



Lesson 3: Protecting Human Health

In order to lessen the harm that pesticides can cause to applicators and the public, it is important to understand the relationship between the **toxicity** of the pesticide product and the effect of exposure.

This lesson will focus on understanding how be aware of toxic effects of a pesticide, and how to protect yourself. You will also learn how pesticides enter the human body. You'll learn how to reduce the risk of exposure to yourself and others, and how to find more information on MSDS.

Key Learning Points

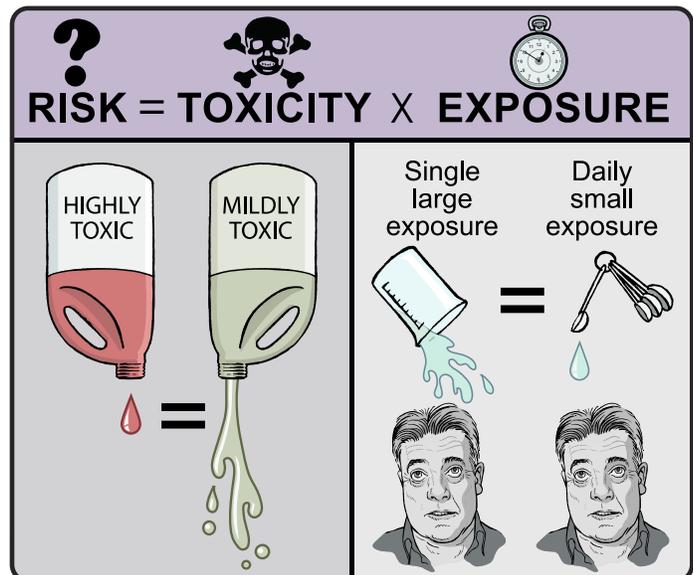
- Explain the difference between acute and chronic toxicity.
- Describe four ways pesticides can enter the human body.
- Describe how assistant applicators can reduce their exposure and personal risk of harm.
- Describe how to locate a MSDS on the work site.
- Explain the use and purpose of a MSDS.

Risk and exposure

It is important to understand the relationship between the toxicity of the pesticide product and the effect of **exposure**. Together, toxicity and exposure determine the amount of risk that an applicator faces.



Inadequate protective equipment increases the risk of exposure.
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Risk depends on how toxic the pesticide is and how much exposure there is to the product.

If somebody got “soaked” with pesticide but washed it off quickly, that would be a large exposure. Somebody who received a very minor splash every day would have a long exposure. Both situations could be bad.

A small exposure to a highly toxic product may be as harmful as contact with a large amount of a product that’s not as toxic.



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Toxicity

Toxicity refers to the ability of the pesticide to cause harm to an organism.

The harm a pesticide causes a human being can vary with the specific pesticide and the age, health condition, sex, weight, route of exposure and amount of exposure.

Exposure

Exposure refers to the way a pesticide enters the body.

The way a pesticide is formulated will affect the method of exposure. Some formulations are easily absorbed by the skin, while others are more likely to be absorbed by breathing in spray particles, fumes, or dust or by absorbing it through the eyes.

An applicator may be exposed to pesticides through spills, splashes, sprays, **vapours** or **drift**. Exposure can also happen when applicators touch sprayed surfaces, protective equipment, application equipment or mixing utensils that are contaminated with the pesticide. People are most at risk of exposure when they are mixing or applying pesticides.

Size Makes a Difference

Another factor in figuring out the risk is the person's size compared to the amount of pesticide they are exposed to.

For example, an adult may be exposed to an amount of pesticide with little consequence. However, the same amount ingested or inhaled by a child would result in a much higher concentration of that pesticide in her body. The risk to her health from the same exposure would be much greater.

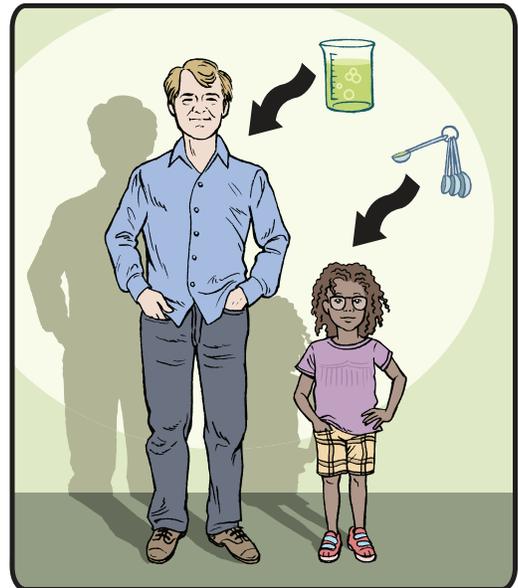
An adult may not be harmed by an amount of pesticide that can seriously injure a child.

