

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 1 General Information

Disclaimer

This training module is intended to be used by qualified trainers only for the purpose of instructing individuals who wish to improve their general knowledge base on the safe handling and management of pesticides or to assist agricultural pesticide applicators seeking first-time certification or re-certification.

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General Information

Pests affect our daily lives. They can impact human health, property values, food supplies, and forest resources. Sometimes, pests will need to be controlled.

- **The most responsible approach to pest control is to use an Integrated Pest Management (IPM) program.**
- **IPM uses a number of pest control measures, depending upon the type of pest to be controlled.**

- **A responsible IPM program will sometimes require the use of chemicals (or pesticides).**
- **If not used responsibly, pesticides can be hazardous to humans and the environment.**
- **Safe pesticide use will help you to better protect yourself, your family, clients, bystanders, animals, and the environment from potential harm.**

Learning Objectives

Completing this training module will help you to:

- Understand and use proper pesticide terms.
- Understand the way different pesticides work.
- Understand the way different adjuvants work.
- Understand pesticide compatibility.

General Comments

This training module combines the information from the Applicator Core Manual and the Mosquito and Biting Fly Manual and is the basis for writing the certification exam required for the authorized use by ground of insecticides for control of mosquito and black fly larvae or their adult stage.

General Comments

- It is important to understand pesticide-related terms when selecting, purchasing, and applying a pesticide.
- You should also be familiar with the active ingredient, formulation, common name, and trade name of those chemicals and chemical families that you use.

Pest

- A pest is any harmful, noxious, or troublesome organism. Pests include weeds, insects, fungi, bacteria, viruses, rodents, or other plants or animals occurring where they are not wanted.

Pesticide

- A pesticide is any device, organism, or mixture intended to prevent, destroy, repel, kill, or mitigate a problem caused by any insect, rodent, weed, nematode, fungus, or other pest; and any other substance or mixture intended for use as a plant growth regulator, defoliant, or desiccant.

Pesticide Terminology

Active Ingredient (a.i.)

- Is that part of a pesticide mixture that actually controls the pest.
- A pesticide can contain more than one active ingredient.
- The same active ingredient can be present in a number of different pesticides.

Inert (or Inactive) Ingredient

- **Is a liquid or solid added to the active ingredient to make it better suited for storage, handling, or application.**

Formulation

- Is a mixture of one or more active and inert ingredients that together create the saleable product.
- Pesticides can be liquids, solids, or gases.

Formulation Types

Liquids

- Emulsifiable concentrates
- Flowables
- Microcapsulated suspensions
- Solutions

Formulation Types

Solids

- Dusts
- Granulars
- Pellets
- Baits
- Dry flowable powders
- Wettable powders

Special Formulations

Fumigants

- Are available as gases, liquids, and solids.
- Liquid fumigants become gases when released (applied).
- Solid fumigants are available as dusts, pellets, or tablets.

Soluble Packages

- Are pre-weighed amounts of product packaged in a water soluble, plastic bag.

Carrier

- **Is mixed with the active ingredient to make the product safer to apply, easier to handle, or better suited for storage.**

Examples: water, oil, solvents, or clay.

Ready-to-use pesticide formulations do not need a carrier.

Adjuvants

- Can be added to the pesticide by the manufacturer or the applicator.
- Adjuvants make the product safer, more effective, easier to handle, or easier to apply.

Types of Adjuvants

<i>Type</i>	<i>Activity</i>
Penetrants	Allow the pesticides to get through the outer layer of a treated surface.
Spreaders	Allow the pesticides to form a uniform coating over the treated surface.
Stickers	Allow the pesticide to remain on the treated surface.
Surfactants	Improve the spreading, dispensing, or wetting properties of a pesticide.
Antifoaming Agents	Reduce foaming of spray mixtures that require vigorous agitation.
Buffering Agents	Increase the solubility of pesticides in water or slow the chemical breakdown of some pesticides by lowering the pH of alkaline water.
Drift Retardants	Increase the droplet size of the spray material, reducing particle drift.

Naming Pesticides

Common Name

- Is the name(s) of the active ingredient(s) in the product.
- Appears in lower case letters, often next to the word “guarantee” on the principal panel of the label.

Trade or Product Name

- Is the registered trademark chosen by the manufacturer.

Examples of Trade and Common Names

Trade /Product Name

Common Name

VectoBac 200G
Methoprene

Bt (*Bacillus thuringiensis*)
Altosid Granular

Fyfanon ULV

Malathion

Trade and Common Names as They Appear on a Label

Altosid® GRANULES

A Granular Sustained Release Insect Growth Regulator
to Prevent Adult Mosquito Emergence

RESTRICTED

GUARANTEE: (S)-Methoprene 1.5%

REGISTRATION NO. 22676 PEST CONTROL PRODUCTS ACT

Understanding how pesticides work, the pests they control, and their chemical family can help you choose the best product for an application.

It can also help you better protect human health and the environment when using a pesticide.

Pesticide Groupings

Pesticides are grouped according to:

- **Target Pests (what pests they control)**
- **Mode of Action (how they control these pests)**
- **Chemical Family**

Pesticide Groupings

1. Target Pests

Target Pest

fungi

plants (weeds)

insects

nematodes

birds

rodents

fish

Type of Pesticide

fungicides

herbicides

insecticides

nematicides

avicides

rodenticides

piscicides

Pesticide Groupings

2. Mode of Action or Route of Entry

- Indicates the way that a pesticide works to stop the normal functioning of a pest, and eventually control or kill the pest.
- Many pesticides can have more than one mode of action.

■ Modes of Action (larval and adult control)

1. Contact
2. Stomach Ingestion
3. Systemic Regulators
4. Fumigants
5. Attractants
6. Repellents
7. Growth

(See Module 3: Pest Control for additional detail.)

Modes of Action

- **Contact insecticides** control pests by direct contact.
- **Stomach ingestion** insecticides control insect pests after the larvae eat the insecticide.
- **Systemic insecticides** are applied to or injected into the animal. They are absorbed and then move (by the blood) throughout the animal.

- **Fumigants** work as a gas and control pests that breathe in the gas or thermal fog.
- **Attractants** have a smell or scent that attracts insects to a trap.
- **Repellents** produce an odour to repel insects from treated plants.
- **Growth regulators** act like a pest's own hormones. They cause abnormal development, usually causing early moulting to the adult.

3. Chemical Family

- A chemical family is a group of pesticides with a similar chemical makeup.
- Pesticides in the same chemical family often have similar modes of action, poisoning symptoms, and persistence in the environment.

Knowing a pesticide's chemical family will help you to:

- **Select the proper pesticide.**
- **Determine the personal protective equipment needed.**
- **Understand the handling precautions needed for each pesticide.**

Pesticide active ingredients can be grouped as inorganic or organic.

- **Inorganic Pesticides**
- **Do not contain carbon.**
- **Have a mineral (copper, sulphur,) or a salt (copper sulphate, sodium chlorate) base.**

Chemical Family

Organic Pesticides

- Contain carbon.
- Most are made from petroleum compounds.
- Organic pesticides derived or made from plants are referred to as 'botanicals'.
- The most important families are:
Organophosphates (OP's), Carbamates, and
Organochlorines (OC's)

Insecticide Families

Organophosphates (OP's)

- Most are insecticides.
- These are among the most toxic pesticides used in Canada.
- They act by inhibiting the cholinesterase enzyme. (*See: Chapter 4: Human Health.*)
- They tend to have a short persistence in soil.
- **Examples: malathion and chlorpyrifos**

Insecticide Families

Carbamates

- Include insecticides, fungicides, and herbicides.
- Most have a short persistence in the soil.
- They are moderately toxic.
- All are cholinesterase inhibitors.
- **Example: propoxur**

Insecticide Families

Petroleum Based Products

- Products act by suffocating pests.

Examples: dormant oils and summer oils

Botanical

- These are rapidly degrading contact pesticides.
- Natural pyrethroids are extracts from plants (e.g., pyrethrin).

Insecticide Families

Synthetic Botanical Insecticides

- These are man-made equivalents of natural pyrethrums.

Example: permethrin

Microbial Insecticides

- Have been developed from commonly occurring microorganisms.
- These are slow acting and very species-specific.

Example: Bti. (*Bacillus thuringiensis israelensis*)

Bacillus thuringiensis israelensis

- **Bacteria is used to control the larval stage of biting flies.**
- **Ingested bacteria break down the stomach of the larvae.**
- **Non-toxic to mammals.**

Compatibility with Other Pesticides

- **Compatible products can be mixed and applied at the same time.**
- **Mixing non-compatible products can result in:**
 - **A negative chemical reaction**
 - **Poor pest control**
 - **Damaged equipment**

General Safety Guidelines

Each time a pesticide is used or handled, the applicator should:

- **Select the correct pesticide for the job.**
- **Handle the product safely.**
- **Keep detailed application and storage records.**

Safe Handling

To handle a pesticide safely:

- Read and follow label information and directions.
- Wear clean, appropriate protective equipment.
- Take first-aid and safety training courses.
- Keep work areas clean.
- Do not wear contact lenses.

- **Never eat, drink, smoke, or chew tobacco when working with a pesticide.**
- **Always wash your hands before eating, drinking, or using the washroom.**
- **Do not shake hands or pick up a child until you have washed your hands and removed affected clothing.**
- **Wash your body, hair, and fingernails well.**

Pesticide Selection

Consider the following factors when selecting the best pesticide to control a given pest situation:

- Pest(s) to be controlled (target pest).
- Product registration and applicator safety.
- Necessary application equipment.
- Personal protective equipment.

- **Product compatibility with other pesticides.**
- **Your work schedule.**
- **Pest resistance.**
- **Environmental factors.**

Target Pest

- It is important to identify the target pest(s) and the nuisance or economic risk they pose when choosing a pesticide.
- Biting fly identification and control are discussed in **Module 7: Pest Management**.

Product Registration

- The pesticide must be registered by Health Canada to control either the larval or adult stages of mosquitoes or biting flies.
- Products used for larval control must be registered for use in or over water.

Pesticide registration is discussed in more detail in Module 2: Regulations.

Beneficial Organisms

- It is important to choose a pesticide that will pose the least hazard to beneficial organisms (e.g., fish, birds, or aquatic predators).

Beneficial organisms are discussed in more detail in Module 6: Environmental Safety.

Safety, Risk of Exposure

- The pesticide should present the least risk to the applicator, other people, animals, and the environment.

Safety is discussed in more detail in Module 4: Human Health, Module 5: Safe Pesticide Use, and Module 7: Environmental Safety.

Required Application Equipment

- The pesticide should be compatible with available application equipment.

Common types of application equipment are discussed further in Module 7: Pest Management and Module 9: Application Technology.

Personal Protective Equipment

- You should wear the correct personal protective equipment (PPE) required to apply a chosen pesticide.
- Make sure all PPE is clean and in good working condition.
- The pesticide label will sometimes call for specific PPE.

**PPE is discussed in more detail in Module 5:
Safe Pesticide Use.**

Environmental Factors

- Pesticide applicators should consider temperature, rainfall, wind, water flow rates, and topography at the treatment site when choosing a pesticide.

Environmental factors are discussed further in Module 8: Environmental Safety and Module 9: Application Technology.

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 2
Legislation**

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Pesticide Regulations

Pesticide regulations are designed to protect vendors, applicators, the public, and the environment.

Federal, provincial, or municipal governments may establish pesticide legislation or by-laws.

Learning Objectives

Completing this chapter will help you to:

- Interpret and apply federal pesticide laws.
- Interpret and apply provincial pesticide laws.
- Interpret and apply municipal pesticide by-laws.
- Access current laws and by-laws.

Federal Pesticide Legislation

Pest Control Products Act (PCP Act)

- Is the principal federal pesticide legislation.
- Is administered by the Pest Management Regulatory Agency (PMRA), a division of Health Canada.

- **Establishes regulations that address the registration, labelling, classification, and re-evaluation of pesticides for all of Canada.**
- **Focus is on human health, environmental protection, and pesticide effectiveness.**

- **The PCP Act ensures that pesticides:**
- **Are manufactured, stored, displayed, distributed, and used safely.**
- **Are not packaged, labelled, or advertised in a way that is misleading or likely to create a false impression of the product.**

Only those pesticides that are registered and have a Pest Control Product (PCP) number can be sold in, or brought into, Canada.

Pesticide Registration

To apply for product registration in Canada, a pesticide manufacturer must supply PMRA with:

- **Product chemistry** (how the pesticide behaves).
- **Human health effects** (acute and chronic toxicity, feeding studies).
- **Metabolism** (breakdown products in the environment or in plants and animals).

Pesticide Registration

- **Residues** (in the soil or in a crop after application, half life).
- **Environmental impact** (effect on non-target animals and the environment).
- **Effectiveness** under Canadian conditions.

Pesticide Registration

The information provided by the manufacturer allows the PMRA:

- **To ensure that the product does not pose an undue risk to human health, plants, animals, or the environment.**

- **To decide which precautionary statements and hazard symbols must appear on the label. This will help those who handle the pesticide to assess potential hazards.**
- **To make a final decision regarding registration of the pesticide and the assigning of a Pest Control Product (PCP) registration number.**

Pesticide Classification

Pesticides are classified by their use.

- There are four classes
 - Domestic
 - Commercial (agricultural or industrial)
 - Restricted
 - Manufacturing
- The class appears on the product label.

Domestic Class

- **Designed for use in or around the home or garden.**
- **Minimal personal protective equipment is needed for safe handling and application.**
- **Training is not required to purchase or apply a Domestic pesticide.**

- **Sold in small packages.**
- **Ready to use, or only minimal mixing is required.**
- **Have a low toxicity and pose a low risk to applicators and the environment when handled according to label directions.**

Commercial Class

- Term 'Agricultural' or 'Industrial' often appears on the label.
- Used in agriculture, forestry, industry, and other commercial operations.
- Active ingredient (a.i.) can be the same as that in a Domestic class product.
- Often packaged in large containers, or prepared with higher concentrations of active ingredient.

- **Can pose a greater risk to human health or the natural environment.**
- **May be too toxic, persistent, or hazardous to be used by the general public.**
- **Special training is required before purchasing or handling these products.**
- **Personal protective equipment must be used when handling these products.**

Restricted Class

- Placed in Restricted class due to high toxicity, method of application (e.g., application to water), or the level of risk to the environment.
- Used in agriculture, forestry, industry, and other commercial operations, with added restrictions noted on the label.

Example of a Restricted Class Product

Teknar HP-D

Larvicide

FOR MOSQUITO AND BLACKFLY
CONTROL

GUARANTEE:

Bacillus thuringiensis subspecies
Israelensis serotype H14 strain SA3A
1200 International Toxic Units per mg.

RESTRICTED

CAUTION:

KEEP OUT OF REACH OF CHILDREN

Potential Sensitizer

READ THE LABEL BEFORE USING

REGISTRATION NO. 19241

PEST CONTROL PRODUCTS ACT

Nature of Restriction

NATURE OF RESTRICTION:

This product is to be used only in the manner authorized; contact local pesticide regulatory authorities about use permits which may be required.

RESTRICTED USES FOR USE IN MUNICIPAL OR PROVINCIAL CONTROL PROGRAMS

For mosquito and blackfly larval control. TEKNAR* HP-D Larvicide may be applied to any water sites except treated, finished drinking water. Applications to irrigation water are permissible.

Manufacturing Class

- Used in manufacturing, formulating, or repackaging.
- Pesticide applicators do not have access to these products.

Other Federal Legislation

Food and Drugs Act (Health Canada)

- Regulates the sale, import, and export of food that might contain harmful or poisonous substances.
- Protects the health of consumers by setting a **Maximum Residue Level (MRL)**, or the maximum amount of pesticide residue, at the time of harvest, that may be contained in food.
- Food is tested under this Act to ensure that MRL's are not exceeded.

Other Federal Legislation

- *Pesticide Residues Compensation Act*
- *Migratory Birds Convention Act*
- *Fertilizers Act*
- *Feeds Act*
- *Fisheries Act*
- *Transportation of Dangerous Goods Act*
- *Canadian Environmental Protection Act (CEPA)*
- **National Building Code of Canada (NBC)**

Provincial Pesticide Legislation

PEI Pesticides Control Act and Regulations

- Administrated by the Department of Environment, Energy and Forestry.
- Establishes the license requirements for commercial pesticide applicator and vendor businesses.
- Establishes the certification requirements for private and commercial pesticide applicators, and for vendor sales staff.

- **Establishes pesticide applicator categories (agricultural, forestry, aerial, landscape, structural, biting fly control, etc.).**
- **Regulates pesticide sale, transport, display, storage, application, special-use permits, disposal, and record keeping AFTER products enter the province.**
- **Establishes penalties for violations.**

PEI Pesticides Control Act and Regulations

Topics covered

- **Transportation**
- **Disposal**
- **Buffer zones**
- **Wind speed**
- **Storage**
- **Licenses/Certification**
- **Notification**
- **Scheduled products**

Transportation Regulations

- Pesticide cannot be transported with foodstuffs, feed, household furnishings, bedding, clothing, or similar commodities.

Transportation Regulations

- Pesticide must be transported in the manufacturer's sealed container.
- The container must be:
 - in a separate, enclosed, leak-proof compartment that is securely affixed to the transport vehicle, OR
 - secured to the transport vehicle using appropriate tie-down straps.

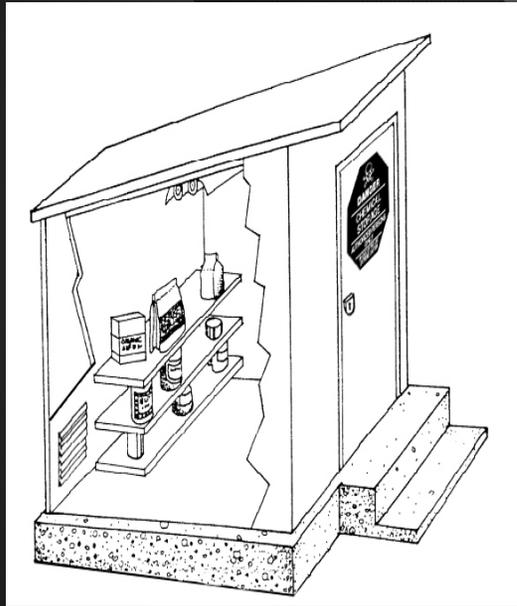
Disposal Regulations

- Pesticide must be disposed of only as prescribed by the manufacturer or the provincial Minister of Environment, Energy and Forestry.
- It is illegal to bury or burn ANY pesticide container.

Application Regulations

- No pesticide container can be brought within 25 metres of an open body of water.
- No pesticide application equipment can be filled, discharged, washed, or flushed within 25 metres of an open body of water or a well.
- No person can apply a dry pesticide formulation, or a liquid formulation under pressure, when the wind speed exceeds 20 km/h.

Storage Facility Regulations



- Pesticide amounts in excess of 100 kilograms or 100 litres of formulated product, must be stored in an approved storage facility.
- This facility must meet the following criteria:

- a) is maintained and used exclusively for the storage of a pesticides;**
- b) is free of an accumulation of waste materials other than pesticide containers;**
- c) has a floor constructed**
 - (i) of concrete or other water-impervious material that**
 - (A) is recessed by at least 10 centimetres from the entrance, or**
 - (B) has a liquid-tight sill that is raised by at least 10 centimetres from the floor, and**
 - (ii) in a manner that will contain and control up to 150% of the volume of any liquid pesticide stored in the facility; or**
- d) has a separate containment unit that is constructed**
 - (i) of concrete or other water-impervious material, and**
 - (ii) in a manner that will contain and control up to 150% of the volume of any liquid pesticide stored in the containment unit;**

- e) provides adequate ventilation, either mechanical or natural;**
- f) has conspicuously placed 'NO SMOKING' signs;**
- g) has a sign that states 'WARNING—PESTICIDE STORAGE AREA' on all doors;**
- h) is not accessible to the public and is locked when the holder of the licence or an employee of the that person is not present on the premises on which the pesticide is stored;**
- i) has properly maintained and approved safety equipment to be used in emergency situations;**
- j) includes secure shelving, raised flooring, or otherwise provide for 'off the floor' product storage;**
- k) has no floor drainage;**

- l) is positioned not less than 8.0 metres from incompatible materials (e.g., fuels, fertilizers);**
- m) has posted, by the nearest phone, the following emergency telephone numbers:**
 - a. 911 (fire, police, ambulance),**
 - b. provincial pesticide enforcement office,**
 - c. provincial or regional poison control centre,**
 - d. provincial environmental emergency office;**
- n) includes an up-to-date product storage inventory; and**
- o) includes, on-site, reference Material Safety Data Sheets (MSDSs) for all stored pesticides.**

Pesticide Applicator Certificate

A person cannot purchase or apply a non-domestic pesticide unless they hold a valid pesticide applicator certificate in the proper category. To obtain a certificate the person must:

- **Successfully complete an approved examination appropriate to the class of certificate, with a mark of not less than 75%.**
- **be 18 years of age.**

Class B Certificate

- Holders are authorized to apply a pesticide to control mosquitoes or biting flies.
- Certificates are valid for 5 years from the date of their issue.

Requirements of Certification

Every Person who holds a Pesticide Applicator Certificate shall keep records of each pesticide use or application, which shall include the following:

- a) the name, address and telephone number, and Pesticide Applicator Certificate Number of the pesticide applicator;
- b) the name, address, and telephone number of the person for whom the pesticide is being applied;
- c) the location and dimensions of the area where the pesticide was applied;
- d) the date and start time of the pesticide application;
- e) the air temperature, wind speed, and wind direction measured at the point of application at the start time of the pesticide application;
- f) the name of any pest to be controlled or the purpose of the pesticide application;
- g) the trade name and *PCP Act* (Canada) number of the pesticide applied;
- h) the rate of pesticide application.

Permit and Licence

Note:

- A Class B Pesticide Application Business License is required to apply, for payment, ANY pesticide designed to control mosquitoes or biting flies.
- A Pesticide Application Permit is required to apply ANY pesticide into, upon, or over a body of water for the control of mosquitoes and biting flies.

Schedule 1 Products (Require a Permit)

SCHEDULE 1 PESTICIDES FOR WHICH A PERMIT IS REQUIRED

1. Dinoseb 300 EC *PCP Act No. 15086*
2. Vecto Bac 200 G *PCP Act No. 18158*
3. Vecto Bac 600L *PCP Act No. 19455*
4. Vecto Bac 1200L *PCP Act No. 21062*
5. Guthion Spray Concentrate *PCP Act No. 8106*
6. Guthion Spray Concentrate Insecticide *PCP Act No. 9398*
7. Guthion 50% WP Crop Insecticide *PCP Act No. 10101*
8. Azinphos Methyl 50W Wettable Powder 50% *PCP Act No. 15645*
9. APM 50W Wettable Powder Insecticide *PCP Act No. 16412*
10. Azinphos Methyl 240 EC *PCP Act No. 17533*
11. Guthion Solupak *PCP Act No. 21374*
12. Clean Crop Azinphos-M 50W *PCP Act No. 22087*
13. Azinphos Methyl 35W *PCP Act No. 22265*
14. Clean Crop Azinphos-M 240 EC *PCP Act No. 22562*
15. APM 50W Instapak *PCP Act No. 22864*
16. Sniper 50W *PCP Act No. 23287*
17. Sniper 50W Clean Pak *PCP Act No. 23323*
18. Sniper 240 E *PCP Act No. 23337*
19. Vapam Liquid Solution Soil Fumigant *PCP Act No. 6453*
20. Terr-o-gas 67 Preplant Soil Fumigant *PCP Act No. 13477*
21. BASF Basamid Granular (Soil Fumigant) *PCP Act No. 15032*
22. Busan 1020 *PCP Act No. 19421*
23. TCC Methyl Bromide Fumigant *PCP Act No. 19498*
24. BASF Metam Fluid 380 G/L *PCP Act No. 19556*
25. Chloropicrin 100 Liquid Soil Fumigant *PCP Act No. 25863*
(EC761/05)

PEI *Pesticides Control Act* and Regulations

- **Applicators must understand these regulations before purchasing and applying a pesticide.**
- **A copy of the *Pesticides Control Act* and regulations can be obtained by contacting:**

PEI Pesticide Regulatory Program

(902) 620-3110

www.gov.pe.ca/go/pesticides

Municipal Pesticide Legislation

Municipal authorities

- May have legislative power to establish by-laws concerning pesticides.
- May establish by-laws and building codes that restrict the location, construction, or operation of pesticide storage facilities.

Contact local municipal councils for more information.

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Training Module 3, Part 1 Labelling

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Learning Objectives

Completing this training module will help you to:

- **Understand the legal status of pesticide labels.**
- **Interpret and apply label information.**
- **Interpret and apply information on pesticide toxicity.**

Product Label

- **A pesticide label is a legal document.**
- **Every pesticide sold in Canada must have an approved label.**
- **The label provides detailed information about the product and its use.**
- **The label is the best information source on a pesticide product.**

Product Label

- Always **READ THE LABEL** before purchasing, transporting, storing, applying, or disposing of a pesticide.
- The label is often fastened to the pesticide container.
- It can also take the form of a small booklet or pamphlet packaged with, or on, the container.

Product Label

- **Contact the vendor for replacement labels.**
- **NEVER use information provided by another source in place of the information on the label.**
- **The label has a Primary Display Panel and a Secondary Display Panel.**

Primary Display Panel

GENERIC EXAMPLE

Altosid® GRANULES

RESTRICTED

GUARANTEE: (S)-Methoprene 1.5%

REGISTRATION NO. 22676
PEST CONTROL PRODUCTS ACT

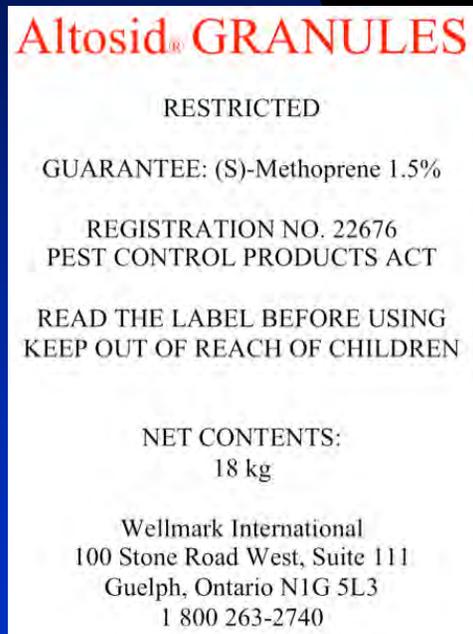
READ THE LABEL BEFORE USING
KEEP OUT OF REACH OF CHILDREN

NET CONTENTS:
18 kg

Wellmark International
100 Stone Road West, Suite 111
Guelph, Ontario N1G 5L3
1 800 263-2740

1. Product or Trade Name

Altosid GRANULES



- Usually the largest lettering.
- Is the registered name under which the manufacturer (registrant) has chosen to sell the product.
- May indicate the **formulation** in full or as an abbreviation. In this case, the product is a Granular

Formulation

- A **formulation** is the form in which a pesticide is sold. This can be as a solid, liquid, or gas.
- It includes everything that is in the container (active ingredient, carriers, dilutants, or other materials).
- The same active ingredient can be present in more than one formulation.

Formulations and their Abbreviations

A formulation can be a gas, liquid, or solid. Each formulation has a unique name and abbreviation.

Gases

- **Fumigant (FU)**

Formulations and their Abbreviations

Liquids

- **Emulsifiable Concentrate (EC)**
- **Flowable (F)**
- **Solution (S or SN)**

Formulations and their Abbreviations

Solids

Dust (DU)

Pellet (P)
(ST)

Soluble Powder (SP)
(GP)

Wettable Powder (WP)

Granular (G)

Seed Treatment

Granule Powder

2. Class Designation

Altosid[®] GRANULES

RESTRICTED

GUARANTEED: (S)-Methoprene 1.5%

REGISTRATION NO. 22676
PEST CONTROL PRODUCTS ACT

READ THE LABEL BEFORE USING
KEEP OUT OF REACH OF CHILDREN

NET CONTENTS:
18 kg.

Wellmark International
100 Stone Road West, Suite 111
Guelph, Ontario N1G 5L3
1 800 263-2740

Restricted

- Designates this as a Restricted class pesticide (under the *PCP Act*).
- Only those trained in safe pesticide handling and application can purchase or apply.
- USE OF THIS PRODUCT IS LIMITED TO: PUBLIC HEALTH OFFICIALS, MOSQUITO ABATEMENT OFFICIALS AND OTHER TRAINED PERSONNEL.

3. Net Contents

18 kg



- Indicates the total volume (litres) or weight (kilograms) of product in the container.
- In this example the container holds 18 kg of product.

4. Precautionary Symbols and Words

Altosid® GRANULES

RESTRICTED

GUARANTEE: (S)-Methoprene 1.5%

REGISTRATION NO. 22676
PEST CONTROL PRODUCTS ACT

READ THE LABEL BEFORE USING
KEEP OUT OF REACH OF CHILDREN

DANGER



POISON

NET CONTENTS:-
18 kg

Wellmark International
100 Stone Road West, Suite 111
Guelph, Ontario N1G 5L3
1 800 263-2740

- Indicates the type and level of hazards associated with this pesticide.

Precautionary Pictograms

Pictograms are used to indicate the type of acute hazard associated with a product.



A **skull and crossbones** on a label indicates that a product is a poison.



