

Workplace Health and Safety Bulletin



Guidelines for Workers Applying Insecticides

Insecticides can be safely applied when proper precautions are followed.

Alberta occupational health and safety legislation

Where workers may be exposed to a harmful substance, Alberta's occupational health and safety (OHS) legislation requires that employers establish procedures to minimize exposure and ensure that workers who may be exposed are adequately trained. This training must include descriptions of the health hazards associated with exposure to the harmful substance and procedures to minimize that exposure. Under the same legislation, workers are obligated to follow safety instructions. Procedures that may be used to limit exposure include engineering controls, administrative controls and personal protective equipment.

Commonly used insecticides (pesticides)

The most commonly used insecticides for pest control in Alberta are summarized in Table 1. The health effects for the various types of commonly used insecticides are summarized in Table 2. A good source of information on the health effects of pesticides is the PAN Pesticide Database, available online at www.pesticide.info.org

Government of Alberta ■
Employment and Immigration

Table 1 Most commonly used pesticides by sales volume (kilograms of active ingredient)

Active Ingredient	Chemical Group	Examples
Chlorpyrifos	Organophosphate	Lorsban, Pyrinex, Nufos
Phorate	Organophosphate	Thimet (used on potatoes)
Silica Aerogel	Inorganic	Protect-It, Drione (mixed with Piperonyl Butoxide and Pyrethrin)
Malathion	Organophosphate	Various crop sprays and livestock back rubbers
Silicon Dioxide	Inorganic	Insecto, Protect-It RTU
Methyl Bromide	Organophosphate	Metho-O-Gas (fumigations by certified applicators only)
Thiamethoxam	Amino Acid	Cruiser, Helix (seed treatment)
Carbaryl	Carbamate	Sevin
Butoxypolypropylene Glycol	Alcohol	Absorbine Conc. Fly Repellent
Cyhalothrin-lambda	Pyrethroid	Matador, Silencer, Saber, Warrior, Demand, Scimitar
Diazinon	Organophosphate	Various crop products and cattle ear tags
Mineral Oil	Oils	Dormant Spray Oil
Terbufos	Organophosphate	Counter (used on sugar beets)
Dimethoate	Organophosphate	Cygon, Lagon
Piperonyl Butoxide	Pesticide Synergist (does not, by itself have pesticide properties, however, when added to insecticide mixtures, their potency is increased considerably)	
Sulphur	Inorganic	Dri-Kill
Permethrin	Pyrethroid	Absorbine Ultrashield, Prelude
Muscalure	Hydrocarbon	Starbar Fly Attractant
Naled	Organophosphate	Dibrom
Soap	Fatty Acid	

*Source: 2008 data Alberta Environment

Table 2: Summary of health effects for commonly used insecticides

Chemical or Chemical Group	Health Effects	Symptoms
Organophosphate (OP)	Interfere with nerve impulse transmission, blocking the action of cholinesterase enzymes essential to proper nerve function.	Headache, sweating, nausea, vomiting, diarrhea, loss of coordination and in extreme cases, death
Carbamate	Similar to OP insecticides, although the effects do not last as long.	Similar to OP insecticides, although the effects do not last as long.
Pyrethroid	Affects the nervous system through other mechanisms other than cholinesterase inhibition	Irritability to sound or touch, abnormal facial sensation, sensation of prickling, tingling or creeping on skin, numbness, headache, dizziness, nausea, vomiting, diarrhea, excessive salivation, fatigue. In severe cases, fluid in the lungs and muscle twitching may develop. Seizures may occur. Irritation of skin and eyes.
Methyl Bromide	Central nervous system depressant	Headache, dizziness, abdominal pain, nausea, vomiting, chest pain, difficulty breathing, blurred or double vision or transient blindness, muscular pain and numbness. There may be a delay of more than 1 hr up to 48 hrs in the onset of symptoms. Severe exposures may cause tremors, convulsions, unconsciousness, permanent brain damage and damage to lungs, liver and kidney. Exposure to more than 10000 ppm methyl bromide for more than a few minutes may cause death. Severe irritation or corrosive skin injury
Silicon Dioxide	Respiratory and skin irritant	Cough, dry skin, redness of skin
Sulphur	Toxic, respiratory and skin irritant	Cough, sore throat, bronchitis and sinus effects, redness and irritation of skin
Thiamethoxam	Neonicotinoid (class of insecticide that affect the central nervous system of insects but have lower toxicity for mammals) affecting the nicotinic acetylcholine receptors	Mild eye and skin irritation
Piperonyl Butoxide	Interferes with the nervous system (potent <u>cytochrome P450</u> and non-specific esterase inhibitor)	Nausea, vomiting, diarrhea, skin, eye and respiratory irritation.
Mineral Oil	Skin, eye irritant	Mild skin and eye irritation
Butyoxypolypropylene Glycol	Respiratory, eye, skin irritant	Irritation of eyes, mucous membranes

