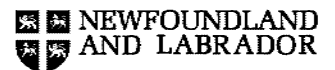


Nova Scotia Commercial Pesticide Vendor Training Manual

This manual, as developed for the P.E.I. Department of Agriculture and Forestry, represents a cooperative project under the Atlantic Working Group for Pest Management Education and Training Standards



Notice

This manual is provided for information only. Users of this manual rely on the contents of this manual at their own risk. This manual is not intended to be a representation of the current law on the subject of pesticide use. Users of this manual should always check with the appropriate authorities in their area to ensure Users are conducting their activities in a proper manner and in accordance with the laws of their jurisdiction. The Government of Nova Scotia, as represented by the Department of Environment and Labour, is in no way responsible for the activities of Users of this manual.

Copyright© 2001, Department of Agriculture and Forestry, Government of Prince Edward Island. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, without prior written consent of the Department.

The use of any pest control product is not endorsed, recommended, or criticized by its being mentioned in this publication.

This manual is available from: Nova Scotia Environment and Labour
5151 Terminal Road
PO Box 697
Halifax, NS B3J 2T8
(902) 424-5300

ISBN 1-894492-01-3

Acknowledgments

This manual prepared for the P.E.I. Department of Agriculture and Forestry by Atlantic Information Services and edited by Don B. Reeves, PEI Department of Agriculture and Forestry. The authors and editor wishes to acknowledge that information contained within the *Certified Crop Protection Consultant Course Manual*, as prepared for the Crop Protection Institute, and the *Industry Standards and Good Practices for Vegetation Management*, as prepared for the Canadian Vegetation Management Alliance, were used to assist in the preparation of this manual.

The author further wishes to acknowledge information gathered from similar vendor training manuals prepared by the New Brunswick Department of the Environment and Local Government and the Ontario Ministry of the Environment.

The *Prince Edward Island Commercial Pesticide Vendor Safety Training Manual* meets the requirements of the *Basic Knowledge Requirements for Pesticide Education in Canada, Vendor/Dispenser Core*. The Prince Edward Island Department of Agriculture and Forestry would like to acknowledge the contributions made by the National Task Force on Pesticide Education, Certification and Training in the development of the National Standard, from which this manual evolved.

The editor gratefully acknowledges the contribution of Kathy Stapleton and Greg Sweetland, New Brunswick Department of the Environment and Local Government; Lynda Rankin, Nova Scotia Department of the Environment and Labour; Susan Hickey, Newfoundland and Labrador Department of Environment; as well as John Delodder, Cavendish Agri Services, and Benny Nabuurs, McCain Produce Inc., on behalf of CropLife Canada, Atlantic Council, in the development and review of the manual content.

Table of Contents

Chapter 1 Introduction to Pesticides

Introduction	1-1
Pesticides	1-1
Pesticide Terminology	1-2
Trade Names	1-2
Common Names	1-2
Chemical Names	1-2
Classifying Pesticides	1-3
Target Pest	1-3
Mode of Action	1-3
Chemical Structure	1-4
Pesticide Formulations	1-4
Types	1-5
Compatibility	1-9
Sources of Information	1-10

Chapter 2 Pesticide Legislation

Introduction	2-1
Federal Legislation	2-1
<i>Pest Control Products Act</i>	2-1
Class Designation of Pesticides in Canada	2-2
Domestic Class	2-2
Commercial Class	2-3
Restricted Class	2-3
Manufacturing Class	2-3
Other Federal Legislation	2-3
<i>Food and Drugs Act</i>	2-3
<i>Migratory Birds Convention Act</i>	2-4
<i>Fertilizers Act</i>	2-4
<i>Pesticide Residues Compensation Act</i>	2-4
<i>Feeds Act</i>	2-5
<i>Fisheries Act</i>	2-5
<i>Transportation of Dangerous Goods Act</i>	2-5
<i>Canadian Environmental Protection Act</i>	2-5
WHMIS	2-6
National Building Code of Canada	2-6
National Fire Code of Canada	2-6

Provincial Pesticide Legislation	2-7
Prince Edward Island	2-7
New Brunswick	2-7
Nova Scotia	2-7
Newfoundland and Labrador	2-8
Municipal Legislation	2-8
Chapter 3 Labelling	
Pesticide Label	3-1
Legal Requirements	3-1
Components of a Label	3-3
Principal Display Panel	3-3
Secondary Display Panel	3-9
Reading the Label	3-13
Material Safety Data Sheets	3-14
Availability	3-16
Summary	3-16
Chapter 4 Pesticides and Human Health	
Introduction	4-1
Exposure to Pesticides	4-2
Staff	4-2
Customers	4-2
Routes of Exposure	4-3
Inhalation	4-3
Ingestion	4-3
Dermal Absorption	4-4
Ocular Absorption	4-5
Toxicology	4-6
Toxicity	4-6
Risk	4-9
Cholinesterase	4-9
Cholinesterase Testing	4-12
Chapter 5 Safety	
Introduction	5-1
Responsibility and Attitude	5-1
General Precautions	5-2
Training	5-2
Protection	5-3
Personal Protective Equipment	5-4
Chapter 6 The Environment	

Environmental Risk	6-1
Persistence	6-1
Mobility	6-2
Non-target Toxicity	6-3
Volume	6-3
Pesticide Fate	6-3
Degradation	6-4
Bioconcentration	6-5
Biomagnification	6-5
Volatization	6-6
Adsorption	6-6
Desorption	6-6
Absorption	6-6
Natural Processes	6-7
Spray Drift	6-7
Surface Runoff	6-8
Leaching	6-8
Soil Erosion	6-9
Pesticides in Water	6-9
Contamination	6-9
Pesticides in Soil	6-11
Contamination	6-11
Pesticides in Air	6-12
Contamination	6-12
Pesticide Impact on Natural Ecosystems	6-12
Animals	6-12
Beneficial Insects	6-13
Fish and Other Aquatic Organisms	6-14
Plants	6-15
Chapter 7 Transportation, Storage, and Disposal	
Transportation	7-1
Federal Legislation	7-1
Other Requirements	7-2
Exemptions	7-4
Provincial Legislation	7-6
Good Practice Guides	7-6
Storage	7-7
Provincial Legislation	7-7
Good Practice Guides	7-7
Industry Warehouse Standards	7-9

Disposal	7-10
Vendor Product	7-10
Customer Product	7-11
Disposal of Pesticide Containers	7-12

Chapter 8 Pest Management

Introduction	8-1
Integrated Pest Management (IPM)	8-1
Elements of IPM	8-2
Pesticide Types	8-9
Evaluation of Results	8-9
Pest Types	8-10
Weeds	8-10
Insects and Mites	8-14
Slugs and Snails	8-17
Diseases	8-17
Vertebrate Pests	8-21
Pesticide Resistance	8-23

Chapter 9 Pesticide Application

Introduction	9-1
Application Equipment	9-1
Equipment Selection	9-1
Equipment Operation	9-2
Equipment Calibration	9-3
Environmental Conditions	9-5

Chapter 10 Emergency Response

Introduction	10-1
Risk Assessment	10-1
Risk Reduction	10-2
Emergency Response Planning	10-3
Preparing an Emergency Response Plan	10-3
Safety Training	10-7
Emergency Services, Supplies, and Equipment	10-7
First Aid Centre	10-7
First Aid Kits	10-8
Emergency Conveyance	10-9
Eyewash/Shower Facilities	10-9
Respiratory Protective Equipment	10-9
Fire Fighting Equipment	10-9

Specific Emergency Response Procedures	10-10
Injuries	10-10
Poisoning	10-11
First Aid	10-13
First Aid Procedures	10-13
Pesticide Spills	10-16
Prevention and Preparation	10-16
Small Spill Containment	10-19
Large Spill Containment	10-19
Dry Product Spills	10-20
Follow-up	10-20
Disposal	10-21
Personal Hygiene	10-21
Reporting Spills	10-21
Pesticide Theft	10-21
Prevention	10-21
Response	10-22
Pesticide Fires	10-22
Preparation and Prevention	10-22
Summary	10-25

Chapter 11 Professionalism

Introduction	11-1
Legal Requirements	11-1
Vendor Responsibilities	11-2
Customer	11-2
Community	11-2
Environment	11-2
Public Relations	11-3
Knowledge and Training	11-3
Attitude	11-4
Work Habits	11-4
Communication	11-4

Appendix A	Glossary of Pesticide Terms
Appendix B	References
Appendix C	Nova Scotia Pesticide Regulations

Introduction to Pesticides

Introduction

A **pest** is any living organism that causes undesirable effects. Some plants or animals may be desirable in one location, but become a pest in another. Pests include organisms in the following groups: fungi, weeds, insects, mites, rodents, slugs and snails, birds, and certain forms of wildlife (e.g., racoons, wolves, deer).

A **pesticide** is any device, organism, or substance that is intended to prevent, destroy, control, repel, or manage a pest. Chemical pesticides are usually a mixture of one or more active ingredients (the chemicals that control the target pests) and several additives. **Additives** are the ingredients included in a mixture to make the product safer, more effective, more convenient to handle, or easier to apply. Pesticides also include plant growth regulators, plant defoliants, and plant desiccants.

Pesticides

Pesticides need to be handled and used safely and effectively so that pests can be managed without harming the vendor, purchaser, applicator, consumers (food), bystanders, or the environment.

Pesticide vendors need to be able to:

- ▶ interpret information on a pesticide label to assist customers and for proper handling at the vendor site and;

- ▶ legally and safely transport, store, handle, and sell

pesticides to protect:

- other employees from hazards;
- the environment from contamination; and
- the public from exposure.

Pesticide Terminology

There are three ways of naming pesticides:

- ▶ by trade name;
- ▶ by common name; and
- ▶ by chemical name.

Trade Names

Trade names appear prominently on pesticide labels with the first letter, or all letters, capitalized.

Common Names

Common names refer to the names of the active ingredients in pesticide products. They appear on pesticide labels in lower-case letters, usually next to the word "Guarantee." The same active ingredient can be found in a variety of pesticide products.

Chemical Names

Chemical names refer to the names of the chemical structures of the active ingredients in pesticide products. They do not usually appear on pesticide labels.

Examples of pesticide products listed by their trade, common, and chemical names are as follows:

Trade Name	Common Name	Chemical Name of the Active Ingredient
Orthene	acephate	acetylphosphoramidothiopate
Round-up	glyphosate	N-(phosphonomethyl) (glycine)
Dithane DG	mancozeb	Manganese ethylenebis (dithiocarbamate) polymer with zinc

Classifying Pesticides

Pesticides can be classified in a number of different ways. Most commonly, they are classified according to:

- ▶ their target (the pests they control);
- ▶ their mode of action (the way they control the pest);
- ▶ their chemical structure;
- ▶ their method of application; and
- ▶ the timing of their application.

Target Pest

Pesticides are often grouped according to the pest they control. Examples of selected pesticide groups classified by target pests are as follows:

Pesticide	Target	Example
fungicide	fungi	Bravo 500
herbicide	weeds	2,4, D
insecticides	insects	Orthene
miticide	mites	Omite
rodenticides	rodent (rats, mice)	Warfarin

Mode of Action

Pesticides can also be classified according to their mode of action—the way they enter or affect the target pest.

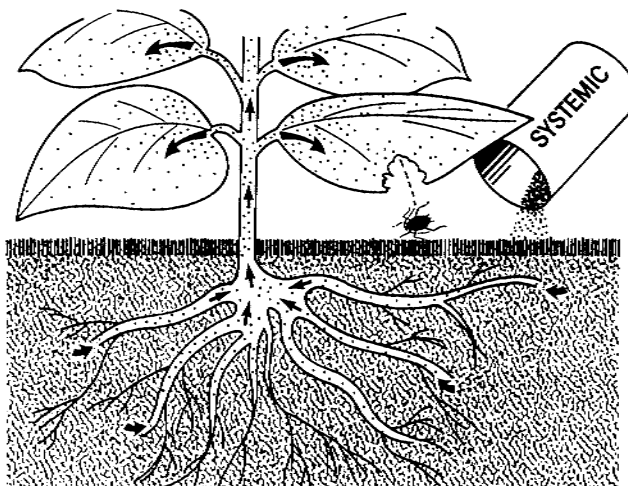
Contact pesticides

Contact pesticides control their targets by direct contact. For example, weeds are killed when enough of their surface area has been covered with a contact herbicide. Insects may be killed when sprayed directly, or when they crawl across surfaces previously sprayed with contact insecticides.

Systemic pesticides

Systemic pesticides control their targets by being absorbed into and moving within treated plants. Translocation is the process whereby a systemic pesticide moves throughout a treated plant. For example, target weeds that receive only a partial spray coverage will be killed by a systemic herbicide as it moves within the plant to untreated areas of leaves, stems, or roots. Target insects may be killed as they feed on the juices that carry systemic insecticides throughout a plant.

Some systemic insecticides are transported through treated animals. For example, a systemic insecticide may be poured on the backs of beef cattle in order to control fly larvae within their bodies.



Chemical Structure

A third way of classifying pesticides is by their chemical structure. Pesticides in the same chemical class or family have similar chemical structures and, usually, a similar mode of action.

Chemical Class	Example
organophosphates	acephate
carbarnates	carbaryl
triazines	atrazine
phenoxys	2,4-D

Pesticide Formulations

Pesticides are manufactured as formulations, which in turn can be in liquid, solid, or gaseous forms. A formulation is a mixture of active ingredient(s) and inert ingredients.

The active ingredient is the chemical part of the formulation that produces the desired effect on the pest


Inert ingredients can include carriers, or adjuvants, that are mixed with the active ingredient to make it suitable for storage or handling, or to improve its effectiveness for controlling the pest.

Types


There are three main types of pesticide formulations: solids, liquids, and gases. Many pesticides are available in different forms or types of formulations. The specific formulation of many pesticides is indicated by an abbreviation that appears on the product label.

D or DU	Dust
DF	Dry Flowable
DV	Device
EC	Emulsifiable Concentrate
F	Flowable
G or GR	Granular
L or LI	Liquid
LO	Live Organism
MS	Microencapsulated
P or PE	Pellet
PA	Paste
PF	Pressurized
PT	Particulate
S	Solution
SC	Soluble Concentrate
SG	Soluble Granule
SN or S	Active Solution
SP	Soluble Powder
SU	Suspension
TA	Tablet
WD	Water Dispersible Granule
WG	Wettable Granules
WP	Wettable Powder
WS	Water Soluble Concentrate

Summary of Formulation Types

Name	Description	Advantages	Disadvantages	Typical Use
 Solids				
Dry Flowable Pesticides	A wettable powder which is formulated into small pellets or granules.	Much less dusty than WP formulations and easier to handle	Requires agitation in spray tank	General use
Dust or Powder	A finely ground dry material of a low active ingredient concentration plus inert ingredients such as talc. No dilution needed before use.	Ready to use	Dusty. Drifts. Can easily be seen on surface	Spot treatment Animal powder
Ear Tag/ Vapour Strips	Slow-release generator - solid base material and a volatile liquid or solid toxicant(s). Slowly emits as a vapour, or releases on contact with skin (ear tag).	Ready to use		Animal ear tags Fly control
Granular	A mix of dry, large free-flowing particles usually with a low concentration of active ingredient.	No mixing required. Ready to use. Drift minimal	Some dust. Requires special application equipment	Soil treatment for insect or vegetation control
Impregnated Fertilizer	Granular fertilizer containing a low amount of herbicide	One step application. Low active ingredient concentration. Not dusty	Could clog equipment	Agricultural soil application
Particulate or Bait	Mixture of large particles not recognized as a pellet or granular formulation. Mixed with edible material.	Easy to spot treat	Pets and children may eat it	Bait for insects or rodents
Pellet	Preformed mixture of active ingredient and inerts to form small solid pieces.	As above	As above	Baits to control rodents, slugs
Seed Treatment	A finely ground dry material containing a coloured dye	Added colour makes it easy to tell treated seed from untreated.	Care must be taken with dye	Seed treatment
Soluble Powder or Granules	A dry material similar to dust or granules above except it is soluble in water	Containers empty easily. No liquid spills	Dusty	General use
Tablet	A preformed "tablet" composed of inerts and active ingredient	Easy to measure and use	Accessible to pets and children	Fumigant
Wettable Powder (W.P.)	Active ingredient plus a powder. Contains a wetting and dispersing agent. Forms a suspension in water.	Containers empty easily. No liquid spills	Dusty. Requires agitation to remain in suspension	General use

Summary of Formulation Types (continued)

Name	Description	Advantages	Disadvantages	Typical Use
 Liquids				
Aerosol	A liquid with one or more solvents. Ready to use in pressurized containers	No mixing required. Low concentration of active ingredient	Pressurized containers are hazardous if punctured or heated	Flying insect control
Emulsifiable Concentrate (EC)	A clear solution with emulsifiers to be diluted in water. Final spray solution has a milky look	A high concentration of active ingredient in each container. Buy less bulk	Possibly flammable	General use
Gel	High assay semi liquid, emulsifiable concentrate	Used with Water Soluble Packaging	Cannot measure "undividable" amounts	Agriculture uses
Micro-encapsulated Suspension	A suspension with active ingredient in micro-capsules giving a slow release of active ingredient	See comments on EC's. Increases' the residue of active ingredient Reduces hazard to operator.	May be expensive	Insecticides
Suspension or Flowable	A cloudy liquid composed of solid particles of active ingredient (finely ground) in a liquid. Must be diluted	See comments on EC's.	Active ingredient may settle out of formulation.	General use
True Liquid/Solution	Active ingredient is in solution, usually water, and when mixed with water remains clear.	See comments on EC's. Requires little agitation when added to water in spray tank	Possibly corrosive	General use
Ultra-low Volume (ULV) Concentrates	Solution of active ingredient designed to be used undiluted only in ULV equipment. Very high concentration of active ingredient	Use without mixing	Concentration of active ingredient during application makes them hazardous. Special equipment required.	Insecticide sprays normally inside structures, also in forestry



Gases

Fumigants	Volatile liquids or solids packaged for release as a gas	Toxic to many forms of the pest at one time. Penetrates cracks and crevices	Area to be fumigated must be well sealed. Highly toxic.	Greenhouses. Mushroom houses. Other structures. Bulk containers.
------------------	--	---	---	--

Source: *Grower Pesticide Safety Course Manual 1998, Ontario Ministry of the Environment*

Vendors should refer customers to government publications to help them select a pesticide formulation that will be effective yet minimize potential adverse effects.

Carriers

Carriers are materials mixed with an active ingredient to make the product safer to handle, easier to apply, or better suited for storage. Materials used as carriers can include water, oil, solvents, or clay.

Adjuvants

Adjuvants are added to pesticides in order to increase their effectiveness. They may help the pesticide spread more evenly to cover leaves, or better penetrate the outer layer of a plant or insect. Adjuvants may also help the pesticide stick to a plant in such a way that it can be contacted by an insect.

Adjuvants may be included in the formulation by the manufacturer or added to the spray tank by the applicator.

Customers should never add an adjuvant unless the product label specifically advises them to do so.

Adjuvants	Function
Surfactants	improve the spreading, dispersing, and wetting properties of a pesticide mixture.
Wetting agents	cause solutions or suspensions to make better contact with treated surfaces.
Spreaders	assist in the even distribution of the spray solution over the target.
Stickers	help the pesticide to stay on the plants or other surface.

Adjuvants	Function
Thickeners	reduce pesticide drift to other areas by increasing droplet size.
Anti-foaming agents	reduce foaming or spray mixtures that require vigorous agitation.
Buffers	slow chemical breakdown of some pesticides by lowering the pH of alkaline water.
Drift reducers	reduce pesticide drift

Compatibility

Compatible pesticides are those that can be mixed together to control a wider range of pests with a single application. Not all pesticides are compatible.

Pesticides that are not compatible can cause:

- ▶ loss of effectiveness;
- ▶ injury to treated plants or animals; and
- ▶ settling out of solids, thereby creating a mixture that can no longer be applied by a sprayer.

Some combinations of pesticides are registered as "tank mixes", with clear use instructions on the labels and supporting data on physical compatibility, efficacy, safety, and residues.

Customers should only use registered tank mixes.

Some pesticide labels state that the pesticide is "compatible" with other pesticides. While pesticides should certainly not be mixed together unless their compatibility is stated on the label, such statements are only indicators of physical compatibility. They do not guarantee that mixing will have no effects on the safety, efficacy, or residues of the pesticides that are mixed.

Sources of Information

There are many sources of information on the safe, effective use of pesticides. These include:

- ▶ the pesticide label;
- ▶ Material Safety Data Sheets;
- ▶ federal and provincial publications;
- ▶ federal and provincial pesticide legislation;
- ▶ qualified experts in extension services; and
- ▶ trade associations.

Pesticide Legislation

Introduction

Pesticides are regulated by federal, provincial, and in some cases municipal governments to protect the vendor, the purchaser, the applicator, the consumer, and the environment. Federal laws deal mainly with the manufacture and registration of products for use in Canada, the labeling of products, and the import and export of products. Provincial legislation complements the federal legislation and regulates the life of a product once it enters a province. Provincial regulations address the transportation, storage, handling, application, and disposal of pest control products, and are more restrictive in these areas than is the federal legislation. This type of management is sometimes referred to as “cradle to grave management.” Federal and provincial legislation are based on current scientific knowledge.

Federal Legislation

Pest Control Products Act

The major federal legislation regulating pesticides in Canada is the ***Pest Control Products (PCP) Act and Regulations***. Responsibility for administering this legislation rests with the Pest Management Regulatory Agency (PMRA) of Health Canada. The regulations focus principal attention on human health, environmental protection, and pesticide performance.

The main purposes of the ***PCP Act and Regulations*** are to ensure that:

- ▶ no person shall manufacture, store, display, distribute, or use any pest control product under unsafe conditions;

- ▶ no person shall package, label, or advertise any pest control product in a manner that is false, misleading, or deceptive, or is likely to create a false impression about the pest control product; and
- ▶ no person shall sell in, or import into, Canada a pest control product unless it is registered.

Product registration

Before a pesticide can be sold or considered for use in Canada it must first be registered under the *PCP Act*. Staff within the Pest Management Regulatory Agency are responsible for evaluating scientific data submitted by the manufacturer regarding efficacy under Canadian conditions, toxicology, food and feed residues, environmental chemistry and fate, environmental toxicology, and chemistry of the product. Only after an extensive review based on the safety, efficacy, and merits of the product is a decision made. Once a pesticide is registered it is given a unique, product-specific Pest Control Product (PCP) “registration” number. This registration provides the manufacturer with the right to sell or manufacture the product in Canada.

The PMRA has established a Pest Management Information Service to provide information on the registration process, product labels, safety precautions, and alternative pest management practices. This service can be accessed by calling 1-800-267-6315, by contacting the PMRA website at <http://www.hc-sc.gc.ca/pmra-arla/english/index-e.html>, or by e-mail at pminfoserv@pmra.hwc.ca

Class Designation Pesticides in Canada

Under the *PCP Act*, registered pesticides are designated as Domestic, Commercial, Restricted, or Manufacturing depending on their toxicity and intended use. The class designation of a product appears on the label.

Domestic Class

Domestic class pesticides are for use in or around the home. When label directions are followed, they can be safely handled with minimal personal protective equipment and without special training. Domestic pesticides are available in small packages, have a low toxicity, and pose minimal risk to

users or to the environment.

Commercial Class

Commercial class pesticides are for use in agriculture, forestry, industry, and other commercial operations.

The terms Agricultural or Industrial, which often appear on a label, are substitutes for the term Commercial.

While the active ingredients may be the same as those present in a Domestic class pesticide, due to the size of the container or concentration of active ingredient, Commercial class pesticides may pose a greater risk to the environment. Some products are classified as Commercial because they are too toxic, persistent, or hazardous to be used by the general population. Applicators of Commercial class pesticides require training on safe handling and application procedures, and on the use of personal protective equipment.

Restricted Class

Restricted class pesticides are essentially commercial type pesticides that have additional limitations on their label. Restrictions may be due to toxicity, application methods, or because they pose a particular concern to the environment. Limitations can involve product display, storage, distribution, or application, or stipulate the necessary qualifications of end users.

Manufacturing Class

Manufacturing class pesticides are used in manufacturing, formulating, or repackaging and are not for use by general applicators.

Other Federal Legislation

Other federal legislation regulates different aspects of pesticide use including pesticide residues in foods, damage to fish or fish habitat, damage to migratory birds, and transport of dangerous goods.

Food and Drugs Act

The *Food and Drugs Act*, administered by Health Canada, is designed to protect the health of consumers by prohibiting the sale of food that contains any harmful or poisonous substance. Where food residues are concerned, safety to

consumers must be proven by Health Canada prior to product registration under the *PCP Act*.

Maximum Residue Limits or MRLs, which specify the maximum amount of pesticide residue calculated at time of harvest that may safely be contained in food products, are established under the *Food and Drugs Act*.

Excessive pesticide residues can be prevented by following label rates, days-to-harvest intervals, number of applications per crop/season, and other label recommendations.