A **flame** indicates that a product is flammable.

Precautionary Pictograms

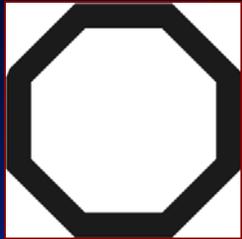


A **bony hand** indicates that a product is corrosive.



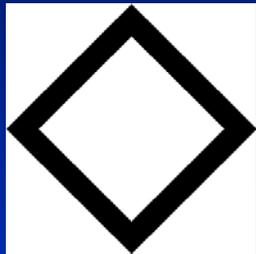
An **exploding grenade** indicates that a product is explosive.

Precautionary Shapes and Words



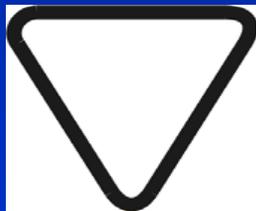
An **octagon** on the label indicates an extreme hazard.

danger



A **diamond** indicates a moderate hazard.

warning



An **upside-down triangle** indicates a slight hazard.

caution

Toxicity

- Toxicity is a measure of how harmful or poisonous a substance is (i.e., its ability to cause injury, sickness, or other unwanted effects).
- Toxic effects can vary with sex, health, age, and weight of the individual; the route of entry; or the duration of exposure.
- Toxicity can be classified as **chronic** or **acute**.

Chronic Toxicity

- **Chronic toxicity** results from a number of exposures to small pesticide doses.
- Adverse effects (symptoms) occur and persist over time.
- Effects are often irreversible.

Acute Toxicity

- **Acute toxicity** results from one or more exposures to a pesticide.
- Adverse effects (symptoms) occur within a few hours to a few days.
- Effects are often reversible.

Acute Toxicity

- **Acute toxicity** is measured primarily by determining the **LC50** or **LD50** of the pesticide.
- **LC50** is the lethal concentration (in parts per million) of vapour that will kill **50%** of the test animals when inhaled over a given time period.

- **LD₅₀** is the lethal dose of substance (measured in mg per kg of body weight) that will kill 50% of the test animals when ingested (swallowed) or applied to the skin.
- **The lower the number of the LC₅₀ or LD₅₀ the more toxic the pesticide.**

The Lower the Number of the LC₅₀ or LD₅₀ the More Toxic the Pesticide.

<u>Pesticide</u>	<u>Oral LD₅₀ (mg/kg)</u>	<u>Toxicity</u>
Metam (Vapam)	97	high
MCPA medium	700 – 1,000	
Metribuzin (Sencor, Lexone)	1,937 – 2,345	low
Glyphosate (Roundup)	4,320	low

The level of **acute toxicity** is indicated on the pesticide label using precautionary symbols, words, and statements.

How Precautionary Shapes and Words Are Determined for a Label

POISON HAZARD SYMBOL — the shape indicates one (or more) characteristics below	 DANGER POISON	 WARNING POISON	 CAUTION POISON
acute oral LD ₅₀	less than 500 mg/kg	500—1,000 mg/kg	1,000—25,000 mg/kg
acute dermal LD ₅₀	less than 1,000 mg/kg	1,000—2,000 mg/kg	2,000—5,000 mg/kg
respirator	required	advisable in confined spaces	advisable in confined spaces
eye protection	required	required	advisable — may be eye irritant

Combining Shapes and Pictograms on a Label

Example

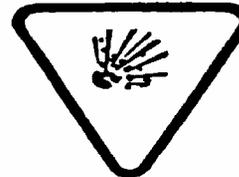
DANGER



POISON



FLAMMABLE



EXPLOSIVE

Warning
poison

Danger
flammable

Caution
explosive

5. “Read the Label” Statement



6. “Guarantee” Statement



The guarantee statement provides:

- **The common name and the concentration of all the active ingredients (a.i.) in the pesticide.**

6. “Guarantee” Statement

- Concentration can be shown as weight per unit volume (g/l) or percentage by weight (**1.5 % by weight**).
- The label example indicates that **1.5 %** (or **1.5 X 18 = 2.7 kg**) of the formulation is the active ingredient **Methoprene**.
- This also means that **18kg – 2.7kg = 15.3 kg** of other another substances is in each container.

Example “Guarantee” Statement

MOSE 30EC

GUARANTEE:menetos..... 30 g/L

- **Label example indicates that there is 30 grams of active ingredient (menetos) in each litre of MOSE 30EC.**

Example “Guarantee” Statement

BIO 300g

GUARANTEE:

Bacillus ferrengis, Serotype
B-112

300 International Toxic Units
(0.3 billion ITU/L)

Adjuvants

Adjuvants are substances added by the manufacturer or applicator to improve one or more of the pesticide's qualities, or to promote better application of the active ingredient.

Adjuvants may include the following:

Surfactants Improve the spreading, dispersing, and/or wetting properties of a pesticide mixture.

More Examples of Adjuvants

Stickers

Allow pesticides to stay on the treated surface.

Drift Retardants and Thickeners

Increase droplet size and reduce drift.

Anti-foaming Agents

Reduce foaming of spray mixtures.

Selecting an Adjuvant

- **Applicators wishing to add adjuvants must follow pesticide label directions.**
- **The label on the adjuvant will list the pesticides and formulations with which it can be safely combined.**
- **Use of an unregistered adjuvant is illegal under the *Pest Control Products (PCP) Act*. It could also change the product's effectiveness or cause injury to the non-target life.**

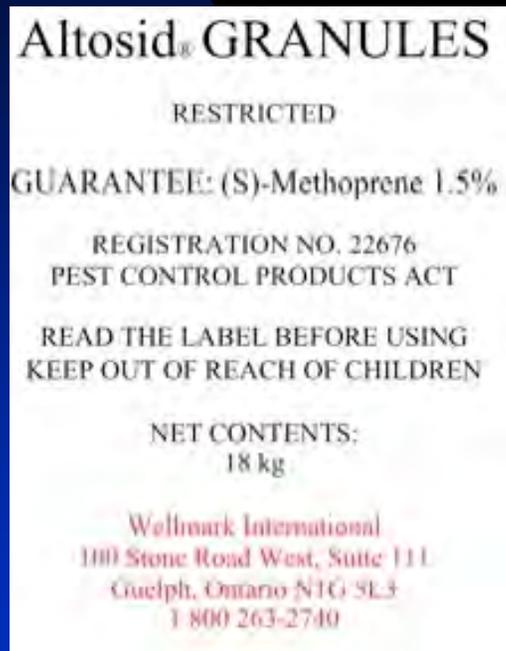
7. *Pest Control Products Act* Registration Number (PCP Number)



- Shows that the product has been registered with Health Canada.
- The *Pest Control Products Act* **Number** is unique to the pesticide formulation.
- Any change in the formulation by the manufacturer will require a new number.

- **Higher PCP numbers indicate more recent product registrations.**
- **Do not purchase a product unless the registration or PCP Number is on the label.**
- **Poison control data bases are tied to this number.**
- **Give this number to the doctor when seeking medical help.**

8. Pesticide Registrant (manufacturer)



- Provides information on the company that registered the product.
- Provides information for contacting the registrant in case of an emergency, or when seeking more detail on the product.

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 3, Part 2 Labelling

Disclaimer

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Learning Objectives

Completing this training module will help you to:

- **Interpret and apply label information found on the Secondary Display Panel.**
- **Find, interpret, and apply Material Safety Data Sheet (MSDS) information.**

Product Label Review

- **A pesticide label is a legal document.**
- **Every pesticide sold in Canada must have an approved label.**
- **The label provides detailed information about the pesticide and its use.**
- **The label is the best information source on a pesticide.**

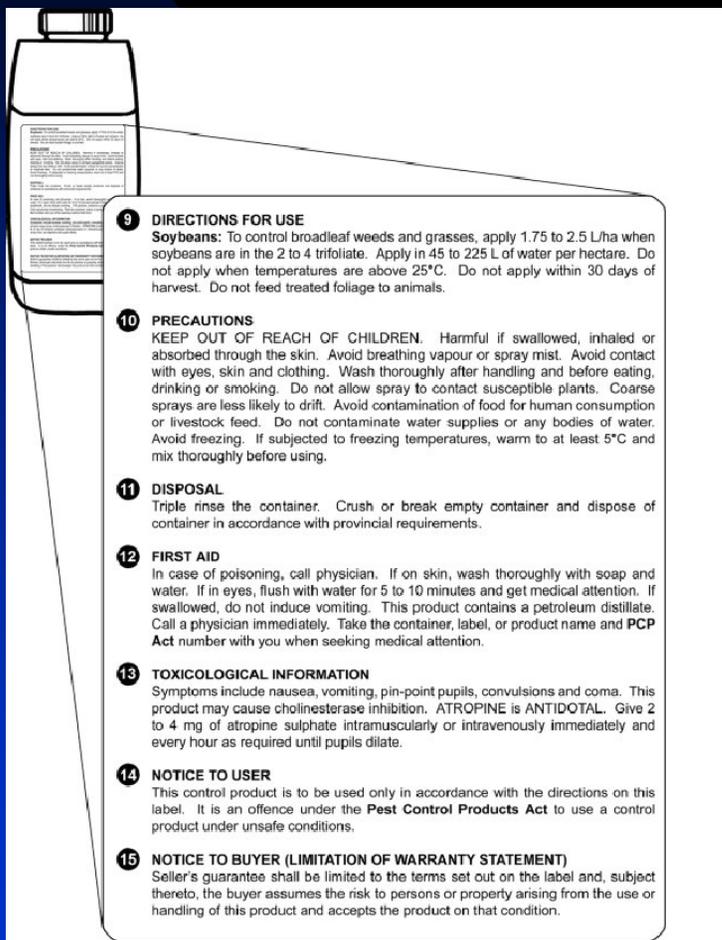
Product Label Review

- Always **READ THE LABEL** before purchasing, transporting, storing, applying, or disposing of a pesticide.
- The label is often fastened to the pesticide container.
- It can also take the form of a small booklet or pamphlet packaged with, or on, the container.

Product Label Review

- **Contact the vendor at once to replace a missing or damaged label.**
- **NEVER use information provided by another source in place of the information on the label.**
- **The label has a Primary Display Panel and a Secondary Display Panel.**

Secondary Display Panel



- 9. Directions for use.
- 10. Precautions.
- 11. Disposal instructions.
- 12. First aid instructions.
- 13. Toxicological information.
- 14. Notice to user.
- 15. Notice to buyer.

9. Directions for Use

Information provided includes:

- Pests that can be controlled (e.g., weeds, insects, or diseases).
- Location where the product can be used.
- Amount of product needed and how it should be mixed.
- Application procedure and rate(s).

- **Type of application equipment needed.**
- **How to ensure a safe application.**
- **When the product should not be used.**
- **Timing and number of applications per season.**

Example Statement: MOSE 30 EC

Directions for Use as Mosquito Larval Control

“Apply as a uniform spray in sufficient water for good coverage at a rate of 35 to 100 ml per hectare. Apply to standing water in pools, shallow ponds, swamps, catch basins, and similar areas where mosquitoes breed”.

10. Precautions

Information provided includes:

- Hazards that can result from product use.
- How to use the pesticide safely.
- How to protect the user and others when mixing, applying, storing, and disposing of a pesticide.

- **Human health or environmental concerns.**
- **Storage, application, handling, and buffer zone requirements.**
- **Re-entry intervals.**

Example: MOSE 30 EC

Precaution statement:

“Do not expose product to excess heat or direct sunlight. Harmful if swallowed or absorbed through the skin. Causes skin and eye irritation.”

11. Disposal

Provides directions on how to safely dispose of the pesticide and product containers.

More detail on “cleaning and discarding of containers” is provided in Module 9: Safe Use.

Example Statement:

“Drain the contents completely into the spray tank. Triple rinse the container. Crush or break empty container and dispose of container in accordance with provincial requirements.”

12. First Aid Instructions

Provides a primary source of First Aid information.

- **ALWAYS read this section of the label before handling a pesticide. Also, ensure that family and fellow workers are familiar with this information.**
- **Provides direction should someone be poisoned or injured by the pesticide, or should the pesticide be spilled on the skin, splashed in the eyes, or swallowed.**

Example Statement:

1% BEGONE

“This product contains Petroleum Distillate. If swallowed, **DO NOT INDUCE VOMITING**. Obtain medical attention or contact a Poison Control Centre

IMMEDIATELY. Take container, label, or product name and Pest Control Product Registration Number with you when seeking medical attention.”

“In case of contact, flush skin or eyes with plenty of water.”

13. Toxicological Information

Provides information that may be needed by medical personnel in case of pesticide poisonings or injuries.

- **May list common signs and symptoms of acute pesticide poisoning for exposure to this pesticide.**
- **May provide information on an antidote.**

- **May describe other substances that can affect medical treatment.**
- **In the event of an accident give the PCP Act registration number and toxicological information to medical authorities.**

Pesticide Poisoning

- **ALWAYS** read the **Toxicological Information** section of the label before using a pesticide. This lists the acute poisoning symptoms.
- Knowing these symptoms can help you to quickly identify a poisoning event.
- If someone is exposed to a pesticide, and any poisoning symptoms begin to show, seek medical help at once.

Common Symptoms of Pesticide Poisoning

Mild Symptoms:

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

Common Symptoms of Pesticide Poisoning

Moderate Symptoms:

Nausea, stomach cramps, trembling, vomiting, loss of muscular co-ordination, diarrhea, excess saliva, mental confusion, blurred vision, sweating, tightened throat or chest, rapid pulse, laboured breathing, cough, and flushed or yellow skin.

Common Symptoms of Pesticide Poisoning

Severe Symptoms:

Vomiting, pinpoint pupils, loss of reflexes, convulsions, increased breathing rate, unconsciousness, inability to breathe, muscle twitching, and fever.

Generic Example Statement:

- **“Symptoms include nausea and vomiting, pin-point pupils, convulsions and coma. This product may cause cholinesterase inhibition. ATROPHINE is ANTIDOTAL.”**

14. Notice to User

Example Statement:

- “This control product is to be used only in accordance with the directions on this label.”
- **It is an offence under Canada’s Pest Control Products Act and the P.E. I. Pesticides Control Act to use a pesticide in an unsafe way.**

15. Notice to Buyer

Example Statement:

- **“Seller’s guarantee shall be limited to the terms set out on the label and, subject thereto, the buyer assumes the risk to persons or property arising from the use or handling of this product and accepts the product on that condition.”**

Additional Information That Can Appear on the Pesticide Label

- **Environmental hazards**
- **Buffer zone statements**
- **Spill cleanup instructions**
- **Emergency contact statements**
- **Steps to reduce drift**

Additional Information That Can Appear on the Pesticide Label

- **Total number of applications per season**
- **Storage information**
- **Resistance management statements**
- **Compatibility**
- **Personal Protective Equipment (PPP) required or recommended**

Spill Cleanup Instructions

Example Statement:

“Wear appropriate protective equipment (gloves, glasses, apron) when attempting to clean up the spill. If the container is leaking, secure leak and place the container into a drum or heavy gauge plastic bag. Contact company (see emergency telephone number) for further information.”

Emergency Contact

Example Statements:

“In case of a major spill or fire, call 1-800-XXX-XXXX.”

“In case of a pesticide poisoning, call the Poison Control Centre at 1-800-XXX-XXXX.”

Environmental Hazards

- Potential environmental hazards appear under the **Precautions** section of the secondary display panel.
- The statements will be specific to each pesticide.

Environmental Hazards

- Products developed for application to open water may be in a **Restricted Class**. If this is the case, their use must be authorized by a provincial regulatory authority and a permit may be required.

Example Statements:

- **“This product is extremely toxic to fish and aquatic invertebrates.”**
- **“This product is very toxic to bees; avoid spraying when bees are foraging. Spray deposit should be dry before bees commence foraging in treated crop.”**

Buffer Zone Statements

- Tells how to protect sensitive areas (water, habitation) located near a pesticide application.
- Buffer zone width is determined by Health Canada during product registration.
- Not all labels have **buffer zone statements**.

Storage Information

- Pesticides can release toxic vapours, and some are highly flammable or can react with other chemicals. For example, stored herbicides can emit vapours that will contaminate other pesticides.

Example Statement:

- “Store this product at least 10 metres (10 m) from other pesticide products.”

Instructions to Minimize Drift

- Explains the steps needed to protect nearby areas.
- Some pesticide labels set legal wind speeds.
- Provincial laws can prohibit pesticide application above or below certain wind speeds.

- Even if no information appears on the label, **remember—maximum wind speeds are a provincially regulated requirement.** (See: Provincial Legislation.)
- Always comply with the most restrictive wind speed requirement.

Example Statements:

“Do not spray in winds exceeding 10 km/hour.”

“Spray drift of this herbicide can be reduced by using high volume sprays under low pressure and coarse sprays.”

“Do not apply this product in the vicinity of sensitive crops when the temperature on the day of application is expected to exceed 30° C.”

Resistance Management Statements

Resistance management statements provide direction on how to avoid pest resistance to a given pesticide.

Example Statements:

“For resistance management purposes, it is recommended that this product be applied not more than twice in sequence or more than six times per crop (annually) or per year for control of perennials.”

“Use a sound resistance management program that includes the use of other products with different modes of action.”

Compatibility Information

- Provides information on whether a product is registered and safe **for tank mixing** with other pesticides.
- Mixing pesticides that are not compatible can reduce their effectiveness, injure the treated crop, plug sprayer nozzles, or damage application equipment.

Tank Mixing

- **Tank mixing is the combining of different pesticides in the same spray tank to be applied to the same area at the same time. This can save time and cost.**
- **All registered tank mixes will be listed on the label of one, or both, products.**

Compatibility Information

Example Statements:

“This product is compatible with most Roundup formulations. However, do not mix with lime or other alkaline materials.”

“Do not use tank mixes containing this product on bent grass.”

Material Safety Data Sheets (MSDS)

Material Safety Data Sheets

- Are **not legal documents**, nor are they a substitute for the label.
- Can provide additional information on health hazards, safety precautions, and guidelines to protect the environment.

Material Safety Data Sheets (MSDS)

- **Applicators should have a copy of, and review, the MSDS for any pesticide they use.**
- **Your pesticide vendor or pesticide manufacturer can supply copies of MSDS.**

Components of MSDS

- **Product identification**
- **Hazardous ingredients**
- **Physical data**
- **Occupational procedures and preventive measures**
- **First aid and emergency procedures**
- **Fire and explosion hazard**
- **Toxicity and health effects**
- **Reactivity data**
- **Preparation data and group**

Example of a MSDS

Page 1

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS
Chemical Product and Company Identification		
Product Identifier:	CONTROL-ALL 500 EC	
Registration Number:	54321	
Chemical Class:	aromatic hydrocarbon solvent 40%	
Product Use:	herbicide to control broadleaf weeds and grasses	
Preparation Date:	2004/05/21	
Supercedes:	2002/08/11	
Manufacturer/Distributor:	see above	
Composition/Information on Ingredients		
Active Ingredient:	monolochlor, 500 g/L emulsifiable concentrate	
CAS No:	10101-22-3	
Chemical Identity:	3-(1-methylethyl)-2H-2,1-monolochlor	
Hazards Identification		
Warning Statements:		
PRECAUTION! Keep out of reach of children. MAY CAUSE EYE AND SKIN IRRITATION. HARMFUL IF SWALLOWED. This product is slightly toxic to fish and aquatic invertebrates.		
Potential Health Effects:		
Likely routes of exposure: eyes, skin, lungs, mouth		
Eye contact: may cause eye irritation		
Skin contact: may cause skin irritation. Prolonged contact may cause increased skin irritation.		
Inhalation: may cause irritation to the nose, throat and lungs.		
Ingestion: ingestion may produce irritation of the mouth, nausea, vomiting and diarrhea. Refer to section 11 for toxicological information.		
First Aid Measures		
Skin Contact:	Immediately remove contaminated clothing and wash affected skin with soap and water.	
Eye Contact:	Flush eyes with plenty of water for 15 minutes and seek medical advice immediately.	
Inhalation:	Remove victim to fresh air and if breathing has stopped, give artificial respiration. Seek medical attention. If swallowed, do not induce vomiting but rush victim to nearest hospital taking the container or this sheet with you.	
Ingestion:	Use gastric lavages and saline cathartics.	
Storage Precautions:	Do not handle or store near flame, heat or strong oxidants. Do not store near food or animal feed. Avoid freezing temperatures.	

Example of a MSDS

Page 2

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS
Fire Fighting Measures		
Flash Point and method:	70 °C Setaflash closed cup	
Ignition Point:	N/D	
Extinguishing Media:	Dry chemical, foam or carbon dioxide. Water or foam may cause frothing when applied to flammable liquids with flash points above 100 °C. Fire-fighters should wear full protective clothing and self-contained breathing apparatus.	
Accidental Release Measures		
Procedures for dealing with release or spills: Before handling any spills, wear protective equipment - see section 8. For small spills, absorb with sand or other non-combustible material like clay or kitty litter. For large spills, dike up and contain the spill. Collect into a suitable container. Absorb the rest with sand, earth or clay. Decontaminate the area and equipment with laundry bleach or hydrated lime.		
Handling and Storage		
Handling Practices: Keep Out of Reach of Children. Avoid contact with eyes, skin or clothing, and wash immediately after exposure. Avoid contact with eyes, skin or clothing, and wash immediately after exposure. Avoid inhalation of spray. Always wash thoroughly after handling. Remove contaminated clothing promptly, and wash it before wearing again. Appropriate storage practices: Store in a well-ventilated, secure area set aside for pesticides. Do not store food, beverages, or tobacco in the same area. Protect from heat.		
Exposure Control/Personal Protection		
Personal Protective Measures:	Wear respirator; neoprene gloves; goggles or face shield	
Preventative Measures:	Do not smoke, eat or drink while working with this product and wash thoroughly before doing so.	
Technical Protective Measures:	Avoid breathing vapours, ventilate enclosed spaces and wear cartridge type respirator.	
Special Precautions for Transport:	Keep containers tightly closed when not in use.	
Physical and Chemical Properties		
Appearance:	clear, viscous, yellow	
pH:	8 - 8.5	
Odour:	aromatic odour	
Form:	liquid	
Water Solubility:	miscible EC formulation	
Boiling Point:	86 °C	
Specific Gravity:	1.002	

Example of a MSDS

Page 3

MATERIAL SAFETY DATA SHEET		Company XYZ Emergency number - 24 hours: 519-674-SSSS
Stability and Reactivity		
Chemical Stability:	stable	
Hazardous Polymerization:	will not occur	
Incompatibility:	Avoid contact with strong acids, alkalis, and strong oxidants; nitric acid, acetaldehyde, hydrogen peroxide, chlorinated compounds.	
Hazardous Decomposition Products:	Thermal decomposition may produce toxic smoke, CO and CO ₂ .	
Toxicological Information		
Acute Oral LD ₅₀ :	756 mg formulated product/kg body weight (rats)	
Acute Dermal LD ₅₀ :	1480 mg formulated product/kg body weight (rats)	
Inhalation LC ₅₀ :	>3.63 mg/L air (4 hour) (rats)	
Dermal Irritation:	mild irritant (rabbits)	
Dermal Sensitization:	Dermal sensitization, Guinea pig - not a sensitizer	
Carcinogenicity:	Monochlor was found not to be carcinogenic in studies with rats and mice.	
Reproductive toxicity:	Monochlor is not developmentally toxic, and does not affect reproductive performance.	
Teratogenicity:	Monochlor was not teratogenic in a study with rats.	
Ecological Information		
Aquatic Invertebrates:	48-hr EC ₅₀ Daphnia magna: 24-37 mg/L; slightly toxic	
Warmwater Fish:	96-hr LC ₅₀ Bluegill sunfish: 5.8-14 mg/L; slightly to moderately toxic	
Terrestrial Invertebrates:	48-hr LD ₅₀ Honeybee: >0.1 mg/bee; Practically Nontoxic	
The results of degradation and bioconcentration studies with this material indicate that the active ingredient is rapidly adsorbed to soil, readily biodegrades in soil and water, and does not bioaccumulate.		
Disposal Considerations		
Waste Disposal: Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, Provincial, and local regulations. Do not flush to surface water or sanitary sewer system. Triple rinse the container. Offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill in accordance with the provincial and local regulations. Do not re-use empty containers.		
Transport Information		
TDG Classification – Road/Rail: not regulated		

PEI Biting Fly Pesticide Applicator Training Course

Training Module 4, Part 1 Human Health

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Human Health

Topics to be Covered

- Pesticide Poisoning.
- High Risk Pesticide Families.
- Cholinesterase Blood Testing.
- Pesticide Risk.

Learning Objectives

Completing this training module will help you to:

- Identify the causes of pesticide poisoning.
- Recognize the symptoms of pesticide poisoning.
- Understand how toxicity differs among pesticide families.
- Minimize the risk of pesticide poisoning.

Learning Objectives

Completing this training module will help you to:

- Recognize the role of a cholinesterase blood test.
- Identify general health effects of pesticides used in the biting fly industry.
- Calculate and assess risk.
- Select pesticides based on their oral and dermal LD_{50} .

Managing Pesticide Poisoning

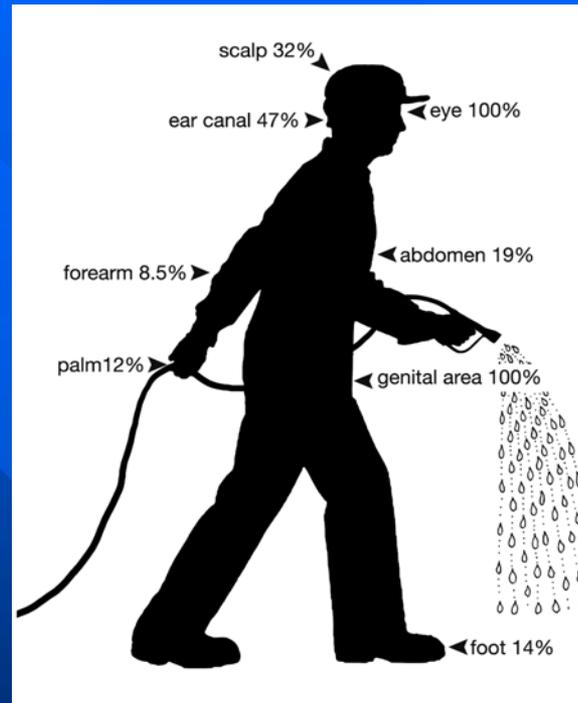
Before Working With Pesticides:

- Have a full medical examination.
- Understand that respiratory or heart disease may stop you from using a respirator.
- Advise your employer of any medical conditions you may have.

Managing Pesticide Poisoning

- Avoid exposure when handling and using a pesticide.
- Review poisoning symptoms on the pesticide label before using any pest control product.
- Seek medical help at once if someone is exposed to a pesticide, and any of the **acute pesticide poisoning symptoms** noted on the label begin to show.

Managing Pesticide Poisoning



- Pesticide absorption rates vary depending upon the body part exposed.

Common Causes of Pesticide Poisoning

DERMAL EXPOSURE

- Not washing hands after handling pesticides, containers, or equipment.
- Splashing /spilling pesticide on skin.
- Not wearing gloves when removing pesticide-contaminated personal protective equipment.
- Applying pesticides in windy weather.
- Not wearing gloves when touching treated plants or when handling spray equipment.

Common Causes of Pesticide Poisoning

ORAL EXPOSURE

- Not washing hands before eating, smoking, or chewing.
- Splashing pesticide into mouth.
- Storing pesticide in anything but the original container.

Common Causes of Pesticide Poisoning

INHALATION EXPOSURE

- Handling pesticides in confined or poorly ventilated areas without wearing a respirator.
- Handling dusts or powders without wearing a respirator.
- Using an inadequate or poorly fitting respirator.

Common Causes of Pesticide Poisoning

INHALATION EXPOSURE

- Being exposed to drift without wearing a respirator.
- Not washing hands before smoking.

Common Causes of Pesticide Poisoning

EYE EXPOSURE

- Rubbing eyes or forehead with contaminated gloves or hands.
- Splashing liquid or dry formulations without wearing goggles.
- Applying pesticides in windy weather without wearing goggles.

Sensitivity

- **Exposure to active ingredients or components of the formulation can appear as a sensitivity.**
- **Repeated exposure can make individuals even more sensitive (Chronic Toxicity).**
- **Sensitivity can appear as a rash, headache, watering eyes, itchy skin, or breathing problems.**

Sensitivity

- Some people are especially sensitive to pesticides.
- Read the toxicological section of the label before using a pesticide so you can recognize acute symptoms of pesticide poisoning.

Pesticide Poisoning

Review:

- **Acute pesticide poisoning** can occur after one exposure to a product. Symptoms can appear within a few minutes to 96 hours.
- **Chronic poisoning** occurs after a number of exposures to a pesticide over a long time. Symptoms appear over time and persist.

Pesticide Families

- Products within the same family can produce similar poisoning effects. Some families are more toxic than others.
- Knowing the chemical family of a pesticide will help you to handle and use it properly.
- **Organophosphate and carbamate** pesticides are the most acutely toxic landscape pesticides.
- Excess exposure can inhibit the function of the **enzyme cholinesterase**.

