

2. Safe Use of Pesticides

For further information on the safe use of pesticides, refer to the *Grower Pesticide Safety Course Manual* found on the Ontario Pesticide Education Program's website at www.opep.ca.

Human Health

Risks of pesticide use

There is some risk each time a pesticide is handled. The amount of risk depends on two things – the toxicity of the pesticide and the degree of exposure.

$$\text{Risk} = \text{toxicity} \times \text{exposure}$$

Toxicity

Toxicity is a measure of how harmful or poisonous a pesticide is. There are two types of toxicity:

Acute toxicity

Acute toxicity is the toxic response that results from a single exposure to the pesticide. The symbols and words on the front panel of a pesticide label give information about the acute toxicity (see Table 2-1. *Label Hazard Symbols and Words* on page 13).

Lethal dose 50% (LD₅₀) is a measure of acute toxicity. It is the dose (in mg of product per kg of body weight) that will kill 50% of test animals (usually rats) within a stated time (24 hours to 7 days). This is commonly measured as the acute oral LD₅₀, which refers to the chemical ingested through the mouth or nose. Dermal LD₅₀ figures, or skin penetration, are also available. The LD₅₀ of pesticides used in greenhouse or outdoor ornamental production is listed in Table 8-1. *Insecticide and Miticide Toxicity and Classification* on page 104, Table 8-2. *Fungicide Toxicity and*

Classification on page 106, Table 8-3. *Growth Regulator Toxicity and Classification* on page 108, and Table 8-4. *Herbicide Toxicity and Classification* on page 108.

The higher the LD₅₀ figure, the less toxic the product is to humans. Products with low LD₅₀ ratings are highly toxic. Pest control products with high acute toxicity that are registered for greenhouse use include dichlorvos (DDVP) and endosulfan (Thiodan, Thionex).

Chronic toxicity

Chronic toxicity is the toxic response from repeated exposure to small doses of a pesticide over a longer period of time. These toxic effects may not appear for months or years after exposure. The symbols on the label do not give information about the chronic toxicity of the product. Use protective clothing and equipment to help reduce exposure and risk of chronic effects.

Exposure

Exposure is a measure of the contact with the pesticide. Workers can be exposed to the pesticide in three ways:

Dermal exposure

Dermal exposure occurs through skin or eyes. The amount and rate of pesticide that may be absorbed depend on several things, including:

- Skin condition at time of exposure: If the skin is moist, or if a rash, broken skin or scratches are present, pesticide is absorbed more easily.
- Part of the body that is exposed: Eyes, genital area, scalp and ear canals absorb pesticides at a higher rate than hands or arms. Eyes are particularly vulnerable because the tissues are very absorbent.

Respiratory exposure

Respiratory exposure (inhalation) occurs when small spray particles, dust, gases or vapours are inhaled.

Oral exposure

Oral exposure occurs when a pesticide enters the mouth or is swallowed.

Cholinesterase blood tests

Organophosphorus and carbamate pesticides can affect the human nervous system. Organophosphorus and carbamate pesticides registered for use in greenhouses or outdoor floriculture include:

- acephate (Orthene)
- carbaryl (Sevin)
- chlorpyrifos (Dursban, Pyrate)
- dichlorvos (DDVP)
- dimethoate (Cygon, Lagon)
- malathion
- naled (Dibrom)
- phosmet (Imidan)

These pesticides can reduce the levels of the enzyme acetyl cholinesterase in the serum and red blood cells. The body uses this enzyme to transmit messages through the nervous system. If cholinesterase levels fall, individuals experience symptoms such as trembling, twitching, blurred vision, and breathing and heart difficulties.

People who routinely use any organophosphorus and carbamate pesticides should have regular cholinesterase blood tests. A family doctor can arrange

these tests, which are covered by OHIP. Workers should have their first test before beginning to handle these pesticides to show their baseline (normal) cholinesterase level. During the spray season, workers who spray organophosphorus or carbamate insecticides regularly for several weeks should have a cholinesterase blood test every 7–10 days. If the cholinesterase level drops to less than half of the baseline level, the worker is showing signs of pesticide poisoning and must prevent exposure to these pesticides until cholinesterase levels return to normal.

Read and Follow Pesticide Label Information





Know the hazard symbols and words

Four important symbols and words show the potential hazards of pesticides. See Table 2-1. *Label Hazard Symbols and Words* on page 13.