Migratory Birds Convention Act

The *Migratory Birds Convention Act*, administered by Environment Canada, protects waterfowl and other migratory birds. It is an offence under this legislation to release pesticides or other substances that are harmful to migratory birds into any waters or any area frequented by migratory birds. If migratory birds are harmed, an applicator can be prosecuted under this legislation. If other animals are harmed, an applicator may be prosecuted under similar provincial legislation.

Fertilizers Act

The *Fertilizers Act*, administered by Agriculture and Agri-Food Canada, regulates all fertilizers used in Canada, including those that contain pesticides. Before a fertilizer/pesticide mixture can be sold or used in Canada it must be registered under the *Fertilizers Act*. This legislation regulates the importation and sale of fertilizer and supplement products by prescribing standards, packaging, and labelling requirements, and by providing for the authority to inspect and sample products for legal compliance.

Pesticide Residues Compensation Act

The *Pesticide Residues Compensation Act* states that a producer will be paid for damages or losses if the sale of their produce is stopped because it contains more pesticide residue than the *Food and Drugs Act* allows. The producer must prove that the pesticide was applied according to the label directions in order to be considered for such compensation.

Feeds Act

The *Feeds Act*, administered by Agriculture and Agri-Food

Canada, provides regulations to prevent the contamination of feed. This legislation regulates the import, manufacture, and sale of feed products by prescribing standards, packaging, and labelling requirements as well as providing for the authority to inspect and sample products for legal compliance with the Act and its regulations.

Fisheries Act

The *Fisheries Act* protects fish and fish habitat (spawning grounds, nursery, rearing, food supply, and migration areas). When using pesticides in areas where there is a stream, pond, lake, etc., attention must be given to observance of the *Fisheries Act*. This Act considers any substance deleterious unless specifically exempted through an associated regulation.

Transportation of Dangerous Goods Act

The *Transportation of Dangerous Goods Act* permits the handling, offering for transport, and transport of potentially dangerous goods only by people who are properly trained. Use of shipping documents, special labels and markings, and proper vehicle placards, as well as adherence to certain safety procedures, are additional requirements. The person who sends the dangerous goods, the person(s) who transports them, and the person who receives them all share responsibility for complying with this legislation. The supplier, manufacturer, and/or distributor can clarify necessary transportation requirements, and should inform vendors if the pesticides are considered dangerous goods and if documents, labels, or placards are required. Additional information on this Act is provided in Chapter 7, Transportation, Storage, and Disposal.

Canadian Environmental Protection Act (CEPA)

The *Canadian Environmental Protection Act (CEPA)*, administered by Environment Canada, is designed to protect the environment as well as human life and health. The Act covers many different areas including:

- ▶ procedures to review and approve chemicals;
- ▶ mandatory reporting of adverse effects;
- ▶ export and import controls;
- ▶ recalls and clean-ups; and
- ▶ new inspection and enforcement powers.

CEPA could be applied if the situation arising was not

regulated under the *PCP Act*.

WHMIS

The **Workplace Hazardous Materials Information System**, commonly known as WHMIS, is a Canada-wide system designed to provide employers and workers with information about the hazardous materials with which they work. Presently, pesticides are exempted from WHMIS rules on labelling and Material Safety Data Sheets (MSDS) because they are covered under the *Pest Control Products Act*.

Vendors should know that the worker's "Right to Know" component is still a requirement for pesticide facilities.

It is the responsibility of supervisors to inform employees about any possible workplace dangers to their health and safety. It is the employee's right to obtain information about substances they work with, including MSDSs where available. (See Chapter 3, Labelling, for additional information on MSDSs.)

National Building Code of Canada

The National Building Code of Canada (NBC) provides minimum requirements for health, life safety, and structural sufficiency in new buildings, with specific requirements for facilities that store hazardous materials, including pesticides. While not enacted in P.E.I., the NBC should be consulted before any new construction or the renovation of an existing pesticide storage facility.

National Fire Code of Canada

The National Fire Code of Canada (NFC), 1990, provides minimum fire safety requirements for buildings, structures, and areas where hazardous materials, including pesticides, are used, and ensures an acceptable level of fire protection and fire prevention in the ongoing operation of such buildings. The NFC classification system for hazardous materials is used in determining the placarding for transportation. The Code also requires fire safety plans in anticipation of emergencies, thereby reducing the likelihood of fires, particularly those that may present a hazard to the community.

Provincial

Each province has enabling legislation governing the

Pesticide Legislation

transportation, storage, sale, handling, mixing, application, and disposal of pesticides within their province. Legislation for the regulation of pesticides varies in approach among the provinces but in all cases it is in addition to, and complimentary to, the federal *Pest Control Products Act*.

Vendors should familiarize themselves with the legislation and the department responsible for the regulation of pesticides in their province of operation.

A copy of the legislation regulating pesticides in this province is appended.

Vendors should ensure that commercial pest control products are sold only to provincially licensed or certified applicators.

Prince Edward Island

Within Prince Edward Island, pesticides are regulated under the *Pesticides Control Act* and Regulations, administered by the Department of Agriculture and Forestry. Copies of the Act and regulations can be obtained by contacting the Pesticides Regulatory Program of the Department of Agriculture and Forestry at (902) 836 8925 or by e-mail at pservices@gov.pe.ca

New Brunswick

In New Brunswick pesticides are regulated under the *Pesticides Control Act* and Regulations, administered by the Department of the Environment and Local Government. Copies of the Act and regulations can be obtained by contacting the Pesticides Management Unit at 1800 561 4036 or by e-mail at pesticides@gnb.ca

Nova Scotia

In Nova Scotia pesticides are regulated under the *Environment Act* and the Pesticide Regulations. Copies of the Act and Regulations can be obtained by contacting (902) 424- 5300 or by e-mail at rankinlx@gov.ns.ca. The Act and regulations can also be viewed on-line at www.gov.ns.ca/enla/pests

Newfoundland and Labrador

Within Newfoundland and Labrador, pesticides are regulated under the *Pesticides Control Act* and Regulations administered by the Department of Environment. Copies of the Act and regulations can be obtained by contacting the provincial Queen's Printer at (709) 729 3649 or by e-mail at [*gprinter@mail.gov.nf.ca*](mailto:gprinter@mail.gov.nf.ca)

Municipal Legislation

Within some provinces, a municipality may have specific by-laws or building codes that place additional restrictions on the location, construction, or operation of pesticide storage facilities, or on the application or use of pesticides. It is important to check with appropriate municipal or county offices for more details.

One regional example is the Halifax Regional Municipality By-law (P-800), passed in 2000, which regulates certain aspects of pesticide use for the purposes of maintaining turf, trees, shrubs, flowers, and other ornamental plants on residential and municipal properties.

Labelling

Pesticide Label

Legal Requirements

The pesticide label, defined in the *Pest Control Products Act* as: “any legend, word, mark, symbol or design applied or attached to, included in, belonging to or accompanying any control product”, is a legal document. Information on the label identifies the manufacturer and tells how a product must be used. It is illegal to use it in any other way, to use it in an unsafe manner, or for a vendor to tell a customer that a pesticide can be used for any purpose that is not on the label.

Vendors must also ensure that all pesticide containers have a valid Canadian label, indicating the Pest Control Product (PCP) Number or registration number. Vendors should immediately notify their supplier if a shipment of product does not contain a Canadian label. **It is illegal to sell or distribute any product until it has been properly labelled.**

The label must be kept on the container and in good condition. If a label becomes illegible, a vendor should contact the supplier for a replacement and place the new label on the package. **It is illegal to sell a pesticide with a damaged or missing label.**

In addition to the information found on a label, manufacturers often provide extra product information. These materials (e.g., pamphlets, brochures, advertising) complement, but do not legally substitute for, the label. The manufacturer may also print information on the wrapper, or on stickers or tags that are attached to the container.

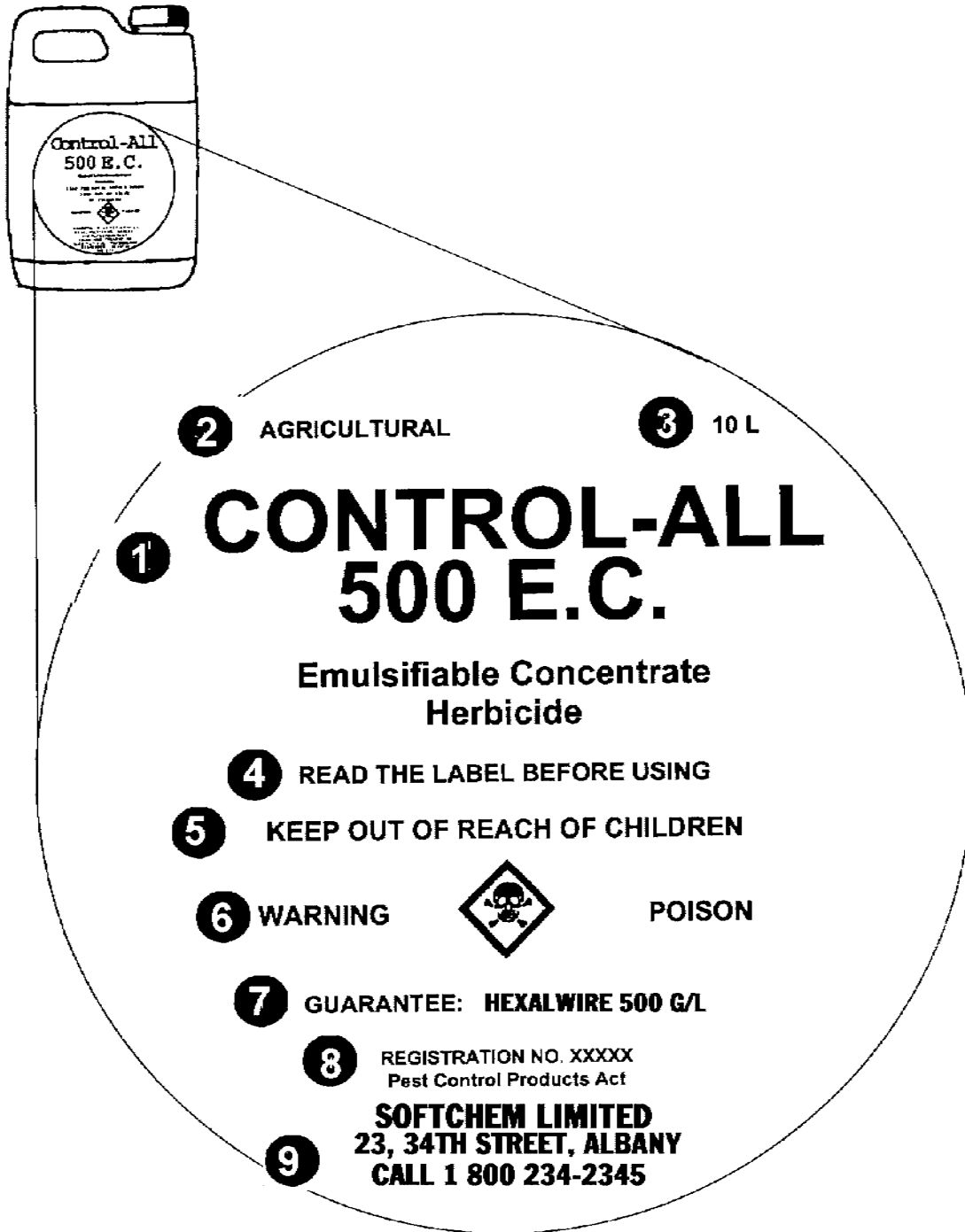


Figure 3.1 Principal display panel

Components of a Label

A pesticide label provides basic information on product use, limitations, disposal, first aid, contents, precautions, formulation, and toxicology. A pesticide label has two main parts, the front or principal display panel, and the back or secondary display panel.

Principal Display Panel

The nine components on the principal label panel (*see* Figure 3.1) are:

- ▶ trade name or product name;
- ▶ class designation;
- ▶ net contents;
- ▶ directions to read the label;
- ▶ warning;
- ▶ precautionary symbols;
- ▶ guarantee statement;
- ▶ registration number (PCP number); and
- ▶ name and address of the registrant.

1. Product name

The product name includes three things:

- ▶ the **brand name or trade name** that is registered with the government. (**CONTROL-ALL** is the registered trademark of this product);
- ▶ the **formulation** of the pesticide. This information will either be printed out or shown as an abbreviation. This product is a liquid—an **Emulsifiable Concentrate (E.C.)**; and
- ▶ a **description of its use**. This product is a **herbicide** used to control weeds.

2. Class designation

This provides information on the class to which a product has been assigned, and indicates who can use the product. There are four class designations:

- ▶ **Domestic.** These products are intended for use around the home, are sold in small packages, and have a relatively low toxicity.

- ▶ **Commercial** (may also be called **Agricultural, or Industrial**). These products are meant for use in commercial, agriculture, forestry, or industry operations and are not for use around the home. They have low to medium toxicity, but must be handled carefully to prevent injuries.
- ▶ **Restricted**. These products may have safety concerns related to plants, animals, or the environment. They often have special, detailed labels to show how to handle them safely. A provincial permit may be required to use a restricted product.
- ▶ **Manufacturing**. These products are used to manufacture or formulate end-use products.

3. Net contents

This tells how much of the product is in the package and is shown in metric units. This label shows there are 10 litres (10 L) in this package.

4. READ THE LABEL BEFORE USING

The *Pest Control Products Act* requires that this warning be on the front panel of all pesticides.

5. KEEP OUT OF REACH OF CHILDREN

This warning must be on either the primary or secondary panel of all pesticides.

6. Precautionary symbols and words

The *PCP Act* Regulations contain symbols and words to show the hazards of using pesticides.

Precautionary shapes

The shape of each precautionary symbol (*see* Figure 3.2) has a particular meaning:

- ▶ the **octagon** indicates an **extreme hazard** and has the word **danger** associated with it;
- ▶ the **diamond** indicates a **moderate hazard** and has the word **warning** associated with it; and
- ▶ the **inverted triangle** indicates a **slight hazard** and has

the word **caution** associated with it.




	Warning Symbol	Signal Word
Triangular shape means low hazard		Caution
Diamond shape means moderate hazard		Warning
Octagonal shape means high hazard		Danger

Figure 3.2 Precautionary Shapes

Precautionary pictograms

Similarly, there are pictograms for each of the precautionary symbols (*see* Figure 3.3). The combination of shape, word, and picture indicates the type and severity of the hazard associated with a given pesticide.

- ▶ the **skull and cross bones**, which indicates **poison**;
- ▶ the **flame**, which indicates **flammable**;
- ▶ the **hand**, which indicates **corrosive**; and
- ▶ the **exploding grenade**, which indicates **explosive**.





Hazard Symbols	Signal Words
	POISON
	CORROSIVE
	FLAMMABLE
	EXPLOSIVE

Figure 3.3 Precautionary Symbols and Words

Multiple symbols

If a pesticide is dangerous in more than one way, all the hazard symbols and signal words must appear on the label.

However, only one warning signal word is required. This warning will be for the most dangerous hazard.

The example below shows that fire is the most dangerous hazard.

Example



No symbols or signal words

If a pesticide label does not have hazard symbols and/or signal words, then the product's hazards are such that the label does not require them. However, basic precautions are still necessary and the user or handler should proceed with care.

7. Guarantee

The guarantee provides the common name of the chemical that forms the active ingredient in the product.

The active ingredient is the part of the pesticide product that actually controls the pest.

There may be more than one active ingredient in a pesticide product, in which case more than one common name will appear on the label. The **chemical name** is the name of the chemical structure of the active ingredient. It is occasionally used on the label in place of the common name if no common name exists.

The guarantee also shows the **concentration**, or how much of the chemical is in the product. The concentration may be measured in two ways:

- ▶ by the weight per unit volume. This label shows that the active ingredient is the chemical **HEXALWIRE**. There are 500 grams of the chemical in each litre of this pesticide product (**500 g/L**); or
- ▶ as a percentage by weight. Another label could show the concentration of the chemical as a percentage. For example, a guarantee of 40% means that in each 100 parts of a pesticide, 40 parts are active ingredient.

8. Registration Number (P.C.P. Act number)

This number, which shows that the product has been registered by PMRA, Health Canada, identifies the product to the government and the manufacturer. The PCP number must be shown on the principal display panel of every pesticide label. It may appear as REG. NO. 12345 P.C.P. ACT or Registration Number 12345 Pest Control Products Act. Any product sold or used in Canada must have a P.C.P. Act Registration Number.

In Canada it is illegal to sell or use products that are labelled with Environmental Protection Act (E.P.A.) numbers.

The PCP number is specific to the formulation in any pesticide container and can be cross referenced by a doctor to find information on how to best treat exposed individuals.

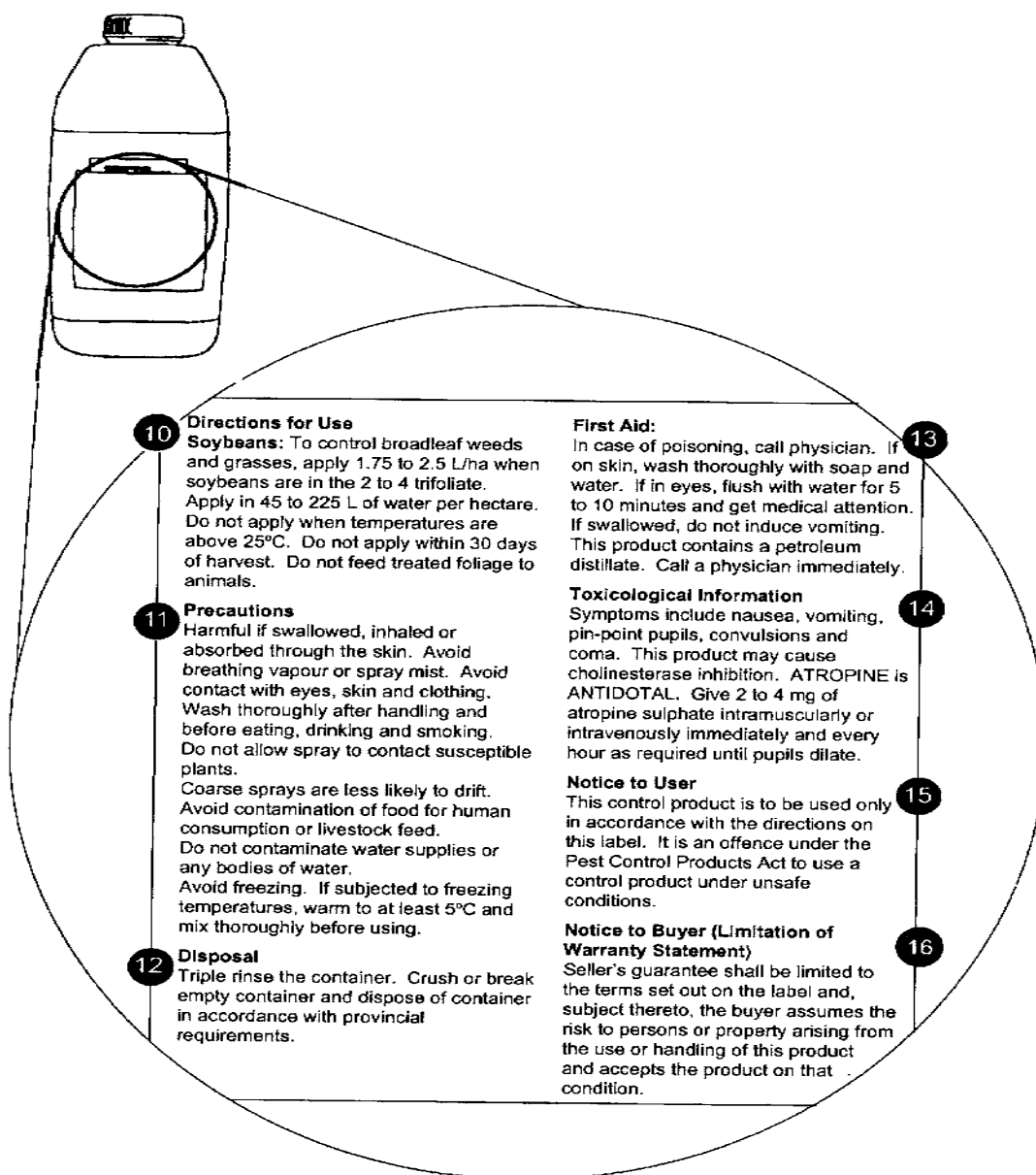


Figure 3.4 Secondary display panel

9. Name and address

The name and address of the company or organization that registered the product must be on the label. This company or organization is called the registrant.

Secondary Display Panel

The seven components on the secondary display panel (*see* Figure 3.4) are:

- ▶ directions for use;
- ▶ precaution statements;
- ▶ disposal;
- ▶ first aid instructions;
- ▶ toxicological information;
- ▶ notice to user; and
- ▶ notice to buyer.

For small size containers of Domestic class pesticides the following components may appear on the lower half of the secondary display panel:

- ▶ name and address of the registrant/agent;
- ▶ net contents;
- ▶ PCP Act registration number; and
- ▶ guarantee.

10. Directions for use, use area, and limitations

The directions for use include information about:

- ▶ what pest the product can be used on (weed, insect, disease, etc.);
- ▶ what crops or animals it can be used on;
- ▶ how much to use and how to mix it;
- ▶ how to apply the product;
- ▶ rate of application;
- ▶ proper equipment to be used;
- ▶ how to protect the crop;
- ▶ when not to use the product;
- ▶ when to harvest (pre-harvest interval, days-to-harvest, pre-slaughter);
- ▶ re-entry period (the length of time to stay out of the treated area); and
- ▶ any other restrictions.

It is important that vendors make customers aware if any of the following statements appear on a specific pest control product label.

Aerial application statement

The statements for aerial application of products were clarified January 1, 2000. Pesticides cannot be applied by air unless the label states specific instructions for such use.

Only products with use instructions for aerial application may be applied by air, and only for the uses that have specific aerial instructions.

The aerial applicator must follow the specific use instructions for mixing and application (buffers, rates, crop, etc.). All other labels must have the statement "Do not apply by air".

Crop rotation statement

Some product labels have crop rotation statements. If there is a carry-over situation with a product, the label will state that the user should conduct a bioassay before planting any crops other than those named on the label.

Total number of applications

Some product labels will state the total number of applications that can be made during a use season. These statements may be necessary to prevent unacceptable food residues, crop damage, soil residues, or the development of pest resistance. Label statements will vary with the product.

Buffer zones

Buffer zones are areas left untreated so as to protect an adjacent area. The need for a buffer zone during application is reviewed by the PMRA on a pesticide-by-pesticide basis. Decisions are based on the organism that needs to be protected, the environmental concentration that will affect the organism, and the methods of application used. Label statements will vary with the product.

Each pesticide is different, and each label is different. Read the label carefully to obtain and understand all related information.

Example of a Buffer Statement

"Overspray or drift into important wildlife habitats such as shelterbelts, wetlands, woodlots, vegetated ditches, ponds, or lake banks, and other cover on the edges of fields should be

Aerial applications to forests, bodies of water, or residential areas may constitute Restricted Uses.

Forest and woodlands management statements

The Forest and Woodlands Management areas are categorized as follows:

Forest or forest management - Restricted:

- ▶ Wooded areas or sites to be planted to forest of more than 500 hectares;

Woodlands management - Restricted:

- ▶ 500 hectares or less of wooded areas or sites to be planted to forest; and

Woodlands management - Commercial:

- ▶ 500 hectares or less of a wooded area, i.e., tree nurseries, rights-of-way, and seed orchards.

11. Precautionary statements

This section identifies hazards that may result from using the product. It tells how to use the pesticide safely and how to protect the applicator and others from danger when mixing, applying, storing, and disposing of the product. Precautionary statements may relate directly to human health or to environmental concerns.

12. Disposal

This section explains how to safely dispose of pesticide containers once the product has been used. (*See Chapter 7, Transportation, Storage, and Disposal, for details of provincial approved methods for disposal.*)

13. First aid

This section tells what to do if someone is poisoned or injured by a pesticide. The customer should always read this section carefully before using any pest control product.

14. Toxicological information

This section gives information on the signs and symptoms of poisoning. It also tells a doctor what antidote to use, and any ingredients that may influence the treatment. It is important to give this information to medical authorities in case of an accident. Additional, product-specific information can be obtained by cross referencing the P.C.P. Act Registration Number.

15. Notice to user

This section tells the person using the product to follow the directions on the label. **It is against the law to use a pesticide in an unsafe way.**

16. Notice to buyer

This section is not on all pesticide labels, but may be present in the form of a Seller's Guarantee, which states that the seller's guarantee is limited to the instructions on the label, and that the buyer accepts all risks associated with the use of the product.

Reading the Label

When selling pesticides, vendors should advise customers to **READ THE LABEL BEFORE USING THE PRODUCT**, and that they are required by law to follow the instructions on the label. Vendors should also be familiar with the label information regarding the registered uses of those products that they offer for sale.