Cholinesterase Inhibiting Larvicides

<i>COMMON NAME</i>	<i>FORMULATION*</i>	<i>ORAL LD₅₀</i>	<i>DERMAL LD₅₀</i>	<i>CHEMICAL GROUP**</i>
Chlorpyrifos	G/EC	135-163	202	OP
Malathion	G/EC	1,375	>4,400	OP

*G = granular; EC = Emulsifiable concentrate;

Cholinesterase Inhibiting Adulticides

<i>COMMON NAME</i>	<i>USE</i>	<i>ORAL LD₅₀</i>	<i>DERMAL LD₅₀</i>	<i>CHEMICAL GROUP**</i>
Chlorpyrifos	R/TF	135-163	202	OP
Malathion	TF/ULV	1,375	>4,400	OP
Dichlorvos	TF/ULV	80	107	OP
Naled	R/TF/ULV	430	800	OP
Propoxur	R/TF/ULV	90-128	1,000	C

R = residual spray; TF = thermal fog; ULV = ultra low volume

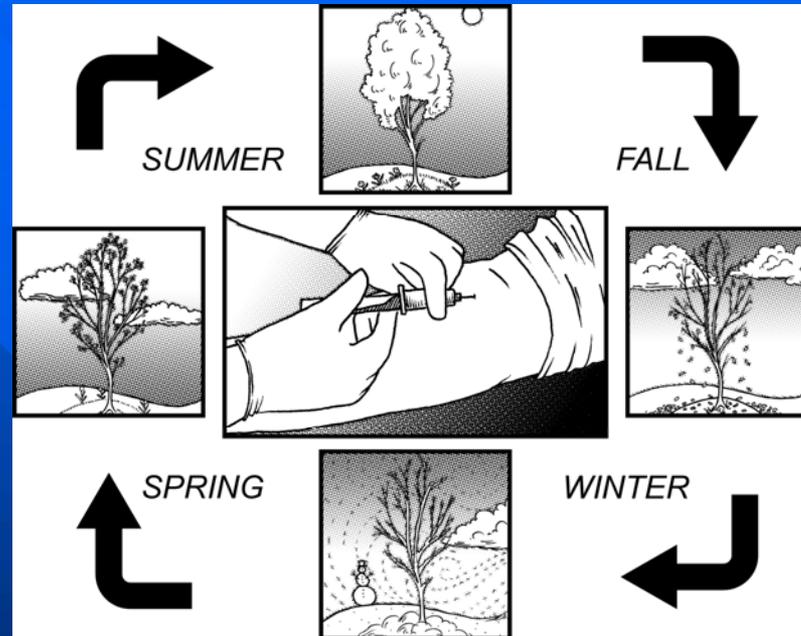
Cholinesterase Inhibition

- Interfering with the levels of the body enzyme cholinesterase will affect messages being sent by the brain to various parts of the body.
- This can cause trembling, twitching, convulsions, or trouble with breathing and the heart. It can even cause death in severe cases.
- Always check the toxicological section of the secondary label panel for statement: “ **This product may cause cholinesterase inhibition**”.

Cholinesterase Blood Test

- A test is available to determine the level of cholinesterase in the blood. Contact your family doctor to arrange a baseline test.
- The **baseline level** of cholinesterase varies between individuals, so your first blood test should be taken **before** handling, using, or being exposed to these pesticides.
- This will determine your **personal baseline level** of cholinesterase.

Cholinesterase Blood Test



Tests should be done at various times of the year to set your baseline value and determine if levels are acceptable.

Cholinesterase Blood Test

- Medical professional will advise if further action is required.
- Early detection of unacceptable exposure avoids chronic poisoning.
- Without further exposure, blood cholinesterase levels will return to normal after about 120 days for organophosphate poisoning (**recovery is more rapid for carbamate poisoning**).

High Risk Biting Fly Pesticides

Organophosphates (OP)

- Repeated exposure can cause acute and chronic poisoning.
- There is often little long-term effect unless exposure continues.
- OP's are quickly adsorbed through the skin, lungs, or digestive tract.

High Risk Pesticide Families

- Affect the nervous system by reducing blood levels of cholinesterase.
- This can be a concern for workers in the biting fly industry.
- Workers should have their blood tested for cholinesterase before the start of each season.

**Examples: Dichlorvos, Malathion,
Chlorpyrifos,
Naled**

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Mild Poisoning Symptoms:

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

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Moderate Poisoning Symptoms:

(Contact a doctor if any of these symptoms are noticed.)

Nausea; stomach cramps; vomiting; loss of muscular co-ordination (trembling); diarrhea; salivation; mental confusion; blurred vision; sweating; tightness of throat or chest; slow pulse; laboured breathing; and flushed or yellow skin.

Common Symptoms of Acute Pesticide Poisoning with Organophosphates

Severe Poisoning Symptoms:

(Contact a doctor if any of these symptoms are noticed.)

Vomiting; pinpoint pupils; loss of reflexes; convulsions; breathing troubles; coma; unconsciousness; bluing of skin; muscle twitching; heart trouble; and loss of bowel control.

Pesticide Families

Carbamates (C)

- Can cause acute poisoning.
- Can affect the nervous system by **reducing the level of blood cholinesterase.**
- Cholinesterase levels recover quickly after carbamate exposure, and the effect is usually short-lived.
- Symptoms are similar to acute OP poisoning.

Examples: **Propoxur**

Other Pesticide Families

Synthetic Botanical Insecticides

- Poisoning is rare.
- Dermal exposure can cause an allergenic reaction.
- Inhalation can cause throat or lung irritation.
- **Avoid breathing product vapours.**

Pesticide Families

Chlorinated Hydrocarbons (CH)

- Act by disrupting the electrical transmission of nerve impulses in the insect.
- Typically these are not persistent, and do not bioaccumulate or biomagnify in the environment.

- **Poisonings are rare, but symptoms include dizziness, sweating, muscle twitching, nervousness, nausea, and vomiting.**
- **Example: Methoxychlor**

Growth Regulators

- Growth regulators are nontoxic to humans and do not affect the nervous system. Examples: **Methoprene and Diflubenzuron**
- **Methoprene** mimics the action of juvenile hormone in the insect and interferes with the moulting (pupa to adult stage) process.
- **Diflubenzuron** disrupts the forming of the chitin (exoskeleton).

Biological

- Bacteria is used to control the larval stage of biting flies.
- Ingested bacteria break down the stomach of the larvae.
- Nontoxic to mammals.

Example: *Bacillus thuringiensis israelensis*

Petroleum-based Products

Petroleum Distillates

- Are used as part of the pesticide formulation as a diluent or as a pesticide themselves.
- Symptoms of acute poisoning include: Nausea, vomiting, coughing, lung irritation (can cause bronchial pneumonia with fever and cough), weakness, dizziness, unconsciousness, and convulsions.

Petroleum-based Products

Aromatic Hydrocarbons

- Are used as part of the pesticide formulation (example: xylene).
- Acute poisoning symptoms include: Dizziness, euphoria, headache, nausea, vomiting, tightness in the chest, staggering, blurred vision, paralysis, rapid breathing, convulsions, and unconsciousness.
- Repeated exposures are hazardous.

Pesticide Risk

Risk of exposure exists any time you handle a pesticide. It is important that you know how to measure, assess, and reduce risk.

Risk = level of exposure X toxicity

- **Exposure** is the amount of contact with a pesticide.
- **Toxicity** is a measure of how harmful or poisonous a pesticide is.

Pesticide Risk

To reduce the risk from pesticides:

- Choose a less toxic product.
- Reduce the level of exposure.

PEI Biting Fly Pesticide Applicator Training Course

Training Module 4, Part 2 Human Health

Disclaimer

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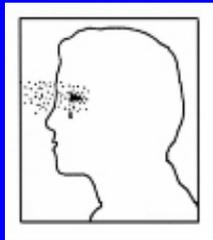
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Learning objectives

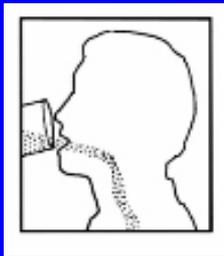
Completing this section will help you to:

- **Identify routes of pesticide exposure.**
- **Identify sources of pesticide poisoning.**
- **Identify and select proper personal protective equipment.**
- **Clean, maintain, and store personal protective equipment.**

Routes and Sources of Exposure



Absorption: taken in through the eye or skin at any place on the body



Ingestion: Taken into the stomach through the mouth

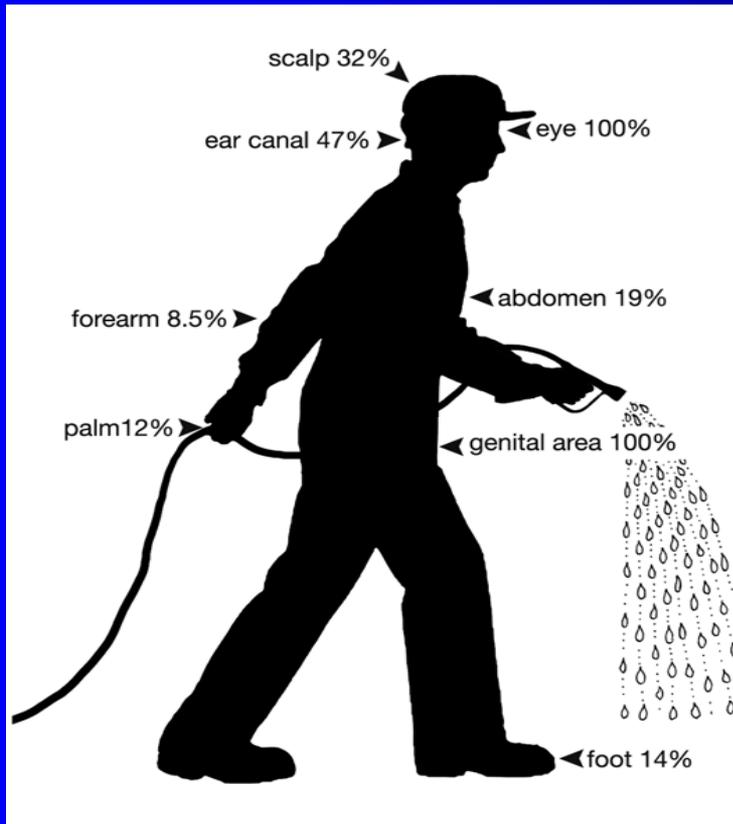


Inhalation: Breathed into the lungs through the nose or mouth

Absorption

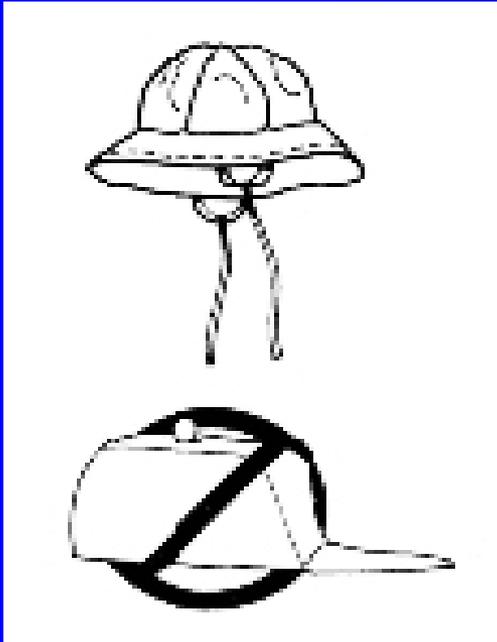
- **The most common route is through the skin.**
- **The absorption rate depends on the pesticide and the affected location on the body.**
- **The head, small of the back, armpits, and groin are the most absorptive body areas.**
- **Pesticide is absorbed at a faster rate through a cut or sweaty skin.**
- **Risk can be reduced by wearing proper PPE.**

Areas That Need Protection From Absorption



- Head
- Eyes
- Body
- Hands
- Feet

Protection of the Head



- The hat should be wide-brimmed, non-absorbent (**not a cloth or leather baseball cap**), and easy to clean.

- **Always wear a hat when handling a pesticide. The head can absorb a pesticide faster than most other parts of the body.**
- **Wash the hat with other contaminated clothing.**

Protection of the Eyes

Face and eye protection is especially important when mixing and loading a pesticide. Product can be quickly absorbed and some can directly damage the eyes.



Protection of the Eyes

Goggles and face shield

- **Wear a full-face respirator, goggles, or a face shield any time pesticide might splash or spray, or dust could pose a risk to the face or eyes.**
- **Wash eye protection equipment thoroughly with a brush, soap, and water after each use.**
- **Store protective equipment away from contact with pesticides.**

Protection of the Body



- **Wear long-sleeved shirts and long-legged pants, or one-piece coveralls.**
- **Clothing material should have a tight weave.**
- **Protective clothing should be clean and pesticide free.**
- **Wear cuffs over gloves and boots.**

Protection of the Body



- **Wear waterproof material (splash pants) if clothing could become wet during a pesticide application.**
- **Wear a waterproof apron when measuring, mixing, or loading pesticides.**

Maintenance of Protective Clothing

- **Rinse off waterproof clothing before removing it.**
- **Store contaminated clothes in disposable plastic garbage bags before washing.**
- **Wash contaminated clothing daily.**
- **Discard clothing that is heavily contaminated by pesticide residue.**

Laundering Protective Clothing

- **Wash protective clothing separate from other laundry.**
- **Wear gloves when handling contaminated clothing.**
- **Pre-soak and wash contaminated clothing separate from normal laundry.**
- **Fill washer with hot water and use a heavy duty detergent. Do not overload the washing machine.**

Laundering Protective Clothing

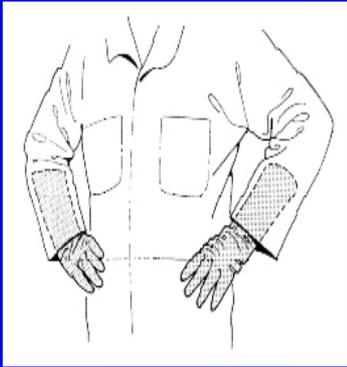
- Repeat the wash cycle, if necessary, to remove stronger chemicals.
- Rinse the empty washing machine by running a full cycle of clean water before washing other clothes.
- If possible, hang wash outside to dry.

Protection for the Hands

Gloves should ALWAYS be worn when:

- **Handling or applying a pesticide.**
- **Rinsing containers.**
- **Working on spray equipment.**
- **Taking off and cleaning PPE.**

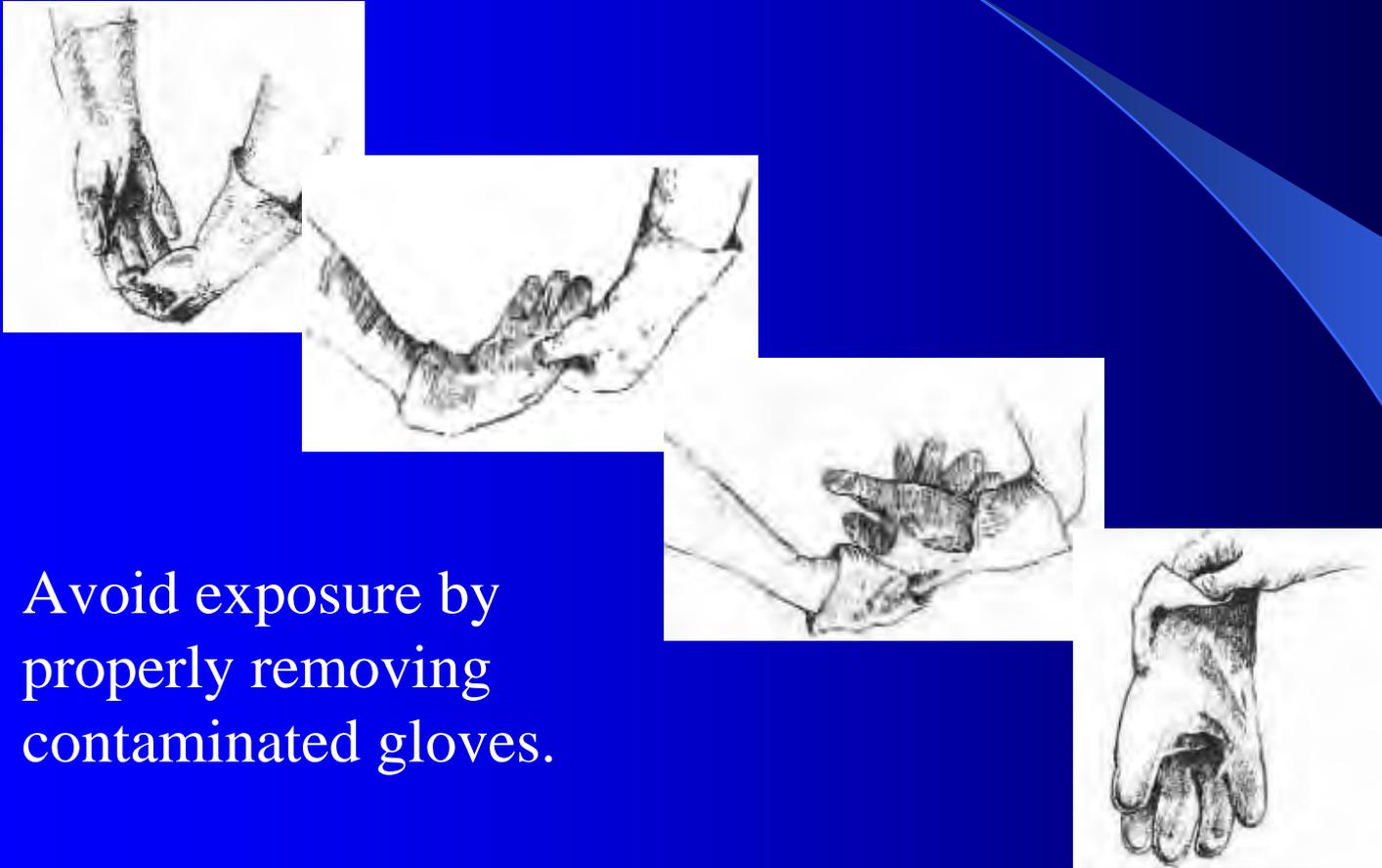
Protection for the Hands



Gloves:

- Wear clean, **unlined gloves** made of non-absorbent, **chemical-resistant material** (butyl rubber, neoprene,).
- ‘Roll up’ the cuff to prevent dripping.
- Gloves must be long enough to cover the wrist and be worn under the sleeves.

Proper Glove Removal



Avoid exposure by properly removing contaminated gloves.

Wearing and Maintenance of Gloves

- **After handling a pesticide, wash gloved hands in soap and water before removing other PPE.**
- **Gloves should be the last item of PPE removed.**
- **Turn gloves inside out as you remove them.**
- **Wash gloves with soap and water and then rinse.**

Wearing and Maintenance of Gloves

- **Check gloves for cuts or holes and throw them away if they become damaged.**
- **Store clean gloves away from pesticides.**
- **Always wash your hands with soap and water.**

Protection of the Feet

Boots:

- **Should be unlined and made from chemical-resistant material, such as rubber.**
- **Should always be worn when handling a pesticide.**
- **Should be at least ankle height.**

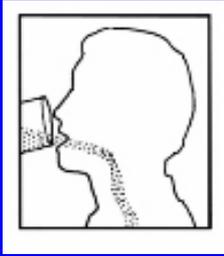
Do not wear leather or cloth footwear (e.g., sneakers).

Wearing and Maintenance of Boots

Boots should be:

- Worn tucked under pant legs.
- Washed inside and out after each use.
- Stored away from pesticides.





Ingestion

Cause

Accidental ingestion.

Transfer of pesticide onto food or drink containers.

Product splashed into mouth.

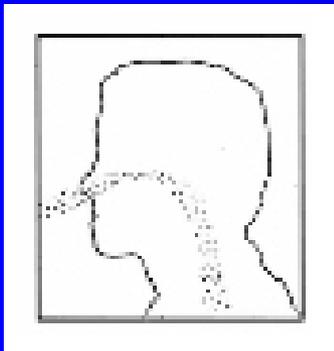
Prevention

Store product in its original container only.

Wash hands after handling pesticides.

Wear splash shield when mixing product.

Inhalation



- Pesticide vapours can be breathed in through the mouth or nose and drawn into the lungs.
- Vapours are quickly and fully absorbed through the lungs and into the blood.
- Vapours pose the greatest hazard when using fumigants.

Respiratory Protection

- Breathing protection is important because pesticides can damage the nose, throat, and lungs.
- A **respirator** is a unit that covers the mouth and nose to prevent the lungs from taking in pesticide spray droplets, particles, and vapours.
- Wear a **respirator** when the pesticide label tells you to, and when there is a risk of exposure to harmful levels of airborne pesticides.

Respiratory Protection

A respirator should:

- Be MSHA-NIOSH or BHSE approved.
- Come with a cartridge to block organic vapours.
- Be worn when the pesticide label tells you to and when there is a risk of exposure to harmful levels of airborne pesticide.
- Fit properly.

Respirator Types



Dust Mask

Stops dust particles but
**DOES NOT STOP
PESTICIDE VAPOURS.**

Respirator Types



Cartridge Respirator

Provides protection against low pesticide vapour concentrations.



Canister Respirator

Provides protection against high pesticide vapour concentrations.

Respirator Types

Air-powered Purifying Respirators

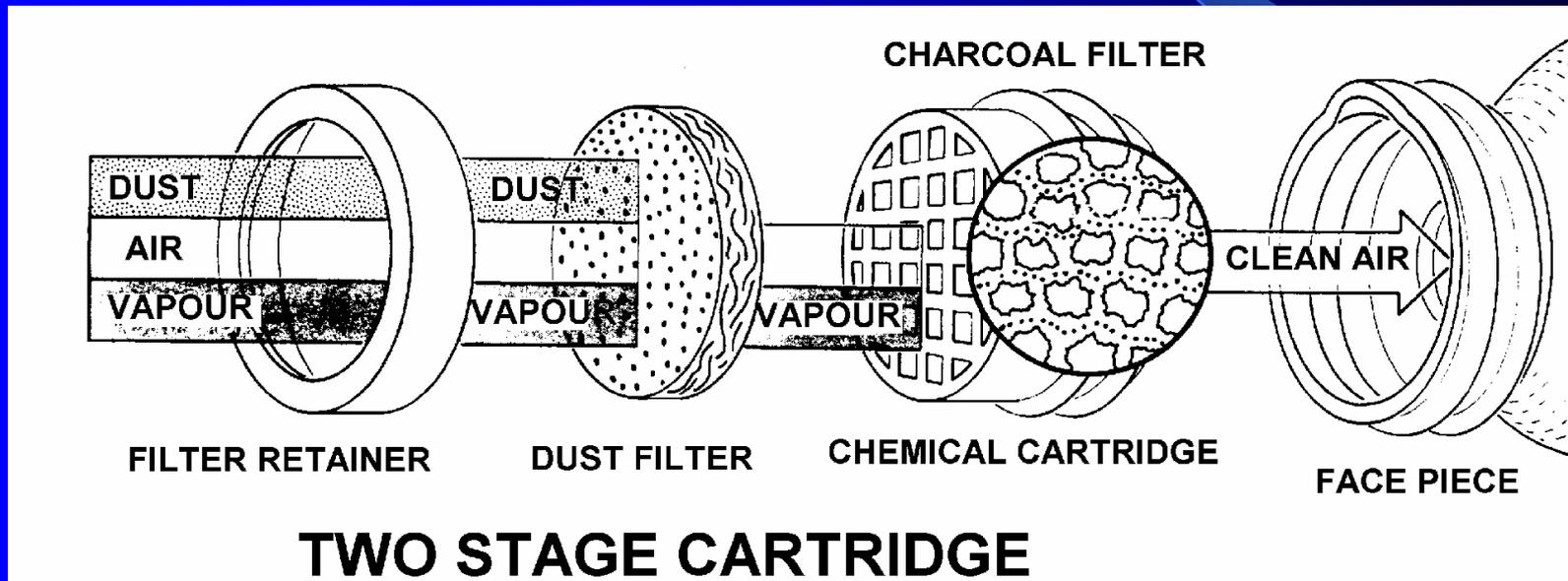
- Use an electric pump to draw air through a charcoal cartridge.
- The purified air is brought to a tight-fitting facemask, loose-fitting helmet, or into the tractor cab.
- Air-powered purifying respirators can be costly.

Respirator Types

Self-contained Breathing Equipment

- Clean air is supplied through a tube from a pressurized tank on the wearer's back.
- This type of equipment should be worn in areas of low oxygen, while applying a fumigant, or when fighting a fire in a pesticide storage area.

How a Cartridge Respirator Works



How Often Should You Change Charcoal Cartridges?

- As a minimum, at the start of each spray season.
- After several hours of use, if the concentration of pesticide vapour is high.
- If the respirator is properly fitted and a pesticide smell or odour is still detected.
- If breathing through the respirator becomes difficult.

Fitting a Cartridge Respirator

- **Respirators come in a number of shapes and sizes.**
- **For proper protection, select one that fits securely.**
- **A tight seal cannot be achieved if the wearer has a beard or other facial hair.**
- **Do a fit test each time you put on the respirator.**

Steps for Fitting a Cartridge Respirator



- Place the palm of your hand over the exhalation valve cover and breath out gently.
- Proper fit occurs when the face piece will bulge slightly (no air leaks between the face and face-piece).
- If there is a leak, take off the respirator and put it on again or readjust the tension of the elastic straps.

Steps for Fitting a Cartridge Respirator

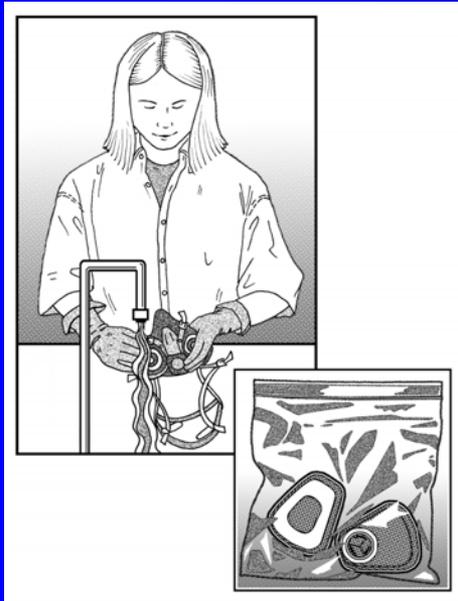


- Place a piece of paper or palms over the cartridge openings and breath in gently. Hold for 10 seconds.
- Proper fit occurs if the face piece collapses (no air leaks between the face and face piece).
- If there is a leak, take off the respirator and put it on again or readjust the tension of the elastic straps.

Maintaining a Respirator

- **Check respirators regularly for damage.**
- **Make sure all valves, mechanical pre-filters, and charcoal cartridges are properly attached and sealed.**
- **Remove pre-filters and cartridges/canisters after each day of use, or when they are not in use.**
- **Keep filters and cartridges in clean, sealed, plastic bags to extend their life.**

Washing the Respirator



- Put on your gloves.
- Remove pre-filters and cartridges/canisters.
- Wash the respirator face-piece in warm water.
- Use a mild detergent and rinse well.

Overhead Applications

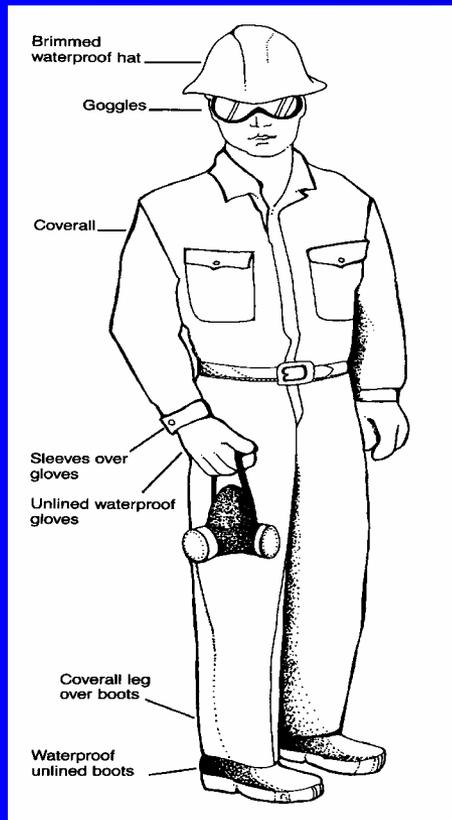


- **Avoid spraying above shoulder height to minimize exposure and drift.**
- **Wear full-face protection, respirator, long chemical resistant gloves, and water repellent clothing and head protection if you must apply a pesticide above shoulder height.**

General Guide for Wearing PPE

- **Wear PPE that is appropriate to the type of pesticide application.**
- **Stop work immediately if protective equipment stops working properly.**
- **Wear coveralls and chemical-resistant, unlined gloves and boots when handling sod or grass clippings recently treated with pesticides.**

General Guides for Storing Personal Protective Equipment



- Do not store PPE in the pesticide storage area or with street clothing.
- Store PPE in a cool, dry area, close to your pesticide storage site for quick access.

- **Keep waterproof clothing (e.g., gloves, boots, apron, and hats) away from sunlight to extend their life.**
- **Keep charcoal cartridges in clean, airtight containers or sealed plastic bags to extend their life.**
- **Change the pre-filter dust pads when cartridges are changed.**

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 5 Safe Pesticide Use

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Learning objectives

Completing this section will help you to:

- **Work safely when handling a pesticide.**
- **Minimize potential pesticide exposure to bystanders.**
- **Safely select, purchase, handle/transport, store, mix, and apply a pesticide.**
- **Clean up safely after a pesticide application.**

Attitude and General Precautions

- Pesticide use in biting fly control has the potential to cause harm to people, pets, beneficial organisms, and the environment.
- It is the responsibility of those handling pesticides to reduce risk by working responsibly at all times.
- This can be accomplished through training, adopting a professional attitude, and following basic safety procedures at all times.