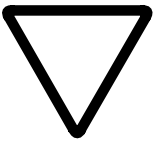
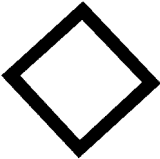
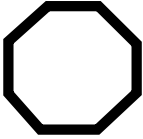
Check the label for special warnings about eye and skin hazards. The front panel of the label may also contain warnings that indicate whether the product is corrosive to eyes or is a skin or eye irritant.

Learn about the health hazards and toxic properties of the pesticide being used. Consult the product label, Material Safety Data Sheets (MSDS) or manufacturer for this information. Check the company websites for MSDS information.

Table 2-1. Label Hazard Symbols and Words

Learn these symbols and words – they could save your life!				
Hazard symbol				
Signal word	Poison	Corrosive	Flammable	Explosive

The hazard symbol always appears inside one of the shapes shown below. The shape and its warning word together indicate the degree of hazard of the pesticide. The greater the number of sides of the shape, the more hazardous the product.

Warning symbol			
	Triangular shape means low hazard (3 sides)	Diamond shape means moderate hazard (4 sides)	Octagonal shape means high hazard (8 sides)
Signal word	Caution	Warning	Danger

First Aid

If a serious accident occurs, call 911.

1. Always protect yourself from injury first. Do not become a victim. Always put on protective clothing and equipment before entering a contaminated area or handling a contaminated victim.
2. Check to see if the victim is conscious.
3. Check to see if the victim is breathing.

If the victim is not breathing:

- Straighten the victim's airway and check for breaths.
- If the victim does not begin to breathe, administer artificial respiration until the victim begins to breathe independently.

- Do not contaminate yourself, especially if the victim has pesticide or vomit around the face or mouth. Use a face shield airway with a one-way valve. Do not breathe the exhaled air from the victim.
- If the victim's pulse disappears, perform CPR if you are qualified to do so.

If the victim is breathing, but unconscious:

- Place the victim in the recovery position (on the side with the head turned slightly to one side). If the victim vomits, try to keep the airway clear.
4. Stop the exposure to the pesticide. Move the victim away from the contaminated area. Remove all contaminated clothing. Use soap and water to wash any skin exposed to the pesticide.

5. Check the four basic facts:

- What? Identify the pesticide. Look for the label, container or leftover pesticide.
 - How much? How much product was the victim exposed to?
 - Where? How did the pesticide enter the body? Did it enter through the mouth, skin, eyes or lungs?
 - When? How much time has passed since the victim was exposed to the pesticide, and how long was the exposure? Were the symptoms immediate or did the poisoning occur as a result of using the pesticide over a longer time?
6. Call the Poison Information Centre.
7. Start the first aid treatment appropriate for the route of entry.
8. Make sure the patient gets medical attention. First aid is not a substitute for professional medical help.

Do not waste time

If you cannot answer the questions (in Number 5 above) quickly, be ready to tell emergency personnel whatever you can.

Symptoms of pesticide poisoning

Mild

Headache, fatigue (tired feeling), loss of appetite, dizziness, weakness, nervousness, nausea, perspiration, diarrhea, loss of weight, thirst, moodiness, irritation of the skin, eyes, nose or throat.

Moderate

Nausea, trembling, loss of muscular coordination, excessive saliva, blurred vision, constricted throat or chest, laboured breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, mental confusion, perspiration, rapid pulse, cough.

Severe

Vomiting, loss of reflexes, inability to breathe or increased breathing rate, muscle twitching, tiny pupils, convulsions, unconsciousness, thirst, fever.

(Source: Grower Pesticide Safety Course manual, Ridgetown Campus, University of Guelph. Available online at www.opep.ca.)

If symptoms occur during or shortly after handling a pesticide, go to a hospital. Take the pesticide label, MSDS sheet or pesticide container. Do not transport the container in the passenger compartment. Refer to the Emergency Procedures for Pesticide Poisoning on the inside back cover.

Poison Information Centre

- 1-800-268-9017
- TTY 1-877-750-2233

General Precautions When Using Pesticides

Always read the label:

- before buying a pesticide
- before using a pesticide
- before storing or disposing of a pesticide

Always keep records of pesticide use.

Protection When Using Pesticides

Tell someone where the work is taking place, what pesticides are being handled, and how long the job is expected to take.

Post emergency numbers, including the Poison Information Centre and Spills Action Centre, near all telephones.

Keep a list of the names and the *Pest Control Products (PCP) Act* registration numbers of all the pesticides handled. It is a good idea to keep a file of the pesticide label booklets for all the products used. Ensure that co-workers and family members know where this list or file is kept in case of an accident.