Vendors should read the label before selling a pesticide to make sure that the product is registered for the intended use of the customer. All uses must be stated on the label. If a use is not listed on the label, it constitutes an improper application and an illegal use of that product. Occasionally, a new use will not immediately appear on the label. Contact the Pest Management Information Service (1-800-267-6315) or your provincial pesticide regulatory agency for clarification.

Vendors should advise customers to check for any special application or safety equipment that may be required (e.g., some products specify the requirement for neoprene safety gloves), and to confirm that the pesticide can be used safely under certain application conditions (e.g., not for application by air).

Vendors should examine the label to see if there are any special storage instructions they, or their customers, must consider. For example, some products must not be subjected to below-freezing temperatures.

Vendors should read the label for instructions on the disposal of unwanted pesticides or pesticide containers. Proper disposal will prevent health risks and environmental damage. Vendors should also ensure that customers are aware of the container recycle services offered.

Pesticide labels are legal documents, so vendors must make sure that all employees who deal with such products take the time to read and fully understand the information they contain. Understanding and interpreting all areas of label information helps vendors to assist their customers in making effective and environmentally sound decisions regarding pest control products. It is, therefore, very important that all sales staff be familiar with the information contained on the labels of the products offered for sale through a vendor facility. Staff should take every opportunity to reinforce the importance that customers read the pesticide label before they transport, store, handle, or apply a pest control product.

Remember, the product label is the most readily available source of emergency response and first aid information in the event of a pesticide spill or poisoning.

Material Safety Data Sheets

Commercial and Restricted Class products may reference the Material Safety Data Sheet (MSDS). An MSDS provides information about health hazards, personal safety, and environmental protection that may not be on the label. Material Safety Data Sheets are organized into nine sections; however, the order in which the sections appear may vary from manufacturer to manufacturer.

1. **Product identification** section gives the trade name, chemical name, and primary use of the product. It also gives the name, address, and emergency telephone numbers of the manufacturer and supplier.
2. **Hazardous ingredients** section explains what the active ingredient is, and may tell what other ingredients are included. It gives the chemical registration numbers and transportation classification for the product.
3. **Physical data** section includes information on appearance, odour, specific gravity, pH, boiling point, etc.
4. **Occupational procedures/ preventive measures** section explains what personal protective equipment must be used, i.e., eye protection, skin protection, and respiratory protection. It also gives safe handling and storage procedures.
5. **First aid and emergency procedures** section explains what to do if someone is exposed to the product. Follow these instructions in an emergency, but always call for medical help.
6. **Fire and explosion hazard** section gives the temperature of the flash point and the ignition point for the product. The section also gives specific procedures to use when fighting a fire.

Vendors should give the local Fire Department the MSDSs for all of the products in the storage facility.

7. **Toxicity/health effects** section tells how human health may be affected by exposure to the product. It gives results of the manufacturer's research on the product. This toxicological data can help a doctor deal with an emergency.
8. **Reactivity data** section gives any special chemical properties of the product. It will also provide the recommended temperature for storage of the pesticide.
9. **Preparation date and group** section tells who prepared the MSDS and when it was prepared. MSDSs must be updated at least every 3 years.

Vendors should make sure their MSDSs were prepared within the last 3 years.

Availability

Material Safety Data Sheets may be obtained from:

- ▶ the pesticide manufacturers;
- ▶ Canadian Centre for Occupational Health and Safety at 1-800-263-8466 or www.ccohs.ca ;
- ▶ the product suppliers;
- ▶ North American Compendiums Ltd., P.O. Box 39, Hensall, Ontario N0M 1X0 (1-800-350-0627 or fax 519-263-2936); and
- ▶ Agrichemical Warehouse Standards Association (AWSA) (www.awsacanada.com) or a member of the CropLife Canada (www.cropro.org).

Summary

Understanding and considering the information on a MSDS helps vendors make effective and environmentally sound decisions regarding emergency response and safe handling practices. It is also important that the local fire department, as well as other emergency responders, have access to copies of MSDSs for each product carried by a vendor.

Pesticides and Human Health

Introduction

Pesticides are designed to kill or otherwise control living organisms and, as such, must be treated with respect. Vendors can play an important role in ensuring that pesticides are handled, as well as applied, safely and responsibly. This begins with appropriate staff being familiar with all product labels, so that they can assist the customer in choosing the least toxic pesticide that is effective against a particular pest, and in informing them of any safety procedures that should be followed to reduce exposure.

Breathing or swallowing pesticides, or spilling or splashing pesticides into the eyes or onto the skin may result in injury. Poisonous chemicals injure or kill people by interfering with biochemical and physiological functions. The nature and extent of injury depends on the toxicity of the chemical as well as the dose (amount of material) that enters the body's tissues. Some pesticides are very toxic and cause poisoning at low doses (a few drops of these are capable of causing severe illness or death). Other pesticides are so mildly toxic that several pounds would have to be consumed before signs of illness would be detected. Because potential hazards exist, however, anyone working with pesticides should avoid exposure to their skin, lungs, digestive tract, or eyes. All pesticides must be treated with respect. It is impossible to accurately predict what effects can result from long-term, repeated exposure to even the least hazardous of pesticides.

Exposure to Pesticides

It is important that vendor staff remember to wear proper personal protective equipment any time they are handling or moving product. This should include off-loading of

Staff

deliveries, movement into storage, loading for the customer, and recycling of empty containers.

Usually the most harmful levels of pesticide exposure result from accidents, some of which are caused by carelessness. Many of these accidents result in injury or poisoning. Spills, fires, or explosions in pesticide storage facilities may seriously endanger employees, emergency workers, and people living or working nearby. Persons involved in transporting pesticides risk possible injury if pesticide containers rupture and spill their contents, or are involved in a fire. Pesticide spills during transport can also pose hazards to the public. Personal protective equipment and prompt emergency procedures can greatly reduce the chances of serious injury when a person is involved in an accident.

Exposure for pesticide vendor staff is most likely to occur as a result of contact with concentrated product from a leaking container or from a spill.

Customers

Vendors should remind customers to read and follow label recommendations regarding the proper protective equipment to wear during mixing and loading, and to adhere to any stated reentry times. People may also be exposed to small doses of a pesticide if they eat contaminated food; touch recently treated livestock, poultry, or foliage; or contact contaminated application equipment or clothing.

The most likely way for a customer to encounter pesticides would be to come into contact with concentrated product during mixing or loading, or with diluted product when entering or working in a treated area too soon after application.

Routes of Exposure

Exposure may occur through inhalation, ingestion, dermal absorption, or ocular absorption.

Inhalation

Inhalation refers to the absorption of airborne particles of a substance. Vapours or gases can be inhaled and then enter the

body through the lungs. Once the pesticide reaches the lungs, it is absorbed almost completely and poisoning may result. Inhalation exposure increases within enclosed spaces.

Prevention and protection

The chance of inhaling pesticides can be reduced by:

- ▶ wearing a properly fitted, pesticide-grade respirator when necessary (e.g., handling certain products or cleaning up spills); and
- ▶ not smoking when off-loading pesticides or when working in a pesticide storage area.

Ingestion

Ingestion or oral exposure refers to the intake of a substance by mouth. It may result from accidental ingestion, suicide attempts, or contamination of food. The most common occurrence of oral intake is when pesticides are moved from their original container, stored in food or beverage containers, and then accidentally swallowed. Because the stomach and the intestines absorb chemicals quickly, such poisonings may be very serious. Some pesticides can also severely burn the mouth, throat, and stomach. For these products the label will indicate “Do Not Induce Vomiting.”

Prevention and protection

The chance of pesticide vendor staff being exposed to pesticides through ingestion can be reduced by:

- ▶ storing pesticides only in their original containers, and away from children or unauthorized persons;
- ▶ never storing pesticides in food or drink containers;
- ▶ washing the hands and face after handling pesticide containers and before eating, drinking, or smoking; and
- ▶ never storing food, drink, or tobacco products in areas where pesticides are stored or handled.

Dermal Absorption

Dermal absorption refers to the intake of a substance through the skin. It can result from contact with concentrated product from direct exposure, handling damaged containers, or wearing contaminated clothing. Absorption is affected by skin condition, location of the exposure, and the pesticide. The body will take in pesticides more easily through a cut, scrape, or abrasion, or if the pesticide stays on the skin for a long period of time.

Skin on different areas of the body also absorbs pesticides at different rates. The scrotal area, armpits, small of the back, head, or any area where moisture/perspiration occurs tend to be most absorptive.

Absorption rates for the insecticide parathion

ear canal	47%
scalp	32%,
palms of the hand,	12%
forearm	8.6%,
eyes and scrotal area	100%.

Components in a pesticide formulation may also affect the amount of exposure and penetration.

- ▶ **Volatile formulations** may pose greater respiratory danger;
- ▶ **Solvents** may increase the rate of absorption;
- ▶ **Emulsifiers** may allow the pesticide to pass through the skin more quickly;
- ▶ **Stickers** may cause the pesticide to stick more easily to the skin, clothing, or personal protective equipment; and
- ▶ **Spreaders and wetting agents** may cause the pesticide to quickly spread out and contaminate larger areas of skin, clothing, and personal protective equipment.

Generally, dermal exposure, especially to the hands and forearms, poses the greatest threat to both pesticide vendors and applicators.

Prevention and protection

The risk from exposure to pesticides through the skin can be reduced by:

- ▶ always wearing appropriate personal protective equipment, including chemical-resistant gloves, when handling pesticides and empty containers and when cleaning up a spilled pesticide;
- ▶ immediately washing the hands and face before eating,

- ▶ drinking, using the toilet, or smoking after having handled pesticides or pesticide containers;
- ▶ being careful not to contact contaminated clothing;
- ▶ not wiping the face or eyes with contaminated gloves or clothing;
- ▶ immediately washing with an abundance of water any area where pesticide has spilled on the body, and removing all contaminated clothing; and
- ▶ not storing personal protective equipment, clean clothing, or personal items in areas where pesticides are stored or handled.

Ocular Absorption

Ocular absorption refers to the intake of a substance through the eyes. Although the eyes form only a small part of the total body's skin their many blood vessels absorb pesticides easily. Some pesticides can irritate the eyes and some can cause temporary or permanent blindness. Exposure can result from splashes or spills, drift, or rubbing the eyes. Special attention should be given to eye protection.

Prevention and protection

The need for eye protection is particularly important when handling concentrated products. Ocular exposure can be reduced by wearing eye protection (e.g., safety goggles or a splash shield). Also, washing the hands thoroughly after handling pesticides will reduce the risk from direct exposure through rubbing the eyes.

Toxicology

People exposed to some types of pesticides may suffer short-term or long-term health problems. Poisoning symptoms or injury sometimes result from a single exposure to a large quantity of pesticide. In other cases, symptoms do not occur until a person has been exposed repeatedly to small doses of a pesticide over a period of time.

It is quite common for individuals to vary in their sensitivity to the level of pesticide exposure.

Some people may show no reaction to a dose that causes severe illness in others. A person's age and body size often influences their response to a given dose—thus infants and young children are normally affected by smaller doses than

are adults. Also, adult females are often affected by lower doses than are adult males.

Toxicity

Toxicity is the harm a particular pesticide can cause to an organism. Toxic effects can vary with sex, health, age, weight, route of exposure, or exposure to other products.

Acute toxicity

Acute toxicity is the response that occurs within a few hours to a few days after exposure. Acute toxic effects may result from a single dose, a single exposure, or from multiple doses received within 24 hours. Acute toxic effects are often reversible.

Measuring acute toxicity

The acute toxicity of a product is indicated on the pesticide label by precautionary symbols, words, and statements, and is measured primarily by the LD₅₀ or LC₅₀.

LD₅₀s only estimate the toxicity of a pesticide to people. LD₅₀s may be determined for oral or dermal exposure routes.

LC₅₀ stands for lethal concentration 50, which is the concentration (expressed in parts per million) of a pesticide in the air or water sufficient to kill half of the test animals exposed to the pesticide.

The smaller the LC₅₀ number, the more toxic the pesticide.

LD₅₀ stands for lethal dose 50, which is the amount of a substance (mg/kg) that will kill 50% of test animals exposed to the pesticide. The smaller the number, the more toxic the pesticide.

Symptoms

Symptoms of acute pesticide poisoning

Some poisoning symptoms may be vague and can be confused with common ailments (flu, excess heat, hangover, food poisoning, etc.); other symptoms are quite severe and debilitating. Acute pesticide poisoning symptoms may appear within a few minutes of exposure or not for many (up to 96) hours after exposure.

Mild symptoms include headache; fatigue; loss of appetite; dizziness; weakness; nervousness; nausea; perspiration; diarrhea; loss of weight; thirst; moodiness; and irritation of the skin, eyes, nose, or throat.

Moderate symptoms include nausea, trembling, loss of muscular co-ordination, excessive saliva, blurred vision, constricted throat or chest, laboured breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, mental confusion, perspiration, rapid pulse, and cough.

Severe symptoms include vomiting, loss of reflexes, difficulty with breathing or an increased breathing rate, muscle twitching, tiny pupils, convulsions, unconsciousness, thirst, and fever.

The recognition of poisoning symptoms should trigger a warning to eliminate exposure and begin preventative actions or first aid procedures. All pesticide products do not have the same poisoning symptoms. Vendor staff should be able to recognize poisoning symptoms based on the type of pesticide being handled. Some pesticide labels or MSDSs describe associated poisoning symptoms.

Vendors should be familiar with the toxicological information for all pest control products that they handle or sell. Toxicological information could be required by medical staff should a poisoning occur.

If anyone on the site is acting or feeling unusual or exhibiting poisoning symptoms, immediately consult a doctor or call the local Poison Control Centre.

Chronic toxicity

Chronic toxicity refers to the adverse response that occurs and persists over time after an exposure(s). Chronic effects are often irreversible, and may result from a single exposure or from repeated exposures. Symptoms resulting from chronic or long-term exposures may not develop for many days, months, or even years.

Chronic effects of pesticide exposure may include skin irritation, reduced body weight, organ damage, tumors, nerve damage, or birth defects. Chronic effects may occur in three situations:

- ▶ as a complication of acute exposure;
- ▶ as a slowly progressive condition; and
- ▶ as the development of undesirable effects, years after exposure.

Risk

Risk is the chance that someone or something will be harmed by the toxicity of a pesticide and exposure to the pesticide.

$$\text{RISK} = \text{TOXICITY} \times \text{EXPOSURE}$$

The greater the toxicity, the greater the risk. Both the type of active ingredient and the concentration of active ingredient affect the toxicity of the product. Some active ingredients are more toxic than others.

Higher concentrations of the same active ingredient increase toxicity. Those responsible for handling and/or mixing are at a high risk because they are dealing with products in a concentrated form.

The higher the exposure, the greater the risk. High exposure, even to a product having a low toxicity, can create risk. An unprotected vendor or applicator who works throughout the entire spray season with a product having a low toxicity is still at some risk.

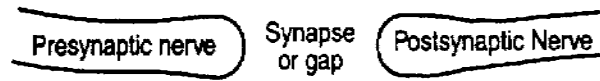
Eliminating or minimizing exposure to a very toxic product minimizes risk. For the customer, risk can be minimized by choosing a less toxic pesticide and/or by reducing exposure.

Cholinesterase

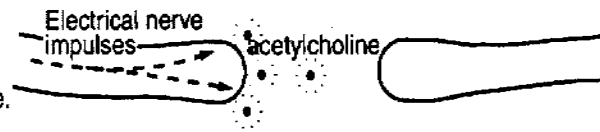
Exposure to organophosphorous (OP) and carbamate insecticides can affect the central nervous system, thereby causing a lowering of cholinesterase levels.

Normal Nerve Function

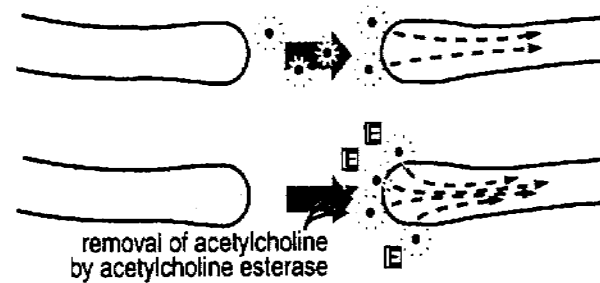
In the nervous system there is a gap or a synapse between nerve cells.



When a nerve impulse is sent from the brain it travels down the nerve cell and is carried across the gap to the next cell. This is done by the chemical acetylcholine.



When the message has been received, the acetylcholine is degraded by an enzyme called acetylcholinesterase (E). This stops the message from continually firing.



Enzyme Inhibition by Pesticide

If an organophosphorous or carbamate insecticide has entered the animal or insect system, the pesticide (P) binds with the acetylcholinesterase. This prevents the enzyme from functioning normally to remove the acetylcholine, thus the postsynaptic nerve is overloaded with messages.



Because the messages keep on firing, the system is overstimulated and the organism experiences twitching, convulsions, and even death.



Figure 4.1 Normal and Enzyme Inhibited Nerve Function

Cholinesterase is an enzyme in the blood that affects the nervous system and the way the brain sends messages to different parts of the body.

To transmit a message throughout the nervous system, a signal must pass from one nerve cell to the next across gaps called synapses. When the message reaches each synapse a chemical, called acetylcholine, is released to carry the message to the next nerve cell (*See Figure 4.1*).

Once the message arrives, cholinesterase breaks down the acetylcholine. This clears the synapse and leaves it ready to receive the next message. If organophosphorus (OP) and carbamate insecticides are present in the body, they bind with the cholinesterase. Therefore, the cholinesterase is not available. When there is insufficient cholinesterase available to break down the acetylcholine, messages continue to be sent to the nerve cells over and over again and the entire nervous system can be affected. This may cause many symptoms, including trembling, twitching, convulsions (fits), breathing and heart difficulties, and even death.

Common Name	Trade Name	Chemical Group
acephate	Orthene	OP
azinphosmethyl	Guthion	OP
chlorpyrifos	Dursban&Lorsban	OP
dimethoate	Lagon & Cygon	OP
pirimicrb	Pirimor	carbamate
carbaryl	Sevin	carbamate
carbofuran	Furadan	carbamate

Cholinesterase

Cholinesterase blood testing is a common method used to determine whether or not an individual is suffering from

Testing

exposure to these classes of pesticides. If a person handles or applies organophosphorus or carbamate insecticides on a regular basis throughout the season, they are advised to have a cholinesterase blood test. Any doctor can arrange these tests.

Everyone has a different base-line level of cholinesterase so it is necessary to have the blood tested before handling, using, or otherwise being exposed to these products. The initial test will establish a person's normal, or base level, blood cholinesterase.

Follow-up testing will indicate whether there has been exposure and thus allow time for preventative action to be taken. These blood tests also help a doctor to diagnose pesticide poisoning, and serve as a warning that more safety precautions are needed.

A decrease in cholinesterase indicates that an individual has been exposed to organophosphorus or carbamate insecticides as a result of failing to wear or maintain the proper personal protective equipment, or failing to wash thoroughly after handling these products.

Early detection of exposure is important. If the cholinesterase level after exposure is less than half of the base-line or normal level, then a person may be showing signs of pesticide poisoning. Such individuals must be removed from any further exposure to organophosphorus and carbamate insecticides until their respective cholinesterase blood levels return to normal.

Safety

Introduction

As noted earlier pesticides can kill or harm people, pets, or livestock and damage a wide variety of beneficial organisms as well as the environment. Safety is critical for all activities involving pesticides, including selection and purchase, transportation, storage, mixing and loading, application, equipment cleanup and maintenance, and disposal.

Responsibility and Attitude

Anyone who may come into contact with pesticides should be familiar with safety practices so as to prevent them from harming themselves, others, or the environment. For example, bystanders must be kept away from storage, mixing, or application areas. It is a vendor's responsibility to control access by locking doors and posting warning signs on all entrances to a storage area. Persons responsible for laundering contaminated clothing must also be aware of proper handling procedures.

Anyone handling pesticides must regularly review safety procedures because:

- ▶ familiarity with a product or procedure may cause vendors or applicators to become careless or complacent;
- ▶ safety procedures or product information may have changed since information was last reviewed; and
- ▶ repetition encourages the automatic adoption of safety procedures.

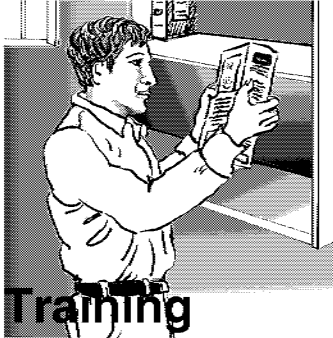
General Precautions

Common safety practices that should be used for all types of pesticide use/handling include:

- ▶ Never eat, drink, or smoke when handling pesticides (e.g., transporting, mixing, loading, applying, disposing,

etc.,).

- ▶ Do not carry food or smoking items when handling pesticides.
- ▶ Always wash before eating, drinking, smoking, or using the toilet.
- ▶ Shower thoroughly, washing body, hair, and under the fingernails at the end of each day after handling pesticides.
- ▶ Always carefully read and follow label information and directions.
- ▶ Do not wear contact lenses when handling pesticides.
- ▶ Immediately remove contaminated clothing and wash any spilled pesticide off the affected person.
- ▶ Wear clean, proper fitting protective clothing.



Employers, supervisors, and employees must co-operate to reduce injuries and illnesses on the job. The employer has principal responsibility for health and safety in the work place. However, supervisors and employees also have duties and responsibilities. Licensed pesticide vendors should ensure that the proper personal protective equipment is available for employees and train them on its use. Vendors should provide employees with information about the pesticides they handle, have MSDSs available, and train all staff to work safely.

Vendor employees should wear any personal protective equipment that is required to protect them from exposure to pesticides. Also, they should familiarize themselves with information about specific products, and receive instruction on how to properly handle pesticides and clean up minor spills.

Protection

Although personal protective equipment is sometimes cumbersome and uncomfortable to wear, it is vital that individuals do everything possible to maximize protection from exposure to pesticides.

Guidelines on protection usually appear on the label under the heading "PRECAUTIONS." Some label precautions may be

quite specific, such as the following:

- ▶ "Wear goggles or a face shield, rubber gloves, long trousers, long-sleeved shirt, and boots high enough to cover the ankles."
- ▶ "Wear full protective clothing, goggles, and rubber (natural or synthetic) gloves when handling this material. If exposure by inhalation of dust or spray mist is likely to be encountered, wear an appropriate respirator mask."
- ▶ "Wear clean neoprene gloves and clean waterproof protective clothing. Wear an appropriate respirator."

While some labels give complete instructions on personal protective equipment, others do not tell exactly what one should wear; they simply imply that some protection is needed.

Statements like the following mean that personal protective equipment should be used.

- ▶ keep from breathing dust or fumes;
- ▶ avoid skin contact; or
- ▶ keep out of eyes.

Often, more personal protective clothing may be needed than is mentioned on a product label.

If a pesticide label has a "DANGER - poison" symbol, always wear extra protection.

In addition to reading the safety precautions on the label, always assess the precaution symbol. A DANGER, WARNING, or CAUTION symbol will indicate the toxicity of the pesticide (*See Chapter 3, Labelling, for more detail.*)

Individuals should wear at least the following when handling most pesticides

- ▶ **coveralls**
- ▶ **unlined, chemical-resistant boots**
- ▶ **unlined, chemical-resistant gloves**

Individuals may encounter some situations that require extra precautions, including:

- ▶ eye or face protection (mixing);
- ▶ waterproof hat (application);
- ▶ respirator (mixing and application);
- ▶ waterproof apron (mixing); or
- ▶ waterproof pants and jacket (mixing or application).

Personal Protective Equipment

The protection used for a particular job should be based on the pesticide label precautions, the pesticide toxicity, and the possibility of being exposed to the pesticide. Always read the label on the pesticide container and follow all directions concerning personal protective equipment.

The personal protective equipment used must be able to handle the rigours of the work and the length of exposure. It is important to have equipment that fits correctly and comfortably.

Additional information on personal protective equipment for a specific pesticide may be found on its Material Safety Data Sheet (MSDS), or obtained from the manufacturer or wholesale company representatives. (*See* Chapter 3, Labelling, for sources of MSDSs.) General information on personal protective equipment may be obtained from:

- ▶ product pamphlets;
- ▶ safety equipment suppliers;
- ▶ applicator handbooks; and
- ▶ pesticide trainers.

Personal protective equipment used for handling pesticides should not be used for any other purpose.

The personal protective equipment needed when handling a pesticide depends upon the risk involved during its use.

Dermal

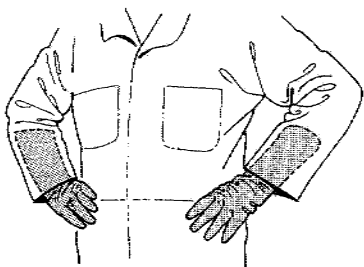
The skin is the major route through which pesticides can enter the body, with the hands being the most highly exposed part of the body.