Reducing Bystander Exposure

Application of a pesticide for the control of biting flies in a populated area can cause public concern. To reduce bystander exposure:

- Apply the pesticide when human activity is low (e.g., after dark or early in the morning).
- Control access and post the treated area.
- Notify the public (newspaper, radio) of the times and areas being treated.

Employee Safety

- **Employers** are responsible for overseeing employee workplace health and safety, training employees to handle pesticides safely, providing information on the pesticides being handled (labels and MSDS's), and providing suitable PPE.
- **Employees** can reduce risk by having a positive attitude, and by regularly reviewing and following product labels and company safety procedures.

Water Safety



- **The risk of drowning always exists when working near or in an aquatic environment.**
- **The added weight from pesticide application equipment can increase this risk.**

Water Safety

To minimize potential risk:

- **Never work alone.**
- **Walk carefully through the site.**
- **Follow boat safety procedures.**
- **Never overload a boat.**
- **Be familiar with hazards in the area (e.g., submersed logs, deep water, rapids, slippery rocks, bottom debris, etc.).**

General Precautions for the Safe Handling of a Pesticide

- Read and follow pesticide label information.
- Wear clean PPE when handling a pesticide.
- Wash after handling a pesticide container, applying a pesticide, and working on pesticide application equipment.
- Never eat, drink, or smoke while applying a pesticide.

- **Remove contaminated clothing immediately.**
- **Shower, wash hair, and clean fingernails at the end of each day of pesticide use**

Pesticide Selection

Consider the following factors when choosing the best pesticide for a given situation:

- The pest(s) to be controlled, pest resistance, and possible impacts on beneficial organisms.
- Which pesticides are registered for the intended use.
- The pesticide(s) that are least toxic to human health and the environment.

- **Applicator safety or risk of exposure, and personal protective equipment.**
- **Bystander safety.**
- **Application equipment needed, and available.**
- **Environmental factors.**
- **Regulatory compliance.**

Pesticide Safety

Practice safety any time you are working with a pesticide.

- **Applicators regularly face a risk of exposure to pesticides. Their actions also determine the extent of risk to bystanders and the environment.**
- **Always work safely and follow good safety practices when handling and managing a pesticide.**

Pesticide Safety Issues

- Keep up-to-date on safety issues.
- Always read and follow pesticide label directions.
- Follow provincial regulations for safe transport, storage, use, and disposal.



Purchase of Pesticides

- **Read the product label to make sure a pesticide is correct for your needs and application equipment.**
- **Purchase only pesticide containers that have clear, readable labels.**
- **Do not accept broken bags, cartons, or leaking containers.**
- **Ask the vendor for a copy of the Material Safety Data Sheet (MSDS) for each pesticide purchased.**

- **Minimize the need for product storage by purchasing only the amount of pesticide needed for immediate use.**

Amount Needed

Label application rate X Size of treatment area

Number of containers

Amount needed ÷ Amount (volume) in each container

Transport of Pesticides

The transportation of pesticides is subject to both federal and provincial legislation.

Federal

Transportation of Dangerous Goods (TDG) Act

- Federal Act governs the movement of commercial and restricted class pesticides.
- Current regulations can be found at www.tc.gc.ca/tdg/clear/tofc.htm

Provincial

PEI *Pesticides Control Act* and regulations.

- Current regulations can be found at www.gov.pe/go/pesticides

Provincial Transport Regulations

When transporting a concentrated pesticide the containers must be:

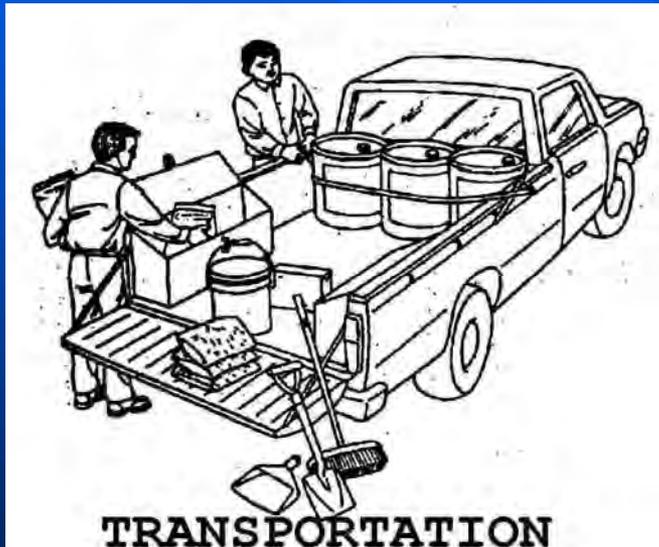
- **Labelled and sealed.**
- **Transported separate from foodstuffs, feed, household furnishings, bedding, clothing, or similar commodities.**

Provincial Transport Regulations

When transporting a concentrated pesticide the containers must be:

- **In a separate, enclosed, leak-proof compartment that is securely affixed to the transport vehicle, OR secured to the transport vehicle using appropriate tie-down straps.**

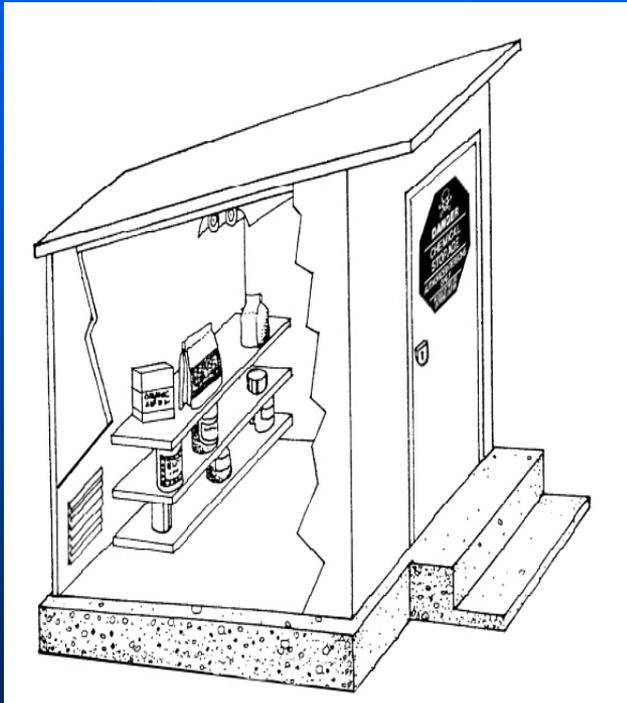
General Guidelines for the Safe Transport of Pesticides



- Pack containers securely and upright to reduce the risk of upsets, leaks, or spills.
- Never transport pesticides in the passenger compartment of a vehicle.

- **Carry a shovel, absorbent material, and safety equipment in case of a pesticide spill.**
- **Protect paper and cardboard containers from moisture.**
- **Never leave a pesticide in an unsupervised vehicle.**
- **Decontaminate the vehicle if pesticide contamination results from broken bags, cartons, or leaking containers.**

Storage of Pesticides



- Store pesticides separately from foodstuffs and animal feed.
- Maintain the storage area in a clean and orderly manner.
- Ensure the storage area is well ventilated.

Storage of Pesticides

- **Ensure there are no floor drains in the storage area.**
- **Have approved safety equipment available and nearby.**
- **Store personal protective equipment outside of the storage area.**
- **Equip the building with the proper number and type(s) of fire extinguishers.**
- **Have absorbent material nearby to clean up a pesticide spill.**
- **Check regularly for leaking containers.**

Storage of Pesticides

- Store only pesticides or related equipment.
- Control access and lock the facility when it is unattended.
- Post **PESTICIDE STORAGE AREA** signs on each point of entry.
- Maintain an up-to-date list of all stored pesticides and keep a copy at a location away from the pesticide storage area.
- Use older product first.

Safe Handling of Pesticides

- **The risk of exposure to pesticides is greatest when mixing and loading concentrated product.**
- **People who handle pesticides should use personal protective equipment (PPE) and follow proper safety measures.**
- **The pesticide label will provide precautionary symbols, warnings, and toxicological information and explain how to handle and use the product safely.**

Before Mixing or Loading

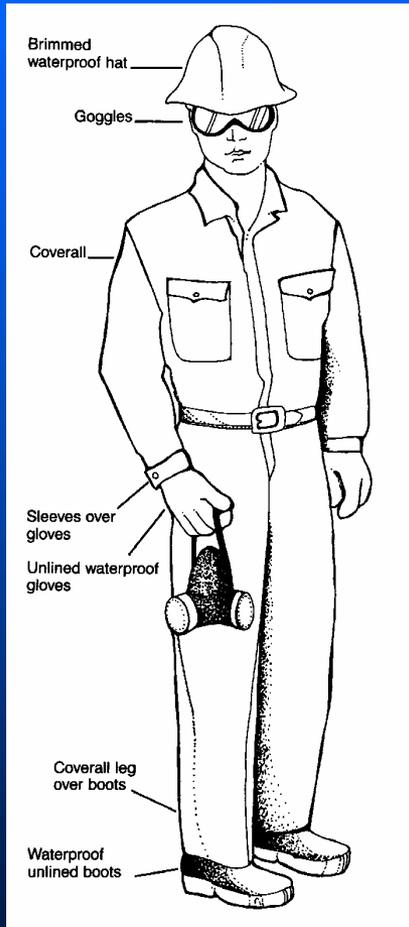
Read the label to:

- Make sure the pesticide is registered for the planned use.
- Confirm mixing directions, application rates, and limits to use.
- Check safety precautions.
- Review poisoning and first aid information.

Before Mixing or Loading

- Calculate and prepare only the amount of pesticide mixture required for the application.
- Make sure clean-up and first aid equipment is nearby and easy to access.
- Choose a mixing and loading site that minimizes your risk of exposure, and eliminates any risk of contaminating water and the environment.

Protection While Mixing and Loading a Pesticide



Wear the following protective clothing and safety equipment:

- Coveralls
- Head protection
- Chemical-resistant gloves and boots
- Face shield or goggles
- Waterproof apron
- Respirator

Pesticide Mixing and Loading Site

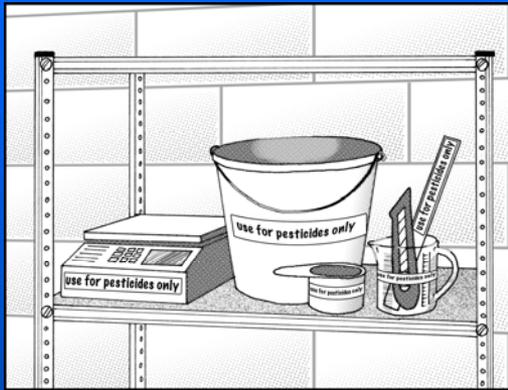
A good pesticide mixing and loading site will be:

- Located outdoors and away from people and pets.
- On a level site near the pesticide storage area.
- Away from drinking water wells and surface waters.

Pesticide Mixing and Loading Site

- Mix and measure pesticides on a strong, level bench or table covered with heavy-duty plastic or a material that will not absorb pesticides.
- Do not use this bench or table for any other purpose.
- Keep a shovel, absorbent material, and safety equipment nearby in case of a product spill. Stop and clean up spilled or splashed pesticide at once.

Pesticide Measuring Equipment



- Use proper tools to open pesticide containers. Open bags using a sharp knife and **clean the knife well after each use.**
- Use scales, measuring cups, and premixing containers to measure product.

- **Use these items only with pesticides.**
- **After use, wash these items with soap and water and store them in a locked area.**

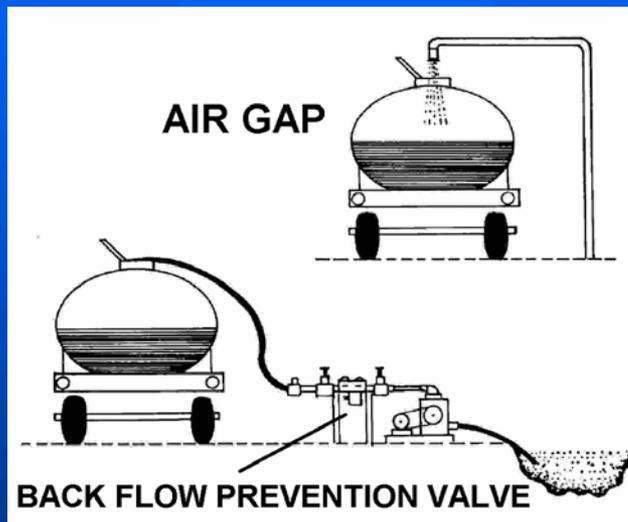
Steps for Mixing and Loading a Pesticide

- **Do not mix or load a pesticide in a boat.**
Working with concentrated product increases the chance of damage to the environment, and it will be impossible to clean up a spill.
- **Do not mix or load a pesticide at the water's edge.**
- **Do not mix a pesticide under windy or adverse weather conditions.**

Steps for Mixing and Loading a Pesticide

- Follow proper procedures for the rinsing of empty pesticide containers (**Explained later in this section**).
- Follow proper procedures for removing, maintaining, and storing personal protective equipment (*see Module 4, Part 2: Human Health*).

How to Minimize Water Contamination



- Keep the filler hose above the water line.
- Use an anti-backflow device.
- Never leave the application equipment unattended.

- **Fill sprayers away from open bodies of water by using a nurse tank.**
- **Take all materials and equipment with you when you leave, and clean them properly.**

Safe Application of a Pesticide

To reduce risk when applying a pesticide:

- **Keep a supply of clean water nearby while at the application site. Use this water to clean items (e.g., PPE) and to wash between job sites.**
- **Cover up or remove items such as animal/bird feeders, water containers, toys, BBQ's, or food utensils to prevent contamination from pesticide drift.**

- **Notify the property owner and adjoining property owners, as required by law.**
- **Post the area to be treated BEFORE treatment.**
- **Ensure that anyone who might enter a treated area is aware of a potential re-entry interval.**
- **Avoid working alone if handling a pesticide under hazardous conditions.**

- **Plan an application route that avoids passing through treated areas.**
- **Direct spray inward around the property borders.**
- **Stay out of recently treated areas.**
- **Keep pesticide application equipment clean and in good working order.**
-

- **Calibrate equipment for the type of application.**
- **Stop the application when moving over an area that does not require treatment (e.g., driveways or walkways).**
- **Shut off spray nozzles on the boom when turning.**
- **Start moving before engaging or turning on the pesticide flow.**

- **If application equipment breaks down... STOP... shut off equipment, put on proper PPE, and make needed repairs at once.**
- **Always wear gloves and goggles when changing or cleaning nozzles. Use a soft brush and clean water (or compressed air). A hard object can damage the nozzle.**
- **Never blow out a nozzle with your mouth.**

Safe Application of a Pesticide

Environmental factors to consider before applying a pesticide include:

- **Certain ambient temperatures can be required for a pest to be active.**
- **The solids content and pH of water used to prepare a pesticide mixture can influence the effectiveness of the pesticide.**

- **Risk of pesticide drift increases with increasing wind speeds.**
- **Steep slopes can limit or restrict the use of certain pesticides that could wash into watercourses. Buffer zone widths may need to be increased.**

Re-entry of a Treated Area



- Humans and pets can be at risk if they enter treated areas too soon following a pesticide application.
- Advise customers and post signs.

- **Put on PPE if you have to re-enter a treated area BEFORE the re-entry time has expired.**
- **Follow re-entry direction on the product label, and ALWAYS wait until liquids have dried.**

Care of Pesticide Application Equipment

A pesticide mix should not be left in application equipment for extended periods because it could:

- Weaken hoses, gaskets, and plastic parts.
- Cause corrosion and mechanical problems.
- Be carried over to the next mixture.

- **Allow suspensions to settle out.**
- **Allow granules to absorb moisture and form lumps.**
- **Reduce the pesticide's effectiveness.**

Cleaning Pesticide Application Equipment

Application equipment should be emptied and cleaned:

- After each day of use.
- When changing pesticides.
- Before off-season storage.

Wear proper personal protective equipment whenever cleaning or working around pesticide application equipment.

Cleaning Pesticide Application Equipment

- Clean application equipment away from open bodies of water and wells.
- Fill the tank with clean water to dilute the spray residue.
- Flow this water through the sprayer.

Details on caring for application equipment are covered in Module 8: Application Technology.

Safe Application of a Pesticide

To avoid having leftover spray mix:

- Take accurate measurements of the area to be treated.
- Follow product label application rates.
- Frequently re-calibrate application equipment.
- Double check your calculations.
- Keep good application records from previous years.

Discarding Old or Unwanted Pesticide

- **Avoid having excess product by buying only the amount of pesticide needed for one season.**
- **Keep inventory records, and use older pesticide stock before buying new product.**
- **Dispose of concentrated pesticide according to product label or provincial regulatory requirements.**
- **Return unopened containers of pesticide to your vendor.**

Cleaning and Disposal of Pesticide Containers

Contaminated, empty pesticide containers can be a **point source** of pollution.

To decontaminate containers:

- Completely drain the contents of the container into the spray tank. Shake out bags into the tank or hopper.

- **Triple rinse (or pressure rinse) containers.
Gently rinse bags once (single rinse)**
- **Add all rinse water to the sprayer.**
- **Cut, puncture, or crush plastic, metal, or paper containers.**
- **Dispose of the containers according to product label directions or provincial law.**

- **Containers cannot be buried, burned, or disposed of except at an approved site or in a manner approved by provincial regulations or recommended by the manufacturer.**

2009 CONTAINER RECOVERY PROGRAM SITES

SITE	LOCATION
Robinson's	Albany
McCain Fertilizer	Bloomfield
McCain Fertilizer	New Perth
McCain Fertilizer	Summerside
Cavendish Agri	Kensington,
Cavendish Agri	Montague
Cavendish Agri	Charlottetown,
Cavendish Agri	Oleary
Cavendish Agri	Summerside
Cardigan Feed	Cardigan

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 6 Integrated Pest Management

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Learning Objectives

Completing this module will help you to:

- Understand the general principals of IPM.
- Know how to use IPM for the management of biting fly pests.
- Manage and reduce pest resistance.

(See: Mosquito and Black Fly Pest Management Modules for more specific details.)

Integrated Pest Management

- IPM is a prevention-based way to manage pests effectively, economically, and safely.
- The goal of IPM is to reduce pest numbers to an acceptable level, not to eliminate them.
- IPM helps reduce the need for chemical pesticides and can help protect human health, the environment, and beneficial insects.

Integrated Pest Management

- An IPM approach can provide a long-term solution to pest problems, even in an aquatic setting where pesticides sometimes cannot be used.

Steps in an IPM Program

- **Prevention**
- **Identification**
- **Monitoring**
- **Injury and Action Thresholds**
- **Treatment**
- **Evaluation of Results**

Step 1: Prevention

Prevention is the basis of any IPM program.

- **An IPM program for the control of mosquitoes can use water management programs or sanitation programs to reduce the breeding areas.**
- **The elimination of water from a site may result in complete control, but this is not usually a practical option.**

Prevention (con't)

- Low areas where water accumulates in the spring or after a rain, can be drained.
- Draining these areas, may, however:
 - Impact fish and waterfowl habitat.
 - Affect water levels in surrounding streams, thereby impacting water available for recreational, municipal, or agricultural uses.

- **It is important to note that:**

All provincial governments of Atlantic Canada require an approval for the alteration of a watercourse (ponds, rivers, lakes, etc.) or a water resource (wetland, marsh, bog, etc.), including infilling or draining the water. The draining or infilling of a watercourse or water resource is not permitted for the purposes of “private gain”.

Small Scale Habitat Modification

Property owners can help to eliminate mosquito larvae habitats by:

- **Draining abandoned wading and ornamental pools.**
- **Placing a tight lid on rain barrels and cleaning out eave troughs.**
- **Removing old tires and containers where rain can accumulate.**
- **Keeping ponds free of emergent aquatic plants.**

Step 2: Identification

Correct pest identification is needed to understand pest biology and to protect beneficial species.

- **The internet, fact sheets, scientific publications, and services provided by private or government pest management experts can help you to identify pests and beneficial species.**

Step 2: Identification

Once a pest is identified you can determine:

- Its life cycle and growth stages (*to select the best time to apply treatment*),
- Its rate of reproduction (*to determine treatment timing and frequency*), and
- Its behaviour (*to select the best time and place for applying treatment*).

Step 3: Monitoring

Look for the presence of mosquitoes and black fly larval or adults by conducting regular inspections (monitoring). Count the pests and record the results. Monitoring can be used to determine:

- The presence, species, and number of pests
- When the pest has reached the most susceptible life stage for a given control method.
- Whether treatment is required.

Step 3: Monitoring

Monitoring can be used to determine the:

- Weather conditions that can favour pest development (rain events and temperature).
- Effectiveness of previous control treatments.

Step 3: Monitoring

- Monitoring will also reveal the presence, species, and number of **beneficial organisms**. (e.g., dragonfly larva, minnows, bats)
- This will help you to determine if there are enough **beneficial organisms** to (naturally) keep the pest population below an acceptable level.

Step 3: Monitoring

Counting and measuring will help you to:

- Estimate the number and time of hatch of biting fly pests.
- Compare pest population records from other sites.
- Determine nuisance and action levels.
- Evaluate the effect of pesticide treatments.

Step 3: Monitoring

Visual Inspections:

- **Involve a close inspection to determine the presence or absence of pests or beneficial organisms.**
- **Are done when and where needed.**
- **Help to identify problem areas (e.g., standing water).**
- **Can involve written comments (e.g., public complaints.).**

- **Take less time than actually counting pests, but give limited information.**
- **Do not generate population numbers for comparison.**

Counting and Measuring Methods:

- Provide more detailed information than visual inspections.
- Provide results that can be compared from week to week.
- Deal with specific numbers, and remove the personal judgment calls of an inspector.

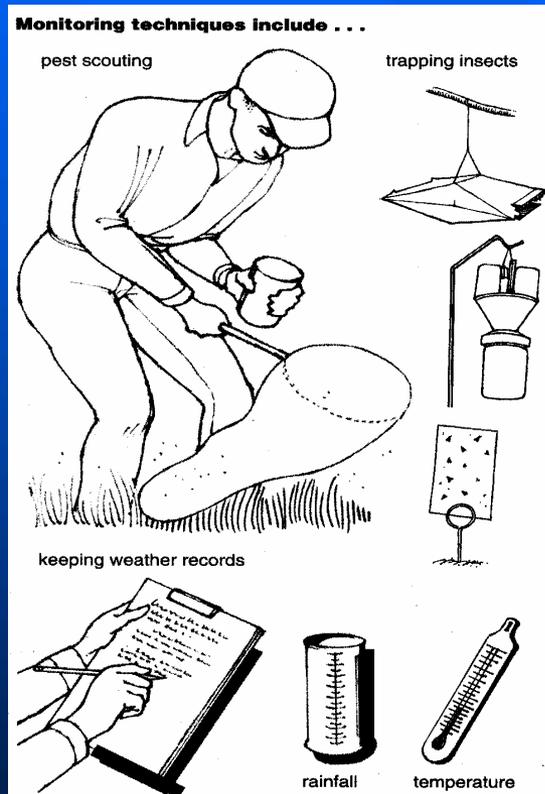
- **Generate information that can be used to make good management decisions.**
- **Often involve taking samples.**

Sampling

- **Select a sampling method suited to the pest and the site (a white dipper, dip net) (See: Pest Management of Mosquito and Black Fly Module).**
- **Take enough random samples to get an estimate that will reflect the situation for the entire area.**
- **Pick sample sites by chance (random sampling).**

- **Use the same sample method each time to better compare results.**
- **Sample when pest problems are expected.**
- **Keep records for future reference.**

Which counting and measuring, the following information should be recorded:



- The number of larvae or adults in a measured area.
- The number of adults caught in traps.
- The size of the area affected.
- The number of days when weather favours the pests.
- Water temperature.

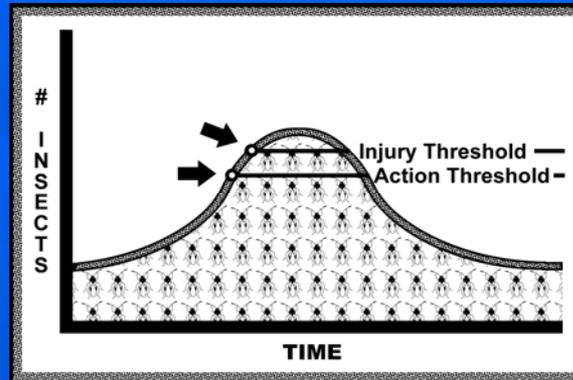
Counting and measuring methods are useful to:

- Estimate the size and spread of a pest population.
- Compare records between sites and dates.
- Evaluate the effectiveness of a treatment method.
- Establish injury and action thresholds.

Step 4: Nuisance and Action Thresholds

- The principal aim of IPM is to keep the pest population at an acceptable (economic, aesthetic, safe) level.
- Action is only necessary when pest numbers reach a certain level.
- When practicing IPM, a few pests can be tolerated.
- Objectives of a pest control program can be met by using nuisance and action thresholds.

Injury or Nuisance Threshold

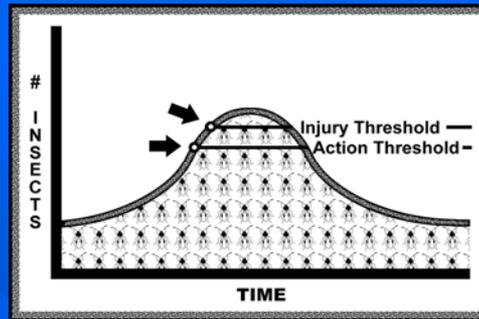


Injury or Nuisance Threshold

- is the maximum number of pests (mosquitoes or black flies) that can be tolerated.

In a biting fly control programs, the injury or nuisance threshold can be based upon health or safety concerns (West Nile Virus), nuisance levels, or aesthetic tolerances.

Action Threshold



- Is the point (*number of pests*) where treatment should be taken to prevent pest numbers from reaching the Injury or Nuisance Threshold.
- This point will differ depending on the type of control method used (chemical vs biological pesticide or adult vs larval control programs).
- Thresholds are based upon a pest's most vulnerable life stage (e.g., larval stage for black flies).



- A client's pest tolerance level can be different than yours.
- Some clients may want no mosquitoes or black flies; others will tolerate a few.
- It is important to work with public demands when designing and explaining an IPM program.

Step 5: Treatment

Where possible, choose a combination of the following measures to control a pest.

Physical (Mechanical) Control

- Screens to keep out insects.
- Pest-repelling devices.

See: Modules 7a and 7b for more detail on physical control methods.

Step 4: Treatment

Cultural Controls

- Habitat modification
- Removal of pest over-wintering sites.

Step 4: Treatment

Biological Controls

- Involve the use of other organisms to control or kill the insect pest (e.g., Bti or natural predators). Bti is very species-specific

Step 4: Treatment

Behavioural Controls

- Involves the use of a pest's natural behaviour for suppression.
- Release of insect sex pheromones to confuse males and disrupt mating.
- Use of pheromones to lure pests into traps.
- Release of sterile male insects (e.g., codling moth).

Step 4: Treatment

Chemical Controls

- Use chemical pesticides to control, suppress, or repel pests (See: Module 7a & 7b).
- Pesticides must be registered under Canada's Pest Control Products Act.
- Remember: Often there may be special requirements when applying products to water (e.g., a provincial use permit may be required).

Pesticide Groups

Chemical pesticides are grouped according to the following properties:

- Selective vs non-selective.
- Residual vs non-residual.
- Persistence in the environment.

Pesticide Groups

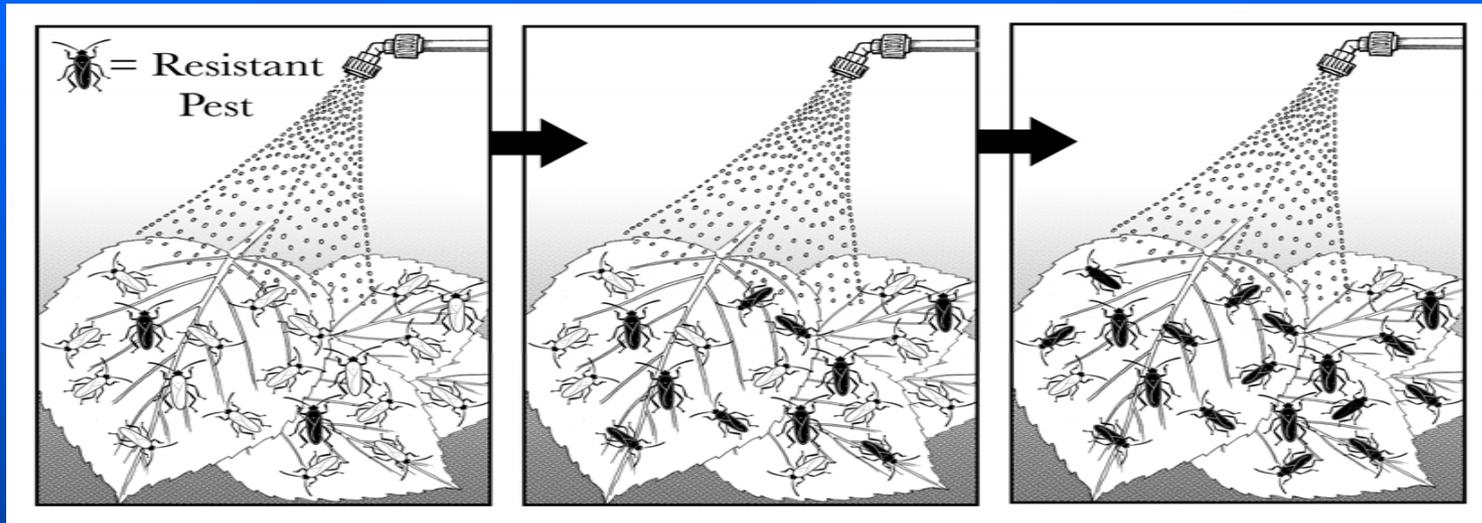
- **Selective:** Toxic to specific species, with limited effects on others (e.g., Bti.).
- **Non-selective:** Toxic to a range of species. Can also harm beneficial and non-target species (e.g., Malathion).
- **Residual:** Remain effective for an extended period of time after application.