Have plenty of clean water, soap, paper towels and an extra set of gloves and coveralls nearby at all times in case pesticide contaminates clothing or skin.

Wear the correct protective clothing and equipment, and be sure that all items are clean and in good repair before wearing.

Never smoke, chew tobacco, eat or drink when handling pesticides. Never carry tobacco or food in clothes. Never leave tobacco, food or beverages in areas where handling or storing pesticides.

Change clothes and wash hands and face before eating, drinking or smoking.

Wash hands before and after using the toilet. The skin in the groin area absorbs pesticides very easily.

When using fumigants:

- Remove livestock and poultry that are in the same building.
- As a safety precaution, have a co-worker help with the fumigation. Always wear personal protective equipment when using fumigants.

When using treated seed:

- Remember that seed dressings or treatments are poisonous to people and livestock.
- Do not inhale the fumes or dust when treating or handling treated seed.
- Wear neoprene or nitrile gloves.
- Wash all residue of these chemicals from skin after finishing the treatment. Chemically treated seed is poisonous.
- Never feed surplus seed to livestock.

Protective Clothing and Equipment

Choose and wear the appropriate protective clothing and equipment. Make sure protective clothing and equipment are clean, fitted properly, in good repair, and in working condition. The appropriate protective clothing and equipment for workers depends on:

- the pesticide being used. Read the precautions section of the label to know what is required.
- the job being done, for example, use more protection when handling concentrated pesticide or when mixing and loading a sprayer.
- the type of application. Enclosed space or air-blast sprayer applications made with open tractors require more equipment.

All persons who work with pesticides need their own set of protective clothing and equipment. Consult the product label to find out what protective clothing is required.

For all pesticides, always wear:

- a water-repellent hat, such as a hard hat or waterproof rain hat. Sometimes the entire head and neck must be protected, for example, when applying pesticides in a greenhouse, applying dusty formulations, or using an air-blast sprayer. In these situations, wear a hood or hat that protects ear canals. Do not wear baseball-style or other cloth hats, which absorb pesticides.
- long pants and a long-sleeved shirt or coveralls. Coveralls can be reusable or disposable. Reusable coveralls are normally cotton or polyester and should be tightly woven. Disposable coveralls should be designated for pesticide use. Water-resistant coveralls are preferred because cotton, denim and cotton-polyester pants cling to the skin if they get wet, which increases the risk of dermal exposure.
- chemical-resistant gloves (unlined). Use neoprene or nitrile gloves (PVC), unless the label states otherwise. Do not wear rubber gloves as many pesticides can break down the rubber material. Wear gloves under sleeves with the top cuffed.

- chemical-resistant boots (unlined). Wear pant legs over boots to prevent pesticide from running down inside the boots.

Read the label. It will describe what extra protective clothing and equipment to wear. For some pesticides, workers should also wear:

- goggles. Use safety goggles with indirect vents so that splashes do not enter the eye. Regular eyeglasses do not provide complete protection. Never wear contact lenses when handling pesticides.
- a face shield.
- a chemical-resistant apron.
- a respirator. A respirator is a unit that covers the mouth and nose to prevent spray droplets, small particles and vapours from entering the lungs. A dust mask is not a substitute for a pesticide respirator. Respirators and replacement cartridges should be NIOSH/MSHA-approved. Use cartridges and pre-filters that protect against organic vapours. For more information, see the Grower Pesticide Safety Course manual, Ridgetown Campus, University of Guelph.

For fumigants:

- When handling methyl bromide, do not wear gloves as they will trap gas next to the skin. Wear a full-face respirator with organic vapour canister or positive-pressure breathing apparatus. Some methyl bromide products require, by label, that self-contained breathing apparatus be worn at all times while using the product.
- When you handle aluminum phosphide, use cotton gloves and wear a NIOSH/MSHA-approved full-face mask respirator with an acid-gas canister.

Always check the label to find the appropriate safety equipment requirements.

When Working in Enclosed Areas

Canister respirators

Canister gas masks are effective for protection against certain harmful gases, vapours and spray particles. They are generally suitable for ventilated areas not subject to rapid change, but should never be used in confined spaces where oxygen deficiency and high gas concentrations may occur.

Use canister respirators when the surrounding air contains low concentrations of toxic gases, vapours or particles derived from soil-drench, granular, dust or foliar spray applications. Pesticides applied in this manner usually have moderate to low toxicity.

Self-contained breathing apparatus

Air-purifying devices do not work in confined spaces where gas concentrations are unusually high. Substances that produce hydrogen cyanide, methyl bromide, chloropicrin or phosphine can produce high gas concentrations and oxygen deficiency as can volatile sprays, smoke generators and foggers that use highly toxic pesticides.