Gloves

Never touch pesticides or pesticide containers with bare hands. Always wear unlined, chemical-resistant gloves when handling pesticides, rinsing or disposing of pesticide containers, or washing safety equipment.

Gloves should be unlined and made of rubber, neoprene, polyvinyl chloride, or polyethylene.

Vendors should have available the type of gloves recommended for the products distributed. **Do not use gloves made of leather, cloth, or canvas, or gloves having a cloth lining.** These materials are difficult to clean and they absorb pesticides, thereby keeping chemical in contact with the hands.



Check gloves for holes or leaks before putting them on and when washing them following use. Trap air inside the glove and put it in water to check for holes. Discard any gloves that are even slightly damaged, as gloves with holes will increase the chance of exposure to the hands and could trap pesticide in contact with the skin.

Keep the sleeves of coveralls over the top of the gloves to prevent any solution from running inside the gloves. For maximum protection, fold down the top of the gloves to make a cuff. With the gloves under the sleeves, the cuffs prevent pesticide from running down the gloves onto the arms when the hands are raised.

Gloves must be:

- ▶ clean;
- ▶ made of an appropriate chemical-resistant material for the pesticide, such as neoprene, nitrile, butyl rubber, or pvc-supported (not leather or cloth);
- ▶ unlined;
- ▶ long enough to cover the wrist and lower forearm; and
- ▶ in good condition (no holes or tears).

Coveralls



Anyone who handles pesticides should at least wear a long-sleeved shirt and long-legged trousers, or a coverall-type garment. Disposable coveralls specifically designed for pesticide use may be used. Selected clothing should be clean (pesticide free), easy to wash, of tightly woven fabric, and waterproof if pesticides are likely to substantially wet the work clothes or coveralls (e.g., splash pants).

Boots

Waterproof, unlined, knee-high boots of rubber or neoprene should be worn when there is the need to clean up a spill. Customers should be advised to wear this type of boot when loading, mixing, or applying pesticides. Leather or fabric covered boots should never be worn when handling pesticides. They absorb pesticides easily and are impossible to clean. Pant legs should be worn outside the boots so that the pesticide doesn't run into the boots. Applicators should thoroughly wash the outside of boots and remove them immediately after using pesticides.

Hats

Head protection should be worn when handling pesticides because the head and neck area can absorb pesticides much easier than most other body locations. Hats should have a wide brim, be made of non-absorbent materials (hard hat or rain wear), and be easy to clean.

Baseball type caps and straw hats are unsuitable head protection for use while handling pesticides.

Apron

Customers should be advised to wear a liquid-proof, chemical-resistant apron when measuring, mixing, or loading pesticides.

Ocular

Eyes need special consideration. Absorption of pesticides through the eyes is nearly 100%, and contamination can range

Goggles

from eye irritation to severe damage. Staff should wear goggles if there is any chance of getting splashed pesticide liquid or dust in the eyes. **Prescription eyeglasses do not provide enough protection**, and goggles will fit over most eyeglasses. Do not use goggles having cloth or foam headbands or ventilation holes.

Do not wear contact lenses when handling pesticides as they are permeable to vapours and gases. They can also keep pesticides in contact with the eyes.

Face shield

Face shields protect the face and eyes from direct contact with a splashed pesticide. Some face shields attach to hard hats. A face shield is recommended when handling damaged containers. Advise customers to wear a face shield when mixing or loading pesticides.



Respirators

R

A respirator may be required to prevent pesticide exposure through inhalation. A respirator is a unit that covers the mouth and nose to prevent pesticide spray droplets, particles, or vapours from entering the lungs. Wearing respiratory protection is important because once in the lungs, pesticides can enter the blood stream rapidly and completely. If inhaled in sufficient amounts, pesticides can cause damage to nose, throat, and lung tissue.

Respirators should be worn when the label so states or when a person may be exposed to harmful levels of pesticides in the air. Respirators must:

- ▶ have a CSA approval, MSHA-NIOSH approval (MSHA - Mines, Safety, Health Association, NIOSH - National Institute of Occupational Safety & Health), or a British Health & Safety Executive (BHSE) approval for pesticide use;
- ▶ have an appropriate cartridge or cannister for specific pesticide use;
- ▶ fit properly;
- ▶ be clean; and
- ▶ contain cartridges that are not over-saturated.

Fitting a respirator

Respirators are available in different shapes and sizes. For proper protection select one that fits properly.

A tight seal cannot be achieved if the wearer has a beard or other facial hair, as the hair prevents direct contact between the face and the edge of the respirator.

Do a fit test each time the respirator is put on. Follow the manufacturer's instructions for respirator fit or use one of the two following tests:

- ▶ place the palm of the hand over the exhalation valve cover and exhale gently. If the face piece bulges slightly and no air leaks between the face and face piece are detected, a proper fit has been obtained. If air leakage is detected, reposition the respirator on the face and/or readjust the tension of the elastic straps to eliminate the leakage. Repeat this fit test.

- ▶ Place flat pieces of paper or the palms of the hands over the open area of the cartridge cap, inhale gently, and hold breath for 5 to 10 seconds. If the face piece collapses slightly, a proper fit has been obtained. If air leakage is detected, reposition the respirator on the face and/or readjust the tension of the elastic straps to eliminate the leakage. Repeat this fit test.

Types of respiratory protection



Types of respirators available include:

- ▶ cartridge;
- ▶ canister;
- ▶ air-powered purifying; and
- ▶ self-contained breathing equipment.

The first three respirators do not supply any oxygen and therefore should never be used in oxygen-deficient atmospheres.



Dust masks provide protection only from dust particles. They are not respirators and should never be used in their place.

Cartridge respirators are the most common type of respiratory protective equipment used when handling pesticides. They consist of a half mask or full mask, and some are now disposable. Special pre-filters and cartridges are needed for protection against pesticides.

The pre-filters only remove dust, small particles, and spray droplets.

The cartridges, which contain activated charcoal, provide protection from pesticide vapours.

Changing cartridges

Consult the respirator directions for recommended usage times.

Cartridges should be changed at least once a year. A respirator is no longer providing appropriate protection and should be changed if the applicator can smell or taste chemical.



Pre-filters and cartridges should always be used together. When buying or replacing cartridges and pre-filters, be sure to ask for equipment to protect against the type of pesticide being handled.

Canister respirators incorporate a full face piece and a canister of charcoal. Their large-volume canister allows for use in higher vapour concentrations, where cartridge respirators may not be sufficient. Use a canister that provides protection from organic vapours.

Air-powered purifying respirators use an electric pump to draw air through a charcoal cartridge, where a filter removes particulates. The purified air is delivered to a tight fitting face mask or a loose fitting helmet. These may be a more comfortable option to the half mask or full mask respirators, especially on hot days or when respiratory protection is needed for long periods of time.

Self-contained breathing equipment supplies air from a tank on the wearer's back via a tube on the headpiece. These respirators are used for the application of fumigants, or for use in emergencies such as a fire or a major pesticide spill.

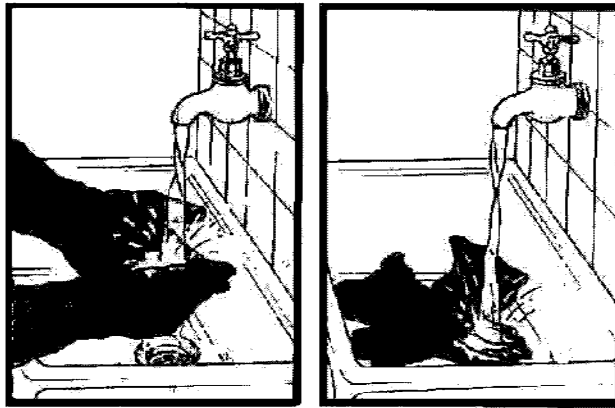
Cleanup and maintenance

Personal protective equipment will retain residue after use so handle all pieces carefully to prevent contamination during removal and cleanup.

Gloves

Gloves should be kept on while removing personal protective equipment, then washed with soap and water before they, in turn, are removed.

Additional care must be taken so as not to contaminate the hands while removing the gloves. This can be achieved by turning the gloves inside out while removing them. Personal protective equipment should be cleaned at the end of each day of use or when a job is finished. Manufacturer instructions for cleaning personal protective equipment should always be followed. Cleanup should be done at the application site, whenever possible.



Clean gloves as follows:

- ▶ leave gloves on while removing and cleaning personal protective equipment;
- ▶ wash gloves before taking them off; and
- ▶ wash thoroughly with detergent and rinse well after each day of use/application.

Check gloves frequently for leaks, discard leaky ones, and replace gloves on a regular basis

Body covering

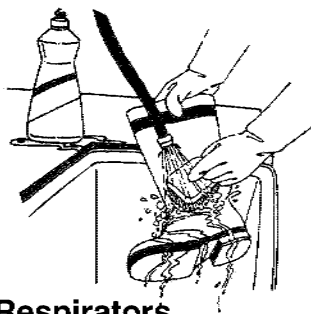
Clean body coverings as follows:

- ▶ rinse off waterproof clothing before removal;
- ▶ discard heavily contaminated clothing;
- ▶ use disposable plastic garbage bags for temporary storage of pesticide-contaminated clothes prior to washing; and
- ▶ wash clothing daily.

Laundering

Laundry instructions are as follows:

- ▶ use chemical-resistant gloves to handle contaminated clothing;
- ▶ use a pre-wash additive on contaminated areas;
- ▶ pre-soak and launder contaminated clothing separately from normal laundry;
- ▶ avoid overcrowding clothes in the washing machine;
- ▶ re-rinse clothing using the pre-soak cycle;
- ▶ use hot water, full water level, and normal wash cycle;
- ▶ use a heavy duty detergent, bleach, or household ammonia (do not mix these cleaners);
- ▶ repeat wash cycles may be required to remove some chemicals;



Respirators



Storage

- ▶ hang clothes out to dry so as to prevent possible contamination of the dryer; and
- ▶ run the empty washing machine through a full cycle again after use, using hot water and detergent to rinse it thoroughly.

Follow the manufacturer's instructions for care/disposal of disposable coveralls.

Clean respirators as follows:

- ▶ Inspect respirators regularly for damage.
- ▶ Make sure all valves, mechanical pre-filters, and charcoal cartridges are properly positioned and sealed.
- ▶ Remove pre-filters and cartridges/canisters after each day of use and place them in a clean, sealed plastic bag. This prevents the cartridge from being used up when not in use.
- ▶ Wash the respirator face piece in warm water using a mild detergent, then rinse well.
- ▶ Prolong the life of charcoal cartridges/canisters by removing them from the respirator and keeping them in a clean, air-tight container when not in use.

Do not store personal protective equipment in the pesticides storage area or with regular clothing. A cool dry storage area close to where the pesticides are stored will help extend the life of protective clothing and allow quick access in case of an emergency. Keeping waterproof clothing (e.g., gloves, boots, etc.) away from sunlight will help extend their life. Keep charcoal cartridges/canisters in a clean air-tight container.

The Environment

Environmental Risk

Pesticides have distinctive chemical and physical properties that influence the degree of environmental risk that each one poses. However, every time a pesticide is applied there is some risk to the environment. The degree of risk depends upon persistence, mobility, non-target toxicity, and volume.

The environmental risk associated with the use of a pesticide can be expressed in the form of the following equation.

$$\text{Environmental Risk} = \text{Persistence} \times \text{Mobility} \times \text{Non-target Toxicity} \times \text{Volume Used}$$

Environmental risk is minimized when any of these risk factors is close to zero.

Persistence

Persistence describes how long the active ingredient of the pesticide remains active in the environment. A pesticide that remains active in the environment for a long period of time is described as persistent. The relative persistence of pesticides is usually compared by determining their half-life.

Half-life is the time required for one-half of the initial concentration of the pesticide to degrade in some part of the environment.

A product is considered highly persistent if it's half-life is greater than one year. The herbicide picloram, used to control vegetation along rights-of-way, is an example of a highly

persistent pesticide. The product carbofuran is considered to be a moderately persistent product, having a half-life of one month to several months depending on soil conditions. The herbicide 2,4 D is considered to be slightly persistent, with a half life of about 2 to 3 weeks. Products with a half-life measured in hours or days are said to be non-persistent (e.g., pyrethrins).

The more persistent a pesticide, the longer the active ingredient is available and so the higher the risk to the environment.

Active ingredient persistence is good for long-term pest control, but it also means that the pesticide can cause environmental damage over a long period of time. Persistent pesticides are more likely to move from the application site into local water supplies. Water contaminated with pesticide is harmful to humans, fish, and wildlife.

Hexazinone (Velpar L) registered for vegetation control on blueberries, is an example of a moderately persistent pesticide. Trace amounts, associated with its use in nearby blueberry fields, have been found in ground water throughout the Maritimes.

Mobility

Mobility is the ability of the active ingredient of the pesticide to move away from the site of application through the soil, water, or air. Members of a chemical family may exhibit similar tendencies for mobility, but other factors, such as soil type, soil conditions, and climate, also influence both the mobility and the persistence of a pesticide in the soil. The more easily the pesticide is able to move away from the site of application, the higher the risk to the environment.

Non-target Toxicity

Non-target toxicity refers to the unintended harmful effect of the pesticide on any organism other than the pest. The risk to the environment increases if the non-target toxicity of the product is high.

Volume

Volume of use refers to the total amount of the product used in the environment. The larger the volume of product that is used in the environment, the higher the potential for environmental damage.

Pesticide Fate

As soon as a pesticide is released into the environment, it's fate is determined by various processes, including:

- ▶ adsorption;
- ▶ desorption;
- ▶ volatilization;
- ▶ runoff;
- ▶ leaching;
- ▶ absorption;
- ▶ breakdown/degradation; and
- ▶ drift.

These processes ultimately determine what impact the pesticide will have on the environment. Both physical and chemical properties of pesticides influence their environmental risk. The most important of these properties are listed in Table 6.1.

Given the sensitive nature of the natural environment, it is extremely important that vendors are knowledgeable concerning the processes listed above, and are prepared to assist customers when selecting crop protection products.

Degradation	how pesticides break down in the environment.
Bio-accumulation	how pesticides accumulate in body tissues.
Volatility	how pesticides change into a vapour when exposed to air.
Adsorption	how pesticides bind to soil particles.
Absorption	how pesticides move into organisms or soil structures.

Table 6.1 Pesticide properties that influence environmental risk

Degradation

The breakdown of pesticides in the environment is known as degradation. The rate of pesticide break down is affected by numerous environmental factors, including temperature, moisture, and pH. This breakdown may occur through microbial activity, chemical activity, or photodegradation.

Microbial degradation is the most common type of pesticide breakdown. Soil microorganisms use the pesticide as a food source, thereby breaking the pesticide into basic compounds such as water and carbon dioxide. Temperature, pH, soil moisture, presence or absence of oxygen, soil fertility, and the chemical or physical properties of a pesticide all affect microbial breakdown.

Chemical degradation is simply a chemical reaction that occurs between the pesticide and other chemicals in the environment, such as water. This type of degradation generally splits the pesticide into less hazardous compounds. The rate of chemical degradation depends upon the temperature, pH, moisture, and the specific pesticide.

Photodegradation refers to the break down of a pesticide by sunlight. If they are to be effective, products that break down very rapidly when exposed to sunlight must be incorporated

into the soil shortly after application.

The speed with which degradation occurs is measured by the pesticides' half-life. That is the time it takes for one half of the initial amount of a pesticide to break down in the environment. For example, 2,4-D has a half-life in soil of about 2 to 3 weeks. If it were applied at the rate of 1 L/ha, 2 to 3 weeks later there would only be 0.5 L/ha of the product left in the environment.

Half life is the time it takes for one half of the initial amount of pesticide to break down.

Bioconcentration

Bioconcentration (or bioaccumulation) is defined as the movement of a chemical from the surrounding medium into an organism. If the chemical is more soluble in fat than in water, it can accumulate in the fatty tissue of aquatic organisms at a higher concentration than found in the surrounding water.

Most of the examples of bioconcentration of chemicals from the environment are observed in aquatic ecosystems; however, some also occur in terrestrial ecosystems.

Biomagnification

The increase in concentration of a toxic chemical, including some pesticides, to higher trophic (feeding) levels in a food chain is referred to as **biomagnification**. Biomagnification from one feeding level to another (algae to fish to osprey) is dependent on the bioconcentration of the chemical in the lower trophic levels and, for this reason, bioconcentration or bioaccumulation and biomagnification are related. Biomagnification occurs when units of a chemical that persisted in the algae are transferred to the fish, and then magnified up the food chain to the osprey. This can result in the osprey accumulating a large quantity of a toxic chemical, thereby resulting in serious problems.

Volatilization

Volatilization is the process whereby solid or liquid substances evaporate into a vapour (gas). The rate at which pesticides evaporate depends upon the pesticide and environmental conditions (temperature, relative humidity, and wind speed). Hot, dry, windy weather increases volatilization.

Small spray drops are more easily volatilized than are large droplets.

When pesticide vapours move from the target crop into the air during or after an application, this movement is called vapour drift.

Vendors should be prepared to advise their customers that vapour drift of a herbicide can cause damage to non-target plants some distance from the point of application. Customers should also be aware that a volatile product may be less effective if it is applied on a hot day, because some of the active ingredient may be changed into a vapour (gas) and thus will no longer be available to affect the pest.

Adsorption

Adsorption refers to the binding of chemicals to soil particles or other material. The degree to which a pesticide binds to the soil varies with the type and concentration of the pesticide, and with the soil type, moisture, pH, and texture. Soils high in organic matter or clay are the most adsorptive. Most soil-bound pesticides are less likely to leach or be broken down by microbes. However, pesticides can be easily moved by wind or water when bound to soil particles.

Desorption

Desorption occurs when bound pesticides are released from the soil or other material. These released pesticide residues are then more readily available for uptake and effect on the environment.

Absorption

Absorption is the movement of pesticides into organisms (e.g., plants, animals) or structures (e.g., soil, wood). Absorption of a pesticide into an organism is not always detrimental since many of these organisms can degrade the pesticides into nontoxic compounds. Usually, a pesticide will not be absorbed if it has adsorbed to the soil.

Natural Processes

Natural processes also determine what happens to a pesticide, and where it ends up, after it is released into the environment.

These natural processes include:

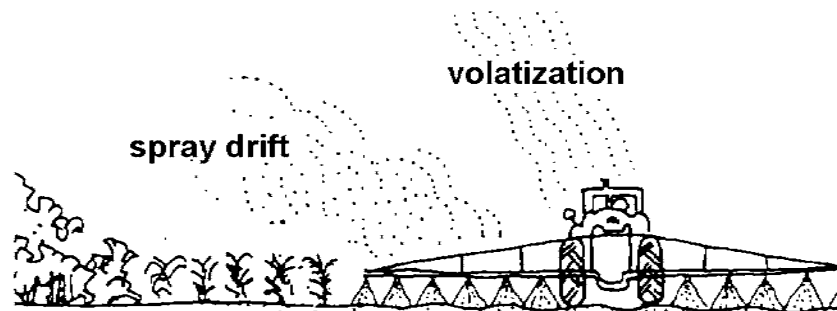
- ▶ spray drift;
- ▶ surface runoff;

- ▶ leaching; and
- ▶ soil erosion via wind and water.

Spray Drift

Spray drift refers to the airborne movement of spray droplets away from a treatment site during application. Spray drift is affected by:

- ▶ spray droplet size. **The smaller the droplets, the more likely they will drift.** Therefore, factors that decrease droplet size (e.g., high temperatures, low humidity) will increase drift;
- ▶ air movement. The more that air moves, the more pesticide spray will drift;
- ▶ stable or atmospheric inversion conditions (inversions occur when wind is calm and air temperature at the ground level is lower than the air above it). Inversions cause spray to remain suspended, then when wind does occur the suspended droplets move as well;
- ▶ the distance between nozzles and the target. The greater the distance, the more that air movement can affect the spray; and
- ▶ the speed of application equipment. The faster that application equipment moves, the more likely it is that drift will occur.



Surface Runoff

Surface runoff is the movement of water over a sloping surface. Pesticides may be either mixed in the water or bound to soil particles that move with the water. The pesticide's characteristics (formulation, solubility, etc.) will affect the amount of pesticide in the runoff. The amount of runoff depends on:

- ▶ the slope of the surface;
- ▶ the texture and type of the surface;
- ▶ the adsorptive ability of the soil;
- ▶ the moisture content of the surface material;
- ▶ the amount of additional moisture (rainfall, irrigation, etc.); and
- ▶ the type and amount of surface vegetation and root development.

Runoff from treated areas or areas contaminated by spills can pollute surface water, groundwater, and soil. A loss of product can occur when it rains before a liquid spray has had time to dry on the soil or vegetation. Even many months after application, heavy rains can carry persistent products and products adsorbed on soil particles in the run-off water. Even during the year following application, a moderately persistent pesticide, such as atrazine, may be moved into water sources by melting snow and spring rains.

Leaching

Leaching is the movement of pesticides with water through the soil. Leaching can occur downward, upward, or sideways. Wood preservatives can also leach from treated wood. Leaching increases when:

- ▶ pesticide solubility increases;
- ▶ the soil has a low water-holding capacity;
- ▶ the soil has a low organic content;
- ▶ adsorption of the pesticide to soil is low or desorption is high;
- ▶ additional water is added (rain, irrigation); and
- ▶ the soil structure becomes coarser.

Soil Erosion

Soil erosion occurs when a soil surface is worn away by water or wind. Any pesticide that has adsorbed to soil particles can be carried by the wind or run-off water to locations considerably distant from the application site. Customers should be aware that soil erosion can move pesticides into the environment.

Pesticides in Water

Both surface water and groundwater can be contaminated by pesticides. Once water is contaminated with a pesticide it may become toxic to marine, aquatic, or terrestrial wildlife; to domestic animals or to humans; or cause damage to sensitive crops from runoff or when used as an irrigation source.

Surface water is visible water (water at the soil surface in open bodies such as streams, rivers, ponds, lakes, and oceans).

Groundwater is found below the surface of the earth, generally saturated in zones of rock, sand, or gravel. Such zones are known as aquifers. The water table is the level below which all the spaces are filled with water. The water table can be near the surface or at depths of hundreds of feet. Much of the water used for consumption by livestock and people comes from groundwater and, if contaminated, associated negative effects may persist over a long period of time.

Contamination

Pesticides can enter surface water and groundwater in several ways:

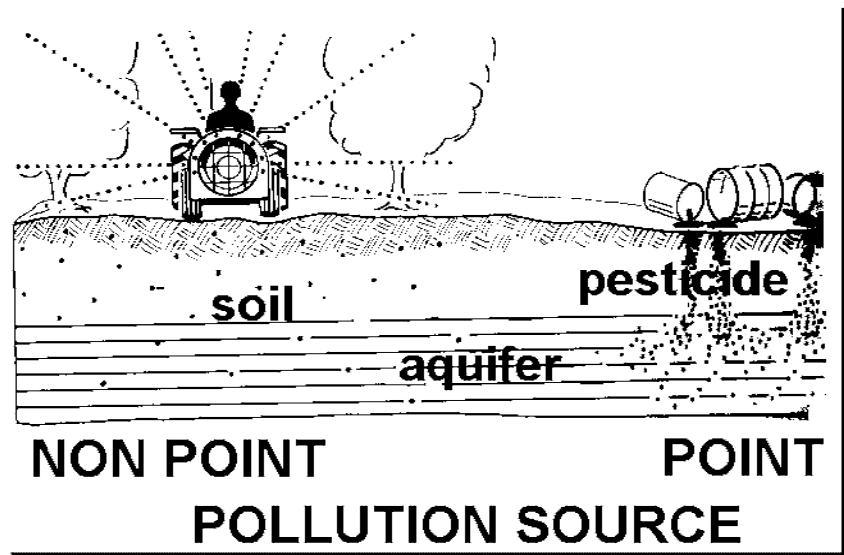
- ▶ natural processes, including runoff, leaching, and erosion;
- ▶ spray drift and/or vapour drift during application;
- ▶ using an application rate higher than is recommended on the product label;
- ▶ pesticide spills during transportation, mixing and loading, storage, application, or disposal;
- ▶ container leaks and/or flooding while pesticides are in storage;

- ▶ back siphoning of pesticides from a spray tank into wells or a surface water source during tank filling;
- ▶ overflow of spray tanks during filling;

- ▶ wastewater from equipment clean up;
- ▶ improper disposal of excess spray mix, unwanted waste pesticides, and pesticide containers; and
- ▶ atmospheric fallout (rain or snowfall containing pesticides).

Once water is contaminated, organisms living in or using the water may be affected. These can include humans, domestic animals, fish, plants, birds, wildlife, insects, etc. Contaminated water can affect them directly (contact or drinking) or indirectly (impact on food supplies or recreational activities). It is difficult (sometimes impossible) and very expensive to decontaminate ground and/or surface water.

After an area has been determined to be contaminated, the pesticide source is classed as either a point source or a non-point source. **Point source contamination** refers to the release of a large amount of pesticide into a small area (accidental spill, pesticide fire, or improper disposal). **Non-point source contamination** refers to the release or application of a pesticide over a large area.