Strength of formulation

The amount of active ingredient in the total pesticide formulation is also a key factor in your risk of exposure. If you are working with undiluted pesticides (also referred to as concentrate), or if the amount of active ingredient in the entire solution is high, your risk is higher.

This is one reason mixing and loading pesticides is the process that involves the greatest risk—because applicators are working with undiluted (concentrated) pesticides.

“One study of worker exposure to azinphos-methyl in the Canadian tree fruit industry found that air levels of pesticide in the mixing area were four times higher than during spray operations.” (from *Standard Practices for Pesticide Applicators* (WorkSafeBC))





Acute and Chronic Toxicity

The harmful effects of toxicity can occur shortly after exposure to pesticides (**acute toxicity**) or they can develop over time (**chronic toxicity**). The toxicity of a product is described on the pesticide label using precautionary symbols, words and statements.

Symptoms of Pesticide Poisoning





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Some of the symptoms of acute toxicity resemble the flu, heat stress or a hangover. Never attempt to diagnose yourself. Seek medical help right away if you feel these symptoms and you work with pesticides.

Symptoms of Acute Toxicity	Symptoms of Chronic Toxicity
nausea, vomiting	skin irritation
fatigue	loss of weight
headache	tumours
sweating	organ damage
chills	nerve damage
dizziness	birth defects
blurred vision	
stomach cramps	
muscle weakness or pain	

Different pesticides may have different poisoning symptoms. Symptoms a pesticide is likely to cause are listed in the *Toxicological Information* section of a pesticide's label and on the pesticide's MSDS.

Acute toxicity is measured using LC_{50} and LD_{50} numbers. These numbers measure the concentration and dose required to have an effect on 50% of the population. You may see these numbers on a MSDS. The most important thing to know is that **the smaller the number, the more toxic the product** (i.e., it takes less of the product to cause a toxic effect).

Routes of Entry

Pesticide exposure occurs when a pesticide gets onto or into the body. There are four primary routes by which a pesticide can enter your body: skin, mouth, breathing it in (lungs) and through the eyes.

If you have access to the Internet, explore the [Routes of Exposure](#) online, then skip ahead to the next section of your lesson, *Reducing Exposure*.

If you are working offline, read the following before moving ahead.

Dermal (Skin) Exposure:

Over 90% of pesticide exposure for applicators comes from contact of a pesticide with skin (the **most common** route of exposure). When pesticides enter the body through the skin, they are absorbed by the blood stream.

Most skin exposures occur to the hands, forearms and forehead. Exposure can result from direct contact with a pesticide concentrate or spray, handling contaminated equipment, or from wearing contaminated clothing or from not washing before using the bathroom.



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The amount of pesticide absorbed by skin is affected by skin condition and the body part exposed to the pesticide. Areas where we sweat a lot absorb chemicals better than dry areas because sweat aids the absorption process. Here are four areas that absorb pesticides easily through the skin:

- Armpits
- Small of the back
- Genital area
- Head

Inhalation (Breathing) Exposure:

When we breathe in pesticide particles (as spray droplets, dust particles, vapours, gases, or fumes), they enter the lungs, where they are absorbed into the bloodstream. Inhalation exposure is the **most serious** route of exposure, because it happens very quickly and the damage cannot be easily reversed. Whenever you think that there is a possibility of inhaling a pesticide, use a respirator. Information on choosing the correct respirator can be found on the product label, the MSDS, and by contacting the manufacturer.

Ingestion (Swallowing) Exposure:

Serious poisoning may result when a pesticide enters the body through the mouth. If you swallow a pesticide, it goes to the stomach where it is absorbed into the blood stream. Some pesticides may be corrosive, as well as toxic. These can burn the mouth, throat and stomach lining if swallowed. To avoid ingestion or oral exposure, take care not to splash when mixing and loading pesticides. Never put pesticides in a container other than the original. Never put a nozzle to the lips or blow into it to clear a blocked spray tip. And always wash before eating, smoking, or drinking. If a respirator is not required, consider wearing a face shield to protect your face and mouth when mixing, loading and handling concentrated pesticide.

Ocular Exposure (Eye)

The eyes are very sensitive and can absorb large amounts of pesticides very quickly. Exposure to pesticides through the eyes (ocular exposure) can occur from splashes, spray drift and dust. Another common cause comes from rubbing the eyes with a pesticide contaminated hand or arm. Note: Eyeglasses and contact lenses do not provide protection from pesticide drift or splash. Use proper eye protection (e.g., safety goggles or splash shield), and don't rub or touch your eyes when handling pesticides.



