive loss of fish.

Prince Edward Island
July, 2007

Thousands of fish were lost when heavy rains washed pesticide-laden soil into P.E.I.'s Dunk River. Conservationists have collected mainly brook trout and rainbow trout from the site, and some salmon. This is the first fish kill in P.E.I. since changes were made to legislation regarding agriculture practice near waterways in 2004. Provincial Environment officials are investigating.

Summary

In this module, you learned the various ways pesticides can accidentally get into the environment including the air, soil and water. You also learned about the environmental dangers that can arise if pesticides are used incorrectly, and the importance of identifying and protecting pesticide-free zones and buffer zones.

Lesson 4 Practice Activity

1. The process when a pesticide changes from a liquid to a gas or vapour is called _____.
2. The unintended movement of a pesticide vapour or liquid through the air is called _____.
3. Dust blowing through the air is an example of _____ drift.
4. The movement of pesticide through a soil is most affected by the soil's _____.
5. You can avoid volatization of a pesticide by not spraying when the air temperature is _____.
6. One way to reduce runoff is to avoid spraying when _____ is forecast.
7. To reduce leaching it is good practice not to _____ for 24 hours after applying a pesticide.
8. A temperature inversion occurs when _____ air sits on top of _____ air.
9. A temperature inversion increases drift because air moves _____ during this time.
10. Pesticide runoff is more likely to occur on _____ land areas.
11. Which of the following statements about contamination of water by pesticides is TRUE?
    a. Pesticides cannot reach groundwater as a result of runoff
    b. The chance of groundwater contamination is higher when a rain immediately follows application
    c. Pesticide contaminated surface water rarely reaches the water table
    d. Erosion is not a factor that contributes to water contamination
12. What two factors should applicators be most concerned about to avoid spray drift?
    a. Temperature and pesticide volatility
    b. Air stability and temperature
    c. Viscosity of pesticide and temperature
    d. Droplet size and wind speed
13. One of the best ways to protect water bodies is to create a _____ before applying a pesticide.

Practice Activity Answer Key

1. volatilization
2. drift
3. soil
4. texture
5. hot
6. rain
7. irrigate/water
8. warm/cool
9. sideways or laterally
10. sloped
11. b. The chance of groundwater contamination is higher when a rain immediately follows application.
12. d. droplet size and wind speed
13. buffer

Glossary

buffer zone: An area or strip of land left untreated to protect a nearby area, e.g. a sensitive water body, or habitation; it is also used to protect a pesticide-free zone. Buffer zones take into account the type of pesticide application equipment, speed of travel, terrain topography, soil conditions and weather conditions.

degradation: Also called breakdown, degradation is the process by which a complex chemical is reduced to a less complex form. This can result from the action of microbes (biodegradation), water, air, sunlight (photodegradation) or other agents.

drift: The movement of pesticide droplets, vapour or dust, by wind or air currents, away from the target area. Drift constitutes one of the major hazards of pesticide application.

fungicide: A pesticide used to control fungi, including rots, moulds and plant diseases.

ground water: Water found in the porous rock and soil beneath the ground. It doesn't run off and is not taken up by plants, but moves into an aquifer (a body of permeable rock that can contain or transmit groundwater, and may supply water for wells, springs, etc.).

leaching: Refers to the movement of chemicals through soil by water.

no-treatment zone (NTZ): Also known as a buffer zone. This is an area of land that must not be treated with pesticide. The buffer zone (referred to as "no-treatment zone" in the IPM regulations) must be wide enough to ensure that no pesticide enters the pesticide-free zone, which can occur through particle drift, vapour drift, leaching or surface runoff .

surface water: Water that is open to the air, such as lakes, streams and ponds, and is subject to runoff.

water table: The point underground that is fully saturated with water. The water table can range from a few feet to hundreds of feet below the surface of the ground.