Pesticides in Soil

Vendors should be aware that soil can be contaminated in the same way as water—by spills associated with mixing and loading, application equipment overflow, or improper disposal, or if the applicator exceeds the recommended rate of application. Contamination of sandy or coarse soils can lead to groundwater pollution; spills on clay or fine soils often remain on the soil surface for longer periods of time and thus are more likely to move to other areas via surface runoff.

Contamination

Soil contamination can be short lived or last for a long time depending on how quickly the pesticide is inactivated by biological, chemical, or physical means. The following factors may affect the persistence of a pesticide in the soil:

- ▶ chemical class or family;
- ▶ type of formulation;
- ▶ strength (concentration) of formulation;
- ▶ ability to form persistent byproducts;
- ▶ weather conditions; and
- ▶ soil conditions (e.g., organic matter, pH, texture).

Breakdown is slowest under dry, cool conditions.

Vendors should be prepared to inform their customers that although highly persistent herbicides are advantageous in cases where long-term vegetation control is needed (e.g., the management of vegetation on rights-of-way and industrial sites), they must be used with care since there is a greater chance of off-site movement through leaching and erosion. Applicators should also be aware that damage to trees some distance from the treatment area can occur.

Highly persistent herbicides or insecticides can limit future uses of a property. Persistent products have a greater chance of contaminating the environment, and may damage sensitive or susceptible crops planted the following season.

Pesticides in Air

A vendor should be prepared to inform customers that spray droplets, dust, mists (spray drift), or vapours (vapour drift) can be added to the air during surface or aerial pesticide

applications.

Contamination

Once in the air, pesticides can be transported to water bodies, non-target organisms, or to the soil. They can also be concentrated within enclosed spaces and harm applicators, bystanders, or non-target organisms.

Pesticide Impact on Natural Ecosystems

Using pesticides indiscriminately can alter or destroy an ecosystem.

Animals

Wild or domestic animals, including birds, can be harmed by numerous pesticides. As a worst case they may die from direct exposure to pesticides or, due to the accumulation of pesticides in their tissues, they may suffer adverse weight loss, reproductive failure, or be unfit for consumption. Contaminating nests, dens, or burrows; destroying wildlife habitat; or destroying their food supply can also harm animal and bird populations. Soil organisms can be harmed by pesticides in the soil.

Vendors should understand how pesticides can negatively impact animals and be prepared to advise their customers to:

- ▶ be sensitive to the presence of wildlife and their young;
- ▶ read and follow all pesticide label information;
- ▶ use pesticides only when necessary;
- ▶ select the least toxic and least persistent of the registered and recommended pesticides;
- ▶ use a target-specific pesticide to minimize impact on desirable organisms;
- ▶ be aware of the effects that granular pesticides and treated seed may have on wildlife, and ensure that such products are properly used and stored;

- ▶ avoid using products that are known to move away from the area of application through drift or runoff; and
- ▶ leave buffer zones around sensitive areas.

Beneficial

Pollinators (bees), insect predators, parasites, and decomposers are a beneficial part of the natural ecosystem and

Insects

may help to control pest populations naturally. In addition, some growers purchase beneficial insects to control specific pests as part of their Integrated Pest Management (IPM) program or to increase pollination.

The widespread use of a non-selective insecticide can kill beneficial insects as well as target pests. If the number of beneficial insects is decreased, the natural balance is upset and surviving pests may quickly increase in number.

Vendors should be aware of the role that beneficial insects play in the natural ecosystem, and be prepared to discuss this with customers. Negative impacts can be decreased by:

- ▶ minimizing pesticide usage;
- ▶ choosing the pesticide least harmful to beneficial insects;
- ▶ not treating the edges of treatment sites, thereby providing for areas where insect predators may take shelter; and
- ▶ minimizing drift onto areas that house beneficial insects.

Pollinators

Vendors should also be prepared to assist their customers to protect bees, which are a special group of beneficial insects and essential for the survival of many plants. An applicator can help protected bees by:

- ▶ letting nearby beekeepers and local beekeeper associations know when hazardous pesticides will be applied;
- ▶ not applying pesticides that are toxic to bees on blooming crops;
- ▶ mowing cover crops and weeds to remove blooms prior to spraying;
- ▶ applying pesticides later in the evening when bees are more apt to be in the hives;

- ▶ selecting a pesticide product that is least harmful to bees; and
- ▶ taking necessary steps to minimize spray drift and vapour drift.

Fish and Other Aquatic Organisms

Fish and other aquatic organisms can be harmed when pesticides enter surface water. This can happen through drift, runoff, soil erosion, leaching, or the deliberate or careless release of a product.

Fish can be harmed indirectly if pesticides destroy food sources, disrupt their ability to reproduce or feed, or damage aquatic vegetation, thereby resulting in a loss of protection or an increase in water temperature.

Selected pesticides (e.g., pyrethroids) are known to be very toxic to fish and aquatic organisms, and all carry special warning notices on their labels.

Vendors should understand that fish can be protected if pesticides are prevented from directly or indirectly contaminating water sources. They should be aware that fish and aquatic organisms can be negatively impacted by pesticides and be prepared to advise customers to:

- ▶ use the correct pesticide rate;
- ▶ frequently calibrate and maintain application equipment;
- ▶ observe buffer zones during tank filling or mixing and application;
- ▶ avoiding spraying in high winds and just prior to rain;
- ▶ fill the sprayer away from water bodies and to use a nurse tank. (Make a habit of bringing the water to the sprayer rather than the sprayer to the water source.);
- ▶ prevent the back flow of contaminated water through the filler hose into the water supply. (Keep the end of the filler hose above the water level in the spray tank at all times, never leave the tank unattended, and use an **anti-backflow device** (e.g., spring-loaded check valve) whenever taking water directly from a water source.); and
- ▶ wash and/or park spray equipment away from a well, stream, lake, or the ocean.

Applicators should always be advised to bring the water to the sprayer, not the sprayer to the water.

People who damage fish or fish habitat as a result of pesticide use may face prosecution and severe penalty under the federal *Fisheries Act*.

Plants

Chemicals that damage or injure plants are said to be phytotoxic, and injury can occur to both target and non-target plants.

Most pesticide damage is caused by herbicides. However, in some cases the damage to non-target plants can result from the use of an insecticide or fungicide. The vendor should be aware of any possible non-target sensitivities noted on a product label and be prepared to inform the customer to protect non-target plants by taking steps to prevent the movement of pesticides onto non-target areas.

Damage to stream-side vegetation can also affect bank stability, the temperature (removal of shade) of land and water, or fish food sources. Stream-side vegetation is also important to other wildlife, and plant damage can harm associated food sources and habitat.

Transportation, Storage and Disposal

Transportation

A pesticide vendor must inform any customer transporting a pesticide if the product is regulated as a dangerous good and, if so, must provide required information on shipping documents, vehicle placarding requirements, or any other special requirements. This information should be obtained from the manufacturer or distributor. Transport Canada can provide additional information, as required, on transporting dangerous goods.

Federal Legislation

Transportation of Dangerous Goods Act

Transportation of Commercial and Restricted Class (non-Domestic) pesticides are regulated by the *Transportation of Dangerous Goods (TDG) Act*. This legislation is the responsibility of Transport Canada, but it has also been adopted and administrated under provincial legislation. Vendors should consult their provincial pesticide regulatory authorities for details.

Other Requirements

In all other situations, consult appropriate provincial regulations to find out whether some or all of the following items are needed.

1. **Shipping documents**, which indicate the shipper, receiver, technical shipping name, product classification, product identification number (P.I.N), degree of hazard, and emergency telephone numbers.
2. **A hazard warning label** on every pesticide package.
3. **Placards** with product identification numbers and symbols on the outside of vehicles (not required when carrying less than 500 kg of a product other than poisonous or corrosive gas, or a substance that produces a flammable gas when mixed with water) (*See Figure 7.1 for details.*)
4. **Appropriate packaging** of dangerous goods during transport.
5. **Training of persons** involved in the transport of dangerous goods.
6. **Reporting of accidents** that represent a danger to health, life, property, or the environment.

All companies that handle pesticides for manufacturing, formulating, or wholesale and all commercial pesticide applicators that transport pesticides from storage areas to application sites or to other storage sites should be familiar with the requirements for the specific pesticides they handle.

Classes and quantities of dangerous goods that require special handling and transport procedures are identified in the *Transportation of Dangerous Goods Act* Regulations. Some pesticide products are included in those classes of dangerous goods known as "gasses" (Class 2), "flammable liquids" (Class 3), "poisonous substances" (Class 6.1), or "products hazardous to the environment" (Class 9.2). (*See Figure 7.1.*)

The transport of non-Domestic pesticides may also be regulated by individual provinces. Vendors and purchasers should familiarize themselves with the legal requirements of their province. (*See Chapter 2, Pesticide Legislation, for details.*)

DANGEROUS GOODS LABELS THE MARKS OF SAFETY










	CLASS 1 EXPLOSIVES
	CLASS 2 COMPRESSED GASES
	CLASS 3 FLAMMABLE LIQUIDS
	CLASS 4 FLAMMABLE SOLIDS, SPONTANEOUSLY COMBUSTIBLE, DANGEROUS WHEN WET
	CLASS 5 OXIDIZERS & ORGANIC PEROXIDES
	CLASS 6 POISONOUS & INFECTIOUS SUBSTANCES
	CLASS 7 RADIOACTIVES
	CLASS 8 CORROSIVES
	CLASS 9 MISCELLANEOUS DANGEROUS GOODS

Figure 7.1 Classification of Dangerous Goods

Exemptions

Non-Domestic pesticides are exempt from some federal and provincial requirements for dangerous goods, but only in the following situations:

▶ **Transport between the retail store and the farm or place of use**

Individuals are exempt from the Regulations when they are transporting most non-Domestic pesticides by road either to or from the retail outlet and the farm or place where they will be used. However, the pesticide must be in the original packaging and/or container, and each container must hold less than 454 L (100 gals). Presently, there is no maximum load limit.

There is NO EXEMPTION if the pesticide being transported is classified as a poisonous or corrosive gas (e.g., methyl bromide), or is a substance that produces a flammable gas when mixed with water.

▶ **Transport from the farm to the place of use by a farm-plated vehicle**

When transporting non-Domestic pesticides by road from the farm to the place of use, individuals are exempt from the Regulations as long as they carry less than 500 kg of pesticide (weight of the load including the container), the transport distance is less than 50 km, and the labels or markings that were on the container or other package when the product was purchased are displayed on each container.

This exemption does not apply when transporting a poisonous or corrosive gas, or a substance that produces a flammable gas when mixed with water.

▶ **Transport from the farm to the place of use by a non-farm plated vehicle**

There are different transportation requirements for vehicles that are not farm-related. For any quantity and any distance travelled, individuals must display on each container the labels or markings that were on the container or other package when it was purchased, carry proper shipping documents, and make sure that the person transporting the pesticide has a training certificate. The training certificate is valid for 3 years.

Individuals must display the appropriate placards on any transport vehicle when carrying any quantity of poisonous or corrosive gases, or a substance that produces a flammable gas when mixed with water, or when carrying more than 500 kg of any product that is regulated as a Dangerous Good.

► **Transport of tanks containing regulated pesticides or regulated pesticide solutions**

Tanks that hold 5,000 L or more of a non-Domestic pesticide concentrate or pesticide solution must display the appropriate placards before and after the pesticide application. No product identification number is required on the placard.

NOTE: These are the only situations under which an individual does not have to follow the *Transportation of Dangerous Goods Act* Regulations.

Provincial Legislation

The transport of non-Domestic pesticides may be regulated by individual provinces. Vendors and purchasers should familiarize themselves with the legal requirements of their province and those of neighbouring provinces. (*For specific*

detail, refer to the provincial legislation attached.) Vendors should be familiar with the regulations and prepared to advise customers regarding any requirements.

Good Practice Guides

In addition to legislated requirements, there are a number of actions that a vendor should take to reduce risk associated with the transport of pesticides, including:

- ▶ Carefully inspect each container of pesticide before preparing it for transportation. Make sure there are no broken bags or cartons and no leaking liquid containers.

- ▶ Load containers carefully to prevent movement or breakage/spillage during transit. Take extra care with liquid pesticides. Make sure the containers are stacked securely so there is minimal danger that they will break or spill. A spill will contaminate the other containers and the vehicle itself. If a spill should occur, do not use contaminated packages. Return them to the manufacturer for disposal or repackaging.

- ▶ Place all pesticide containers in an enclosed compartment that is securely affixed to the vehicle; never place them in the cab or passenger area.

- ▶ Advise the customer if there are specific requirements for placarding.

- ▶ Advise the customer that pesticide products must not be left unsupervised in a vehicle unless:
 - the vehicle is in a place not accessible to the public;
 - the pesticide is locked in an enclosed part of the vehicle (but not the cab or passenger area); or
 - the vehicle has a placard which says, “Chemical Storage Warning - Authorized Persons Only”.

- ▶ When offering a delivery service, make sure all employees handling pesticides are trained and know the transport requirements for the product, that the contingency plans for accidents and spills are in the vehicle, and that the vehicle is equipped with a fire extinguisher and spill recovery kit.

Storage

Proper storage of pesticides by the vendor and by the customer can prevent cross contamination of products and help to protect employees, the general public, emergency responders, farm animals, and the environment. Label directions for proper storage should be followed to prolong the shelf life of pesticides.

Provincial Legislation

Vendors should familiarize themselves with provincial legislation and any guidelines governing their storage of pesticides. Vendors should also be familiar with legislation or guidelines that apply to their customers (farmers, commercial applicators, aerial applicators, etc.) and refer them to appropriate provincial authorities for specific details.

Good Practice Guides

General storage

In addition to legislated mandatory requirements for the storage of pesticides, facility managers should:

- ▶ read and follow storage instructions on pesticide labels and MSDSs;
- ▶ store pesticides only in their original container/packaging and with the original label intact;
- ▶ store pesticides in a dry area;
- ▶ check containers regularly for leaks, tears, rust, or loose lids;
- ▶ keep an inventory of the quantity, type, and age of the pesticides in storage. Keep this list up-to-date, handy, and outside of the storage site;
- ▶ have adequate lighting so products are easily recognized;
- ▶ keep containers/packages upright and off the floor;
- ▶ have areas in and around the storage site posted as “**no smoking**” areas;
- ▶ provide the local fire department with a copy of the site map, a list of products that might be stored, and the MSDSs as requested;
- ▶ invite the local fire department to visit the site;
- ▶ keep appropriate personal protective equipment near (but not in) the storage facility;
- ▶ keep emergency response equipment near (but not in) the storage facility;
- ▶ at all times keep access routes to/from the site clear for emergency equipment;

- ▶ keep a list of emergency telephone numbers (e.g., fire department, medical personnel, and poison control centres) posted near the storage area;
- ▶ follow all federal/provincial Building, Fire, and Electrical Codes;
- ▶ follow the manufacturer's suggested stacking heights, and make sure that stacked tiers are stable and secure;
- ▶ keep flammable and combustible materials stored in a separate section of the warehouse, away from heating systems. Keep this area well-ventilated and free from any possible source of flame;
- ▶ keep enough space between rows to permit a visual inspection of containers for corrosion and leaks;
- ▶ never refuse a shipment of damaged goods. Secure damaged containers and follow procedures for the disposal of unwanted pesticide. Decontaminate the transport vehicles/equipment and other containers; and
- ▶ keep Material Safety Data Sheets, technical bulletins, product labels, and other information up-to-date and readily available for customers and all employees. (*See Chapter 3, Labelling, for additional information on MSDSs.*)

Storage location

The storage facility should be:

- ▶ in a building separate from other work areas;
- ▶ away from wells, ditches, or open water bodies (50-metre minimum);
- ▶ sited at least 50 metres from private residences, hospitals, schools, or buildings with a high occupancy;
- ▶ away from areas frequented by people (untrained staff, the general public, children, and animals should be kept away from the storage area);
- ▶ on non-permeable soil;
- ▶ away from areas where flooding may occur; and
- ▶ accessible to emergency personnel outside of normal business hours.

Bulk storage

On a regular basis, vendors should check all pumps, valves, etc., located on bulk pesticide storage containers and immediately replace damaged or worn parts. Make sure that all bulk storage tanks have dikes or retaining walls and an impervious base to collect any pesticide in the case of a spill. Ensure also that all liquid transfer systems are designed to prevent overflow while filling operations are under way, and have a system to contain and dispose of tank and pump washing water.

Temporary storage

Many of the principles that apply to permanent pesticide storage facilities would also apply to temporary storage facilities. Vendors and customers must follow provincial regulations or requirements.

Industry Warehouse Standards

CropLife Canada has implemented Warehousing Standards for the storage of crop protection products. These standards are separate and distinct from the requirements specified by provincial pesticide regulations for the storage of pesticides, and apply to all sites in Canada that store non-Domestic plant protection products.

This industry-managed program is regulated through the Agrichemical Warehouse Standards Association. Licences are renewed every 2 years, following approval from qualified auditors. For further information on the Warehousing Standards, contact CropLife Canada at 416-622-9771.

Disposal

Vendor Product

Because of a shift in customer needs, at times individuals or vendors may have unwanted pesticide concentrate that requires disposal. The most practical way to get rid of this product is to sell it to another customer who can use it according to label directions. This may require contacting vendors in other geographic areas where there is a continued demand for the product(s) in question. Another option may be to return product to the manufacturer. Vendors should contact their provincial pesticide regulatory authority for information if disposal is the only available option.

Disposal of waste product

Vendors may find that as a result of damaged containers or spill cleanups that they have waste product that requires disposal. In addition, some vendors accept and store unwanted pesticide as a service to customers. While waiting for proper disposal, vendors should:

- ▶ cover all drums containing pesticide materials and label each with the wordings “Danger - spilled pesticide” or “DANGER” and the name of the pesticide;
- ▶ consult appropriate provincial/industry authorities for advice on proper disposal, and a licensed hazardous waste disposal company to arrange for pick-up and disposal. Remember to follow all requirements under the *Transportation of Dangerous Goods Act* regarding proper transport and disposal documentation. In some provinces, it may be acceptable to take the drums to a designated hazardous waste disposal site. Consult with provincial regulatory officials before this is done.

Never take drums to a garbage dump unless authorized to do so by your provincial pesticide regulator.

Customer Product

Disposal of concentrated product

Customers can minimize the likelihood of having unwanted pesticide product(s) by following several basic principles. First they should plan their pesticide needs carefully and purchase only the amount of product required to do the treatment. However, even with careful planning they may still find that they have concentrated product in their storage facility at the end of the use season. Product carried over to the next season may not be needed because of a change in crops or a change in the service they offer (e.g., a decision to close a lawn care business).

To address the issue at time of purchase, vendors may be asked to assist customers in calculating the amount of product required to conduct one or a number of applications. (See Chapter 9, Pesticide Application, for an example of such

calculations.) It can be suggested to the customer that, at the end of each season an inventory be taken of product(s) remaining in storage. Customers should be reminded to refer to this inventory list at the start of next year's spray season and to use available stored product before purchasing new product. They should make certain that the old inventory is effective for use by contacting the manufacturer.

Vendors should also remind their customers that the safest way to dispose of a pesticide concentrate is to use it according to label directions. Many vendors will take back unopened containers as a service to their customers.

Disposal of waste product

Vendors should advise customers to contact their appropriate provincial pesticide regulatory authority for advice on proper containment and disposal of any waste product.

Disposal of surplus tank mixture

Vendors should remind customers to make every attempt to minimize the amount of excess product left in the spray tank at the end of a treatment. Vendors may be asked to assist customers in determining the total amount of product required to do a treatment, how to accurately measure the area to be treated, or how to calibrate the application equipment.

Product left in the tank at the end of an application should be applied according to label directions on another site that requires an application of this pesticide.

A customer must NEVER re-spray the treated area with undiluted spray mix. Spraying an area twice will DOUBLE THE RECOMMENDED PESTICIDE APPLICATION RATE.

Customers should contact their appropriate pesticide regulatory authority for more information on product disposal.

Disposal of

Vendors should contact their appropriate provincial regulatory

Pesticide Containers

authority for information on the proper method of disposal for empty pesticide containers, and be prepared to advise customers to read the label and follow all precautionary statements.

Pesticide Container Recycle Program

In most provinces the recommended way to dispose of empty, rinsed, plastic pesticide containers is to return them to an authorized pesticide vendor for recycling.

Vendors should advise their customers that it is a violation of both provincial regulations and industry guidelines to use empty pesticide containers, including large plastic drums, for anything other than their original intended purpose. Such drums should not be used or sold as garbage cans, flotation devices, etc.

Most licensed pesticide dealerships accept plastic containers during normal business hours. Containers must be clean, rinsed (triple or jet), and contain no liquid material. Container lids must be removed and, if possible, pesticide labels should also be removed. Dealer personnel must inspect each container to make sure that it is acceptable for recycling. Containers collected in the Maritime Region are chipped, and the plastic chips are shipped to be made into products such as plastic fence posts.

A plastic fence post made from recycled containers is a better gift to future generations than are containers abandoned throughout the natural environment.

Rinsing

Customers should be aware that once a pesticide has been added to the spray tank, the container should be rinsed (**triple or jet rinsing for plastic or metal containers, and a single rinse for bags with plastic or foil liners**) to remove any remaining product. Even after rinsing, trace amounts of a pesticide may remain. All containers not being recycled should be punctured or crushed so that they cannot be used

again for any other purpose.

Burning

Vendors should advise customers that the burning of plastic containers or other hazardous substances is prohibited by law in many Canadian provinces. The burning of empty paper containers is NOT recommended and is also against the law in some provinces. Vendors and customers should check with their appropriate provincial pesticide regulatory authority for further details. Low-temperature burning generally does not destroy remaining pesticide product, but rather results in it being vaporized. The vapours may then drift to other areas, posing a hazard to public health and the environment. Breathing the smoke from these fires can be harmful.

Burying

The burying of empty pesticide containers, even if they have been properly rinsed, is not recommended and may be against the law in some provinces. While properly rinsed containers do not pose an environmental threat, their decomposition rate is very slow. A plastic container may take several centuries to break down. Customers should contact their provincial pesticide regulatory authority for proper disposal options.

Pest Management

Introduction

The goal of pest management is to manage pests effectively, economically, and safely. Pest management typically involves the suppression of pest numbers to acceptable levels. It does not usually involve eradication, or the total elimination of a pest population.

Vendors should be able to provide advice to their customers with respect to the nature of the pest control product and the interpretation of the product label for all pesticides that they sell. Vendors are discouraged from recommending pest control strategies, or specific pest control products, to customers UNLESS they otherwise qualify as a pest control specialist.

Integrated Pest Management (IPM)

In Canada, the Expert Committee in Integrated Pest Management proposed the following definition of IPM in 1995:

“Integrated Pest Management (IPM) is a decision making process that uses all necessary techniques to suppress pests effectively, economically, and in an environmentally sound manner.”

IPM does not attempt to eliminate all pests. By using methods that have the least potential to harm people and the environment, IPM tries to reduce a pest population to the level where damage is acceptable. Growers should be

encouraged to use an integrated pest management approach to crop protection.

Some of the immediate benefits of IPM include:

- ▶ enjoying more cost-effective pest control;
- ▶ slowing the development of pest resistance; and
- ▶ reducing dependence on one type of control.

IPM also addresses consumer and government concern about the careful use of pesticides. Consumer fears are now limiting pesticide use and this trend may accelerate unless the public believes that pesticides are being applied in a responsible manner.

Elements of IPM

The elements of integrated pest management are:

Pest prevention

1. Prevention is important because avoiding pest problems is often more economical and gives better and longer-term results than does relying on treatments. Reducing pest problems through preventative steps also makes any pest treatments undertaken more effective if indeed they are required. Cultural or physical control methods could be considered preventative, for example selecting disease- or insect-resistant plants, managing growing conditions to produce healthy plants, cleaning to eliminate food sources for pests, or screening buildings to keep out pests.

Pest identification

2. Identification, which involves the correct identification of pests, minimizes the chance that beneficial species may be mistaken for problem ones. Similarly, proper identification can indicate when treatments are not required (e.g., if certain beneficial species are present in sufficient numbers).

If vendors or customers cannot identify a pest, help should be obtained so that a correct identification can be made. Information on pest and beneficial species identification and biology may be available from:

- ▶ government or scientific publications;
- ▶ government or other diagnostic services, including pest monitoring service firms;
- ▶ pest control representatives (e.g., pest

- management firms, technicians, pesticide company sales/technical reps, etc.);
- ▶ government pest management specialists;
- ▶ universities and colleges; and
- ▶ local Internet or other electronic references.