Reducing Exposure

There are four right ways to reduce exposure.

1. **Have the right attitude.** Be safety conscious at all times. Your attitude will help you do the right things to keep yourself and others safe.
2. **Use the right methods.** Make sure you follow your supervisor's instructions and label instructions for applying pesticide, storing pesticide, and cleaning and maintaining equipment.
3. **Use the right protective equipment.** You can reduce your exposure significantly by wearing the right gear for the pesticide you're using, and for the task you're doing. Always check the label for the recommended equipment.
4. **Follow the right safety practices.** Always assess your risk of exposure before you begin working with pesticides. If you are unsure how to be safe, ask your supervisor for appropriate training.

After handling pesticides, always wash your hands before eating, drinking, smoking, and using the washroom.

Safety Tip:

Practice "walk in, spray out." Be sure to begin an application at the furthest point from your exit so you don't have to walk through a treated area.

Poisoning Response Readiness

It's important to know what to do in case of pesticide poisoning. That means being prepared, and knowing what to do before a poisoning occurs.

Note: You should tell your supervisor any time you feel unwell or suspect that you have been exposed to poisoning.

You can assess how ready you are for poisoning response with this [Checklist for Poisoning Response Readiness](#). If you feel there's an item on this list that you can't check off, talk to your supervisor and ask for help.

You'll learn more about emergency response planning in Lesson 7: Emergency Response.



Where to find a MSDS

One of your “Checklist for Poisoning Response Readiness” items directs you to take the label to the doctor. Some pesticides will give additional information on the Material Safety Data Sheet, so this is a helpful item to bring along also. Your employer will provide the MSDS.

You should know where to find the product label and MSDS in an emergency. Just know where you can access it—even if you don’t read it, you should be able to find it and give it to someone else who needs it, like paramedics attending the emergency.

You might require a MSDS when...

- You are writing or reviewing an emergency response plan.
- You need to determine the acute toxicity of the pesticide (the LD₅₀ or the LC₅₀).
- You want to know if the pesticide you will be transporting is classified as a dangerous good under Transportation of Dangerous Goods (TDG Regulations).
- You want additional information on personal protective equipment

Your employer is legally required to provide access to the MSDS for all hazardous products you work with, including pesticides. Ask your supervisor to provide a valid Canadian MSDS:

- Ask your pesticide supplier to send one.
- Look for MSDS on the supplier’s website.
- Look for MSDS on the manufacturer’s website.
- Search online for the product name and “MSDS”.

Look at these websites that provide sample MSDSs.

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Summary

In this lesson, you learned about the toxicity of pesticides, and the routes of exposure. You learned how to protect yourself from chronic and acute poisoning. You also learned about additional regulations that have been designed to protect the health of applicators and the general public, and how to obtain an MSDS, especially for emergency purposes.



Lesson 3 Practice Activity

1. Which of the following best defines risk as it applies to pesticides?
 - a. The possibility that the pesticide may cause harm.
 - b. The degree of exposure a person confronts.
 - c. The percentage value of toxicity caused by a pesticide.
 - d. The human factor that causes error.
2. What does the term *toxicity* mean?
 - a. The concentration of active ingredient.
 - b. The ability of a pesticide to cause harm.
 - c. The level of exposure needed.
 - d. The amount of risk.
3. Which of the following statements about exposure to pesticides is correct?
 - a. Exposure determines toxicity
 - b. Risk increases as exposure decreases
 - c. Exposure does not affect risk.
 - d. Length of time a pesticide is used affects exposure
4. Which of the following best defines acute toxicity?
 - a. Effects of exposure to a pesticide seen over a long period of time
 - b. Irreversible health effects caused by a pesticide
 - c. Harmful effects that happen a short time after exposure
 - d. Hidden serious effects of a pesticide that are delayed
5. What are four major pathways that a pesticide can enter the body?
 - a. Eyes, nose, ears and skin
 - b. Skin, breathing, ears and eyes
 - c. Skin, sweat, eyes and breathing
 - d. Swallowing, breathing, eyes and skin



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6. Which one of the following areas of the body absorbs a pesticide most easily?
- feet
 - forearm
 - eyes
 - head
7. What is the most common form of exposure to a pesticide?
- Ingestion
 - Dermal
 - Eyes
 - Inhalation
8. Which of the following activities is most likely to cause acute exposure to a pesticide?
- Mixing a pesticide
 - Cleaning application equipment
 - Transporting a pesticide
 - Storing pesticides
9. Istvan is applying pesticides on a hot day. What did he do wrong?
- He did not wear appropriate head protection.
 - He did not wear appropriate lung protection.
 - He did not wear appropriate gloves.
 - He touched exposed skin while applying pesticides.
10. David went straight to softball practice after work. He removed his coveralls and put them in a plastic bag in the back of the truck, locking the canopy. What did he do wrong?
- He did not store his personal protective equipment correctly.
 - He did not shower thoroughly after using pesticides.
 - He did not inform his teammates that he'd been exposed to pesticides.
 - He should have kept gloves on if he wasn't going to wash before practice.