Use a self-contained breathing apparatus when applying highly toxic pesticides, especially in an enclosed space.

Other protective clothing

Wear other protective clothing in keeping with requirements listed on the pesticide label.

Safety equipment

Read the label for safety equipment recommendations and requirements. Protective clothing and equipment can be purchased from the suppliers listed in Table 2-2. *Ontario Suppliers of Protective Clothing and Equipment* on page 17.

Table 2-2. Ontario Suppliers of Protective Clothing and Equipment

3-M Canada Inc.	Occupational Health and Environmental Safety P.O. Box 5757 London, ON N6A 4T1 www.3m.ca	Tel: 519-451-2500 Toll-free: 1-800-364-3577 Fax: 1-800-603-7758 OHS: 519-452-4600
Acklands Grainger	90 West Beaver Creek Road Richmond Hill, ON L4B 1E7 www.acklandsgrainger.com	Tel: 905-940-5535 Fax: 905-940-5537 Email: contact@agi.ca
Aearo Canada	6889 Rexwood Road Mississauga, ON L4V 1R2 www.aearo.com	Tel: 905-795-0700 Toll-free: 1-800-387-4304 Fax: 905-564-5250
DuPont Personal Protection	45 Dalkeith Drive Brantford, ON N3P 1M1 www.dupont.ca	Tel: 519-753-9306 Toll-free: 1-800-387-9326 Fax: 519-752-2161
Huron Tractor	39995 Harvest Road Exeter, ON N0M 1S3 www.hurontractor.com	Tel: 519-235-1115 Fax: 519-235-1939
HAMISCO	3392 Wonderland Road London, ON N6L 1A8 www.hamisco.com	Tel: 519-652-9800 Toll-free: 1-800-668-9800 Fax: 519-652-9661
Levitt-Safety (Eastern) Limited	2872 Bristol Circle Oakville, ON L6H 5T5 www.levitt-safety.com	Tel: 905-829-3299 Toll-free: 1-888-453-8488 Fax: 905-829-2919
International Safety	355 Harry Walker Parkway North, Units 9 & 10 Newmarket, ON L3Y 7B3 www.internationalsafety.com	Tel: 905-898-6906 Toll-free: 1-877-342-5477 Fax: 905-898-1597
Mitt & Robe Co.	751 Norfolk Street North Simcoe, ON N3Y 3R6 www.mittrobe.ca	Tel: 519-428-4050 Toll-free: 1-877-893-6565 Fax: 519-428-5142
MGS Horticultural Inc.	50 Hazelton Street Leamington, ON N8H 1B8 www.mgshort.com	Tel: 519-326-9037 Fax: 519-326-5861 Email: info@mgshort.com
MSA Canada Inc.	5535 Eglinton Ave. West Unit 222 Toronto, ON M9C 5K5 www.msanet.com	Tel: 416-620-4225 Toll-free: 1-800-267-0672 Fax: 416-620-9697
Plant Products Co. Ltd.	314 Orenda Road East Brampton, ON L6T 1G1 www.plantprod.com	Tel: 905-793-7000 Toll-free: 1-800-387-2449 Fax: 905-793-9157
Safety Express	4190 Sladeview Crescent Units 1 and 2 Mississauga, ON L5L 0A1 www.safetyexpress.com	Tel: 905-608-0111 Toll-free: 1-800-465-3898 Fax: 905-608-0091 Email: info@safetyexpress.com
Sun Parlour Greenhouse Growers Cooperative	230 Essex Road 31 Leamington, ON N8H 3W2 www.sunparlourgrower.com	Tel: 519-326-8681 Fax: 519-326-3413
The St. George Company (Suppliers of Kasco Helmets)	P.O. Box 430 20 Consolidated Drive Paris, ON N3L 3T5 www.thestgeorgeco.com	Tel: 519-442-2046 Toll-free: 1-800-461-4299 Fax: 519-442-7191 Email: sales@thestgeorgeco.com

Care of Protective Clothing and Equipment

After spraying, clean all protective clothing and equipment.

Never let children, pets or livestock come in contact with contaminated clothing or equipment. Also ensure that they cannot come into contact with the puddles of water that result when cleaning equipment.

Wash gloves with soap and water and then leave them on to remove other protective clothing and equipment.

Always remove protective clothing and equipment outdoors. If a granular pesticide was used, shake the clothing outdoors in a safe place. Be sure to empty pockets and cuffs.