Reference information only

Knowledge of the biology of pests and beneficial species will help when making management decisions. Important biological information includes the following:

- ▶ *knowing the life cycle and stages of growth of the pest allows treatments to be made when the pest is most susceptible (there may only be a very short window of time during which a treatment will be effective);*
- ▶ *knowing how rapidly the pest species reproduces helps determine the timing and number of treatments;*
- ▶ *knowing how rapidly beneficial species reproduce helps in deciding whether treatments may be required;*
- ▶ *the life cycle of the host may be important since certain treatments can harm the host if applied at the wrong stage; and*
- ▶ *the behaviour of the pest may influence the timing or choice of a treatment (e.g., the pest may only be present at certain times of the day or night or in certain locations).*

Pest monitoring and field scouting

3. Pest monitoring and field scouting are vital parts of IPM. When making pest management decisions, proper monitoring can provide information about pest populations and sites (e.g., the need for treatments and when they will be most effective).

Pest monitoring

Customers should be aware that in the Atlantic Region, provincial and federal agencies conduct pest monitoring programs for specific pests in important crops. They frequently issue status reports and predict infestation

levels to assist producers to make pest management decisions. The nature of the monitoring program varies with the pest and the crop involved.

A good monitoring program can:

- ▶ significantly reduce the need for treatments;
- ▶ improve the success of pest management programs; and
- ▶ reduce treatment costs

Reference information only

Monitoring consists of making regular inspections and writing down the results (making records). Monitoring includes checking, and often counting, to determine:

- ▶ *pest damage;*
- ▶ *pest presence, species, and abundance (does the pest population exceed the injury threshold?);*
- ▶ *weather conditions (do they favour pest development, such as diseases?);*
- ▶ *the pest's life stage (is it at a stage susceptible to a particular management method?);*
- ▶ *the host's stage and condition (is it suitable for the management action being considered?); and*
- ▶ *beneficial organism presence, species, and abundance (are there enough to keep the pest population below the injury threshold?).*

Reference information only

In addition to monitoring for the pest itself, it is important to also monitor the presence of beneficial predator and/or pollinator insects and to record (or have ready access to) local weather conditions. The presence of large numbers of beneficial predators is a key consideration when making decisions about insecticide applications. Likewise, the presence and activity of pollinators should be confirmed so that the most appropriate insecticide can be chosen and the application timed to minimize harm to the beneficial species.

Daily weather patterns, especially temperature, rainfall, and humidity, can have a significant impact on the spread and virulence of plant pathogens, so accurate weather records are very useful in predicting the seriousness of disease outbreaks and making decisions about fungicide applications. On a seasonal basis, weather also plays a role in determining

Field scouting

Informed decisions about the application of pest management measures in a particular field require careful and timely monitoring within the field itself. Traditionally this has often been done by the farmer, but more and more frequently producers are coming to rely on the services of professionally trained crop scouts to carry out this task and to provide recommendations on necessary control measures when they are warranted.

Vendors should be aware of any field scouting services available within their region, and be prepared to advise their customers of the services offered for the crops grown.

Reference information only

Careful and appropriate scouting of a field is essential to gain an accurate picture of the pest problem and to estimate its potential severity. Specific scouting techniques vary considerably, depending upon the crop, the pest, and their stages of development.

Reference information only

Scouting for weed pests

The goal is to assess the severity of known weed species and to provide early warning of new species that may be invading. When scouting for the latter, note species present in field margins and other adjacent non-cropped areas. Scout fields in advance of potential herbicide application windows (pre-seeding, early post-emergent, pre-harvest, post-harvest, late fall).

Scouting for insect pests

The goals are to identify the insects present in order to determine which, if any, may present a problem and to assess their numbers and the extent of damage already caused. Assessments may be based on insect numbers and the stage of insect/crop development or the extent of crop damage, depending on the species. Assess populations of highly mobile insects by estimating their number per square metre.

Insects with limited mobility can be counted by pulling plants and shaking the insects off onto the ground or a small ground sheet. Sampling for small, mobile, difficult-to-see insects is best done with a sweep net. Infestations can be estimated indirectly by examining roots, crowns, leaves, stems, and seeds for signs of insect damage. Pheromone, light, or stick traps are used to trap adult insects and the results used to estimate the potential damage that may be caused by the next generation.

Scouting for diseases

Great care must be taken in the gathering of samples so that a disease is not further spread to other areas of the field. Many factors can cause plant reactions that resemble disease symptoms. Examine roots, crowns, stems, leaves, fruits, and seeds for symptoms. In many cases, only a qualified diagnostic lab can make accurate diagnosis. Where seed-borne diseases are a concern, a sample of each seed lot should be submitted to an accredited seed diagnostic laboratory to determine the level of infection.

Injury and action thresholds

- 4. Injury and action thresholds** are used to decide when to apply control treatments.

The **injury threshold**, sometimes called the injury level, occurs when a pest population reaches numbers such that it causes unacceptable injury or damage sufficient to justify treatment.

The **action threshold**, sometimes called the treatment threshold or action or treatment level, is the point at which treatment should take place in order to prevent the pest population from reaching the injury threshold.

To establish injury and action thresholds, pest managers may access information available from:

- ▶ government and scientific publications;
- ▶ pest management specialists;
- ▶ universities or colleges; and
- ▶ grower organizations.

Management methods

5. IPM involves using all available information to select **management methods** and then apply them in a co-ordinated approach. Vendors should advise their customers that specific information about management methods for different pests is available through extension specialists, government publications, colleges, and universities. Most treatments fall into the following general methods:

Cultural method - includes treatments that can prevent pests from developing or spreading. They may disrupt the pest or host life cycle, or make the environment less favourable for survival of the pest. They include rotating crops, tilling the soil, providing optimum plant growing conditions, implementing sanitation practices, and replacing plants that are susceptible to infestation with more resistant cultivars or species.

Legal method - laws may limit the development of pest populations by restricting human activities (e.g., quarantine, import/export of plant material, etc.).

Mechanical/physical method - includes treatments that use equipment, devices, or the manipulation of environmental factors such as temperature and humidity to prevent the spread of pests or reduce pest populations. This category includes the use of mechanical cultivators, mowers and brushing equipment, traps, screens, vacuums, freezers, heat applicators, and sound and other repellent devices.

Biological method - includes treatments that use living organisms to control/kill the pest. Biological treatments include:

- ▶ introducing predators, parasites, or micro-organisms to attack pests;
- ▶ conserving naturally occurring predators and parasites; and
- ▶ using grazing animals to consume weeds.

The use of parasites or predators involves careful planning since these are effective only at certain locations and times,

and may have an impact on plant or animal species that are not pests.

Genetic method - involves the protection of the host and/or control of the pest by using organisms having special genetic traits (e.g., resistance to disease).

Behavioural method - includes treatments that take advantage of a pest's natural behaviour to suppress the population. These include using pheromones (which are chemicals produced by insects to repel or attract other insects of the same species) to disrupt mating patterns or to attract pests to a trap, or releasing sterile males to inhibit pest reproduction.

Chemical method - includes treatments that use naturally derived or synthesized pesticides to kill, attract, repel, or alter the growth of pests.

Pesticide Types

If the applicator has chosen chemical control, the following are some terms that should be understood.

Selective pesticides are toxic to some pests, but have little or no effect on other pests or non-target organisms.

Non-selective pesticides are toxic to a wide range of pests, beneficial species, and other non-target organisms.

Residual pesticides continue to be effective on a treated surface or in the treated area for an extended period following application (long-term control).

Persistent pesticides remain active in the environment for a long time. Sometimes they can accumulate in animal or plant tissues.

Non-persistent pesticides do not remain active in the environment for more than 1 year.

Evaluation of

Evaluation involves:

Results

- ▶ making post-treatment observations on pests and non-target organisms;
- ▶ comparing post-treatment observations with pre-treatment monitoring records to determine treatment effects;
- ▶ reviewing treatment records, including methods, dates, times, rates, costs, etc.;
- ▶ obtaining feedback from clients or site users, if possible, about treatment effectiveness; and
- ▶ identifying any possible improvements to pest management, including preventative actions that could be taken.

IPM brings together monitoring, a knowledge of pest biology, and the use of all available control methods to create a crop protection or pest management program that is as cost effective and environmentally safe as possible.

Pesticide vendors should be familiar with local pest experts, government agencies, trade associations, IPM practitioners, etc., as sources of valuable information to improve the success of their customers' pest management programs.

Pest Types

Weeds

A weed is a plant that grows where it is not wanted. Weeds become a pest when they:

- ▶ compete with cultivated plants for light, water, and nutrients;
- ▶ reduce crop yields;
- ▶ harm people or livestock;
- ▶ contaminate foods;
- ▶ reduce visibility along transportation corridors;
- ▶ are alternate hosts for other pests;
- ▶ are aesthetically unpleasing; or
- ▶ affect structures or equipment.

Weed types

Annual weeds complete their life cycle within 1 year. Most annuals produce many seeds to ensure their survival. Annuals can be divided into two groups; summer annuals, that germinate in the spring, and winter annuals, that germinate in

the fall.

Biennial weeds live more than 1 year but less than 2 years. They grow from seeds that typically germinate in the spring. The first year they store food, usually in short fleshy roots, and generally produce only a rosette of leaves. The following season the plant uses the stored food and grows vigorously, produces seeds in the summer or fall, and then dies.

Perennial weeds live more than 2 years. Often no seed is produced the first year; thereafter seeds can occur every year for the life of the plant. Almost all perennial weeds spread by seed. Many also spread via other plant parts such as creeping stems, stolons, or roots; rhizomes (a root-like underground stem); underground bulbs; or a broken piece of root. Perennial weeds may be shallow rooted or deep rooted.

Perennials are considered the hardest weed type to control.

Weed identification

Weeds need to be identified in order to determine the best control method(s). Vendors should advise their customers to obtain assistance from weed control specialists if a positive plant identification is difficult to establish.

Identifying leaf stages

It is important for an applicator to have correctly identified desirable plant (crop, turf) and weed leaf stages because some herbicide labels refer to these for timing of the pesticide application. Often, herbicides are only effective when desirable plants and weeds are at certain stages of growth. For example, a herbicide label may recommend application at the three-leaf or trifoliolate stage. Use of the herbicide before or after this stage will reduce its effectiveness and could result in poor weed control and/or injury to crops. Regular monitoring of the growth of weeds and surrounding plants can help to ensure that herbicides are not applied past the stage when they will be effective. Vendors should advise their

customers, if necessary, to obtain assistance from weed control specialists when attempting to identify leaf stages.

Weed management

Vendors should be prepared to direct customers to obtain assistance on weed management methods from an extension specialist. Examples of pest management methods for weed control include the following:

Cultural control, which emphasizes competition to discourage weeds, includes:

- ▶ use of nurse or companion crops (a fast-growing crop planted along with a slower growing crop to compete with the weeds. The nurse crop can be mowed when the slower crop is established); and
- ▶ increasing the ability of desired plants to compete against weeds by using good cultural practices (e.g., optimum fertilizer rates, watering, etc.).

Mechanical (physical) control, which disrupts weeds, includes:

- ▶ cutting weed tops prior to seed production;
- ▶ tillage and band weeding;
- ▶ mowing, burning, or other sanitation practices; and
- ▶ using mulch to suppress seed germination.

Biological control includes:

- ▶ grazing a field prior to weeds going to seed; and
- ▶ releasing pest-specific insects or other natural agents.

Chemical control includes the use of pesticides, typically herbicides or plant growth regulators.

Herbicides

Herbicides are classified according to selectivity, mode of action, timing of application, and residual effectiveness.

Selectivity

Selectivity explains what plants will be controlled.

Selective herbicides will kill or damage certain plants, but not others. For example, some herbicides will control broadleaf weeds but not grass.

Non-selective herbicides kill or damage all of the plants in a treated area.

Some herbicides are both selective and non-selective depending upon their rate of application (e.g., glyphosate when used in forestry).

Mode of action

Mode of action explains how the herbicide kills a plant.

Contact herbicides kill plant parts contacted by the herbicide. They are effective against annual weeds, but only "burn off" the tops of perennial weeds. They exhibit very little or no movement within the plant itself.

Systemic herbicides enter the roots or above-ground parts of plants and move, or are translocated, throughout the plant. Effects may not show for a week or more after treatment. If too much of a systemic herbicide is applied to the leaves, it may kill the leaf cells too quickly and prevent translocation to the site of action in a plant.

Timing

Timing of application refers to the pest stage(s) when control can be successfully undertaken.

Herbicides are applied at different stages of crop or weed growth. Vendors should direct the customer to read the label for the most effective and safest time to apply any herbicide.

Pre-plant herbicides are applied to the soil before seeding or transplanting. Some pre-plant herbicides are volatile and need to be incorporated directly into the soil. These are called **pre-plant soil-incorporated treatments**.

Pre-emergence herbicides are applied to the soil after planting, but before the emergence of the specified crop or weed. Pre-emergence may refer to the germination of either the weed or the crop. Pre-emergence herbicides control weeds before, or soon after, they emerge.

Post-emergence herbicides are applied after the specified crop or weed has emerged, to control established weeds. The application may be soon after emergence or up to a specific plant height or leaf number.

Residual effectiveness

Residual effectiveness refers to the length of time over which a chemical control measure may remain effective.

Non-residual herbicides, which are quickly inactivated in the soil after application, do not affect future crops. Non-residual herbicides will not control later germinating weeds.

Residual herbicides do not break down quickly and may control weeds for several weeks to several years. They may also limit the crop type that can be grown the following year(s).

Soil sterilants are non-selective residual herbicides that are applied to soil to prevent the growth of plants for a long period of time (i.e., a few months to many years). Vendors should be familiar with these products and be prepared to advise customers before they purchase them.

Plant growth regulators

Plant growth regulators are used to change (speed up, slow down, or stop) the vegetative or reproductive growth of plants.

Insects and Mites

There are many different insects and mites. Most insects are beneficial; only a few are considered to be pests when they damage property, crops, food, feed, or livestock, or when they carry diseases affecting man or animals.

Differences

	Insects	Mites
Pair of antennae	1	None
Sets of legs	3	4
Skeleton	exoskeleton	exoskeleton
Body segments	3	2

Life cycles

Insects and mites, which change as they grow, go through 3 or 5 different stages. The common stages are: egg, nymph, larva, pupa, and adult.

Pest control is specific to the stage of growth. **The best control is usually achieved during the early stages (young, nymph, or larva).** Eggs and pupa are not affected by most insecticides and miticides. For more information on life cycles, vendors should advise their customers to contact appropriate extension specialists.

Management

Types of pest management methods include:

- ▶ exclusion;
- ▶ cultural;
- ▶ mechanical/physical;
- ▶ biological;
- ▶ insect pheromone methods;
- ▶ genetic; and
- ▶ chemical (pesticide).

Customers should be aware that knowing specific information about management methods for each pest encountered is important for planning a good pest management program. For example, parasites and predators of a pest must be known if they are to be used to control a pest; resistant qualities of a host must be known to choose a resistant host; or the exact time when a control method is effective must be known to obtain the most benefit.

Insecticides and miticides

Insecticides and miticides are often classified according to their selectivity, mode of action, and residual effectiveness.

Selectivity

Selective insecticides only control certain insects or mites and generally do not harm non-target organisms.

Non-selective insecticides may control all insects, mites, or both in a treatment area.

Mode of action

Contact insecticides must come in contact with the pest to be effective. They can be applied to the pest or to the surfaces that a pest would be expected to touch. Some

contact insecticides have a residual effect and can kill the pest for some time after application.

Systemic insecticides enter plants or animals and flow in the sap or blood. Pests that suck the sap or blood are then killed by the insecticide it contains. Some insecticides are both systemic and contact.

Stomach poisons must be swallowed by the pests to be effective. They are usually applied to the pests' food and thus eaten with the food. Sometimes, stomach poisons are mixed with food to form a poisonous bait.

Suffocating insecticides (oils or soaps) typically clog the breathing system, but these can also affect egg survival.

Residual effectiveness

Some insecticides have a short residual period of effectiveness of 1 or 2 days; others have along residual periods of effectiveness (several weeks or more). Residual insecticides control undesired insects/mites for a longer period of time.

Insecticide types

Fumigants are insecticides that work in a gaseous form. Fumigants are often used to kill pests in enclosed spaces or in soil, where they breathe the poisonous fumes.

Growth regulators act like an insect's own growth hormones. They disrupt the normal development of the insect, and it dies before it becomes an adult or before it can reproduce.

Silica dusts or gels are inert powders that kill crawling pests by abrading their bodies, thereby causing them to loose body fluids and die. Contact insecticides are sometimes mixed with these powders.

Attractants are insecticides that may attract female insects for egg laying, or attract male insects to artificial female traps.

Repellents are insecticides that repel insects, and thus will keep them away from their hosts. They are typically used against mosquitoes and other biting flies.

Sticky pastes are placed on traps that attract pests. Chemical

attractants or colours are used to attract the insects to the trap. Once trapped, the pest will not cause damage. Sticky pastes are also used as barriers to restrict the movement of crawling pests or to determine insect populations.

Microbial insecticides are selective insecticides containing microbes (tiny organisms, e.g., Bacillus thuringiensis) that are sprayed on plants. After they are eaten, the microbe or a poison the microbe produces, kills the target insects. A positive characteristic of microbial pesticides is that they are typically only poisonous to selective insects. Application early in the development stage of the insect is often most effective.

Slugs and Snails

Slugs and snails are soft bodied animals that reproduce by laying eggs. They become pests when they damage plants, feed, or food, or when they carry diseases affecting man or animals.

Molluscicides

Slugs and snails are first attracted by an odour and then are killed after eating the molluscicide. It is important to advise the customer that these pesticides are quite toxic and must be kept away from children, pets, birds, or animals.

Diseases

A healthy plant can become diseased when subjected to dramatic changes in its environment or life functions. Disease symptoms are caused by environmental stress, herbicide damage, insect damage, and/or microorganism infections (e.g., fungi, bacteria, virus, nematodes, etc.). It is important that vendors advise customers to correctly identify the cause of the symptoms so that an effective treatment can be chosen.

Causes

Causes of disease may include the following:

Environmental stress. Unfavourable environmental conditions, which stress plants and cause abnormal growth or disease-like symptoms, include extremes of light, temperature, water, or nutrients, and toxic chemicals (e.g., air pollutants). Plants weakened by

environmental stress are more likely to be infested by pests. Recognizing and relieving the stress will help prevent infectious diseases.

Herbicide damage. Such damage usually occurs over large areas (treated areas), injuring and/or killing wanted and unwanted vegetation.

Insect damage. This damage generally occurs in isolated areas when insects eat foliage or suck plant juices, thereby causing undesirable changes.

Pest infections. Micro organisms, including fungi, bacteria, viruses, and nematodes, can cause various diseases. Micro organisms are pests when they damage desirable plants. Identification is usually based on visual symptoms or on pest identification.

Types

Types of diseases include:

Fungi, the largest group of organisms that cause plant diseases, feed on living or decaying tissue. This group includes moulds, mushrooms, and rusts. Most fungi reproduce by tiny spores, which are usually moved by wind or water to land on a host plant. Some fungi (e.g., rusts) need two different hosts to survive and reproduce. If environmental conditions are good, the fungus spores germinate, produce threadlike filaments that infect the host, absorb nutrients, and give off toxins that cause disease symptoms.

Infection begins when the fungus is able to enter plant tissue. When the plant responds to infection by growing abnormally, it is said to be diseased. Inside the plant the fungus is protected and difficult to control. Some symptoms that may be caused by fungi include cankers, dieback, galls, leaf spots, rots, rusts, and wilts. Customers should be aware that the movement of infected plants, plant parts, and soil may spread the fungus.

Bacteria, or single-celled organisms that can only be seen with a microscope, cause some major plant diseases. Bacteria are spread by wind and rain, by ground or surface water, or by contact with contaminated animals or equipment. They usually enter a plant through natural openings or wounds. Under favourable conditions, bacteria reproduce very quickly, using the plant as a source of food. Some blights, galls, and rots are caused by bacteria.

Viruses cannot be seen with an ordinary microscope, yet they can cause diseases that often reduce plant vigour and crop yields. They reproduce only when they are in living cells and can be spread by mechanical means (e.g., during pruning or harvesting), in propagation material (seeds, tubers, and other plant parts), or by vectors (insects, mites, nematodes, and fungi). Mosaics, ringspot, and leaf roll are examples of diseases caused by viruses.

No insecticides are available to control viruses directly. However, some insecticides may be used to control virus vectors.

Nematodes are small worm-like organisms that may feed on plant roots, stems, and leaves. They can effect the movement of water and nutrients in a plant, and they can create wounds that may allow fungi or bacteria to enter. Nematodes multiply by producing eggs and spread by movement of infected plants, animals, and seeds, or through contaminated soil or water. Some symptoms that can be caused by nematodes are wilting, stunting, lack of vigour, and growth deformities.

Disease management

Three conditions must be present for a pathogenic disease to develop. These are:

- ▶ a disease-causing organism (pathogen);
- ▶ a host susceptible to the disease; and
- ▶ an environment favourable to the disease organism and/or unfavourable to the host.

Taking away or changing any one of these three conditions will control the disease. For example, a disease problem can

be prevented by keeping the organism out of an area; using strains of plants that are resistant to, or are not affected by the disease; reducing the population of disease causing organisms; or manipulating the environment to favour the host but not the pathogen.

Chemical control of disease-causing organisms can involve the use of fungicides, bactericides, and nematicides. For more information, customers should be referred to crop extension specialists.

Fungicides

Fungicides are often described according to how they work (mode of action).

Protectants

Protectant fungicides provide a protective film of fungicide on or around the host to prevent fungus spores from germinating.

Fungi are most vulnerable to fungicides between germination and infection. After the plant is infected the fungicide normally will not kill the fungi inside the plant, but it can protect the plant from more infection. Repeated pesticide applications are required since any new plant growth is not protected.

Eradicants

Eradicant fungicides kill fungus organisms that have already infected the plant, but have not become well established within the plant. Eradicant fungicides have limited value when fungi are well established within plants.

Systemics

Systemic fungicides are absorbed by plants and move within them. They may act as protectants, eradicants, or both. Once inside the plant, systemics move to new areas of plant growth.

Bactericides

Bactericides are chemicals that are toxic to bacteria. They kill bacteria on contact and must be used before the bacteria infect a plant.

Nematicides

Nematicides move through the soil as a gas, or via soil water,

and depend on the presence of spaces between the soil particles for their movement. A few nematicides are applied as liquid or granular formulations and are not fumigants (e.g., oxamyl). These may act by direct contact with nematodes or systemically so that nematodes feeding on or in the plant acquire a lethal dose.

Fumigants

Fumigants are chemicals, in the gaseous state, that move through the air spaces between soil particles in sufficient quantities to be lethal to a pest organism.

Vertebrate Pests

Vertebrate pests typically include birds, rodents, rabbits, and regional pests such as bats, wolves, raccoons, skunks, moose, etc. These animals become pests when they damage property, crops, feed, food, or livestock, or when they carry diseases affecting man, animals, or birds.

Vendors should be aware of and prepared to advise customers on the importance of knowing vertebrate pest behaviour and biology because it is important in determining the most effective control methods, the best time to implement the control, and the best location for control (e.g., traps,

repellents, or poisoned baits). For more information, vendors should refer their customers to extension specialists.

Management

Vertebrate pests may be managed/controlled by:

- ▶ excluding them from a feeding or breeding location;
- ▶ destroying or changing their habitat;
- ▶ encouraging natural predators;
- ▶ repelling or frightening them away;
- ▶ shooting or trapping;
- ▶ poisoning them with pesticides (e.g., avicides, rodenticides); or
- ▶ preventing pest reproduction with chemosterilants.

Customers should check with provincial authorities about laws that could affect vertebrate control programs. Provincial and/or federal legislation for the protection of wildlife may prevent the destruction of some pests or special permits may be required for their control. Shooting, trapping, or the use of pesticides may be limited to specified times of the year or

Legal status

specified locations.

Pesticide control

Pesticides used for vertebrate control include the following:

Chemosterilants reduce bird populations by inhibiting reproduction.

Bird repellents may be non-poisonous or poisonous to birds.

- ▶ **Non-poisonous repellents** are sticky and irritate the bird. They are usually placed on exterior ledges, windowsills, beams, and places where birds are not wanted. Noise making devices, visual devices, and glue-paste materials also act as repellents.
- ▶ **Poisonous repellents**, when eaten by birds, make the birds act strangely. The birds' strange behaviour then repels other birds.

Acute rodenticides kill rodents after one feeding.

Anticoagulant rodenticides cause internal or external bleeding and death after they are eaten. These are available as single-dose rodenticides, which involve only a single feeding or multiple-dose products, which need several feedings over several days.

Vendors must advise their customers to carefully read the label before using any rodenticide, as cats and dogs are highly susceptible to these pest control products.

Fumigants are poisonous gases used to kill burrowing rodents, gophers, and ground squirrels.

Piscicides are used to kill fish in bodies of water. Vendors must advise their customers to consult with provincial pesticide regulatory authorities before they purchase or use these products.

Animal repellants are used to keep animal pests away from plants, buildings, or other treated areas.

Pesticide Resistance

Pesticide resistance describes the situation that occurs when a portion of a pest species is able to survive a pesticide dose that had previously been successful in controlling the species.