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11. Hugo needed to pick up pesticides on his way to the job site. He put them in the back of his hatchback car. What did he do wrong?
- He did not wear protective equipment.
 - He did not roll down a window for ventilation.
 - He did not use a vehicle in which the pesticides could be transported separately.
 - He did not call his supervisor to say he would be bringing the pesticides to the site.
12. Hugo takes a quick bathroom break, so he leaves his gear on, goes to the washroom, and right back out. What did he do wrong? (Select all that apply)
- He did not inform a coworker where he was going.
 - He did not post a notice to say when he would return.
 - He did not remove his gloves and coveralls.
 - He did not wash before using the toilet.
13. The instructions say to wear head protection and gloves, and long sleeves and pants. Istvan gets dressed for the application, and then puts his pack of cigarettes in his pocket. What did he do wrong?
- He isn't spraying at a safe distance from the neighbour's yard.
 - He isn't wearing the correct protective equipment.
 - He's carrying smoking items on his body while applying pesticides.
 - He's using an incorrect application technique.
14. Megan's supervisor asks her to mix a new pesticide that's kept in the store room. Megan has used this type of pesticide before. So she puts on her gear and starts mixing. What did Megan do wrong?
- She did not read the label first.
 - She is not wearing the correct kind of gloves.
 - She is not storing the pesticide correctly.
 - She is mixing in an incorrect location.
15. In which of the following scenarios would consulting MSDSs for the pesticides you are working with be helpful? Select all that apply.
- The fire department is inspecting your storage facility.
 - You need to know if you have to follow Transportation of Dangerous Goods directions when moving pesticides.
 - Your supervisor has tasked you with a new application job.
 - You're making a routine application of Roundup in a parking lot.
 - You've spilled some pesticide with a danger warning on your skin, and you're going to the emergency room at the local hospital.





Practice Activity Answer Key

1. a. The possibility that the pesticide may cause harm.
2. b. The ability of a pesticide to cause harm.
3. d. Length of time a pesticide is used affects exposure
4. c. Harmful effects that happen a short time after exposure
5. d. Swallowing, breathing, eyes and skin
6. c. eyes
7. b. Dermal
8. a. Mixing a pesticide
9. d. He touched exposed skin while applying pesticides.
10. b. He did not shower thoroughly after using pesticides.
11. c. He did not use a vehicle in which the pesticides could be transported separately.
12. c. and d.
It's important to remove protective gear and wash thoroughly before using the toilet to reduce your exposure.
13. c. No food or drink should be kept on your person while working with pesticides. Pesticide can transfer to the food or cigarettes which will lead to your exposure through skin or digestive contact.
14. a. She did not read the label first.
15. b. You need to know if you have to follow Transportation of Dangerous Goods directions when moving pesticides.
c. Your supervisor has tasked you with a new application job.
and e. You've spilled some pesticide with a danger warning on your skin, and you're going to the emergency room at the local hospital.



Glossary

exposure: When contact occurs with a pesticide orally (through the mouth), ocularly (in the eyes), dermally (on the skin), or through inhalation (breathing into the lungs).

toxicity: The potential for an ingredient to cause ill health or death within a few hours to a few days after a single dose or exposure.

acute toxicity: The potential for an ingredient to cause ill health or death within a few hours to a few days after a single dose or exposure. Expressed as LD50 or LC50. Note, the smaller the LD50 or LC50 measurement, the more toxic the product.

chronic toxicity: The potential for an ingredient to cause adverse effects which develop slowly or occur a long time after exposure and last for a long time, i.e. years.

MSDS: Material Safety Data Sheet—legislated under Workplace Hazardous Materials Information System (WHMIS). Provides information on health hazards, personal safety and environmental protection for hazardous products. A MSDS is not a legal document. It may not be available for all pesticides. However, employers are required to provide MSDSs at all work sites for all chemicals that employees may be exposed to.

vapour: Gas produced by a substance which is a solid or liquid at room temperature. A gas or vapour is not the same as an aerosol or mist which are composed of tiny droplets of liquid suspended in air.

drift: The movement of pesticide droplets, vapour or dust, by wind or air currents, away from the target area onto areas not being treated. Drift constitutes one of the major hazards of pesticide application.

undiluted: Pesticides that are undiluted are in their concentrate form—no water or other substance has been added to weaken or carry the formulated product.