Dispose of clothing that has been contaminated by spills of highly toxic or concentrated pesticides. Place contaminated clothing in a plastic bag and take it to a landfill site.

Coveralls and other spray clothing must be washed separately from other clothes. They should be washed after each use. After laundering, place them in a plastic bag and keep them separate from other clothing.

Continue to wear gloves while washing protective equipment. It is best to wash equipment outdoors. If the work area does not have a clean-up area outside, designate specific buckets solely for equipment clean-up. Mark them and keep them in a designated place. Wash the inside and outside of goggles, hat, boots and any water-repellent clothing in warm soapy water, rinse well and let air-dry.

Respirators

Remove the cartridges and prefilters from the respirator.

Discard cartridges, canisters and filter pads at the interval set by the manufacturer or earlier if breathing becomes difficult, or a pesticide taste or odour is noticed.

Record the date the cartridge is first used.

Remove cartridges and filter pads from the face piece and store in clean, sealed plastic bags.

Wash the face piece in warm soapy water, rinse thoroughly and dry in a well-ventilated area. Air drying prevents damage to the inlet and outlet valves.

Never use alcohol or other solvents for cleaning, as they will damage the rubber and plastic.

Rubber, vinyl or plastic boots and gloves

To avoid getting pesticide on hands, wash the outside of boots and gloves with detergent and water before taking them off.

After removing boots and gloves, wash them inside and out with detergent and water, rinse thoroughly and dry in a well-ventilated area.

How to wash clothes used for spraying

Never mix spray clothing with household laundry. All clothing used for spraying must be stored and washed separately from other clothing. Wash spray clothing after each use. Remember to use chemical-resistant gloves to handle pesticide-contaminated clothing.

Presoak clothing before washing. Use one of three methods:

- hose off garments outdoors
- soak in separate tub or pail
- use the prewash cycle in an automatic washer

Use hot water, the highest water level and the longest cycle with heavy-duty detergent. Wash as prescribed for heavily soiled clothing.

Wash clothing twice.

After washing, hang outside (preferably in bright sunlight) until completely dry. Do not use a clothes dryer.

Clean the washing machine. Run the washing machine through one complete cycle using only detergent and hot water (no clothing).

Personal hygiene

Always wash your hands before eating, drinking or smoking.

When finished for the day, take a bath or shower as soon as possible. The longer a pesticide remains on the skin, the greater the risk that it will be absorbed into the body.

Wash hair and under fingernails. Shower with a lot of soap and water.

Always change into clean clothes.

Wear clean work clothes every day. A small spill on the previous day's clothes may seem unimportant, but wearing the same clothing again without washing it prolongs exposure and increases risk.

Pesticide Application Procedures

Sprayers

Sprayers that can deliver sufficient volume for adequate coverage are satisfactory for applying emulsion-type insecticides.

If applying herbicides, always use a sprayer dedicated for that purpose. Do not use a sprayer to apply insecticides or fungicides to crops if it has been previously used for herbicide applications.

Adequate agitation is essential when applying wettable powder formulations.

Pumps should be capable of delivering the flow and pressure required and compatible with materials sprayed.

Keep in mind that the higher the pressure, the greater the danger of drift.

Calibrate your sprayer at least twice during the season with each set of nozzles used. The wear on nozzles and other parts will alter the amount of spray delivered.

Check all nozzles for flow rate at least once a year. Replace nozzles when their output is 10% greater than rated output.

Sprayer calibration

Sprayer calibration is an important part of integrated pest management. Sprayer calibration:

- ensures that the proper amount of pesticide is applied
- ensures uniform pesticide application and coverage
- minimizes leftover tank mixtures, which can present disposal challenges

Handheld or backpack sprayer calibration

Many people use handheld spray guns or backpack sprayers for treating problem areas or spraying areas that were missed. To calibrate these sprayers:

- Measure an area that is 100 m², for example, 10 m × 10 m, or 25 m × 4 m.
- Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure you will use during the pesticide application.
- Spray the water over the 100 m² area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.
- Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 m².

To convert the application rate of any pesticide to the amount required for a small area, follow this guide:

$$\begin{aligned} \text{dry measure: } & 1 \text{ kg/ha} = 10 \text{ gm}/100 \text{ m}^2 \\ \text{liquid measure: } & 100 \text{ L/ha} = 1 \text{ L}/100 \text{ m}^2 \end{aligned}$$

For more information on calibration, see OMAFRA Publication 75, *Guide to Weed Control*. There is also a calibration calculator on the OMAFRA website at www.ontario.ca/crops.