Because of a genetic difference, a resistant pest population can develop that is not affected by or is resistant to the particular pesticide. When these pests reproduce, they pass on their resistant trait(s). When one particular pesticide is used repeatedly on such a population, the susceptible individuals are eliminated while the resistant ones continue to reproduce and become dominant.

After a pest population develops resistance to a pesticide, the effectiveness of other closely related pesticides may also be reduced. Some applicators may attempt to achieve control of the pest by **increasing the pesticide application rate**, but this will result in increased selection pressure and hence **will speed up the development of resistance**. There is also evidence to suggest that **the repeated use of pesticides with the same mode of action will, sooner or later, result in the appearance of a resistant organism**.

Failure to follow label rate recommendations is illegal and may speed-up the development of pest resistance.

Pesticide Application

Introduction

Once an applicator has identified a pest, attention commonly focuses on how to properly address control. As noted earlier there are various options, including the use of crop protection products or pesticides.

The principles of application technology involve application equipment and the environmental constraints that affect the use of pesticides.

Application Equipment

Some products, such as ant traps, baits, and other rodenticides, come with their own pre-calibrated application equipment and no further calibration or dilution is required. For all other products the customer must select the type of equipment to use.

Application equipment should apply the pesticide uniformly and at the correct rate to the desired target, and not contaminate non-target areas. The equipment must therefore:

- ▶ be selected carefully;
- ▶ have the proper components;
- ▶ be operated correctly;
- ▶ be calibrated accurately; and
- ▶ be properly maintained.

Equipment Selection

A variety of equipment is available for the application of pesticides (back pack sprayers, tractor driven boom sprayers, in-furrow injection applicators, aerial applicators, etc.).

Customers should choose the equipment that best suits:

- ▶ the size of area to be treated;
- ▶ the pest to be controlled;
- ▶ the pesticide formulation selected for use; and/or
- ▶ the label recommended method of application.

Equipment Operation

Vendors should assist their customers in interpretation of the label instructions for application rates, and advise them to operate application equipment in a manner consistent with the instructions on the pesticide label.

Amount of pesticide to purchase

Label directions

The “Directions for Use” section of any pesticide label indicates to the applicator how much pesticide should be applied. For ready-to-use formulations, the label will recommend the amount of formulated pesticide that is to be applied per area or volume (recommended pesticide rate).

Calibration

Calibration procedures for specific application equipment may be outlined in the operator manual or recommended by industry or government specialists. To calculate how much total product the customer will need to purchase, one can multiply the amount of formulated product by the size of the area to be treated.

Example

When applying a particular pesticide, the label directions indicate an application rate of 2.2 L of liquid concentrate per hectare. The customer has calculated the size of the area to be treated to be 6.3 hectares.

**The customer would need to purchase:
(2.2 L/ha X 6.3 ha) = 13.9 L to do the treatment.**

For formulations that are diluted, the label will recommend:

- ▶ the amount of formulated pesticide that is to be applied per area or volume (recommended pesticide rate), or
- ▶ the amount of diluent or carrier that is to be applied per area or volume (recommended sprayer output).

NOTE: The terminology used to describe these rates varies widely on labels.

Vendors should ensure that their customers understand that

Equipment Calibration

prior to use, application equipment must be calibrated so that it will deliver the correct amount of sprayer mixtures. The output of a sprayer is referred to as the calibrated sprayer output.

Calibration can be defined as checking and adjusting the delivery rate. Properly calibrated and operated equipment will deliver the correct amount of pesticide, and in a uniform distribution, to the treatment area. There are many different calibration procedures. Vendors should always advise their customers to use an accurate calibration method suited to the type of application equipment being used.

Equipment that is not properly calibrated may apply the pesticide at an incorrect rate or in a non-uniform distribution, thereby resulting in areas of over, or under, application.

Over-application of a pesticide may result in:

- ▶ increased application costs;
- ▶ damage to the application site;
- ▶ damage to the environment;
- ▶ increased applicator or bystander exposure; and
- ▶ excessive pesticide residues.

Under-application of a pesticide may result in:

- ▶ poor control of the pest;
- ▶ need to re-treat the area (increased application time and costs); and
- ▶ development of resistant strains of pests.

Application of pesticides in excess of, or lower than, label rates is ILLEGAL.

Calibration method

A simple method whereby a customer can calibrate sprayer output is to:

- ▶ mark out 1 hectare (an area 100 m x 100 m = 10,000 sq m = 1 ha);
- ▶ fill the spray tank with water to a set mark;
- ▶ spray the measured hectare at the same speed, pump pressure, etc., as for the intended application;
- ▶ measure the amount of water needed to refill the sprayer to the original mark on the tank (e.g., 40 litres).
- ▶ Since a hectare was sprayed, this volume (in this case, 40 litres) is the calibrated sprayer output or delivery rate per hectare of the equipment.

Note

If the label indicates that the pesticide should be applied at a rate of 2.2 L of liquid concentrate in 30 L to 60 L of water per hectare, and it took 40 L of water to refill the tank to the mark, (the calculated sprayer output is 40 L/ha), then there is no further adjustment required to the equipment (speed of travel, pump pressure, etc.). This is because the 40 L/ha is between the label recommended rate of 30 L and 60 L of water per hectare.

This method cannot tell anything about the condition or delivery rate of individual nozzles, or the uniformity of delivery across the spray swath.

For more detailed information on calibration, sprayer pressures, nozzle selection, equipment output, etc., vendors should direct their customers to contact their local equipment dealer, or private or government sprayer calibration services.

Environmental Conditions

Environmental conditions, such as air movement, relative humidity, and temperature, can affect pesticide applications and/or pesticide effectiveness. Limitations on application temperature and wind speed may be indicated on the pesticide label or be defined under provincial legislation or regulations. Vendors should refer their customers to the product label or their provincial pesticide regulatory authority for details.

Customers should consider environmental factors before applying pesticides as certain weather conditions will increase the likelihood of negative impact on the environment (pesticide drift, run-off, vapour drift, leaching, etc.).

Emergency Response

Introduction

There is a potential for high risk associated with distributing, transporting, or storing of pesticides and vendor staff must be prepared for emergencies such as poisonings, minor or major accidents, vehicle accidents, spills, or fire. Steps to ensure that a pesticide vendor business is as safe as possible for employees, the community, and the environment include:

- ▶ identification of all possible areas of risk;
- ▶ implementation of measures that should reduce these risks; and
- ▶ development and installation of a plan of action that should minimize the risk, if an accident does occur.

Risk Assessment

Reducing the risk associated with any pesticide sales facility starts with doing a risk assessment or risk evaluation of the entire business. One should examine all problem areas or activities that could potentially create an accident or emergency. Then, the consequences of these problems should be considered. Risk assessment should help to answer the question: “What are the unwanted events that could occur which could harm the employees, the business, the environment, or the community.”

Vendors should not limit their assessment merely to pesticide storage, shipping, receiving, or transporting activities. A risk assessment should be conducted for the entire operation, including any activity that could lead to a fire, a spill, or a minor or major injury. Ultimately, the practice of risk assessment should provide ideas on how to minimize or even prevent the occurrence of possible problems.

Vendors should prepare a list of possible emergency events and control mechanisms for their entire facility (*see* Table 10.1).

Event	Cause	Control Mechanism
Minor injury	Employee slipped on floor	Maintain clean floor
Spill	Forklift tipped over	Repair edge of ramps
Fire	Spark from welder	Fire extinguishers available No welding in storage area
Vandalism	After hours break-in	Install adequate outdoor lighting, alarm systems, etc.
Major injury	Employee overcome with fumes from broken container	Provide adequate ventilation, clean up all spills, and provide and maintain personal protective equipment.

Table 10.1 Risk assessment examples

Risk Reduction

Once high risk areas have been identified, changes necessary to minimize the likelihood of an accident should be undertaken. This may involve physical modifications to the storage facility (increasing the fire rating of walls and doors, re-designing the ramp for the forklift, installing fire extinguishers) or changes in the way the facility is operated (controlling access to storage area, training staff, improving operating procedures for handling pesticides). At the end of this exercise both the facility and its operation should be as safe as possible.

Emergency Response Planning

Accidents will always happen, so vendors must be prepared to respond to these events. An Emergency Response Plan (ERP) will allow a vendor to act quickly and effectively when there is an emergency involving pesticides. The ERP should provide specific instructions for responding to and dealing with the emergency events identified for a facility. It should be designed to reduce the impact on the

facility, the employees, the community, the public, and the environment.

The ERP can also be designed to reduce the possibility (or risk) of an emergency occurring. The process of preparing an ERP often results in the prevention of emergencies because workers learn to spot and control hazardous conditions before they cause serious problems. Planning also ensures that the facility and emergency response services are properly equipped to handle the type of emergencies associated with the storage, handling, and transport of pesticides.

It is important that a pesticide storage and distribution facility develop Emergency Response Plans (ERP) for:

- ▶ accidents causing minor or serious injury;
- ▶ gas and odour release;
- ▶ pesticide spills;
- ▶ fires or explosions;
- ▶ natural disasters (floods, ice storms); and
- ▶ transport accidents.

Preparing an Emergency Response Plan

Vendor facilities include stationary sites, such as offices and storage depots, as well as any vehicles used to deliver pesticides. The development of an ERP will depend on the type of emergency anticipated, the size of the operation, the availability of emergency response services, the site location, etc. The steps necessary to prepare an emergency response plan for a facility include:

- 1. Assign emergency co-ordinators.** One person must be given overall responsibility. Then, co-ordinators should be assigned for specific duties. Someone is needed to co-ordinate:
 - ▶ communications;
 - ▶ site security and transportation;
 - ▶ first aid;
 - ▶ fire fighting;
 - ▶ environmental control; and
 - ▶ plant operations.

Emergency response teams should have the authority to

direct and manage employees and be available 24 hours a day. Alternate employees should be ready to take over if any team member is not available. In small businesses, one person may be responsible for many or all duties.

2. Make an emergency calling list. Make a list of the local authorities in the order in which they should be called when an emergency occurs. On the calling list, note the information that is needed to provide to the authorities. This includes:

- ▶ name;
- ▶ location of the accident;
- ▶ description of the emergency;
- ▶ products and quantities involved;
- ▶ injuries; and
- ▶ potential dangers.

Groups to inform include:

- ▶ employees on site;
- ▶ managers and/or supervisors off site;
- ▶ local fire and police departments;
- ▶ provincial pesticide authorities;
- ▶ neighbours;
- ▶ legal representatives (lawyers);
- ▶ insurance agencies;
- ▶ other citizens; and
- ▶ the media.

Keep a record of the time at which calls were placed and the name of the person reached. This information may be needed later (e.g., in court).

3. Make a list of emergency helpers from the community. Contact neighbouring businesses to see if they can help in an emergency. Get a contact name and phone number, list the equipment they have available, and note the time needed for them to respond. For example: materials from the local gravel pit for the construction of dikes, or a back hoe, might be needed.

4. **Map the warehouse and surrounding area.** The map should include:
 - ▶ all buildings, tanks, loading docks, containment areas;
 - ▶ waterways, sewers, and drains;
 - ▶ outside perimeter fencing;
 - ▶ access routes;
 - ▶ main shutoff for electricity, water, and gas;
 - ▶ areas of hazardous materials;
 - ▶ location of emergency equipment;
 - ▶ directions (north/south);
 - ▶ instructions for building dikes and dams to block runoff;
 - ▶ evacuation routes and shelters that could be used; and
 - ▶ neighbouring residents.

5. **Keep accurate inventory records at the business site, but away from the warehouse.** Pesticide product names, *PCP Act* registration numbers, volumes stored, and locations should be noted. Keep product labels and MSDSs for information. If any product requires special emergency treatment, make a note of it.

6. **Have all the emergency equipment available and in working condition.** This includes fire extinguishers, personal protective equipment, and containment equipment. Check with the local fire department to determine or confirm exactly what is needed.

7. **Outline the emergency procedures in the exact order in which they need to be done.** When writing the step-by-step procedures consider the following:
 - ▶ emergencies expected to be handled;
 - ▶ emergencies needing outside help;
 - ▶ procedures for each kind of emergency;
 - ▶ evacuation procedures;

- ▶ every task that must be done;
- ▶ the person responsible for each task (put a name beside every task); and
- ▶ training for employees.

Talk to provincial pesticide regulatory authorities, a lawyer, and an insurance agent to make sure that everything needed is included.

Invite outside helpers to tour the facility and discuss ways in which to work together in an emergency. Be sure that everyone understands their responsibilities.

PRACTICE each emergency procedure so that everyone knows what to do.

- 8. File the plan with responsible employees and local authorities.** Plans should be updated annually, or any time that changes in the facilities or the products carried are made. Be sure to keep all employees informed of any changes.

An Emergency Response Plan may be a vendor's most important business document. It can prevent a minor occurrence from becoming a major disaster. This information should be compiled in a single manual and copies made available to all staff.

Safety Training

Pesticide vendors should ensure that training is provided regularly for appropriate personnel in the various emergency procedures developed for their work areas, including:

- ▶ first aid and CPR;
- ▶ firefighting techniques and use of a fire extinguisher;
- ▶ safe operation of a forklift;
- ▶ putting on, cleaning, and maintaining of personal protective equipment;
- ▶ use of an eye wash; and
- ▶ use of information contained on MSDSs and product labels.

Emergency Services, Supplies, and Equipment

Emergency services, supplies, and equipment, as described below, should be available for every storage site.

First Aid Centre

First aid centre

Large vendor operations may chose to designate a room or a portion of a room to serve as a first aid centre. Provincial Occupational Health and Safety regulations will assist in defining the contents of a first aid centre and which businesses must have them.

In addition, the following materials should be available at facilities and to work crews that handle pesticides:

- ▶ clean water, soap, and towels for washing;
- ▶ one-way mask for giving artificial respiration;
- ▶ clean water for drinking;
- ▶ list of emergency phone numbers;
- ▶ syrup of ipecac (available from drug stores) to induce vomiting;
- ▶ unlined gloves impervious to chemicals for the person who administers first aid; and
- ▶ MSDSs for all products likely to be handled at the site.

First Aid Kits

First aid kits

Requirements for emergency first aid supplies and equipment are based on the number of workers per shift on a specific site, the type of work being done, and the location of the work. Vendors should check provincial first aid regulations for a description of the necessary contents of first aid kits. The items listed in Table 10.2 should be available for emergency response near any pesticide storage area.

ITEM	PURPOSE
clean water	drinking, washing skin or eyes
soap	washing pesticide off skin



chemical impermeable gloves	protecting the person administering first aid
cup	for drinking
face mask with one way valve	protecting the person giving mouth to mouth resuscitation
bandages	preventing pesticides from entering wounds
blanket	to cover a victim
phone numbers	to call for assistance
paper towel	cleaning up
plastic bag	collecting vomit

Table 10.2 Items for a First Aid Kit

Emergency Conveyance

Emergency conveyance

Workers must have access to emergency conveyance, either through a local ambulance service (911) or by an emergency conveyance on the work site. Emergency conveyance vehicles must be large enough to accommodate a stretcher and passenger.

Eyewash/Shower Facilities

Eyewash and shower facilities

Wash facilities, an eye wash kit, or a deluge shower should be immediately available wherever there is a possibility that a worker will be splashed with pesticides or other harmful substances. As a minimum, a container of clean water and an eyewash kit should be located near the storage area and carried in each vehicle used to deliver pesticides.

Respiratory Protective Equipment

Respiratory protective equipment

Respirators equipped with pesticide cartridges or self contained breathing apparatus should be available and worn wherever workers may be exposed to airborne contaminants.

Fire Fighting

Firefighting equipment

Firefighting equipment should be available outside of all

Equipment

storage sites, on each fork lift, and in vehicles used to transport pesticides. Storage areas are rated as ordinary hazards, and require a minimum of a 2-A:10-B:C fire extinguisher within 9 metres or a minimum 2-A:20-B:C fire extinguisher within 15 metres travel distance to the extinguisher. Fire extinguishers on forklifts should have as a minimum a 5-B:C rating. Vehicles used to transport pesticides should carry a minimum 2-A:20-B:C rated extinguisher.

An individual should not fight a fire involving pesticides unless they use proper personal protection equipment.

Fire fighting equipment should be inspected regularly to ensure:

- ▶ full charge;
- ▶ the hose and nozzle are unobstructed;
- ▶ the pull pin and seal are intact; and
- ▶ extinguishers are clean and free from corrosion.

A log of inspections and repairs should be kept. If low pressure or damaged seals are found, the extinguisher should be repaired or replaced immediately. If regular equipment is removed for longer than a few hours, replacement equipment should be substituted.

Specific Emergency Response Procedures

Pesticides can be dangerous. They must be handled carefully to prevent injury to the user or to other people. Staff should know how to handle them safely to prevent accidents, and always be prepared for an emergency. Here are some things to do before an accident happens:

- ▶ be familiar with the label of products being handled, paying special attention to the PCP Act number, the guarantee, and any precautionary or first aid statements;
- ▶ be familiar with the symptoms of pesticide poisoning;
- ▶ know the emergency telephone numbers;
- ▶ have access to plenty of clean water where pesticides are being handled or transported; and
- ▶ ensure a number of the staff have taken a First Aid Course. In most communities, St. John Ambulance

offers courses to help prepare for various types of emergencies. Doctors or local hospital staff can sometimes be a source of information.

Injuries

Vendors should develop a response plan for dealing with both minor and major accidents. The plan should include information on:

- ▶ emergency phone numbers;
- ▶ ambulance services;
- ▶ location of First Aid Kits, blankets, respirators, etc.;
- ▶ list of staff trained in CPR or First Aid; and
- ▶ contents of a general First Aid kit.

Vendors working with pesticides should learn the signs of chemical poisoning and be familiar with appropriate first aid treatment in case of an accident. Accident victims are often not capable of helping themselves. If an accident occurs, people need to assess the hazard, stay calm, and act quickly. Prompt action may save a life.

If a rescue of a fallen or trapped employee is required, vendors must carefully assess the situation. If the rescue cannot be made safely by Emergency Response Team members, keep the employee warm and provide encouragement until the ambulance/fire crews arrive.

Poisoning

Rapid and organized response in poisoning emergencies is important, as it minimizes the negative effects to a poison victim.

General procedures for any pesticide poisoning include:

- ▶ Have someone call 911 for help.
- ▶ Assess the hazard before approaching the victim. **Protect yourself first.** This might require putting on personal protective equipment (respirator, waterproof gloves, coveralls), as required, prior to the rescue.
- ▶ Move the victim away from any spilled pesticide or smoke. If the victim is exposed to fumes or smoke, first protect yourself with a self-contained breathing apparatus. (**Note: Unless there is an immediate threat to life, do not move the person if spinal cord injury is suspected.**)
- ▶ Check to see if the person is conscious. If the person is unconscious, check if the person is breathing and, if

necessary, give artificial respiration. Use a one-way face mask to prevent pesticide exposure from the person's mouth. Cardiopulmonary resuscitation (CPR) may be necessary if the pulse disappears. CPR should only be done by properly trained people.

- ▶ If the victim is unconscious but breathing, remove contaminated clothing and wash contaminated skin. Place the victim in a semi-prone position turned slightly to one side so as to protect the victim from choking should he or she vomit. **Do not administer anything by mouth.**
- ▶ Call a Doctor or Poison Control Centre. Give them information on the product from the MSDS and label. If the victim is critically ill, have someone make all emergency calls. Do not leave a seriously ill person alone. Be prepared to provide information on:
 - the telephone number from where the call is made;
 - condition of the victim (e.g., breathing, in shock, symptoms, length of exposure, etc.);
 - the exact name of the product as it appears on its label;
 - the PCP Act registration number from the label;
 - the circumstances of the poisoning (fumes, spray drift, spill, etc.);
 - any first aid actions taken prior to the call; and
 - name, age, and weight of the victim.

Stay on the line to receive information on first aid treatment, to provide additional information, or to direct emergency response services to the victim's location.

- ▶ Keep the person quiet, warm, comfortable, and reassured. Position the person. Place the person on their side with their head lower than the rest of their

body and turned to one side. If the person is not conscious, keep their chin pulled forward and their head tilted backward slightly to allow breathing to take place. (An unconscious person should never be transported flat on their back.); and

- ▶ arrange emergency transportation and alert the nearest hospital as to the victim's impending arrival.

First Aid

First aid provides immediate assistance (helps to stabilize a person and sustain life) until medical help can be reached. If a person feels ill during or after handling pesticides, seek medical attention immediately.

Staff working with pesticides or closely associated with these workers should be familiar with:

- ▶ all relevant emergency phone numbers;
- ▶ signs and symptoms of pesticide poisonings; and
- ▶ first aid for pesticide poisoning for the products being used.

First Aid Procedures

The victim may be suffering from both physical injury and a pesticide accident at the same time. Internal injuries usually take precedence over the contamination. The proper sequence for first aid treatment of pesticide accident victims is as follows:

1. Put on protective gloves.
2. Address respiratory concerns. If the victim is not breathing, use a one-way airway device to prevent cross contamination.
3. Address circulation issues (heart beating).
4. Have someone call for medical help (911).

Ocular exposure

Procedures for ocular exposure (in the eye):

Follow steps 1–4 listed above, plus:

5. Hold the eyelid open and wash the eye immediately with clean running water for 15 minutes or more.
6. Await medical help.

Dermal exposure

Procedures for dermal exposure to non-corrosive pesticides:

Follow steps 1–4 listed above, plus:

5. Remove the victim's contaminated clothing, including footwear.
6. Immediately drench the skin with cold water. Cold water is preferred, as hot water opens pores and increases absorption.
7. Wash the victim's skin and hair with soap and water.
8. Dry the victim and wrap them in a blanket (treatment for shock).
9. Wait for medical help.

If someone has been exposed to an organophosphorus or carbamate insecticide because of a spill, quick action is required. First call for medical assistance; then, assess the hazard where the victim is located, put on the proper personal protective equipment, and address the needs of the victim.

Any affected person should be kept away from organophosphorus and carbamate insecticides until their cholinesterase level returns to normal.
--

Burns on the skin

Procedures for chemical burns on the skin:

Follow steps 1–4 listed above, plus:

5. Remove the chemical to stop the burning. Do not wait for clothing to be removed. Brush dry chemical off the skin and clothing, then rinse with water. If the chemical is a liquid, rinse with lots of running water.
6. If a shower is available, place the victim in the shower first and then remove all contaminated clothing.
7. If no shower is available, remove contaminated clothing.
8. Immerse the burned area in ice water.
9. Cover the burned area with a loose, wet, clean cloth.
DO NOT apply anything to the burn.

10. Wait for medical help.
11. Do not touch, remove any clothing stuck to the skin, break any blisters, or use ointments on the burned area.

Oral exposure

Procedures if pesticide is swallowed (oral exposure):

Follow steps 1–4 listed above, plus:

5. Read the product label or MSDSs for instructions.
6. DO NOT INDUCE VOMITING UNLESS UPON INSTRUCTION OF A POISON CONTROL CENTRE OR DOCTOR, OR IF SPECIFICALLY INDICATED ON THE LABEL AND IF THE PATIENT IS ALERT.
7. DO NOT INDUCE VOMITING IF THE PERSON IS UNCONSCIOUS OR HAVING CONVULSIONS.
8. DO NOT INDUCE VOMITING IF A CORROSIVE MATERIAL OR PETROLEUM-BASED PRODUCT WAS SWALLOWED. INSTRUCTIONS SHOULD BE ON THE LABEL.
9. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR DROWSY PERSON.

Procedures to induce vomiting

Under the direction of a doctor or Poison Information Centre:

Give syrup of ipecac (15 ml [1 tablespoon] to children, 30 ml [2 tablespoons] to adults). One-dose bottles of this product are available at most drugstores. Follow with one to two glasses of water or fruit juice. Repeat in 15 minutes if vomiting has not occurred.

Without direction from a doctor:

Give a conscious, non-convulsive patient several glasses of warm water to drink. If this does not work, tell the patient to tickle the back of their throat with their own finger. Vomiting caused by tickling is usually not complete and the patient must be seen by a doctor as soon as possible.

The patient should be kept lying down with their head below the level of their feet. This position allows any vomit to drain away from air passages. If the poison cannot be identified, collect some of the vomit for analysis by medical authorities.

Inhaled pesticides

Procedures if pesticides inhaled(dust, vapours, gases):

NOTE: If the victim is in an enclosed space, emergency responders should first put on all necessary personal protective equipment.

Then follow steps 1–4 listed above, plus:

5. Move the victim to fresh air.
6. Loosen tight clothing.
7. Prevent chilling or overheating.
8. Keep the person quiet.
9. Get medical help.

If full recovery takes place after first aid measures are undertaken, all victims should seek assessment by medical personnel before they return to work. Vendors should then review and study what went wrong so as to avoid an accident recurrence, and, if needed, revise their emergency response plan.

Pesticide Spills

Pesticide spills are hazardous because the pesticide or vapours may poison people, animals, or plants. Spilled pesticides, when not properly addressed, may also contaminate soil, sewer systems, streams, food or feed, surfaces (e.g., wood or concrete), lakes, wells, and other water sources.