Pesticide Groups

- **Persistent:** Remain active for many months after application.
- **Non-persistent:** Break down quickly in the environment.

(See: Chapter on Mosquito and Black Fly Pest Control.)

Pesticide Resistance



- Resistance develops when a few of the pests survive a chemical pesticide treatment.
- Offspring of these pests then develop resistance to the chemical.

- **Once resistance develops, the use of even the highest label application rates can speed up even greater resistance.**

How to Delay Pest Resistance

To minimize or prevent pest resistance:

- Use a combination of physical (mechanical), cultural, biological, or genetic pest control measures.
- Use pesticides only when monitoring results indicate they are needed (Action Threshold).
- Alternate between different chemical families when using pesticides.

Record Keeping



- Date, time, and location.
- Target pest(s) (e.g., numbers, stage).
- Control method used (product).
- Application rate.
- Equipment settings.
- Weather conditions.
- Environmental factors.
- General observations.
- Evaluation of treatment results.

Step 5: Evaluation of Results

Preparing detailed records of the pest control / management strategies you use can help you to:

- Evaluate current pest management programs.
- Compare control methods (e.g., products, equipment settings, and timing).

- **Address post-treatment problems (e.g., property damage, off-site movement, complaints).**
- **Forecast future pest problems.**
- **Plan management programs for future years.**

Developing an IPM Program

- An **Integrated Pest Management** program is a decision-making tool that involves planning and acting to control pests.
- The control measures used should be effective, affordable, and environmentally safe.
- The goal is to maximize pest control, while minimizing environmental and health risks.
- Pest control is used only when, after careful monitoring, it is called for.

Assemble Background Information

Before starting an IPM program:

- Record past pest problems and treatment methods.
- List pest problems common to the area.
- Review provincial legislation and municipal by-laws (permit requirements for applications to water).

- **Carry out a site assessment (e.g., topography, sensitive areas, proximity to residential areas, water courses).**
- **Determine client expectations.**

Draft an IPM Program

- Use all applicable background information.
- Address the six IPM steps (prevention, identification, monitoring, thresholds, treatment, and evaluation).
- Include client input when drafting the program.
- Identify actions (e.g., removal of old tires, draining containers, use of repellants) that the client can undertake.

Putting IPM into Practice

- Start with a few small sites and build as experience is gained.
- Select a site with few pests.
- Start with a client (e.g., municipality) prepared to support the principals of IPM.

Environmental Considerations



- Environmental factors can affect the safety and effectiveness of a pesticide application.
- Observe existing and predicted conditions at or near the application site.

Environmental Considerations

- Factors to consider include temperature, relative humidity, precipitation, air movement, and topography.
- Check and follow all pesticide label precautionary statements.

Environmental Considerations

Temperature

- Pests may not be active in cool temperatures. Product may be lost (due to vapour drift) in high temperatures.

Environmental Considerations

Precipitation

- Rain can reduce pesticide effectiveness by washing off the product or diluting product applied directly to water.
- Rainwater fills discarded tires and cans, thereby providing more hatching sites for mosquitoes.

Environmental Considerations

Air Movement

- High winds can carry a pesticide away from the site (particle drift), thereby reducing effectiveness or affecting non-target areas.

Sensitive Areas

- Biologicals may have to be used in/around sensitive areas (water bodies) or on susceptible plants.

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 7, Part 1
Mosquito Pest
Management**

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General Comments

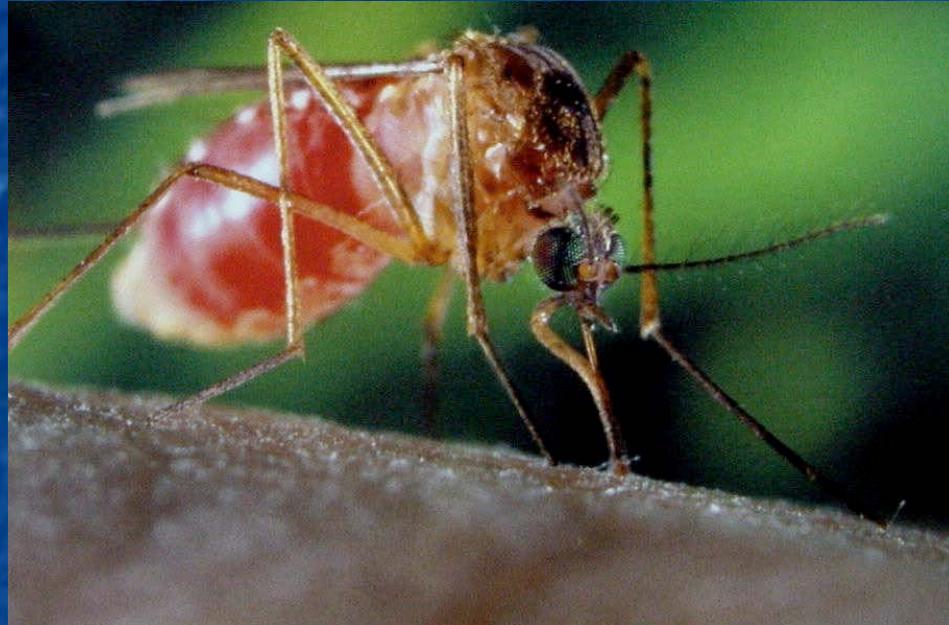
- This training module combines the information from the *Applicator Core Manual* and the *Biting Fly Manual* and is the basis for writing the certification exam required for the authorized ground-based use of insecticides to control mosquito larvae or their adult stage.
- **Note that mosquitoes are not true 'biting flies', but for ease of explanation, they will be considered as biting flies in this module.**

Learning Objectives

Completing this module will help you to:

- **Understand why mosquitoes can be pests.**
- **Understand the biology of mosquitoes.**
- **Better select control measures for the management of mosquito larvae or adult stages.**
- **Make informed decisions to manage human and environmental risk.**

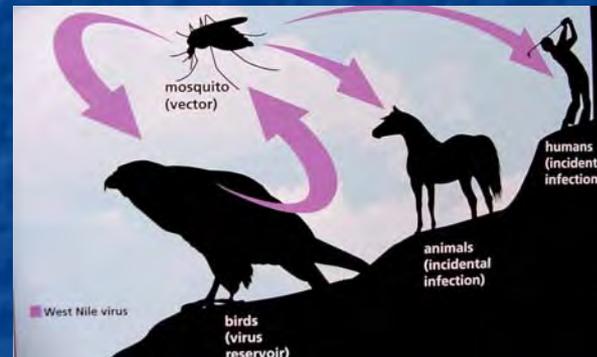
Mosquitoes as a Pest



Pest Issues

- **The biting activity of mosquitoes is usually considered to be merely bothersome, but bites CAN result in serious human health effects.**
- **Intensive scratching of mosquito bites may open wounds and lead to secondary infection.**

- **Some mosquitoes can transmit heart worm nematodes to dogs and West Nile virus (WNV) to humans.**



West Nile virus (WNV) is primarily a disease of birds but, occasionally, humans and horses can be infected.

Transmission

- **Transmission of WNV is most likely to occur during mosquito season (mid-May until late Sept–Oct in the Atlantic region).**
- **Mosquitoes belonging to the genus “Culex” are primarily responsible for WNV transmission.**
- **Members of the crow family are especially sensitive to the virus. Monitoring of crow deaths may provide an early warning for humans.**

Infection

- **The likelihood of being infected with WNV is extremely small, and most people who are infected will NOT experience symptoms.**
- **About 20% will develop mild flu-like symptoms (fever, headache, and body aches), a rash on the trunk, or swollen lymph glands, which can last about one week.**
- **Less than 1% will develop meningitis or encephalitis.**

Mosquitoes

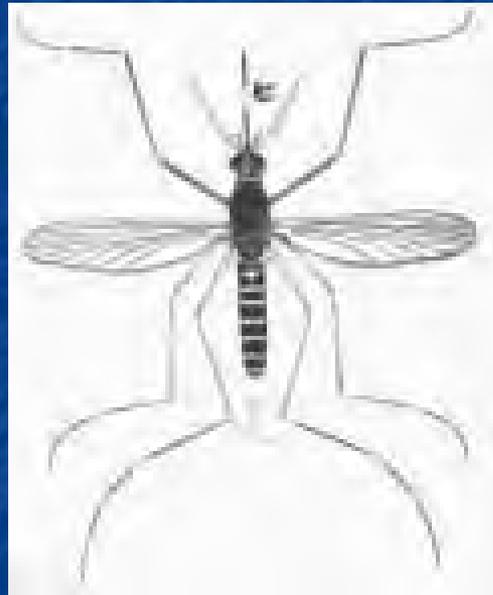
- Mosquitoes belong to the family Culicidae, and all have piercing and sucking mouthparts.
- PEI has recorded 34 different species of mosquitoes.
- Accurate species identification is important to understand mosquito biology and to select suitable control measures.

Body of the Mosquito

Head

Thorax

Abdomen



Proboscis or sucking mouth parts

Wings and six legs attached to the abdomen

Feeding

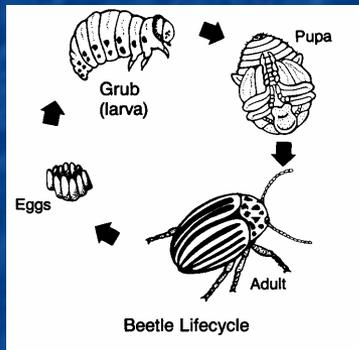
- **Male mosquitoes do not feed on blood, only on flower nectar.**
- **Female mosquitoes secrete saliva down a tubular mouth part into the wound, then suck the blood up through a second mouth part.**
- **The blood provides nutrients for mosquito egg development.**
- **The saliva prevents coagulation and improves blood flow.**

Saliva

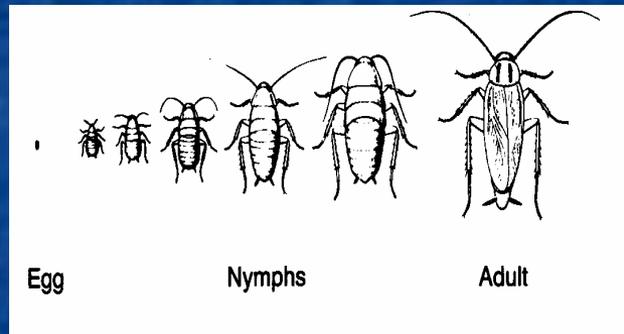
- **The saliva secreted by the female mosquito can:**
- **Cause an allergenic reaction (e.g., redness, swelling, discomfort) in humans.**
- **Carry disease-causing organisms (e.g., heartworm, WNV.)**

Insect Life Cycles

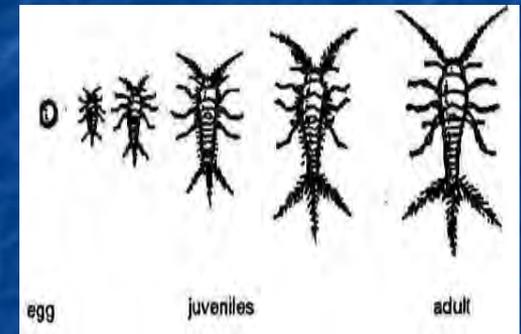
Insects will complete three or more changes or stages in a life cycle. A change is called a **metamorphosis**.



**Complete
Metamorphosis**



**Incomplete
Metamorphosis**



**No
Metamorphosis**

Mosquito Life Cycle

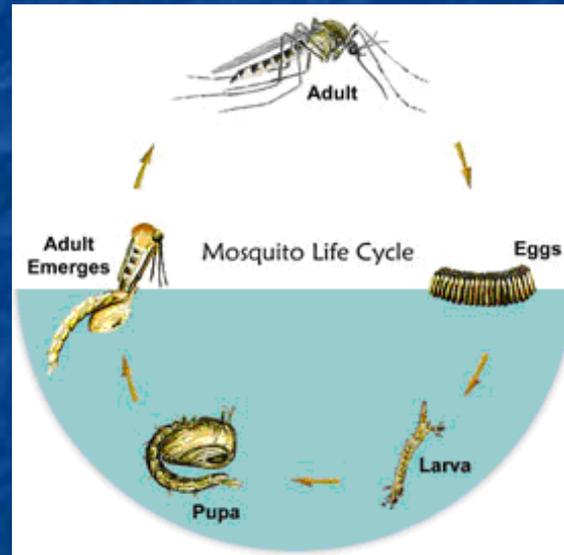
Adult

Adult
Emerging

Pupa

Egg

Larva
(wiggler)



Complete metamorphosis

Life Cycle

- **The egg, larva, and pupa stages occur in water.**
- **The female deposits fertilized eggs and a blood meal in water or damp soil.**
- **Eggs hatch into larva or “wrigglers”.**
- **The larva feed on algae and microorganisms found in the water.**

- **Standing or slow moving water provide ideal spots for laying eggs and for larval development.**

Egg Stage



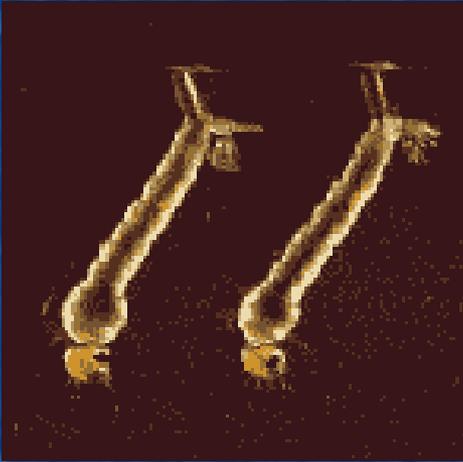
Eggs are often laid in boat-shaped 'rafts' that float on the surface of standing or slow moving water.

Larval Stage

Larva can be found:

- In stagnant water (not in moving streams or large lakes).
- In natural sites (e.g., shallow ponds and the edges of small, deep ponds).
- In man-made sites (e.g., culverts, catch basins, tin cans, old tires, bird baths, flower pots, and eve troughs).

Larval Stages



- Larva have four (4) different stages.
- Stages are called instars.
- Each instar is larger than the previous one.
- Identification is most accurate at the 4th instar.
- Most control programs are directed at controlling the larval stage.
- Larvicides are used to manage mosquito larva.

Pupal Stage



- The pupal stage follows the larval stage.
- Pupa float on the surface and do not feed.
- Adult mosquitoes develop during this stage.
- Control is rarely attempted at the pupal stage.

Adult Stage



- Adults emerge from the pupa.
- **Adulticides are used to control air-born adults.**
- A number of generations occur during one season.
- Different mosquito species over-winter in different stages.

Mosquitoes in Atlantic Canada



- Most common Genus is Aedes.**
- Eggs over-winter and hatch in the spring.
- Eggs are laid in damp soil or leaf litter.
- Spring Aedus have one (1) generation.

- **Commonly found along golf course “roughs”, grass ditches, and power line rights-of-way.**
- **Summer Aedes have many generations (depending on weather conditions) and can carry heart worm.**

Mosquitoes in Atlantic Canada

Genus Culex.

- Will feed on humans, but prefer to feed on birds or reptiles.
- Of particular interest, since they carry WNV to birds and may bridge the gap to humans.
- Three generations per year.

- **Survive the winter as adults.**
- **Boat-shaped rafts, containing several hundred eggs, are laid on the water surface.**
- **Maximum biting activity is late July to late August.**

Mosquitoes in Atlantic Canada

Genus *Coquillettidia*.

- Adults are strong flyers and voracious biters.
- Egg masses are similar to Genus *Culex*.
- Larvae swim down and attach to the roots of aquatic plants.
- Larvae survive the winter buried in the mud.
- Usually only one (1) generation per year.
- Control must be an adulticide.

Control Management Programs

- **Control programs conducted on PEI are primarily undertaken to reduce the blood feeding (annoyance) aspect of biting flies.**
- **Identifying the larval and adult stages, and the biology of the pest, is key to developing appropriate control measures.**
- **A variety of Integrated Pest Management (IPM) based control measures are available. (See Module on IPM for general description.)**

IPM for Mosquito Control

General Steps:

- Identify the species and numbers of mosquito larvae or adults present.
- Determine the most efficient and effective means of control.
- Some sites require a larvicide program; others will require an adulticide program.

- **Some sites lend themselves to water management or sanitation programs to reduce breeding sites.**

Monitoring

Monitor populations to establish:

- Presence or absence of disease-carrying species.
- Proximity of larval habitat to human activity.
- Size of area needing treatment.
- Most suitable control methods.
- Type of application equipment required (aerial, ground, backpack sprayers).

Egg Monitoring



Ovitrap

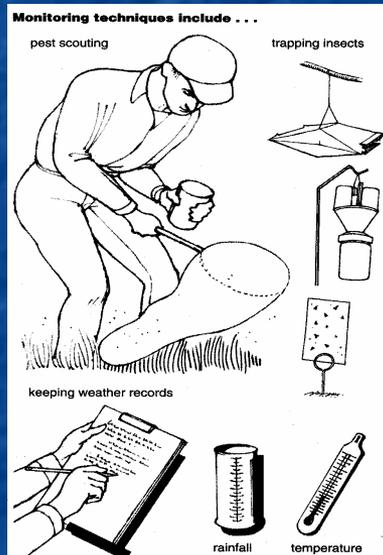
- An ovitrap is a useful tool for collecting information on container breeding mosquitoes.
- Collected eggs give a good indication of the number of *Aedes* larvae.
- Females lay eggs on a water-soaked felt strip.

Monitoring Larvae

When monitoring larval populations:

- Identify the species present and where they are found.
- Determine the relative numbers present.
- Be systematic to insure no areas are missed.
- Develop site maps for control.

Larval Surveillance Equipment



- White bottomed dipper.
- Small dip net.
- Container to hold larvae.
- Location maps.
- Items to record information.
- Boots or hip waders.

Collecting Larvae

- **Timing of the monitoring program and site types will depend on species. (Specific details on pages 16 & 17 of the Biting Fly Manual.)**
- **Identify suitable sample sites.**
- **Locate and code sites on a map or aerial photograph.**
- **Records should include species, number and time when larvae are present, and any natural enemies.**

Collecting Larvae

- Skim the water surface with the dipper or dip net.
- Wait for larvae to wriggle to the surface and sweep again.
- Check if there are 4th instar present (for easier identification).
- Preserve mature larvae in 70–95% ethanol.
- Label with date, location ID, and collector's name.

Identification

- **Consult with a specialist if it's necessary to identify an exact mosquito species.**
- **Larvae can be reared to adult stage for easier identification.**
- **Refer to Identification Keys found in the Biting Fly Manual (pages 20–21).**

Why Monitor For Adults

- Will help to establish what species are causing problems.
- Will help to establish where the most severe biting activity occurs.
- Will help to develop thresholds to establish if or when control measures are required.

Monitoring for Adults



New Jersey Light Trap

- Light bulb attracts adults.
- Fan draws them in.
- Monitors many species.
- Needs power source.
- Adults can be damaged.
- Expensive.
- Non-selective.

Monitoring for Adults



CDC Type

- CO² attracts adults.
- Fan draws them in.
- More species specific.
- Battery powered fan.
- Adults are not damaged.
- Easily stolen.
- Needs to be monitored every 24 hrs.

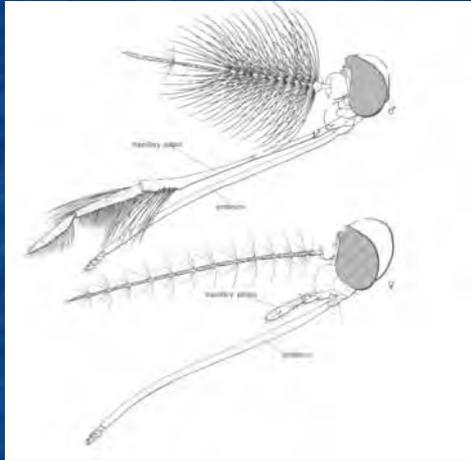
Monitoring for Adults

Gravid Traps

- Black plastic container filled with water attracts females.
- Females are sucked into trap during process of laying eggs.
- Selective for *Culex* species.



Identification



Male Antennae

Female Antennae

- Males have long, plumose antennae.
- Consult a specialist if you must identify to a particular species level.

Record Keeping

Detailed records should be kept to:

- Identify areas that consistently require treatment (hot zones).
- Monitor costs to determine future budgets.
- Establish program effectiveness.
- Identify areas that need improvement.
- Defend courses of action taken.

Record Keeping

Keep detailed records of:

- Larval and adult surveillance (maps, photographs, numbers, locations, etc.).
- Larval and adult treatment (products used, rates, timing, site alterations, etc.).
- Application equipment (type, settings, maintenance, etc.)
- Public notification (bulletins, postings, newspaper / radio notices, etc.).

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 7, Part 2
Mosquito Pest
Management**

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Mosquito Control

Selection of the best control method depends on:

- **Financial resources.**
- **Public acceptance.**
- **Necessary, and available, equipment.**
- **Level of control required.**
- **Environmental concerns.**

Biological Impact

- **Impact on the environment must be considered when developing a mosquito control program.**
- **Larvae can be an important food source for fish, amphibians, and other insects.**
- **Inappropriate amounts of insecticides placed into the water can alter the ecosystem or directly harm other organisms.**

Control Programs

- **Habitat Modification**
- **Mechanical Exclusion**
- **Mechanical Reduction**
- **Biological Control Agents**
- **Repellents**
- **Larvicide Applications**
- **Adulticide Applications**

Habitat Modification

- Intent is to reduce the amount of standing water.
- Draining large areas may not be practical or environmentally acceptable.
- Any major alteration (filling or draining) of water resources requires provincial approval.
- Encourage property owners to eliminate larval habitats (e.g., discarded tires and cans, ornamental pools, bird baths, and eave troughs).

Mechanical Exclusion



- **Wear clothing designed to minimize exposure (e.g., long-sleeved shirts, screened hats, light coloured jackets, and pants).**

- **Reduce the number of exterior lights used in the evening or install special yellow bug lights.**
- **Install and maintain window and door screens.**



Mechanical Reduction

This method includes:

- **Light traps and electric bug swatters and zappers.**



Biological Control Agents

- Includes the use of predators, parasites, and pathogens for mosquito control.
- Most common agent is the bacterium *Bacillus thuringiensis israelensis* (also known as BT H-14).
- Contents of the bacteria are selectively toxic to mosquito and blackfly larvae.
- Liquid or granular forms are applied to water.

Repellents

- A variety of repellents is available to the general public.
- Their effectiveness depends on the active ingredient, their concentration in the formulation, and the extent of coverage.



Repellents



A Fact Sheet on repellents can be found at:

<http://www.hc-sc.gc.ca/pmra-arla/english/pdf/pnotes/deet-e.pdf>. **Sonic**

NOTE: sonic repellents do not work

Larvicide Application

- Application should take place when the majority of larvae are at the 2nd or 3rd instar stages (mid-way through their development).
- Effectiveness should be evaluated 24 – 48 hr. after treatment.
- Effectiveness can be reduced if rain follows a larvicide application.
- A second treatment might be required.

Larvicide Applications

- Most programs use chemical or biological larvicides.

<i>COMMON NAME</i>	<i>CHEMICAL GROUP*</i>	<i>FORMULATION*</i>
BT (H14)	Bacteria	S, G
Methoprene	IGR	S, B
Diflubenzeron	IGR	WP
Chlorpyrifos	OP	EC, G
Malathion	OP	EC

OP=organophosphate; B=botanical; IGR=insect growth regulator

S=solution; G=granular; B=briquette; WP=wettable powder;

EC=Emulsifiable Concentrate; C=capsules

Formulations

Capsules

- **Active ingredient(s) is inside a covering that breaks open after several hours of exposure to water.**
- **Useful for small treatment areas.**
- **No application equipment is required.**

Formulations



Briquettes or Dunks

- Slow, sustained release of product (Bti).
- Useful for *Culex* larvae found in small containers.
- Residual action depends on the rate of water exchange.

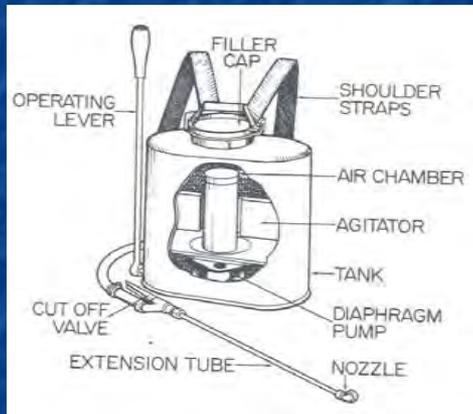
Formulations

Emulsifiable Concentrates, Wettable Powders, and Solutions

- Product is mixed with water before application.
- Suitable for control in catch basins, open ditches, etc.
- Variety of application equipment can be used.

Application Equipment

Examples of different application equipment.



Backpack Sprayer



Vehicle Mounted Mist Blower

Granules



- Do not drift or adhere to vegetation.
- Provide a sustained release of product (Bti).
- Useful for *Aedes* larvae control.
- Allow for easy identification of the area treated.

Granular Application Equipment

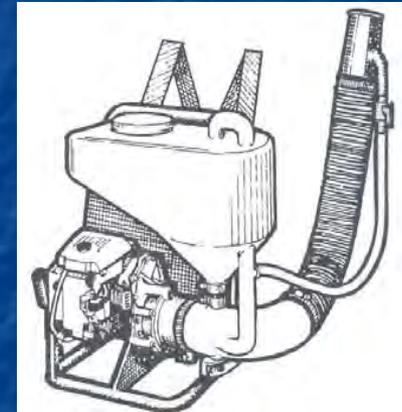
Examples of application equipment.



Manual



Vehicle-mounted



Powered backpack

Adult Mosquito Control Programs

- **Adult control may not be necessary if a larvicide program is successful.**
- **Adult control provides only temporary relief (few hours – few days). Pupating adults from surrounding areas cause re-infestation.**
- **Adulticide may be applied as a residual spray, a thermal fog, or an ultra low volume (ULV) application.**

Chemical Groups and Method of Application

<i>COMMON NAME</i>	<i>CHEMICAL GROUP*</i>	<i>APPLICATION METHOD**</i>
Dichlorvos	OP	TF, ULV
Propoxur	C	RS, TF, ULV
Chlorpyrifos	OP	RS
Naled	OP	RS, TF, ULV
Permethrin	SB	RS
Malathion	OP	F, ULV
Pyrethrin	B	F, ULV
methoxychlor	CH	RS, TF

*OP=organophosphate; CH=chlorinated hydrocarbon; B=botanical; SB=synthetic botanical; C=Carbamate.

** RS= residual spray; TF=thermal fog; ULV=ultra low volume; F=Fog

Residual Spray

- Typically used where specific areas are to be protected (e.g., private yards, work areas, parks, play fields, golf courses), or to prevent a migration of mosquitoes into an area.
- Delivered by backpack, truck-mounted mist, and high-pressure sprayers.
- Applied during the day to areas of dense vegetation where adults are resting.
- Results in less drift than other methods of application.

Thermal Fogging

- **The insecticide is mixed with diesel oil or fuel oil, heated in a warm manifold, and then applied as a fog of fine droplets.**
- **There is a high risk that fog will drift.**
- **Thermal fogging has minimal residual effect.**
- **Only effective for a limited time (few hours or days).**

Thermal Fogging

- Needs an exposure of 20–30 seconds to be effective.
- Fogging is most effective in evening and early morning, when the greatest number of adults are moving.
- Application should be made at right angles to the wind.

Thermal Fogging

- Wind should not be zero or more than 15 km/hr.
- Method is nonselective and can impact other insects.

Thermal Fogging Equipment



Hand held models



Vehicle mounted

Ultra Low Volume (ULV)

- Formulations used have a high concentration of active ingredient.
- Product is broken into very small droplets and dispersed.
- Fine droplets (aerosol) produce less drift than thermal foggers.
- Kills by direct contact with adults.
- ULV is most effective when used during the afternoon or early evening.

ULV Application equipment

Referred to as ULV Cold Foggers



Hand held



Backpack

Types of Larvicides and Adulticides

Four Groups

- Insect Growth Regulators.
- Botanicals.
- Chlorinated Hydrocarbons.
- Organophosphates and Carbamates.