Exposure to insecticides

Insecticides can enter the body by ingestion, inhalation or absorption through the skin. Alberta's OHS legislation requires employers to ensure that worker exposure does not exceed the Occupational Exposure Limit (OEL) established for a harmful substance. If no OEL has been established, the employer must ensure that all steps are taken to keep each worker's exposure as low as reasonably practicable/achievable. Alberta OHS legislation has established the following OELs for the insecticides listed:

Alberta's OHS legislation requires employers to ensure each worker's exposure to insecticides is as low as reasonably practicable.

Insecticide	8 hr OEL mg/m ²	Skin Notation
Carbaryl	5	No
Chlorpyrifos	0.1	Yes
Diazinon	0.01	Yes
Malathion	1	Yes
Naled	0.1	Yes
Phorate	0.05	Yes
Sulphur	10	Yes
Terbufos	0.01	Yes
Trichlorphon	1	No

“Skin notation” indicates whether or not the vapour can be readily absorbed through the skin.

Insecticides without OELs

There are a number of commonly used insecticides for which there are no OELs. However, exposure must be kept as low as reasonably practicable/achievable. The solvents used to dilute the active ingredients in the pesticide formulations may contain xylenes or petroleum distillates, which may cause dizziness, nausea and vomiting, and may have OELs of their own. Formulations containing xylenes should be handled as flammable liquids.


Minimizing exposure during application

To minimize workers' exposure to insecticides while they are being applied, workers should follow the following practices:

- Orient spray swaths to apply the insecticide with a slight crosswind, with each successive swath upwind of the last.
- Do not apply insecticides in winds greater than 10 to 16 kph, or during an atmospheric temperature inversion.
- Ensure applications are supervised by a certified pesticide applicator in accordance with the latest edition of the *Environmental Code of Practice for Pesticides*. Following this code will ensure that applications are conducted in a safe and legal manner, that equipment is in good working order and that pesticide concentrates and wastes are handled appropriately.
- Prevent skin contact, inhalation or ingestion of insecticide. Workers must not eat, drink or smoke in a work area contaminated by a harmful substance. Workers working with or applying insecticides must wash their hands and faces thoroughly before eating, drinking or smoking. These activities should not take place where workers have been applying insecticide.

Workers must not eat, drink or smoke in a work area contaminated by a harmful substance.

For more information

 www.qp.gov.ab.ca/documents/codes/PESTICID.cfm
Environmental Code of Practice for Pesticides

Personal protective equipment

Where engineering or administrative controls cannot adequately reduce exposures, or where these controls are impractical, personal protective equipment is required. Personal protective equipment appropriate for insecticides falls into three categories:

- protective clothing to prevent skin contact
- respiratory protection to prevent inhalation
- eye protection to prevent contact with the eyes.

Protective clothing

- Workers applying pesticides should wear disposable coveralls over a long-sleeved shirt and pants, nitrile or neoprene gloves, and nitrile or neoprene boots. Anyone mixing or loading pesticide concentrates should wear a waterproof nitrile apron to protect against concentrate spills. A face shield is recommended if splashing could occur during mixing or loading operations. Additional protective equipment identified on the pesticide's label or Material Safety Data Sheet should be worn.
- Workers applying pesticides should shower thoroughly after completing each day's application. The clothing worn during application should be laundered separately from other clothing.
- Clothing should be washed in accordance with Alberta Agriculture and Rural Development's instructions for laundering clothing used during pesticide application.

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For more information

 [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/aet635](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/aet635)
How to Wash Pesticide-Soiled Clothing

Respiratory protection

If respiratory protection is required, workers should wear an air-purifying respirator equipped with an organic vapour cartridge with a dust/mist prefilter (OV/P95). Respiratory protection is necessary when other methods of reducing exposure are not practicable. If there is an established OEL for the substance being used, respiratory protection should be worn unless it can be verified that exposure is below the OEL.


Using a Respirator


When respirators are used, they must be fit tested and properly maintained. Air-purifying vapour cartridges must be changed periodically, depending on the amount of exposure, to prevent the chemical from breaking through the cartridge. While odour and taste should not be used as the sole indicators of the presence of the chemicals, if the worker wearing a cartridge respirator smells, tastes or otherwise detects chemicals while working, the respirator-to-face seal must be examined to see if it is intact. The respirator seal should be examined away from the application area. If the seal is intact, the cartridge should be replaced. If a proper seal cannot be maintained, the respirator should be replaced.