Growth Regulators

Methoprene

- Control pupae when they are moulting to adults.
- Short residual (several hours).
- Liquid and briquette formulations.

Growth Regulators

Diflubenzuron

- Prevents the development of an exoskeleton in larvae.
- Residual life of several days.

Botanical

Pyrethrin

- **A natural extract of chrysanthemums.**
- **Formulated with piperonyl butoxide to be more effective.**
- **Fast working at low temperatures.**
- **Applied as a capsule to small areas for the control of larvae, or as a thermal fog or ULV formulation for adult control.**

Chlorinated Hydrocarbons (CH) and Carbamates (C)

CH Methoxychlor

- Available as an emulsifiable concentrate.
- Used to control adults.

■ C Propoxur

- Used to control adults.

Organophosphates

Chlorpyrifos

- Used to control adults.
- Has a residual of several weeks.
- Available in granular formulation.

Malathion and Dichlorvos

- Has a short residual effect.

Factors that Can Influence the Effectiveness of an Insecticide

- **Timing of the Application** (Insects can be more vulnerable during certain life stages.)
- **Environmental Conditions** (Humidity, rain, and temperature can affect an insecticide.)
- **Pesticide Resistance** (If insecticides from the same family are used repeatedly, insects can build up resistance after a few generations.)

Record Keeping

Detailed records should be kept to:

- **Identify areas that consistently require treatment (hot zones).**
- **Monitor costs to determine future budgets.**
- **Establish program effectiveness.**
- **Identify areas that need improvement.**
- **Defend treatment actions taken.**

Record Keeping

Keep detailed records of:

- Larval and adult surveillance (maps, photographs, numbers, locations, etc.).
- Larval and adult treatment (products used, rates, timing, site alterations, etc.).
- Application equipment (type, settings, maintenance, etc.).
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**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 7, Part 3
Black Fly Pest
Management**

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Learning Objectives

Completing this module will help you to:

- **Understand how black flies can be a pest problem.**
- **Understand the biology of black flies.**
- **Know what control measures to use to manage larval or adult stages.**

Black Fly Biology

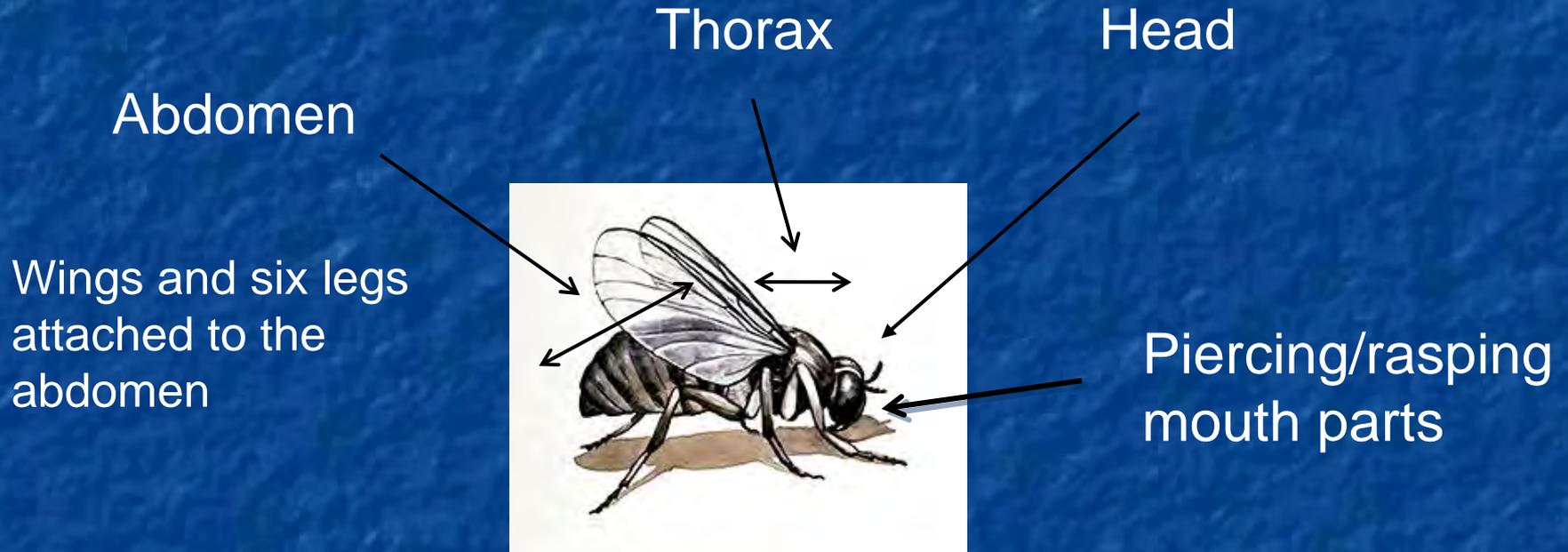


Black flies belong to the family
Simuliidae.

Black Fly Biology

- **The adult female feeds on blood, causing irritation and discomfort to humans, domestic and wild animals, and birds.**
- **The piercing/rasping mouth parts break the skin before sucking the blood.**
- **Black flies feed only during the day.**
- **Males feed on flower nectar.**

Body of the Black Fly



Adult Black Fly

Adult Identification

- **Adults are 1–5 mm in length.**
- **They have stout, hump-backed bodies.**
- **They have short, broad wings and short legs.**
- **There are about 150 species in Eastern Canada.**

Adult Identification

- Many genera do not bite humans.
- Only *Prosimulium fuscum-mixtum* and *Simulium venustum-verecundum* are considered pests.
- Consult a specialist for accurate species identification.

Prosimulium fuscum-mixtum

- Are the first black flies to appear.
- Adults are pale to dark brown.
- Legs are uniformly brown, with white bands.
- Last only 1–2 weeks.

Simulium venustum-verecundum

- Are the next species to appear.
- Adults are black.
- Legs are black, with white bands.
- Population peaks in June or early July.

Life Cycle

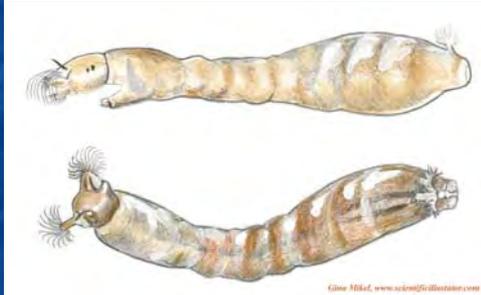
- **Black flies have four life (4) stages (egg, larva, pupa, and adult).**
- **The first three occur in well aerated, fast flowing water.**
- **Individual species differ in:**
 - **Over-wintering stage.**
 - **Water temperature preference.**
 - **Stream type preference.**
 - **Number of generations.**

Life Cycle

Eggs

- Eggs are laid on or in moving water, or on rocks or weeds near the surface.
- Females can lay 200 to 500 eggs.
- Eggs can hatch into larvae within days or several months, depending on the species.
- Some species over-winter in the egg stage.

Larvae



- Can be dark brown, green, or pale in colour.
- Filter passing organic matter from the water.
- Moults 5 to 8 times before pupating.

Larvae

- **Attach to stones, sticks, or vegetation found under the water.**
- **Spend 2 weeks to several months in this stage, depending on the species.**

Pupae



- Larvae spin a silk-like cocoon, attached to objects in the water.
- The shape of the cocoon varies with the species.
- Pupae change to adults in this stage.

Adults



- **Emerge from the pupae, rise to the surface, and take flight immediately.**
- **Mate soon after emergence.**
- **Fertile females then start searching for blood.**

Adults

- **The life span in this stage varies from a few days to several weeks.**
- **Biting activity can continue into October in some areas.**

Behaviour

- The egg, larval, and pupal stages are found in well aerated, fast flowing water.
- Larvae and pupae get their oxygen directly from the water.
- Adults can fly 30–40 km; even up to 100 km when carried by the wind.
- Adults are most active when the wind is less than 5 km/hr; at dusk and dawn; on cloudy days; or when storms are approaching.

Management Program

A management program consists of several components:

- **Monitoring larval populations.**
- **Monitoring adult populations.**
- **Species identification.**
- **Methods of larval control.**
- **Methods of adult control.**

Monitoring Larval Populations

A survey for larvae should:

- Extend over a large area, as adults travel great distances.
- Begin when the ice breaks up in spring.
- Be repeated at 10–14 day intervals for as long as the black flies are a problem.

Monitoring Larval Populations

A survey for larvae should:

- Involve checking the submersed surface of rocks, twigs, and vegetation or artificial substances (e.g., light coloured ceramic tiles, survey tape) placed on the bottom.

Larval Survey



Larvae Attached to Submersed Vegetation

Monitoring Adult Populations

Adult surveys can be conducted by:

- **Using a sweep net in areas where adults are biting and around vegetation near breeding sites.**
- **Counting the number of adults that land on a dark cloth during a 2-minute interval.**

Identification of the adults will indicate which species are a problem.

Identification

For accurate identification of larval and adult stages, refer to the keys located on pages 47– 50 in Chapter 2: Pest Management of the Biting Fly Manual or consult an insect specialist.

Larval Control Methods

Biological Control Agents

- Can include the use of predators, parasites, and pathogens.
- Only bacterium *Bacillus thuringiensis israelensis* (Bt H-14 or **Bti.**) is commercially available in Canada for larval control.
- Bti. is highly selective and effective.

Larval Control Methods

Application of Bti.

- Bti. is applied when numerous, 6-mm long, larval stages are identified.
- Bti. is best applied after winter ice is off the water, and extending until mid-May.
- Bti. should be applied at 400–800 metre intervals, above rapids and below ponds and dams.

Larval Control Methods

For control to be effective, all flowing water sources within a large, surrounding area should be treated.

Methods for Controlling Adults

- **Exclusion**
- **Repellents**
- **Chemical larvicides**

Adult Control Methods

Exclusion

- **Wear light coloured clothing designed to exclude black flies (long-sleeved shirts, long pants, head nets, etc.),**
- **Work indoors if possible.**

Adult Control Methods

Repellents

- Use the same repellents that are effective against mosquitoes (See: Module 7a Mosquito Management).

Adult Control Methods

Chemical Adulticides

- Only methoxychlor and propoxur are registered.
- These may be applied as a residual spray, a thermal fog, or an ultra low volume (ULV) application.

Adult Control Methods

Chemical Adulticides

- Refer to (Module 7a: Mosquito Management) for appropriate types of application equipment).
- Applications should take place when adults are most active (i.e., early morning or late afternoon on warm, still, overcast days.
- Usually control is limited to a few hours.

Integrated Pest Management

- **Black fly control programs conducted in PEI are primarily undertaken to reduce the blood feeding (annoyance) aspect of biting flies.**
- **Identifying the larval and adult stages and the biology of the pest is key to developing appropriate control measures.**
- **A variety of Integrated Pest Management (IPM) based control measures are available (*See Module on IPM for general description*).**

IPM for Black Fly Control

General Steps:

- Identify the species.
- Monitor to determine the numbers of black fly larvae and adults present.
- Determine the most efficient and effective means of control.
- A larviciding program may be the control choice in some areas; an adulticide program may be best for others.
- Keep accurate treatment records to improve future programs.

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 8, Part 1 Environmental Safety

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General Comments

- **Everyone shares responsibility for protecting the natural environment. To make the best choices, you will need to understand the short- and long-term effects of pesticides on the environment.**
- **Biting fly control programs typically require the application of pesticides to water or into the air.**
- **Care must be taken at all times to reduce non-target exposure and to protect the environment.**

General Comments

- Pesticides used to control the larval stages of biting flies are applied to water, but these products tend to be quite specific and are often applied to small areas. This minimizes negative effects on non-target species.
- Adulticides are less specific and are applied in a manner where they can drift.
- If possible, control programs should stress the use of larvicides rather than adulticides.

Learning Objectives

Completing this module will help you to:

- **Understand what happens to pesticides in the environment.**
- **Understand the impact that improper pesticide use can have on the environment, people, and animals.**
- **Understand how to prevent contamination in an urban environment.**

Learning Objectives

- Understand how to prevent contamination of water and land with good planning and problem solving.
- Understand the residual activity of pesticides used for biting fly control.
- Identify which pesticides have the least impact on non-target species.

Environmental Risk

As an applicator you should:

- Select and apply pesticides that will cause the least harm to the environment.
- Understand that long-term impacts can show up in the form of contaminated land and water.
- Understand that as an applicator **YOU** are responsible for minimizing the impacts of pesticide use on human health and the environment.

Processes That Decide the Fate of Pesticides in the Environment

- **Absorption** – the movement of a product into plants, animals, soil, or structures.
- **Adsorption** – the binding of a product to soil particles.
- **Desorption** – the release of a product from soil particles.
- **Volatilization** – the evaporation of a product.

Processes That Decide the Fate of Pesticides in the Environment

- **Spray Drift** – the airborne movement of spray droplets or particles away from a treatment site during application.
- **Run-off** – the movement of water down a slope.
- **Leaching** – the movement of pesticides (or other chemicals) with water through the soil.
- **Degradation** – the breakdown of a product.

Absorption



- Refers to the movement of pesticides into organisms (plants or animals) or structures (soil or wood).
- Absorption into an organism is not always bad, since many of these organisms can break pesticides down into non-toxic compounds.
- In most cases, a pesticide will not be absorbed if it has adsorbed.

Adsorption

- Is the binding of a chemical to soil or another substance.
- The amount of pesticide that binds to soil depends on:
 - pesticide type and concentration,
 - moisture content,
 - pH, and
 - texture of the soil.

Adsorption

- Organic soils or soils with a fine clay texture are most adsorptive.
- Pesticides adsorbed to soil can be moved with the soil by wind or water erosion on to adjacent properties or into watercourses.

Desorption

- Occurs when a pesticide bound or adsorbed to soil or another substance is released.
- Example: a herbicide bound to soil particles can be released if the soil particles move into a watercourse. When the herbicide moves into the water, aquatic plants can then take up the herbicide and be negatively affected.

Volatization

- Volatization is the process whereby a solid or liquid becomes a vapour (gas).
- A pesticide is more likely to become a vapour in hot, dry, windy weather and if the spray droplets are small.
- A pesticide vapour can readily move away from the treatment site onto nearby property and affect sensitive plants.
- This movement is referred to as Vapour Drift.

Vapour Drift

Vapour drift can be reduced by:

- **Using low spray pressures and large droplet sizes.**
- **Spraying only when temperatures are relatively cool.**
- **Following label precautions for pesticide application in higher temperatures.**
- **Using low volatile formulations.**

Particle (Spray) Drift

Particle (spray) drift:

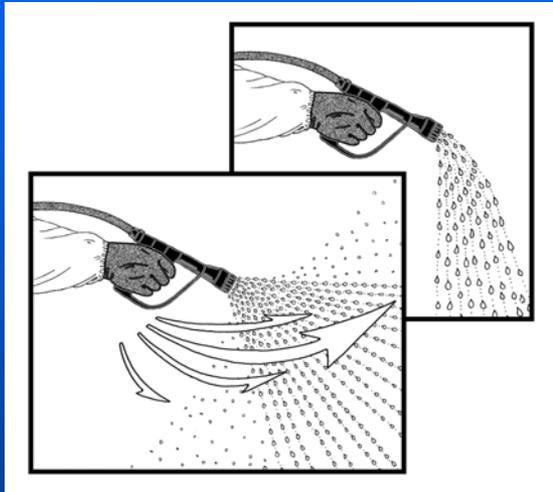
- Refers to the airborne movement of spray droplets away from the application site during an application.
- Can reduce the effectiveness of pest control as a lesser amount of product is delivered to the pest.

Particle (Spray) Drift

- Can result in off-target contamination and damage.
- Is more prone to occur:
 - at higher wind speeds,
 - as the distance between the nozzle and the target increases, and
 - if the droplets are small.

Particle (Spray) Drift

High pressure produces small droplets, which are more likely to drift.



To reduce particle (spray) drift:

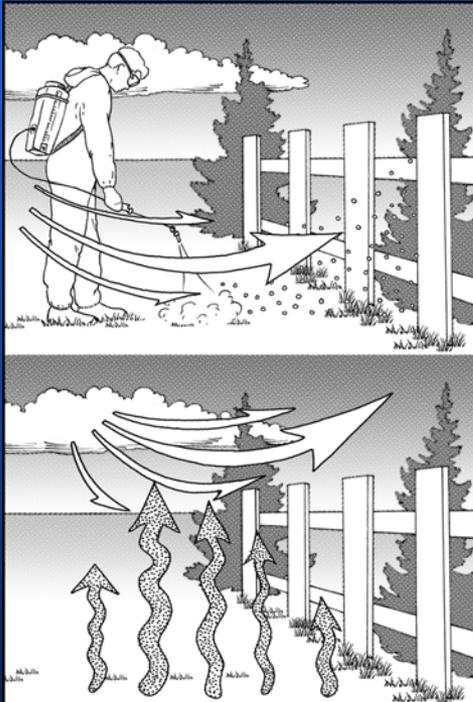
- Avoid using high spray pressures.
- Avoid applying pesticides when winds are strong.
- Follow wind speed directions on the pesticide label, or as required by provincial law.

Particle (Spray) Drift

To reduce particle (spray) drift:

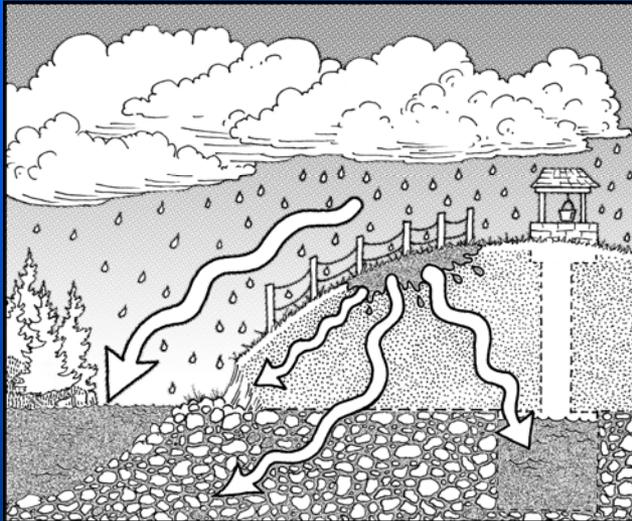
- Select nozzle types to produce droplet sizes that are just small enough to give good coverage.
- Decrease the distance between nozzles and the target.
- Add a low-drift adjuvant to the spray tank to decrease drift.
- Consider using a granular product if you need to apply pesticides near sensitive plants.

Particle (Spray) Drift vs Vapour Drift



- Particle (spray) drift is the movement of spray particles during an application.
- Vapour drift occurs after an application.

Physical Processes That Affect Pesticide Mobility



- Surface runoff
- Leaching
- Soil erosion

Surface Runoff

- Is the movement of water down a slope. Any pesticide mixed in this water will also move.
- The amount of runoff can be reduced by:
 - Delaying a pesticide application if rain is expected.
 - Using extra care when applying a pesticide to sloped areas.
 - Not applying a pesticide to bare ground.

Leaching

- Is the movement of chemicals (pesticides, fertilizers) with rain or irrigation water through the soil.
- The movement can be downward, upward, or sideways.
- Product that leaches can get into surface or ground water.

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 8, Part 2
Environmental Safety**

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 8b
Environmental Safety**

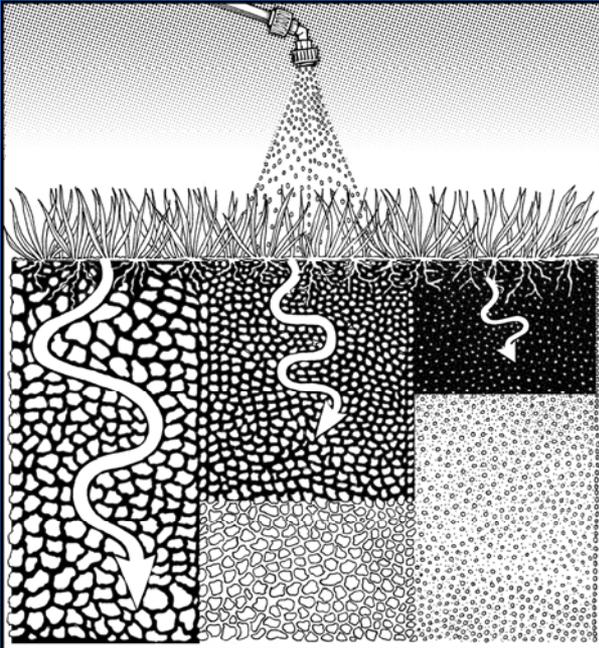
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Leaching



- Pesticides will leach through coarse-textured (sandy) soil faster than through fine-textured (clay) soils.

Leaching

The risk of leaching increases when:

- **Pesticide solubility is high. This results in more product being dissolved in the water.**
- **Adsorption is low. This makes more pesticide available for leaching.**
- **Desorption is high. This also makes more pesticide available for leaching.**
- **Excess water (irrigation) is added.**

The risk of leaching can be reduced by:

- **Immediately cleaning up any spilled pesticide.**
- **Removing rinsed containers from the application site.**
- **Using low water-soluble products.**
- **Following label application rates.**

Degradation

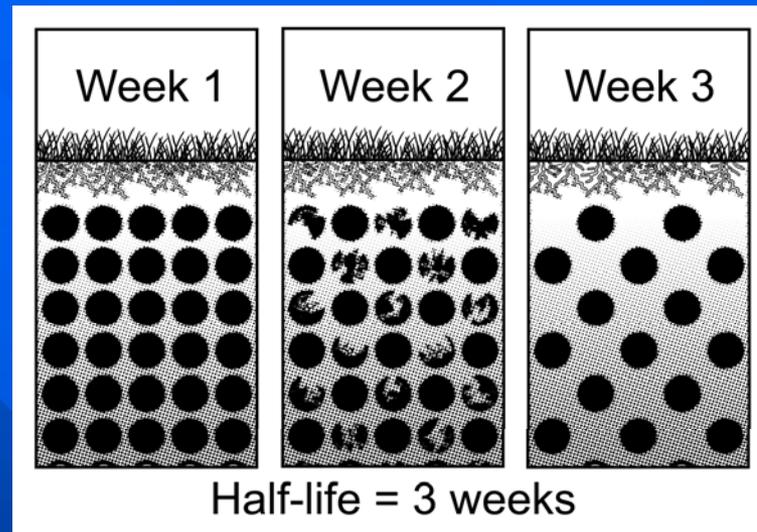
- Is the breakdown of a product into other components.
- The active ingredient of a pesticide can be degraded by:
 - Microbial degradation
 - Chemical degradation
 - Photodegradation

Degradation and Half-life

The rate of breakdown of a chemical in the environment is referred to as its half-life.

- Half-life is the time it takes for one-half of the initial amount of a pesticide to break down in the environment.
- Half-life can be measured in days (least persistent) or years (most persistent).

Degradation and Half-life



The half life is 3 weeks in this example.

Persistent Pesticides

- Pesticides that do not break down quickly are described as **persistent**.
- The longer the active ingredient takes to break down the longer it is available to move, accumulate in plant or animal tissue, and pose a risk in the environment.
- Persistence can vary with soil type and climate.
- Products persist longer in cold, sandy soils that are low in organic matter.

Types of Degradation

- **Microbial degradation**
- **Chemical degradation**
- **Photodegradation**

Microbial Degradation

- Occurs when soil microorganisms use the pesticide as a food. **This is the most common type of degradation.**
- Rate of degradation is affected by:
 - Soil temperature.
 - Soil pH, moisture, and fertility.
 - Presence of oxygen.
 - Chemical or physical properties of the pesticide.

Chemical Degradation

- Occurs when a chemical reaction breaks a pesticide into less hazardous compounds.
- Rate of degradation is affected by:
 - Soil temperature
 - Soil pH
 - Soil moisture
 - Chemical or physical properties of the pesticide.

Photodegradation

- Refers to the breakdown of a pesticide by sunlight.
- Products that photodegrade quickly usually must be incorporated into the soil to be effective.

Contamination Sources

Point Source Contamination

- Occurs when a large amount of pesticide is released in a small area (e.g., spill, fire involving pesticides, improper disposal).

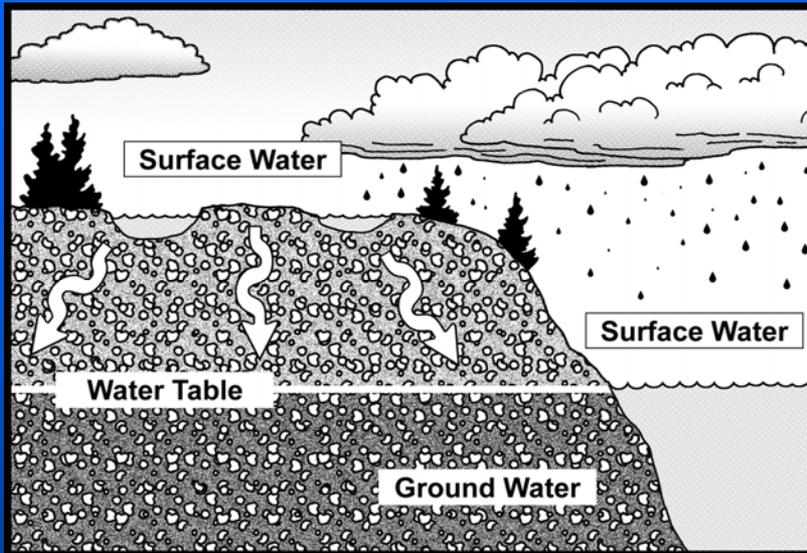
Non-point Source Contamination

- Occurs when a pesticide is applied according to label rates but then moves from the application site.

Protecting Water Resources

- **Water is a valuable natural resource and needs to be protected.**
- **To prevent damage to drinking water, waterways, and aquatic life always exercise care when handling or applying any pesticide.**

Aquatic Impact of Pesticides



- Pesticides can contaminate surface water (water we see, such as ditches, streams, lakes, and ocean) and groundwater (water found in aquifers below the surface).

- **Groundwater is the source of most of our drinking water.**
- **Once groundwater is contaminated, it can remain this way for a long time.**

Protecting Water Resources

Improper handling of a pesticide can:

- Contaminate runoff water, or water used for irrigation.
- Contaminate surface water, and kill aquatic animals and plants.
- Disrupt fish mating and feeding, or damage aquatic plants.

Protecting Water Resources

When undertaking an adulticide program:

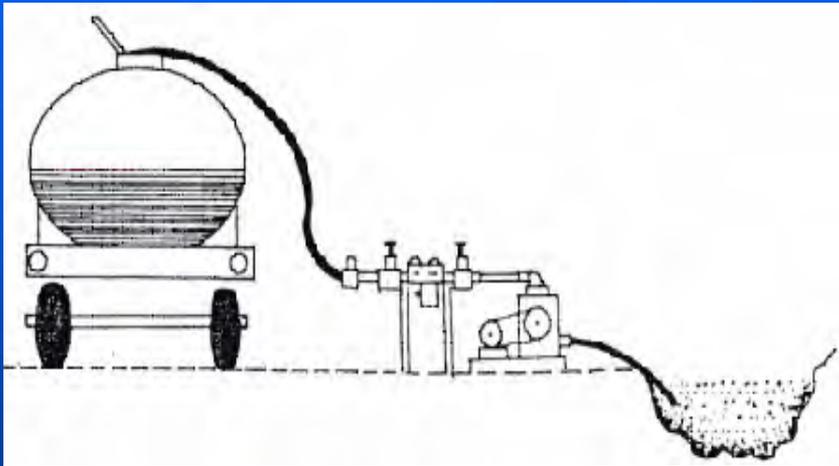
- **Consult provincial and municipal authorities to identify the locations of municipal surface and groundwater supplies.**
- **Always mix pesticides, and wash application equipment, away from water sources.**
- **Put container rinse water into the spray equipment as part of the make-up water.**

- **Consult provincial authorities for instruction on the disposal of unwanted, mixed product.**
- **Follow label directions and provincial buffer regulations when mixing or applying pesticides near water (see: Section 2 Legislation).**
- **Immediately clear up any spilled pesticide.**

- **Apply product only under suitable weather conditions (low wind).**
- **Wash application equipment and protective clothing where this activity will not contaminate water sources.**
- **Use pesticides that are selective or species specific.**

- **Maintain application equipment and check regularly for leaks in tanks, hoses, and nozzles.**
- **Ensure that application equipment is properly calibrated.**
- **Follow all label directions.**
- **Prevent back siphoning of water when filling application equipment.**

Prevent Back Siphoning



- Use a back-flow or one-way valve.
- Keep the end of the filler hose above the water level in the tank.
- Never leave equipment unattended.

Soil Contamination

Soil contamination as a result of a pesticide spill, poor container disposal, overflow of equipment, or exceeding label application rates can:

- **Damage plants.**
- **Harm soil organisms.**
- **Contaminate drinking and irrigation water.**

Protecting Soil Resources

Pesticides can contaminate soil when:

- The recommended product application rate is exceeded.
- Product is spilled during mixing and loading.
- Application equipment overflows.
- Pesticide containers or surplus spray mixtures are not disposed of properly.

Air Contamination

- Pesticides can enter the air through spray drift, vapour drift, or when contaminated soil erodes and is carried by wind.
- Airborne pesticide particles (droplets, mist, dust, or vapours) can move to water bodies, non-target organisms, or adjoining property and cause damage.

Air Contamination



Contamination of the air is of particular concern in adult biting fly control programs, since the product must be airborne to be effective.

Protecting Air Resources

To help prevent air contamination:

- Limit pesticide application to proper weather conditions, as outlined on the label or in provincial regulations.
- Reduce the travel speed of the application equipment.
- Use the lowest spray pressure possible to reduce generating mists and small droplets.

- **Reduce the travel speed of the application equipment.**
- **Ensure that the nozzle is at the proper height above the ground.**
- **Apply an adulticide only when pest population counts indicate there is a need.**

Non-target Organisms

- Aquatic organisms, birds, beneficial insects (e.g., dragonfly nymph) and fish are considered to be non-target organisms.
- The toxicity of a pesticide to non-target organisms is usually stated on the product label under 'Warning Statement' or on the MSDS.

Protecting Non-target Organisms

Impacts on non-target organisms can be reduced by reading the information under ‘Environmental Precautions’ found on the secondary panel of the label, and then following all label directions.

Examples of ‘Environmental Precaution’ Statements

- “This product is very toxic to fish and aquatic organisms”.
- “This product is very toxic to bees; avoid spraying when bees are foraging. Spray deposit should be dry before bees commence foraging in treated area.”

Beneficial Insects



**Dragonfly
Nymph**

- Only a few insects cause harm or damage and are considered to be pests.
- Many insects are beneficial.
- Some insects (e.g., dragonfly nymphs) function as a key part of IPM programs by controlling biting fly populations.

Beneficial Insects

- A decrease in beneficial insect numbers can lead to an increase in harmful pest populations.
- Protect beneficial insects by:
 - Minimizing product use,
 - Choosing selective, least-toxic pesticides,
 - Reducing the potential for drift.

Toxicity to Non-Target Plants

- **Phytotoxicity (injury to plants) can occur when poorly a applied pesticide contacts non-target plants.**
- **Damage can be minor (slight burning or browning of leaves) or severe (death of plant).**

Ways to Reduce Phytotoxicity

- Prevent or minimize drift.
- Follow label mixing directions for proper product application rate.
- Take care when using a fog sprayer near sensitive plants.

Products Used in Biting Fly Control

- **Bacteria.**
- **Insect Growth Regulators.**
- **Botanical and Synthetic Botanical.**
- **Chlorinated Hydrocarbons.**
- **Organophosphates and Carbamates.**

Environmental Concerns

Bacteria (*Bacillus thuringiensis israelensis*) (Bti)

- Bti are only active in alkaline conditions that exist in the gut of certain insects (e.g., mosquitoes, black flies, other fly species).
- Bti pose no hazard to mammals or fish.
- Bti is one of the most selective and environmentally benign products.

Insect Growth Regulators

Methoprene

- Is easily broken down in the body of vertebrates and has a low toxicity to mammals and birds.
- Only affects insects in their larval stage.
- Has a very short half-life and must be specially formulated (briquette) to increase residual activity.

Insect Growth Regulators

Methoprene

- **Can be toxic to shrimp, crabs, and fish if applied at higher than label rates.**

Botanicals and Synthetic Botanicals

Pyrethrum

- Has a short residual life
- Quickly breaks down outdoors in light and air.
- Has little toxicity to mammals.
- Is very toxic to fish.

Organophosphates and Carbamates

Chlorpyrifos (OP)

- May be active for weeks in larval habitat.
- Is toxic to fish and crustacea.
- Care must be taken when used in an aquatic habitat.

Propoxur (Carbamate)

- Is toxic to bees.

Preventing the Accidental Release of a Pesticide

- **Keep equipment (tanks, storage compartments, backpacks, hoses, etc.) locked or secure on the transport or application vehicle when not in use.**
- **Develop a contingency plan to deal with a pesticide spill.**
- **Equip each vehicle with a spill kit.**
- **Never leave behind empty containers, excess spray mix, or pesticide product at a client's property.**

General Comments

- **Everyone shares responsibility for protecting the natural environment. To make the best choices, you will need to understand the short- and long-term effects of pesticides on the environment.**
- **Biting fly control programs typically require the application of pesticides to water or into the air.**
- **Care must be taken at all times to reduce non-target exposure and to protect the environment.**

General Comments

- Pesticides used to control the larval stages of biting flies are applied to water, but these products tend to be quite specific and are often applied to small areas. This minimizes negative effects on non-target species.
- Adulticides are less specific and are applied in a manner where they can drift.
- If possible, control programs should stress the use of larvicides rather than adulticides.

**PEI Biting Fly Control
Pesticide Applicator Training
Course**

**Training Module 9
Application Technology**

Disclaimer

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Application Technology

Choosing proper pesticide application equipment and understanding how to use, and maintain it, safely is necessary for effective pest control AND protection of the environment.

Application Technology

When selecting pesticide application equipment, choose a type that will:

- **Apply the proper amount of pesticide to the target.**
- **Give the maximum pest control.**
- **Be best suited for the size of the treatment site.**

Learning Objectives

Completing this module will help you to:

- **Choose equipment best suited for the application of a larvicide or an adulticide for the control of mosquitoes and biting flies.**
- **Identify and interpret environmental factors before selecting application equipment.**
- **Make pesticide use calculations for different types of applicators.**

Application Equipment

- **Application equipment is the key component in transferring an active ingredient to the target.**
- **To be effective the equipment must be:**
 - **Appropriate for the job.**
 - **Set up and calibrated properly.**
 - **Used according to manufacturer specifications.**
 - **Maintained properly.**
 - **Designed to minimize applicator exposure.**

Application Equipment

There are many different types of equipment available for applying solid or liquid pesticides for biting fly control.

Applicators for applying a solid:

- Equipment delivers pesticide (e.g., capsules, briquettes, granules) directly into the water.

Applicators for applying a liquid:

- Pesticide is mixed in a tank and applied to the target through a nozzle(s) as a fog or spray droplets.

Capsules and Briquettes



- Placed directly into larval habitat (i.e., water).
- Gloves should be worn when handling these products.
- Application rate is stated on the label (e.g., Apply 1 briquette for every 10 m² of water surface area).

Calculating the Amount of Pesticide Needed (by Surface Area)

1. Measure the width and length of the pond at several locations and determine the average measurements.
2. Multiply the average length by the average width to find the area. (e.g., **7.8 m X 4.5 m = 35.1 m²**).
3. Refer to the label for the proper application rate. (e.g., **1 capsule per 10 m²**).
4. (**35.1 m² / 10 m²**) = 3 or 4 capsules.

Calculating the Amount of Pesticide Needed (by Volume of Water)

1. Measure the width, length, and depth of the pond at several locations to determine the average measurements.
2. Multiply these measurements to find the average volume. (e.g., $7.8 \text{ m} \times 4.5 \text{ m} \times 0.5 \text{ m} = 17.5 \text{ m}^3$).
3. Refer to the label for the proper application rate (e.g., $1 \text{ briquette per } 10 \text{ m}^3$).
4. Calculate the number of briquettes needed.
($17.5 \text{ m}^3 / 10 \text{ m}^3$) = 2 capsules.

Granular Formulations



- Granular pesticides can be applied by hand to small areas.
- Gloves should be worn when spreading product.
- Uniform application rates are hard to achieve.
- Granular pesticides can also be applied using manual or motorized spreaders.

Calculating the Amount of Pesticide Needed for Hand Application.

1. Calculate the surface area.
2. Multiply the length by the width to find the area. (e.g., $7.8 \text{ m} \times 4.5 \text{ m} = 35.1 \text{ m}^2$).
3. Refer to the proper label rate (e.g., 6 kg/ ha).
4. Convert the application rate to square metres.
(e.g., $6 \text{ kg/ha} = 0.6 \text{ g/m}^2$)
Apply ($35.1 \text{ m}^2 \times 0.6 \text{ g/m}^2$) = 21 g to the site.

Manual Spreaders

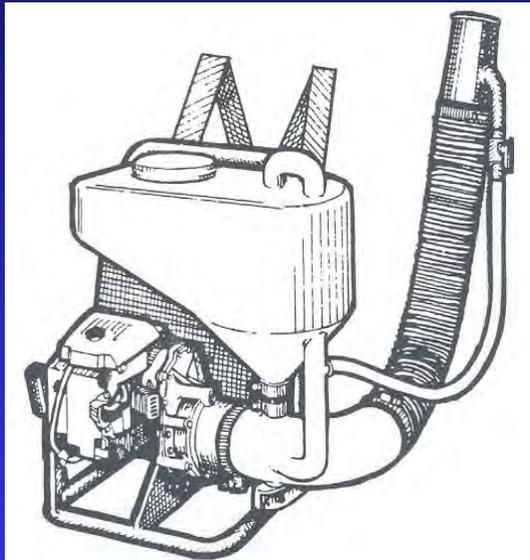


- Containers can hold several kilograms of granules.
- The operator walks at a uniform speed and rotates the handle.
- Vanes on a spinning plate spread granules in all directions.
- When using a manual spreader, wear long sleeved gloves and pants without cuffs.

Calibration of a Manual Spreader

1. Half fill the container with granular formulation.
2. Start walking at a uniform speed, and turn the handle at a constant rate to achieve a uniform swath width.
3. Measure the swath width (e.g., 5 m).
4. Determine the distance you need to walk to treat 1/10 of a ha. (e.g., $1,000/5 \text{ m} = 200 \text{ m}$).
5. Select the proper rate from the label (e.g., 5 kg/ha).
6. Adjust the flow lever to deliver 0.5 kg over 200 m.

Motorized Spreader



- Backpack sprayer uses an air blast system to spread granules.

Motorized Spreader

- Swath width is much wider than with manual spreaders.
- These are more expensive and heavier than manual spreaders.
- Care must be taken when walking near the edge of water courses.

Calibration of a Motorized Spreader.

- 1** Partially fill the hopper with granular formulation.
- 2** Set the throttle and walk at a uniform speed to get an even swath width.
- 3** Measure the swath width (e.g., 15 m).

Calibration of a Motorized Spreader.

- 4** Determine the distance that you need to walk to treat 1/10 of a ha. (e.g., $1,000/15 \text{ m} = 67 \text{ m}$).
- 5** Select the proper rate from the label (e.g., 5 kg/ha).
- 6** Adjust the throttle lever to deliver 0.5 kg in 67 m.

Liquid Sprayers

Examples of liquid pesticide application equipment.



Backpack Sprayer



Vehicle Mounted Mist Blower

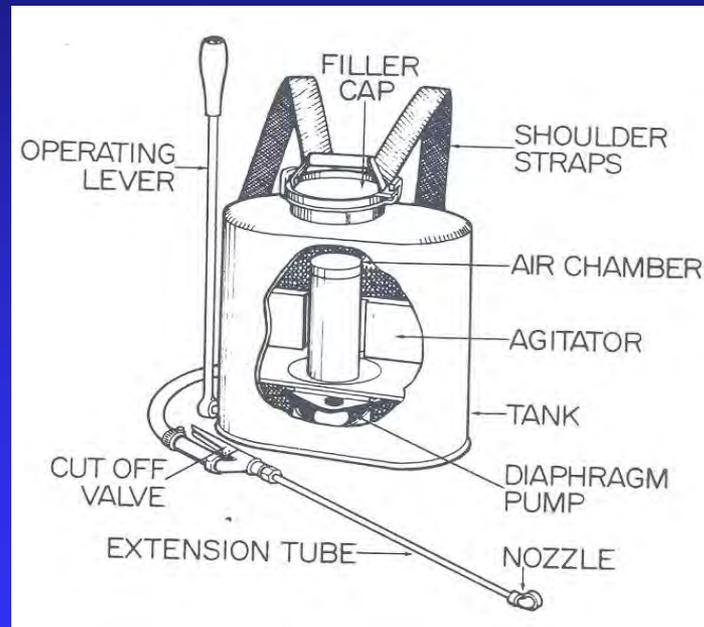
Equipment for Liquid Formulations



Hand Operated Sprayers

- Use compressed air to apply a pesticide through a hose and nozzle to a small area (a spot treatment).
- Risk of applicator exposure can be high.
- Output varies with nozzle size, pressure, and walking speed.
- These work best in water with few aquatic plants.

Basic Sprayer Components



Steps for Calibrating a Back Pack Sprayer (Test Area Method)

- 1. Mark out a test area (e.g., 10m X 10m or 100 m² or 0.1 hectare).**
- 2. Partially fill sprayer with water and record the water level in the tank (e.g., 3L).**
- 3. Pressurize the sprayer and begin to spray the test area, walking at your normal application speed.**
- 4. Spray the entire 0.1ha and note the new level of water in the tank (e.g.,1L).**

Steps for Calibrating a Back Pack Sprayer (Test Area Method)

5. Output of the sprayer is (3L - 1L = 2L applied to 0.1 ha)
6. Sprayer is now calibrated to deliver 20L/ha
0.1 ha required 2L
1 ha will require (2L X 10) = 20L.
5. Check how this compares with the recommended rate noted on the product label.

Steps for Calibrating a Back Pack Sprayer (Test Area Method)

- In our example the test run showed the back pack sprayer would spread or delivers 20L of formulated product over a Hectare.
- If label recommended an application rate of between 15 L/ha and 25L/ha, then the sprayer is correctly calibrated for this product.
- However if the calculations from the test showed it delivered 30L/ha, then it is outside the range, not calibrated correctly and changes must be made.

Steps for Calibrating a Back Pack Sprayer (Test Area Method)

Options:

- Increase pressure to force more product out of equipment. This might generate a lot of small particles and get spray drift.
- Walk faster to cover area quicker and use less product. Applicator might not be able to keep this pace for entire treatment area.
- Change nozzle for one with a smaller opening. **Best option.**

Calibration of Liquid Sprayers

- **Basic calibration steps involve:**
 - **Setting up the sprayer.**
 - **Measuring application rate (L/ha).**
 - **Correcting the application rate and volume if needed.**
- **Once calibrated then you can calculate the amount of formulated product to add to the spray tank.**

Calibration

- **Equipment should be calibrated :**
 - **When the equipment is new.**
 - **At the start of each season.**
 - **When travel speed or nozzle spacing is changed.**
 - **When sprayer output is changed.**
 - **When parts are changed (e.g., nozzles, hoses, pump).**

Calculations

How much area would this tank treat if it held 4L?

- 1. Previously calibrated that equipment delivers 2L to treat 0.1ha.**
- 2. Therefore a 4 L tank would treat**

$$\frac{4\text{L} \times 0.1\text{ha}}{2\text{L}} = 0.2 \text{ ha or } 2000 \text{ m}^2.$$

***(1ha = 10000m²)**

Calculations

How much product should be added to a full (4L) tank if the label rate is 50 ml/100m²?

- 1. Previous calculations show a full (4L) tank will treat 2000m².**
- 2. Label rate is 100m² requires 50ml.**
- 3. 2000m² will require $\frac{50\text{ml} \times 2000}{100} = 1000 \text{ ml}$**

Equipment for Liquid Formulations

Motorized / Mechanical Equipment

- Used to apply a liquid pesticide mixture to a large area.
- Pressure is achieved using a power-driven pump.
- Product is delivered through nozzle(s).

Examples include power hose, boom, and air blast sprayers.

Power Applicators



Hose and Reel



Hand Held Wand

Basic Sprayer Components

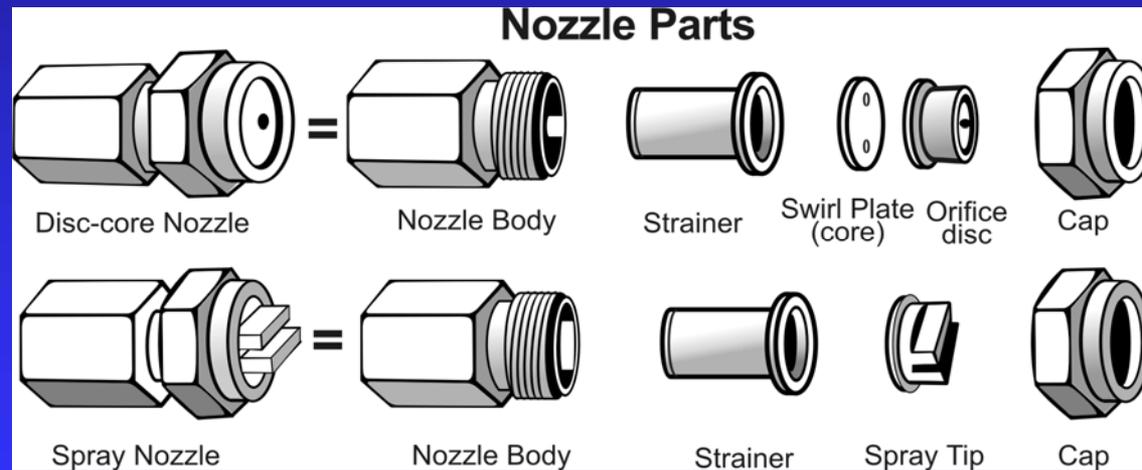
- **Nozzles are a key component of any liquid pesticide application system because they:**
 - **Metre the amount of pesticide delivered.**
 - **Break (atomize) liquid into droplets.**
 - **Spread droplets in a given pattern.**

Basic Sprayer Components

- **Each sprayer nozzle is designed to do a specific job with a particular type of pesticide formulation.**
- **Nozzle types vary by output capacity, spray pattern, and operating pressure.**

Basic Sprayer Components

Nozzles Parts



Worn Nozzle Tips

**As a nozzle tip wears, the opening changes.
This alters the application rate.**

Worn nozzles can:

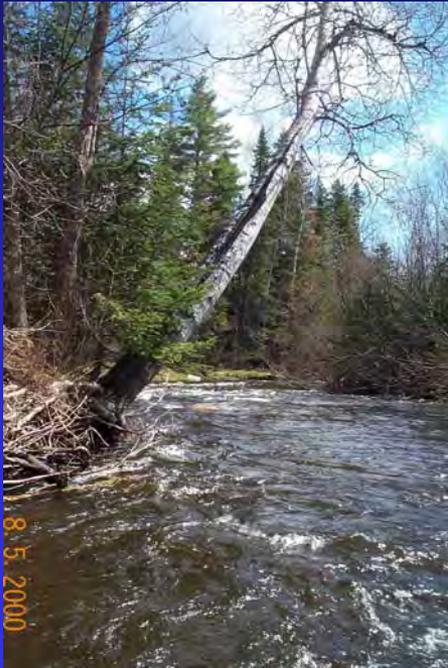
- **Produce a poor spray pattern.**
- **Waste pesticide and money.**
- **Result in poor pest control.**
- **Produce higher pesticide application rates.**

Nozzle Performance Characteristics

Droplet Size

- Is the size (measured in microns) of a particle of liquid that is formed as the spray mix is forced through the nozzle.
- Nozzles can form a range of droplet sizes, from very small to large.
- More droplets become fine (small) as the spray pressure increases.

Control of Black Fly Larvae



- Product is applied directly to flowing streams.
- Exact calculation of the amount of pesticide required is critical.
- Too little can result in poor control.
- Too much can impact aquatic life.

Control of Black Fly Larvae

The amount of larvacide required will depend on the flow rate of the stream. To calculate flow rate:

- **Measure the average stream depth.**
- **Measure the average stream width.**
- **Measure the average velocity using a flow meter or by timing the movement of a floating object.**
- **Calculate stream flow (see next slide).**

Calculating Stream Flow

Example

- Average depth = 0.5 m.
- Average width = 2.5 m.
- Average stream velocity = 0.94 m/second.

Calculated Stream Flow

$$\begin{aligned} &\text{depth} \times \text{width} \times \text{velocity} = \\ &(0.5 \text{ m}) \times (2.5 \text{ m}) \times (0.94 \text{ m}) = 1.18 \text{ m}^3/\text{sec} \end{aligned}$$

Amount of Product Needed

Example

- Stream flow = $1.18 \text{ m}^3/\text{sec}$.
- Label application rate = $100 \text{ ml}/\text{m}^3/\text{sec}$.

To calculate the amount of product needed:

stream flow X label rate

$$1.18 \text{ m}^3/\text{sec} \quad \text{X} \quad 100 \text{ ml}/\text{m}^3/\text{sec} = 118 \text{ ml of product.}$$

Product Application

- **The 118 ml of product should be diluted in enough water for an application period of 15–30 minutes.**
- **The mixed product should be uniformly applied across the entire stream to ensure good mixing and coverage.**

Example Label Information

‘Better mixing with the water in the stream will be obtained if the MOSE 30EC insecticide is introduced at a turbulent spot in the stream, or from more than one container if the stream is fairly large.’

‘MOSE 30EC insecticide should be mixed with water and the mixture dispersed into the stream from a container with an adjustable valve set to empty within the required 30 minute period.’

Adult Biting Fly Control

Residual Sprays

- **Adulticides are applied to adult resting sites (e.g., foliage and structures) during the day.**
- **Applications are made using backpack compressed air sprayers or power sprayers.**
- **A residual effect extends the control period.**
- **Most product labels list the application rate as a percentage (0.5 to 1.0% active ingredient).**

Example Label Information

‘Spray infested areas thoroughly, including outside surfaces of screens, doors window frames, foundations, patios and other areas where insects may enter.’

‘Apply with a low-pressure sprayer equipped with a coarse spray nozzle. Spray surfaces only until wet. Avoid excessive run-off.’

Calculation for Residual Sprays

- Equation for calculating the amount of product (X) to add to the tank.

$$X = \frac{(S) (A)}{C}$$

X = Amount of concentrate. S = % A.I. in the spray.

A = Amount to be prepared. C = % A.I. in product.

Example Calculation

Calculate the amount of concentrate required to make 40 L of a 1.25% A.I. solution. Label Guarantee = 25% A.I.

$$X = \frac{(S) (A)}{C} = \frac{(1.25) (40)}{25} = 2 \text{ L}$$

X = Amount of concentrate. **S** = % A.I. in the spray.

A = Amount to be prepared. **C** = % A.I. in product.

Thermal Fogging

- **The insecticide is mixed with diesel oil or fuel oil.**
- **Mixture is heated in a hot manifold and applied as a fog of fine droplets.**
- **Fogger must be warmed up before opening the diesel/insecticide flow line.**
- **Calibrate fogger according to manufacturer's specifications.**

Thermal Fogging Equipment



Hand held models



Vehicle mounted

Ultra Low Volume (ULV) Applicators

- Equipment dispenses pesticide at a low volume.
- Pesticide is broken into very fine droplets (less than 20 microns).
- Most formulations come ready-to-use and require no dilution.
- Application equipment must be calibrated to deliver the correct droplet size.

ULV Application Applicators

Also referred to as ULV Cold Foggers



Hand held



Backpack

Preventative Maintenance

Should be done on a regular basis throughout the year. To keep application equipment working well:

- **Overhaul the pump annually.**
- **Check all tires for proper inflation. Air pressure will affect the size of the tires, alter the application rate, and cause uneven pesticide application.**

Cleaning Equipment

- **Cleaning removes any accumulated pesticide residue in the tank (or hopper), hoses, and nozzles.**
- **Leftover residue can mix with new product, alter the effect of the second pesticide, and damage turf or ornamentals.**
- **Clean equipment before:**
 - **Using it for the first time.**
 - **Using a different pesticide.**
 - **Storing it during the off-season.**

Steps for Cleaning Liquid Application Equipment

- **Put on personal protective equipment (PPE).**
- **Wash the outside of the tank with soap (or mild detergent) and water.**
- **Remove nozzle tips and screens, and clean them using a strong detergent and water. Use a soft brush.**

Steps for Cleaning Liquid Application Equipment

- Partly fill the spray tank with clean water.
- Flush this water through the boom or nozzle for at least ten minutes before draining. Boom sections should be flushed one at a time.
- Repeat the rinse cycle if residue can still be seen.
- Fill the tank nearly full with clean water.

Steps for Cleaning Liquid Application Equipment

- Add a cleaning agent and then agitate and circulate this mix through the system for at least 15 minutes.
- Spray out and drain completely.
- Repeat the wash cycle.
- Rinse twice with clean water and drain.
- Wash PPE and hands.

Steps for Cleaning Granular Application Equipment

- Equipment should be cleaned after each use.
- Put on personal protective equipment (PPE).
- Remove all pesticide from the device.
- Clean the inside of the hopper.
- Clean and oil the flow-control slides or valves.
(Wipe off excess oil.)
- Wash PPE and hands.

Protecting Human Health and the Environment

Follow these guidelines to minimize hazard to human health and the environment when cleaning pesticide application equipment:

- **Never use a piece of wire, nail, or metal object to clean nozzle tips. These can damage the opening, distort the spray pattern, and increase nozzle output.**

- **Use a toothbrush or soft material to clean nozzle tips.**
- **Wear protective clothing and equipment (PPE) when cleaning sprayers and measuring containers.**
- **Wash hands and PPE after handling application equipment.**

- **Never blow out nozzle tips using your mouth.**
- **Follow label directions or contact your regulatory authority for direction for the disposal of un-used product.**
- **Clean up spilled granules to prevent soil contamination and intake by birds and wildlife.**

- **Clean application equipment away from waterways, ditches, wells, or other water sources.**
- **Comply with provincial regulations for distances of equipment from bodies of water.**
- **Clean up puddles of rinse or wash water. These can be hazardous to children, pets, or wildlife.**

PEI Biting Fly Control Pesticide Applicator Training Course

Training Module 10 Professionalism

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Learning Objectives

Completing this module will help you to:

- **Develop a more professional image for dealing with the public.**
- **Understand the importance of good public relations.**

Professionalism

- **As an applicator of insecticides for biting fly control, you should understand that chemical pesticides are an important tool in the Integrated Pest Management ‘toolbox’.**
- **You need to recognize that because these pesticides may be applied to water, potential risk to the aquatic environment must be considered.**

Professionalism

- You also need to recognize that some of these pesticides may be applied in densely populated, urban areas, so exposure and risk to human health can be high.

As a professional, you must work with skill and integrity. Key factors that display professionalism include:

- **Knowledge of your job.**
- **Attitude, image, and work habits (how you conduct yourself on the job).**
- **Communication with clients, staff, and the public about your work.**

Knowledge

As a pesticide applicator, you must be familiar with:

- **Federal, provincial, and municipal laws that govern pesticide use in your province and community.**
- **Interactions between the pest, the host, and the environment.**

As a pesticide applicator, you must be familiar with:

- **Applicator training programs and provincial certification and licensing requirements for transporting, storing, handling, mixing, applying, and disposing of a pesticide.**

Knowledge

As a pesticide applicator, you must understand:

- **How to select, use, and take care of pesticide application and personal protective equipment.**
- **Public concerns regarding pesticide use, human health, and the environment.**
- **How to respond quickly and properly to a pesticide-related emergency, spill, or fire.**

Knowledge

As a pesticide applicator, you must understand:

- **How to obtain needed information on pesticide use (e.g., resource experts, publications, and trade organizations).**
- **Current information on pest control options. (This includes Integrated Pest Management.)**
- **The benefits and risks associated with various pest control methods.**

Knowledge

Pesticides and their legal use change over time.

- **It is important to keep up-to-date on changing pesticide laws, pest control products, application techniques and equipment, and public concerns.**
- **Keep current by attending seminars; talking to pesticide/equipment sales representatives; taking courses; and reading journals, papers, and other relevant publications.**

Attitude and Work Habits

A professional attitude will help you to:

- **Protect yourself and the environment when working with pesticides.**
- **Reduce pesticide use by practicing IPM.**
- **Respect public concerns regarding pesticide use.**

Attitude and Work Habits

A professional attitude will help you to:

- **Respond quickly and properly to pesticide spills, other emergencies, and public inquiries.**
- **Make 'educated' and sound recommendations.**

Attitude and Work Habits

Practice professional work habits.

- Apply pesticides according to label directions.
- Notify people of a planned pesticide application (e.g., nearby residents, neighbours with known health issues, etc.).
- Avoid a pesticide application that might affect bystanders.

Attitude and Work Habits

- Practice integrated pest management (IPM).
- Apply a pesticide only when the weather allows.
- Keep detailed pesticide application records.
- Practice safety at all times.
- Keep an up-to-date inventory of stored pesticides.
- Notify your local fire department of the location of any pesticide storage site.

Attitude and Work Habits

- **Keep pesticide application equipment clean and in good working order.**
- **Use and maintain application equipment and vehicles in a safe and proper manner.**
- **Develop an emergency response plan to quickly and effectively respond to a pesticide spill or fire.**
- **Do follow-up inspections of all treatments.**
- **Immediately clean up any spilled pesticide.**

Communication

Communication is key to a well-informed public.

- **Good communication can prevent misunderstandings and loss of public support.**
- **It is important for pesticide applicators to educate members of the public on IPM and their role in biting fly control.**

Communication

To communicate effectively:

- Be honest, polite, and cooperative.
- Provide timely and accurate information.
- Respect public health and environmental concerns.
- Listen to public concerns and respect the viewpoints of others.