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A qualified person, using the U.S. Occupational Safety and Health Administration (OSHA) or an equivalent method, must determine the change-out schedules for air-purifying respirators for substances that have poor warning properties (for example an odour threshold that is above the OELs). The employer must provide written procedures that explain how the calculations for the schedules are made and confirm the method used for calculations. In addition, the employer must ensure that workers understand and use this cartridge change-out system.

For more information:

 http://employment.alberta.ca/documents/WHS/WHS-PUB_ppe001.pdf
Respiratory Protective Equipment: An Employer's Guide (PPE001)

 http://employment.alberta.ca/documents/WHS/WHS-PUB_ppe004.pdf
Guidelines for the Development of a Code of Practice for Respiratory Protective Equipment (PPE004)

Eye protection

Eye protection, such as goggles or a face shield, should be worn in conjunction with respiratory protection to minimize vapour exposure to the eyes. Another alternative is the use of a full-face, air-purifying respirator.

Medical monitoring of workers exposed to insecticides

There is no legislated requirement for workers exposed to insecticides to have a medical assessment. However medical monitoring of workers handling or applying organophosphate insecticides can be used to check the effectiveness of control measures to minimize exposure and to help diagnose suspected overexposure.

Effects of insecticides on the nervous system

OP and carbamate insecticides inhibit the function of acetylcholinesterase (AChE) in the body. AChE stops the action of acetylcholine, a neurotransmitter found in the body's nervous system. The autonomic nervous system (the part of the nervous system that controls involuntary body actions such as blinking) uses acetylcholine to turn nerves on and off. Exposure to OP and carbamate insecticides allows concentrations of acetylcholine to continue to build up in the body so that the nerves continue to fire, causing neurologically based symptoms in various body organs.

Using the AChE level to assess exposure to OP or carbamate insecticides is accurate only if the unexposed baseline level of the substance in the body is known. This is because the level of AChE in the body:

- varies from person to person
- tends to stay fairly constant, unless it has been decreased due to liver damage (for example, hepatitis) or inhibited by another substance (a number of medications can inhibit AChE in the body).

When to monitor

Monitoring of exposed workers has two parts, pre-exposure assessment and periodic monitoring. It is important to do the assessments keeping in mind the body's different responses to different insecticides. Following OP insecticide exposure, the body's level of AChE will return to normal in about 100 days, provided there is no further exposure. Following exposure to carbamate pesticides, the body's AChE levels may return to normal in a matter of hours.

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Pre-exposure medical assessment

A pre-exposure medical assessment will:

- identify medical conditions that could increase the worker's health risk due to exposure to OP and carbamate pesticides
- establish the worker's unexposed (baseline) AChE level
- evaluate the worker's capability to use the necessary personal protective equipment.

The assessment should check for the following conditions:

- hepatitis
- liver disease or dysfunction
- kidney disease
- alcoholism
- asthma
- pesticide allergies
- use of medications, including cholinergic or parasymphomimetic drugs
- myasthenia gravis, a disease characterized by progressive fatigue and generalized weakness of the skeletal muscles, especially those of the face, neck, arms and legs, caused by impaired transmission of nerve impulses following an autoimmune attack on acetylcholine receptors.
- epilepsy

After determining that there has been no known pesticide exposure in the past 60 days, a blood sample should be collected for AChE analysis.

Periodic assessment

Additional monitoring should be carried out:

- once a month, as long as the worker is using OP or carbamate pesticides
- at the end of use (for short-term use)
- following any acute, accidental, large exposure.

When the pesticides are used infrequently (for a day or two, or several times a year), routine scheduling of AChE levels is not necessary. In this case, a baseline measurement should be taken, followed by additional monitoring if there is an accidental spill or the worker has symptoms of exposure.

The American Conference of Governmental Industrial Hygienists (ACGIH) has established Biological Exposure Indices (BEIs[®]) for insecticides that inhibit AChE. The indices compare the level of AChE with a baseline level for each substance. The measured value should not be less than 70 per cent of an individual's baseline level.

Workers should contact their family physician if they have health concerns or experience adverse health effects related to exposure to insecticide exposure.

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For more information:


Alberta Environment
Information Centre
Main Floor, Oxbridge Place
9820-106 Street
Edmonton, Alberta T5K 2J6
780-427-2700


Email: env.infocent@gov.ab.ca

 www.environment.alberta.ca/01535.html

Contact us:

Province-Wide Contact Centre

 Edmonton & surrounding
area:
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Web Site



www.worksafely.org

Getting copies of OHS Act, Regulation & Code:

Queen's Printer



www.qp.gov.ab.ca



Edmonton 780-427-4952

Workplace Health and Safety



<http://employment.alberta.ca/whs-ohs>

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Dial 310-0000, then the area code and telephone number you want to reach

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