Communication

- **Take part in industry-led communication efforts (e.g., mail-outs, forums, presentations).**
- **Provide solid facts and avoid less-than-honest statements.**
- **Develop client information brochures that are based on fact and science.**
- **Educate your clients regarding their role in an IPM biting fly control program.**

Legal Requirements

- **There are legal requirements for buying, handling, and applying many pesticides.**
- **Federal, provincial, and municipal laws are designed to protect public health and the environment from pesticide misuse.**
- **These same laws can also work to protect an applicator.**
- **As a professional, you should be familiar with provincial legislation and municipal by-laws.**

Reducing Bystander Exposure

Applying a pesticide in a residential area increases the risk of exposure to the public. To reduce exposure:

- **Notify nearby property owners.**
- **Post the area at all access points.**
- **Apply a pesticide when traffic flow is reduced.**
- **Restrict access when treating public areas.**

Complaints

Public complaints and concerns regarding the use of pesticides are common. To reduce these complaints comply with provincial regulations by:

- **Notifying owners/residents of nearby properties before using a pesticide.**
- **Complying with label directions and provincial regulations (e.g., wind speeds, posting, etc.,).**

Complaints

When you become aware of a complaint it is in your best interest to:

- **Respond quickly and properly.**
- **Visit the affected area with the person who made the complaint and openly discuss their concerns.**

Complaints

Remember that you may be legally and financially liable for property (e.g., gardens, ornamentals, belongings) damaged as a result of an improper application of a pesticide.

PEI Biting Fly Pesticide Applicator Training Course

Training Module 11, Part 1 Emergency Response

Disclaimer

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Learning Objectives

There is risk of exposure any time a person comes into contact with a pesticide. Anyone who handles or might be exposed to a pesticide must be prepared to respond to an accidental poisoning, burn, spill, or fire.

- **Completing this module will help you to:**
- **Assess the hazards of a pesticide spill or fire, and apply emergency measures.**
- **Secure pesticides and minimize theft.**

Emergencies Involving Pesticides

You can plan for pesticide emergencies by:

- Knowing all the areas of risk.
- Knowing how to respond to different incidents.
- Taking the necessary steps to reduce risk.
- Having the right information on hand.
- Contacting the proper authorities.

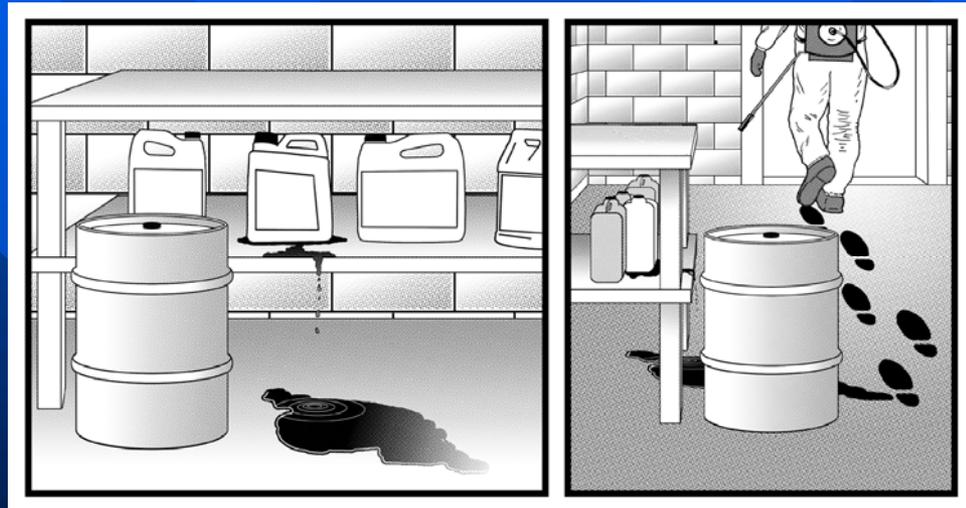
Pesticide Spill Emergencies

- A pesticide spill can occur when a product is being transported, stored, or handled at the application site.
- A pesticide spill can poison people, animals, and plants.
- If not properly cleaned up and decontaminated, a pesticide spill can contaminate soil, water, and vehicles.

Pesticide Spill Emergencies

Three steps are involved when addressing a pesticide spill:

- Prevention
- Preparation
- Response



Preventing Spills

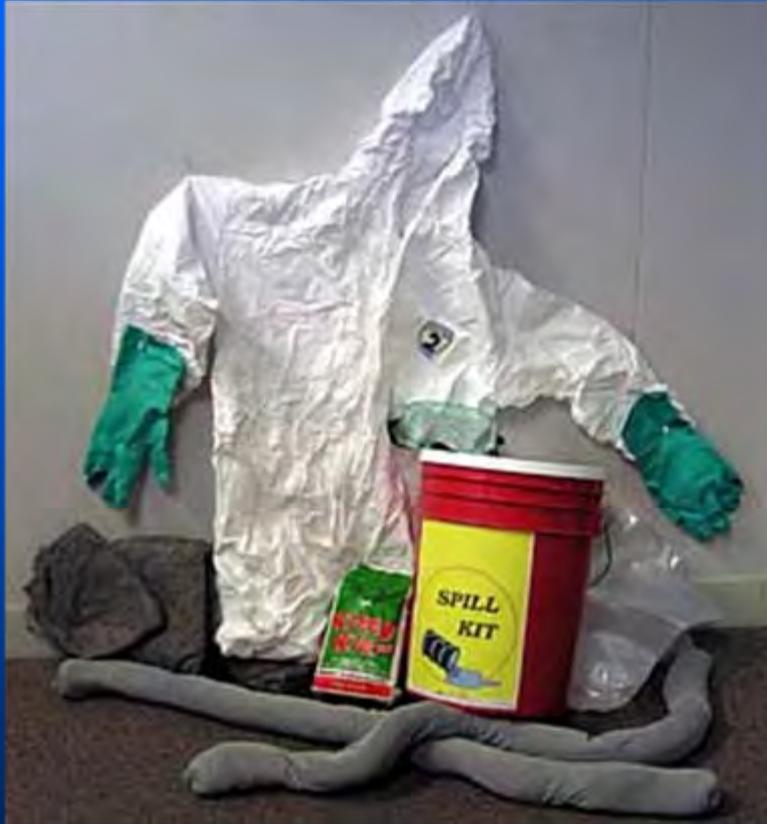
You can reduce the chance of a pesticide spill, and the resulting risk, by following these guidelines:

- Regularly check pesticide containers for leaks, holes, and other signs of stress.
- Store pesticides in a proper storage facility.
- Keep pesticide containers on pallets and off the ground. Do not over stack containers.

Preventing Spills

- Take extra care when mixing, handling, or moving pesticide containers or loaded application equipment.
- Regularly inspect and maintain application equipment, and never leave it unattended when filling.
- Make sure that workers are trained to handle pesticides properly.

Preparing for Accidental Spill Emergencies



To prepare for a pesticide spill emergency:

- Keep personal protective equipment (PPE) on hand.

- **Keep a spill kit on hand, including:**
 - **Absorbent material**
 - **A sealable container to hold contaminated waste.**
 - **A shovel to contain and pick up contaminated material.**

Preparing for Accidental Spill Emergencies

- **Keep copies of the MSDS's and the following emergency phone numbers handy:**
 - **Local Dept. of Environment.**
 - **Fire, police, and ambulance service.**
 - **Poison control centre.**
 - **Canutec (613 996 6666)**
- **Know what to do if a spill occurs.**

Responding to a Spill

If a pesticide spill occurs, you must respond quickly and properly. To put your **Emergency Response Plan** into action:

- **Assess the hazards.**
- **Take steps to protect yourself and others from exposure to spilled pesticide.**
- **Put on proper personal protective equipment.**
- **Remove any victims. Call 911 if required.**

Responding to a Spill

- If the spill is in a storage area, ventilate.
- Keep people and animals away from the spill area.
- Follow personal safety practices (e.g., do not smoke, eat, or drink during cleanup activity).
- Check the pesticide label and MSDS for instruction on containing the spill.
- Cover a liquid spill with absorbent material (vermiculite or pet litter).

Responding to a Spill

- Clean up the spill quickly, but use care.
- **Never try to wash away a spill using water.**
- If cleanup guidelines are not given on the label, sweep or shovel contaminated absorbent material into a container lined with a heavy-duty plastic bag.
- Seal the container and label with information on the spilled pesticide (trade name, PCP Act number, date of spill).

Responding to a Spill

- Locate the manufacturer's emergency phone number and call for more information (your local pesticide vendor may be able to help with this).
- Follow product disposal guidelines. These may be given on the product label or MSDS.
- If a pesticide spill occurs, you must contact the:

PEI Environmental Emergencies

24-hour toll-free number 1-800-565-1633

Pesticide Spill

- Any amount of spilled pesticide can pose a hazard.
- A spill of **less than** 20L or 20Kg of concentrated product or less than 200L of pesticide mix is considered to **be a small spill**.
- An amount larger than this is considered to be a **large spill**.
- Large spills are more likely to impact people or pets, or to contaminate property or the environment.

Steps for Cleaning up a Pesticide Spill

- Put on proper PPE.
- Contain or reduce further spillage. If possible, pump large spills into drums.
- Cover a liquid spill with absorbent material.
- Shovel contaminated soil and absorbent material into a lined container.

Steps for Cleaning up a Pesticide Spill

- Seal and label the container (product name, *PCP Act* number, amount of product, and date).
- Contact provincial regulatory authorities for proper disposal procedures.
- Decontaminate area according to the label or MSDS.

Never flush the area with large amounts of water.

Decontaminating the Spill Area

Pesticide residue left after cleanup can remain active. This residue can further contaminate soil, water, or hard surfaces.

To decontaminate soil:

- Refer to the product MSDS and label. These may provide information for dealing with minor pesticide spills during mixing, loading, transporting, or application.
- Contact the pesticide manufacturer or the PEI Department of Environment, Energy and Forestry for information on decontaminating soil.

Decontaminating the Spill Area

To decontaminate hard surfaces:

- Use a small amount of wash water. Use only enough to extract the pesticide. Do not dilute it.
- Contain the wash water to the contaminated area.
- Work the wash water and degradation agent into the spill area with a coarse brush or broom. Only use bleach when called for on the label.

Decontaminating the Spill Area

To decontaminate hard surfaces:

- Absorb excess liquid with more absorbent material (e.g., pet litter or vermiculite).
- Sweep the used absorbent material into a waste container.

Decontaminating the Spill Area

- Seal the waste container, label it (date, *PCP Act* number, and trade name of the spilled pesticide), and store until you are able to properly dispose of it.
- If you are unsure of how to dispose of the contaminated material, contact the PEI Department of Environment, Energy and Forestry.

After Cleaning up Spill



Prepare warm soapy water.



Remove and wash PPE



Remove gloves last.

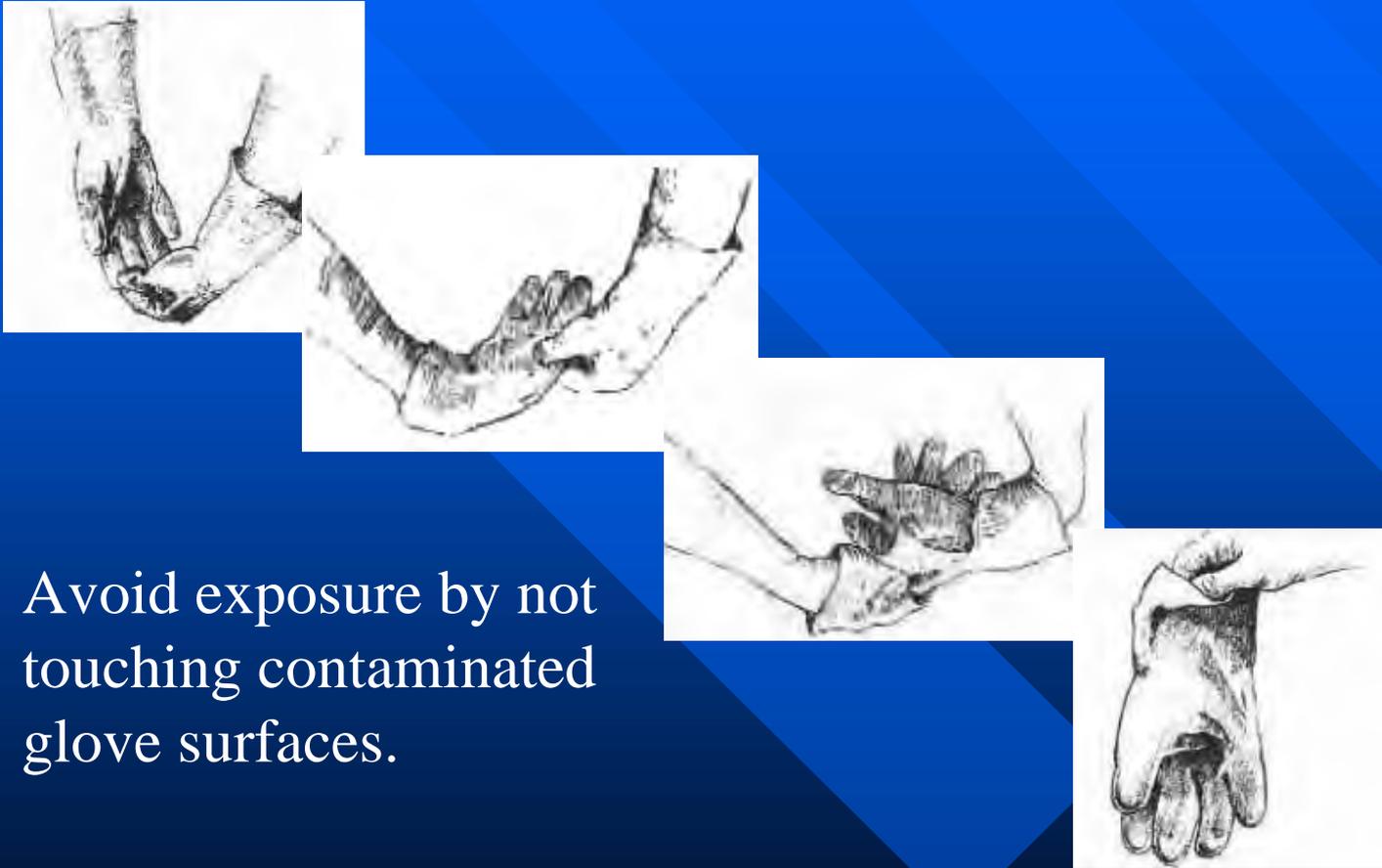
Decontamination of Cleanup Equipment and PPE

- Equipment and PPE used to clean up a pesticide spill must be decontaminated after use.
- Before removing PPE, wash any equipment used in the cleanup (e.g., broom, shovel) with soap and water.

Decontamination of Cleanup Equipment and PPE

- Remove and wash goggles, respirator, boots, and coveralls using soap and water.
- Wash gloves before taking them off.
- Remove gloves last and wash hands and face.

Proper Glove Removal



Avoid exposure by not touching contaminated glove surfaces.

Personal Hygiene

There is always a chance of exposure, even when wearing PPE.

- Shower and change immediately if clothing becomes heavily contaminated. Do not wait to finish the cleanup activity.
- Wash hands and face with warm soapy water before eating, smoking, drinking, or changing into street clothes.
- Take a full shower as soon as possible.

Personal Hygiene

- **If any person involved in the spill or cleanup activity begins to feel sick (e.g., nausea, headache, etc.), take him/her to the nearest hospital at once. Take along:**
 - **A clean pesticide label (if possible).**
 - **The PCP Act number.**
 - **All medical treatment information on the label or MSDS.**

Pesticide Fire Emergencies

Fires involving pesticides can pose a special danger because:

- Many pesticides are flammable; a few are even explosive.



Flammable

TDG Safety Marks



Explosive

Pesticide Fire Emergencies

- Some pesticides produce highly toxic fumes when burned.
- Fumes from a pesticide fire can poison people (e.g., firefighters), animals, or plants.
- Runoff water from fighting the fire, which can contain pesticide residue, has the potential to contaminate soil, wells, and other water sources.

Pesticide Fire Emergencies

Three steps are involved when addressing a pesticide fire:

- Prevention
- Preparation
- Response



Preventing Fires

You can help to avoid a fire by following these guidelines:

- Do not use an open flame (welding, burning, cutting) in a pesticide storage facility.
- Follow national and local fire, building, and electrical codes when locating and constructing a storage facility.
- Prevent unauthorized access to a storage facility by securing doors and windows.
- Do not smoke in, or around, a storage facility.

Preparing for a Fire Emergency

Prepare an Emergency Response Plan for dealing with fires. The plan should include the following fire control guidelines:

- Keep a list and the Material Safety Data Sheet of all stored pesticides.
- Keep these references within easy access, but away from the storage facility.

Preparing for a Fire Emergency

- Encourage the fire department to visit the site before a fire occurs, or provide them with the list and the exact location of all stored pesticides (site plan).

Preparing for Fire Emergencies

- Post “danger” or “warning” signs at all points of access to a pesticide storage facility.
- Keep emergency telephone numbers nearby.
- Keep a fire extinguisher, approved for fighting chemical fires, near the storage area.
- Have a step-by-step plan to respond to fire. This should tell how to respond, who is to perform each task, and how to contain any runoff water.

Responding to Fire

An Emergency Response Plan should be put to work as soon as an incident occurs. You should:

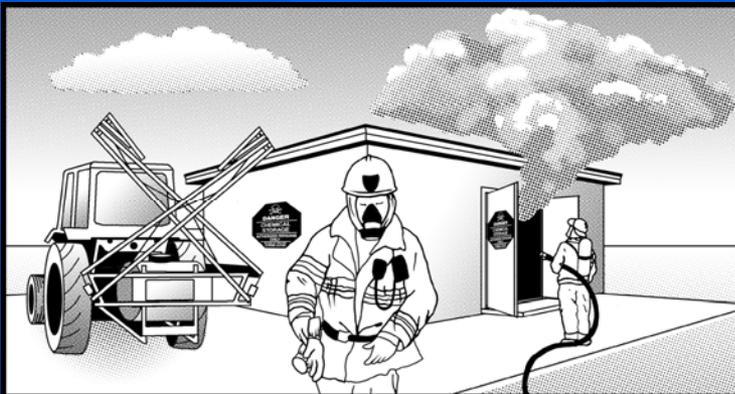
- **Get away from the fire.**
- **Dial 911 at once to notify the fire department.**
- **Confirm that all workers and family members are safe.**

Responding to Fire

An Emergency Response Plan should be put to work as soon as an incident occurs. You should:

- **Keep people and animals upwind and away from the fire. This will help to protect them from toxic fumes, runoff, and explosions.**

Responding to Fire



- Make sure that firefighters know that the structure on fire contains pesticides or application equipment.
- Give firefighters a list of all pesticides in the facility.

Responding to Fire

- If required, make dams or dikes to contain runoff water and to prevent it from getting into waterways, wells, and other environmentally sensitive areas.

- Report all fires involving pesticides to the:

PEI Environmental Emergency

24-hour toll-free number

1-800-565-1633

Pesticide Theft

In the case of pesticide theft, the owner of the stolen product can be held liable for any related accident involving the pesticide. To help prevent pesticide theft:

- Lock the storage facility and use a security system.
- Ensure adequate outdoor lighting.

Pesticide Theft

- **Limit access to the pesticide storage facility at all times.**
- **Secure pesticides when transporting them.**
- **Never leave application equipment unattended.**
- **Stolen pesticides can be tracked using the supplier's batch or lot numbers.**

Pesticide Theft

- If a theft of pesticide occurs, contact the police, PEI Department of Environment, Energy and Forestry, your insurance company, and your pesticide supplier at once.

PEI Biting Fly Pesticide Applicator Training Course

Training Module 11, Part 2 Emergency Response

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Learning Objectives

There is a risk of exposure any time a person comes into contact with a pesticide. Anyone who handles, or might be exposed to, a pesticide must be prepared to respond to an accidental poisoning, burn, spill, or fire.

Learning Objectives

Completing this module will help you to:

- **Prepare and use an emergency response plan.**
- **Assess pesticide emergencies and apply first aid.**
- **Respond to the variety of emergencies that can occur.**

Emergency Response Plan

An incident can occur quickly and without warning. An **Emergency Response Plan** can reduce the impact of a pesticide emergency on human health and the environment. A good plan should identify the steps needed to deal with:

- **Fire.**
- **Incidents causing personal injury.**
- **Spills or incidents during transport.**
- **Vapour and/or odour release.**

Emergency Response Plan

An Emergency Response Plan will include a:

- List of contacts and emergency response numbers.
- List of emergency assistance resources.
- Site map for the office and storage area.
- Accurate pesticide inventory.
- Step-by-step outline of emergency procedures.
- Record of emergency equipment and supplies.

Telephone List

List the name and 24-hour telephone numbers for:

- Fire, police, and medical assistance (911).
- Owner, managers, and key staff (home and office).
- The provincial 24-hour environmental emergency line (1-800-565-1633).

Telephone List

List the name and 24-hour telephone numbers for:

- All provincial authorities who must be called in case of an emergency.
- Neighbours.
- Your insurance agency.

Update and review your plan annually.

Emergency Telephone List

- An emergency contact list should be posted near any telephone located in a pesticide handling, mixing, or storage area.

EMERGENCY PHONE NUMBERS

Doctor _____

Fire _____

Police _____

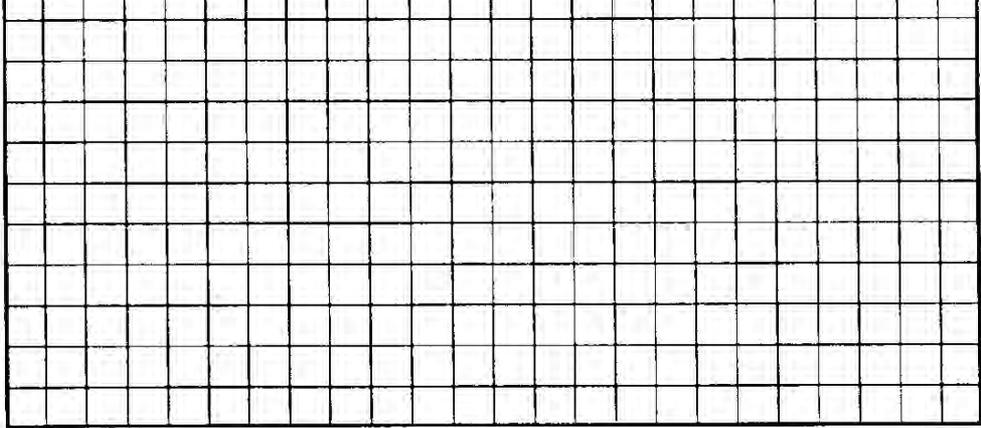
Ambulance _____

Poison Control Centre _____

Environmental Emergencies _____

Site Map

Prepare a map locating the pesticide storage structure and all surrounding features.



LEGEND

Drainage Ditch	(DD)	Irrigation Canal	(IC)
Yard Ditch	(YD)	Stream	(S)
Street Drain	(SD)	River	(R)
Drain Lines or Culverts		Lake	(L)
(underground)	—————	Well	(W)
Area Drainage	—————▶		

Emergency Response Plan

An Emergency Response Plan will only work if equipment and supplies are on hand, and staff are ready to respond.

- **Review the plan annually to ensure all workers are familiar with the location of, and information contained in, the plan.**
- **Copies of the plan should be stored in different places, including the cab of each vehicle.**
- **Update the plan annually.**

First Aid

First Aid:

- Is the means to help stabilize a sick or injured person until medical help arrives.
- Can prevent further injury and save lives.
- Cannot take the place of medical help.
- Should be learned by all staff.

First Aid Procedures for Pesticide Exposure

- Those who work with pesticides should be prepared to deal with chemical-related emergencies.
- Staff should be trained to administer general first aid procedures for pesticide poisoning, respiratory exposure, exposure to the eye and skin, and pesticide ingestion.

Pesticide Labels and Information on First Aid

- Principal source of first aid information is the pesticide label.
- Read the first aid section of the label before handling any pesticide.
- If someone is working with you, review first aid information with him or her.

First Aid Kit

- **Your emergency supply inventory should include a well-stocked and maintained first aid kit.**
- **A list of materials for a first aid kit is provided in Chapter 9, page 192 of the Core Manual.**
- **Keep a first aid kit in the pesticide storage facility, office, and close to any area where pesticides are handled (ideally, in each vehicle).**
- **Check provincial regulations for details regarding the type and contents of kit required.**

Pesticide Poisoning Response

People who work with pesticides should know the (mild, moderate, or severe) symptoms of a pesticide poisoning. They should also know proper first aid techniques.

- **Assess the danger**
- **Do not enter a dangerous situation.**
- **Protect yourself from injury before giving treatment to another person.**

Pesticide Poisoning Response

- Put on protective clothing and equipment.
- Remove the victim from the contaminated area.
(Move only if a spinal cord injury is not suspected.)
- Call, or have a bystander call, an ambulance and/or the Poison Control Centre.
- Check the victim's breathing and pulse. If he/she is not breathing, give artificial respiration. (Wear a mask with a one-way valve.)

Pesticide Poisoning Response

- **Remove any contaminated clothing.**
- **Wash any skin exposed to the pesticide with soap and plenty of warm water.**
- **Keep the patient quiet, warm, and comfortable and reassure them to minimize shock.**

Pesticide Poisoning Response

- If possible, supply emergency and medical responders with:
 - Information on the pesticide involved (e.g., *PCP Act* number, trade name, concentration).
 - Duration, route, and amount of exposure.
 - Relevant medical history of the victim.

First Aid and Routes of Exposure

First aid to be undertaken will depend on the pesticide's route of entry. A pesticide can enter the body:

- By breathing it into the lungs (respiratory).
- Through the eyes (ocular exposure).
- Through the skin (dermal exposure).
- By swallowing it (ingestion).

Refer to Chapter 9, pages 193–195), of the *Core Manual* for first aid procedures for addressing each of these routes of exposure.

Treatment for Respiratory Exposure

Vapours and fine droplets can be breathed into the lungs and cause respiratory exposure. When this happens to another person, act quickly and:

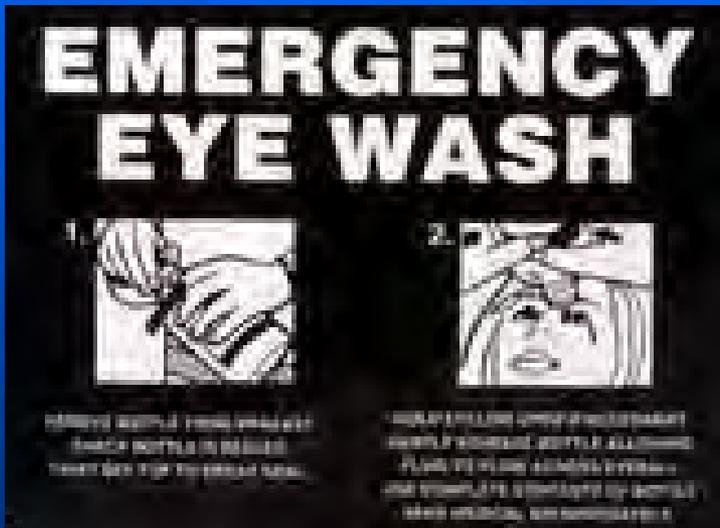
- Call for medical assistance.
- Reduce your risk by putting on proper PPE.
- Move the patient to fresh air.
- If needed, apply first aid and treat for shock.
- Attend to the patient until assistance arrives.

Exposure to the Eye

- Pesticides can splash into the eye during loading or overhead application.
- Product is then quickly adsorbed into the blood stream, causing poisoning.
- Some products are also very corrosive and can cause long-term damage to the eye.
- The label information will provide a warning.

Treatment

If a pesticide enters the eye:



- Hold the eyelid open and rinse with plenty of water for at least 15 minutes.
- Follow the first aid instruction on the label.
- Call for medical assistance or take the patient to the hospital.

Exposure to the Skin

The skin, in particular the hands, is the most likely site for pesticide exposure. Exposure to the skin can occur from:

- **Touching contaminated containers or application equipment.**
- **Splashing product on the face when mixing or loading.**
- **Rubbing against treated vegetation.**

Treatment for Dermal Exposure

Steps for treatment:

- Remove the patient's contaminated clothing.
- Drench the contaminated area with cold water.
- Call for medical assistance if there is extensive exposure, the product is corrosive, or the patient becomes unconscious.
- Wash the patient's skin and hair with soap and water. Clean under the fingernails if this area is contaminated.
- Give first aid until medical help arrives.

Treatment for Chemical Burns

Some products are very corrosive and can burn the skin on contact. Should this happen:

- Call for medical assistance.
- Remove contaminated clothing and drench the affected area with plenty of cold water.
- **Do not apply anything to the burned area.**
- Give first aid, as required.

Treatment for Ingestion

Accidental ingestion most often occurs as a result of someone placing a pesticide in a container other than the original (e.g., pop can, coffee cup). When this happens:

- Act quickly and call for medical assistance.
- Read and follow label directions for poisoning.
- First aid directions will state whether to induce vomiting or not induce vomiting.
- Provide first aid until medical help arrives.
- **Never give anything by mouth to an unconscious patient.**

Inducing Vomiting

Only induce vomiting if:

- **The patient is conscious.**
- **The label clearly states “induce vomiting”.**
- **You are instructed to do so by the Poison Control Center or medical personnel.**

Follow up to an Exposure

- Anyone poisoned (dermal, inhalation, ocular, or ingestion) by a pesticide should have a full medical assessment.
- Family members should be advised to watch the victim for recurring symptoms of poisoning. Ensure that they are aware of the acute toxic symptoms as noted on the label.
- **REMEMBER: First aid is never a substitute for professional medical treatment.**