Prevention and Preparation

Risk from leaking containers or pesticide spills can be reduced by following good storage practices (stacking height restrictions, adequate lighting), ensuring proper handling by forklift operators, securing product while in transit, and conducting regular inventory inspection.

Maintaining a storage facility floor and containment walls that are impervious to chemicals should minimize broad-scale environmental damage in the case of an accidental spill. It should also make necessary clean-up easier and less costly. The design of the containment system should depend on the types and quantities of pesticide being stored.

All employees should know what to do when a pesticide spill occurs. They should also be aware of the hazards involved in a pesticide accident. Vendors should ensure that all appropriate employees are trained to properly use

personal protective equipment. If everyone is well prepared, health hazards can be reduced and environmental damage kept to a minimum.

Decontamination kit

The vendor should have a decontamination kit for use at all sites where pesticides are stored, loaded, or handled. The kit should be fully equipped and easy to access in an emergency.

Facility

A well-equipped spill decontamination kit should contain:

- ▶ 1 - 12 litre package of heavy duty detergent;
- ▶ 4 - 25 kilogram bags of absorbent material;
- ▶ 2 - 4 litre containers of sodium hypochlorite (laundry bleach);
- ▶ 4 - 25 kg bags of hydrated lime (do not mix bleach and lime);
- ▶ 2 square mouthed shovels or spades;
- ▶ 2 yard brooms;
- ▶ 1 hand pump with hose;
- ▶ 2 - 205 litre open-head drums with lids;
- ▶ 2 - 205 litre sealable drums;
- ▶ 2 - 20 litre open-head drums with lids;
- ▶ labels to identify contents of drums;
- ▶ 2 heavy plastic bags;
- ▶ 2 cartridge type respirators;
- ▶ 2 pair of safety goggles;
- ▶ 4 pair of industrial chemical resistant gloves;
- ▶ 2 pair of chemical resistant boots; and
- ▶ 2 pair of overalls.

Vehicle kit

The following cleanup equipment should be available on trucks used to transport pesticide products:

- ▶ personal protective equipment;
- ▶ emergency phone numbers;
- ▶ absorbent material;
- ▶ a shovel;
- ▶ an empty container with a lid for transferring ruptured

- containers or contaminated materials; and
- ▶ blank labels for identifying the contents of waste containers.

Kits should be inspected regularly.

Protection

Vendor staff should always put on appropriate personal protective equipment before entering a contaminated area or handling a patient. Employees who will be involved in spill cleanup must wear proper personal protective equipment. If the spill is in a storage area, someone wearing respiratory protective equipment should first enter the storage area to open all windows and doors for ventilation. Electric ventilation systems should be used only if they are explosion proof as explosive levels of flammable materials may be present in the air.

Before beginning cleanup, the area should be roped off and unauthorized people and vehicles kept away. Flares or smoke should never be used near a chemical spill. If the spill occurs on a roadway, vehicles should be prevented from traveling over spilled material.

If any person has come into contact with a pesticide, action must be taken to stop the exposure quickly. Move the patient from the contaminated area and remove all contaminated clothing. Wash the affected skin with soap and water to prevent further exposure. Other first aid procedures may be necessary so get medical attention as soon as possible.

Small Spill Containment

For a **small spill** of liquid pesticide within a storage confinement area the following steps should be taken:

- ▶ Put on personal protective equipment as required.
- ▶ Absorb liquid material using activated charcoal, coarse clay, or cat litter. Commercial absorbents are also available.
- ▶ Shovel the contaminated absorbent material into a drum.
- ▶ Label the drum (name of pesticide and date).
- ▶ Neutralize any remaining residues. Consult the MSDS

and other information sources to determine specific neutralization techniques.

- ▶ Contact a licenced hazardous waste handling company.

Large Spill Containment

For a **large spill** of liquid outside of storage confinement areas the following steps should be followed:

- ▶ Assess the hazard and put on personal protective equipment.
- ▶ Contain material by diking off the area with an earthen dam to keep products from entering water supplies and drainage systems. Make the diked area as small as possible.
- ▶ **Do not wash the spill away with large quantities of water.**
- ▶ Close any drains.
- ▶ Pump large spills into drums.
- ▶ Put commercial absorbent material or cat liter over the spill area and shovel this and any contaminated soil into drums.
- ▶ Label the drums (pesticide and date).
- ▶ Contact the provincial pesticide authority and a licenced hazardous waste handling company.
- ▶ Neutralize any remaining residues. Consult the MSDS and other information sources to determine specific neutralization techniques.

Dry Product Spills

For spills involving **dry pesticide products**, the following steps should be taken:

- ▶ Dampen the area very slightly with small amounts of water.
- ▶ Shovel the material into drums with tight-fitting lids.
- ▶ Label the drums (pesticide and date).
- ▶ Contact the local pesticide regulatory authority if required and a licenced hazardous waste handling company.
- ▶ Neutralize any remaining residues. Consult the MSDS and other information sources to determine specific neutralization techniques.

Never use water to wash down a spill. The chemical will leach into the soil, or it may enter the water system, sewage system, streams, or lakes.

For a spill in the storage facility or while in transit notify:

- ▶ the manager;
- ▶ the product manufacturer for emergency response measures and cleanup procedures;
- ▶ the appropriate provincial regulatory authority; and
- ▶ if a major spill is involved, contact the local hospital or other medical personnel to alert them to possible medical problems. (Pass on toxicity and antidote information to hospital staff.)

Follow-up

Following a cleanup:

- ▶ Ensure that all equipment (coveralls, gloves, boots, shovels, etc.) used is contaminated, and then quarantine it for decontamination or disposal.
- ▶ Thoroughly decontaminate the truck containing the spilled material before transporting other products.
- ▶ Ensure any emergency responders involved in the clean up are advised that their clothing might be contaminated and direct them to wash thoroughly before smoking or eating.
- ▶ Watch for poisoning symptoms in any employees or emergency responders.

Disposal

Consult with the appropriate provincial authority for advice on proper disposal of clean-up material. The drums containing the clean-up material should be covered and labelled with "spilled pesticide - DANGER" and the name of the pesticide. Do not take these drums to a garbage dump unless environment officials have authorized it. Contact a licensed hazardous waste disposal company for disposal of the drums.

Personal Hygiene

After the spill has been cleaned up, all workers must take showers and change into clean clothing. If clothing becomes contaminated, shower and change immediately even if the clean-up is not finished. Wash all clothing, boots, gloves, etc., with soap and water as soon as possible.

If any person involved in the accident or clean-up begins to feel sick (nausea, headache, etc.), immediately take them to the nearest hospital. Take along the PCP Act registration number and any additional medical treatment information from the label or MSDS. The doctor or Poison Control Centre staff can find the necessary medical information for treatment of the patient from the PCP Act registration number.

Reporting Spills

Vendors should contact their local and/or provincial environmental emergencies office as well as their provincial pesticide regulatory authority if the amount spilled is required to be reported. The owner of the material, or the person who had control of it immediately before the spill, should assess the situation and take responsibility for the spill even if they are not at fault. The owner/controller may later seek compensation from those responsible.

Pesticide Theft

Prevention

Vendors can help to prevent the theft of pesticides by having secure doors and windows, by keeping the pesticide storage area securely locked when unattended, and by having adequate external lighting. The vendor may be liable in the event of an accident.

Response

If a theft occurs, vendors should notify the police and the appropriate government authorities. Advise them of the PCP Act registration number, the quantity of the product stolen, and any human health or environmental hazards noted from the label or MSDSs.

Pesticide Fires

An uncontrolled fire in a pesticide storage area can be extremely dangerous because the pesticides involved may be flammable, explosive, react with water, or generate toxic fumes when burning. For these reasons, special fire control tactics are required. If not properly addressed, the initial hazard from the fire can be further compounded by contamination of the air, surface water, groundwater, or soil.

Preparation and Prevention

A facility that stores pesticides can reduce the risk to life and property through the development and implementation of a comprehensive emergency response plan. The following is

a list of some things that can be done.

- ▶ Prepare for the possibility of fire by developing the plan before a fire occurs.
- ▶ Provide the local fire department, as well as other nearby fire departments that might be called to provide mutual aid, with the names and quantity of products being stored.
- ▶ Keep up-to-date copies of the Material Safety Data Sheets both at the facility and at a secure, off-site location.
- ▶ Take the time to carefully map a floor plan of the pesticide storage facility and an overview sketch of the facility.

Floor plan

The floor plan of the storage area should indicate:

- ▶ the location of the fire extinguishers and personal protective equipment;
- ▶ the position of all windows, fire doors, and access or emergency exit doors;
- ▶ location of ventilation inlets and outlets;
- ▶ the exact location of any flammable or explosive pesticides; and
- ▶ location of access aisles for fire fighting equipment.

The overview sketch of the facility should include:

- ▶ any water sources and the volume of water available for fire fighting;
- ▶ location of any manholes, waterways, or ditches;
- ▶ the direction runoff water would flow, to help determine how to control such runoff;
- ▶ location and function of other on-site buildings;
- ▶ the fence line, gates, and points of access;
- ▶ fire routes; and
- ▶ location and function of off-site buildings (hospitals, residential areas, schools, recreational facilities, industrial sites, etc.) surrounding the property boundary.

These detailed plans should be provided to the local fire department, and an invitation extended to them to visit the site so as to make them familiar with the quantity and location of stored products.

Employees should be familiar with what to do in an emergency and trained in the proper use of safety equipment. Vendors should prepare procedures for evacuating and notifying the fire department.

It is critical that the local fire department be made aware that pest control products are being stored at the vendor location and that they have a site map indicating the exact location of the storage site(s).

Fire plan

Vendors should make a detailed, step-by-step plan of what to do if a fire occurs. Identify in advance a person to co-ordinate activities with emergency personnel and to respond to news media questions. A fire emergency plan should include the following:

- ▶ Immediately evacuate and isolate the area where the fire is detected. Have a predetermined location for all staff to meet. Account for all staff so fire fighters know when they first arrive whether they need to do a search and rescue or merely attempt to control the fire.
- ▶ Call the local fire department (911) immediately when smoke or fire is detected anywhere at the facility. The pesticide storage area and the building in which it is housed should have a fire detection system connected to a 24-hour automatic monitoring service.
- ▶ Determine the location and extent of the fire if this can be done safely.
- ▶ Remind fire fighters and emergency responders that anyone in the vicinity of the fire may be exposed to toxic fumes, poisonous run-off, and/or concentrated pesticides from leaking or exploding storage containers, and of the additional danger posed by burning pesticides and thus the importance of wearing self contained breathing apparatus.
- ▶ Call Environment Canada.
- ▶ Call the police so that they can assist the fire fighters with traffic control or initiate an evacuation of the surrounding area.
- ▶ Call the local medical authorities and/or the local Poison Control Centre and advise them of the chemicals involved.

- ▶ Cordon off the area and set up an emergency command centre for police, municipal disaster services, government officials, company staff, or other emergency personnel.

No one should take unnecessary risks in fire fighting. It is wiser to wait for the fire department than to be poisoned or injured.

Inform emergency response personnel:

- ▶ as to whether all staff are accounted for;
- ▶ as to what pesticides are in the affected area (provide Material Safety Data Sheets if available);
- ▶ to avoid contaminating the surrounding area by using a minimum amount of water;
- ▶ that runoff water should be controlled; and
- ▶ that their clothing should be decontaminated before leaving the scene.

Summary

Vendors need to be knowledgeable about ERP procedures if they are to minimize the risks of handling pesticides. A pesticide vendor facility can be a safe working environment. To minimize risk, facilities need to prepare Emergency Response Plans for pesticide poisonings, spills, or fires, and for minor and major accidents. Everyone should participate in drills that involve the use of the ERP and be properly prepared to respond to their assigned duties, whether it is a drill or a genuine emergency. Being prepared with a well documented and practiced Emergency Response Plan will make the facility a safer place for the employees, the community, and the environment.

Reference material only

Fire prevention

A pesticide storage facility can be made a safer place by:

- ▶ *keeping an inventory of stored pesticides in easily accessible locations away from the storage area;*
- ▶ *informing the fire department as to where all pesticides are stored;*
- ▶ *posting a warning sign on all entrances to the storage facility;*
- ▶ *keeping emergency phone numbers handy;*
- ▶ *keeping a fire-extinguisher approved for chemical fires near the storage area;*
- ▶ *getting advice from the local fire department about adequate fire equipment for the facility, i.e., a sprinkler system;*
- ▶ *installing a plan of action in case there is a fire;*
- ▶ *installing a smoke alarm / detection system;*
- ▶ *training employees to respond properly in an emergency;*
- ▶ *not using open flames for welding, burning, or cutting in the pesticide storage area;*
- ▶ *using stretch wrapping rather than shrink wrapping, because stretch wrap does not require heating;*
- ▶ *ensuring that the pesticide storage area follows the required codes (i.e., National Fire Code, National Building Code, National Electrical Code);*
- ▶ *not having spare flammable compressed liquified storage cylinders inside the storage facility;*
- ▶ *not allowing flammable or combustible products to be stored inside the storage facility;*
- ▶ *not allowing staff or customers to smoke in the storage area;*
- ▶ *ensuring that the heating system is designed to prevent contact with explosive vapour; and*
- ▶ *securing doors and windows to prevent unauthorized people from entering the property.*

After a fire has occurred:

- ▶ *secure the area to prevent entry;*
- ▶ *make sure emergency responders are aware of the importance of decontaminating all equipment used in the emergency;*
- ▶ *report adverse health effects noted by anyone involved in the fire;*

- ▶ *contact the proper provincial authorities for advice on disposal of the debris;*
- ▶ *advise provincial or municipal authorities of any runoff; and*
- ▶ *have staff cooperate with local fire department personnel to assist in determining the cause of the fire.*

Environmental concerns

Ground and surface water contamination

Historical evidence has shown that environmental damage resulting from fires involving pesticides increases in proportion to the volume of water used in an attempt to control and extinguish the fire. This run-off water is normally heavily contaminated with toxic compounds and is extremely difficult to contain without diking. Similarly, products of incomplete combustion, due to low temperature burns, tend to be substantially more toxic and less stable than are the original compounds.

Air contamination concerns

Air quality during a pesticide fire, at or near ground level, will deteriorate dramatically as the combustion temperature is reduced. A combustion temperature of 982 degrees Celsius, for example, provides complete thermal decomposition of pesticides with resulting emissions of primarily carbon and water. At this temperature all contaminants are carried into the high atmosphere where dispersion ensures that toxic levels at or near ground level do not occur.

As the combustion temperature is reduced, various noxious and toxic gases can be created. In addition, steam generated from the addition of water to the fire carries contaminated particles into lower levels of the atmosphere where they return quickly to the ground. As an example, air dispersion models run on pesticides indicate that where exit temperatures drop from 650 degrees Celsius to 400 degrees Celsius, the level of ground level contaminants rises by a factor of three.

Life safety concerns

First responders and the public

Protection of first responders and the public is a major concern with fires involving pesticides. Historically,

pesticides have not been the cause of serious casualties among public and first responders who have been adequately trained.

As demonstrated in the previous discussion on air quality, the management of respirable contaminants at ground level hinges on the temperature of combustion, and the exit temperatures from a structure. When fires have been allowed to burn at high temperatures, the risk has been lowered significantly.

First responders at an incident involving pesticides must be protected with a minimum of self-contained breathing apparatus and standard turn-out gear. If a facility is fully involved or free burning, life safety is greatly enhanced by remaining outside the structure and upwind of smoke and exhaust gasses to protect exposures of other buildings while the pesticide structure burns itself out.

Professionalism

Introduction

The dispensing, transporting, storing, and disposing of pesticides is not only a business but also a profession. A profession that carries with it a great number of responsibilities because of the potential impact of pesticide use on customers, the public, and the environment. These responsibilities require that the employees and management of all pesticide vending facilities conduct themselves and their business in a professional manner. Equally important, they must be perceived by the community to be doing so.

Legal Requirements

A pesticide vending facility is a component of the community and so it is required that business be conducted in a legal manner at all times.

Some of the items that a facility operator must consider include the following:

- ▶ Be familiar with and comply with all federal, provincial, and municipal regulations, and with industry standards. This will include:
 - selling only federally registered products;
 - controlling access to the storage site for Commercial and Restricted Class products;
 - storing, transporting, and disposing of pesticides in compliance with provincial regulations and industry standards; and
 - maintaining the storage site as required by provincial regulations as well as by industry standards.

- ▶ Make sure the business is licenced and that the employees are fully trained or certified as required by provincial regulations or industry standards.

- ▶ Keep sales records (e.g., a description of the pesticide [name, PCP number, quantity, package size, etc.] and the license or certification number of the purchaser) as required by provincial regulations.
- ▶ Maintain appropriate insurance, including general liability, on-site debris removal and disposal, off-site pollution, and property insurance.
- ▶ Follow provincial regulations and industry standards for displaying non-Domestic products.

Vendor Responsibilities

A number of ways exist whereby a pesticide distribution and storage facility can display professionalism.

Customer

Customers will often look to the vendor as a source of information. As a professional, a vendor should be in a position to provide information and general advice to customers, or to direct them to local sources of information on:

- ▶ selection of personal protective equipment;
- ▶ disposal of empty pesticide containers and unwanted product;
- ▶ Integrated Pest Management programs;
- ▶ Material Safety Data Sheets; or
- ▶ proper transportation, handling, use, storage, and disposal of pesticides.

Community

The business of storing and transporting pesticides carries with it a high potential for risk to the surrounding community. It is a vendor's responsibility to make the operation of distributing and storing pesticides as safe as possible for their employees, for those living in the surrounding community, and for the environment.

Environment

Vendors have a responsibility to show both customers and the public that they care for the environment. The best way to do this is by example. Selected ways to show professionalism and help protect the environment include the following:

- ▶ Promote and participate in container collection and recycling, and in unwanted pesticide collection programs.

- ▶ Immediately clean up any pesticide spills and stress the importance of doing this to customers.
- ▶ Advise the fire department of the importance of minimizing the amount of water used to fight a fire in the storage facility, and have a plan for the containment of run-off water.

Public Relations

Public relations refers to positive interactions between the staff or management of the pesticide sales/storage facility and customers, property owners bordering the facility, emergency responders, concerned citizen groups, the crop protection industry, and government personnel.

Good public relations will:

- ▶ enhance credibility;
- ▶ improve public and customer confidence; and
- ▶ help to deal with complaints or difficulties arising from pest control activities.

Vendors can build strong positive public relations by:

- ▶ being knowledgeable and trained about the profession;
- ▶ having a good attitude;
- ▶ carrying out work activities in a professional manner; and
- ▶ communicating with the public.

Knowledge and Training

Management and staff should continue to upgrade their knowledge of the pesticide sales business by attending seminars, trade shows, and courses or by reading journals, papers, and other literature. They must also be knowledgeable regarding:

- ▶ provincial and/or municipal regulations for pesticide vendors and applicators;
- ▶ information on individual product labels; and
- ▶ resources (people, publications, organizations, etc.) that can provide specific types of information.

Attitude

It is important that vendor management and staff project a positive attitude. This can be shown by:

- ▶ responding quickly and effectively to requests for information and to complaints, concerns, or

- emergencies;
- ▶ being credible (e.g., honest, courteous, polite, and respectful of others) at all times;
- ▶ only selling pesticides for registered uses;
- ▶ refusing to work under unsafe conditions;
- ▶ complying with government and industry standards;
- ▶ considering the concerns of bystanders/neighbours regarding outlet operation; and
- ▶ being conscientious of varying public opinions.

Work Habits

Vendor staff can conduct work activities professionally by:

- ▶ being environmentally safety conscious and human safety conscious and following safety practices;
- ▶ advising others to handle and apply pesticides responsibly, according to the label and other application guidelines;
- ▶ using clean, well-maintained equipment;
- ▶ avoiding unethical sales gimmicks; and
- ▶ setting a good example for customers.

Communication

Communication, which involves listening as well as speaking, can be improved by:

- ▶ understanding the things that concern customers and others in the community;
- ▶ listening to public concerns and trying to understand and appreciate varying viewpoints;
- ▶ understanding that a confrontation may be avoided by becoming a good listener, and by being honest, frank, open, and cooperative;

- ▶ keeping the community informed about business practices, especially when it affects their health or safety; and
- ▶ involving local and neighbouring fire departments, emergency response services, municipal council, community groups, neighbours, and the media in mock disasters at the facility. Make sure they are aware of Emergency Response Plans for spills, injury, vehicle accidents, and fires.

Appendix A

Glossary of Pesticide Terms

Absorption is the movement of pesticides into organisms (plants, animals) or structures (soil, wood, etc.).

Action threshold is the point at which treatment should take place in order to prevent the pest population from reaching the injury threshold.

Active ingredient (a.i.) is the part of a pesticide formulation that produces the desired effects.

Acute toxicity is the adverse effects that occur within a few hours to a few days after exposure.

Adjuvant is a substance added to a pesticide mixture to enhance the pesticide's qualities.

Adsorption is the binding of chemicals to soil particles or other material.

Baits are mixtures of large particles, not recognized as a pellet or granular formulation, and an edible material.

Calibration is a procedure for checking and adjusting the delivery rate of application equipment.

Certified applicator means a person possessing a provincially approved pesticide applicator certificate bearing the name of that person.

Certified assistant means a person possessing a provincially approved pesticide assistant certificate bearing the name of that person.

Chemical name is the name of the chemical structure of the active ingredient.

Chronic toxicity refers to the adverse effects that occur and persist over time after exposure(s) to a poison.

Commercial pesticides are products registered for use in agriculture, forestry, industry, or other commercial operations.

Common name refers to the name of the active ingredient.

Degradation is the breakdown of pesticides into other compounds.

Deleterious substance refers to any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat, or to the use by man of fish that frequent that water.

Dermal absorption is the intake of a substance through the skin.

Desorption occurs when bound pesticides are released from the soil or other material. Released pesticide residues are then more available for uptake and effect on the environment.

Domestic pesticides are registered for use in or around the home.

Dry flowables are wettable powders which are formulated into small pellets or granules.

Dusts are finely ground dry materials consisting of a low active ingredient plus inert ingredients. They are ready to use.

Emulsifiable concentrates or emulsions are a clear solution with emulsifiers to be diluted in water. They form milky spray mixtures when combined with water.

Eradication refers to the total elimination of a pest population.

Flowables or suspensions are liquids that consist of solid particles of active ingredient suspended in a liquid.

Formulants refer to inert or other materials that are added to the active ingredient to make it suitable for storage, handling, or application.

Formulation is a mixture of active ingredients and formulants.

Granulars are a dry mixture of large, free-flowing particles with a low concentration of active ingredient.

Groundwater is found below the surface of the earth. Most groundwater occurs in zones of rock, sand, or gravel that are saturated with water. These zones are known as aquifers.

Guarantee statement states the active ingredients in the product and the amount of each ingredient.

Half-life is the time it takes for one-half of the initial amount of a pesticide to break down in the environment.

Ingestion or oral exposure refers to the intake of a substance by mouth.

Inhalation refers to the absorption of airborne particles of a substance.

Injury threshold is when a pest population reaches numbers such that it causes unacceptable injury or damage, sufficient to justify treatment.

Integrated Pest Management (IPM) is a decision making process that uses all necessary techniques to suppress pests effectively, economically, and in an environmentally sound manner.

Label is defined in the *PCP Act* to include: any legend, word, mark, symbol, or design applied or attached to, included in, belonging to, or accompanying any control product.

LC₅₀ stands for lethal concentration 50, which is the concentration (expressed in parts per million) of a pesticide in the air or water sufficient to kill one-half of the test animals exposed to the pesticide. The smaller the number, the more toxic the pesticide.

LD₅₀ stands for lethal dose 50, which is the amount of a substance (mg/kg) that will kill one-half of the test animals exposed to the pesticide. The smaller the number, the more toxic the pesticide.

Leaching is the movement of pesticides with water through the soil.

Manufacturing pesticides are used in manufacturing, formulating, or repackaging and are not for use by applicators.

Maximum Residue Limit or MRL is the maximum amount of pesticide residue that may safely be contained in food products. MRLs are established by the Health Evaluation Division of Health Canada.

Micro-encapsulated suspensions are composed of small capsules of active ingredient suspended in a liquid. They slowly release the active ingredient.

Net contents may be listed as weight or volume measures. This information will help the applicator to decide how many packages of a pesticide product are needed.

Non-point source refers to when the pesticide is applied over a large area.

Ocular exposure is the intake of a substance through the eyes.

Open body of water means a river, stream, watercourse, bay, estuary, open municipal reservoir, farm pond, dugout, or other body of water, whether it contains water continuously or intermittently.

Pest Management Regulatory Agency (PMRA), Health Canada, is responsible for administration of the *Pest Control Products Act* and Regulations.

Pellets are mixtures of active ingredients and formulants. They are typically formed into spheres, cylinders or other small solid pieces.

Pest is a harmful, noxious, or troublesome organism. Pests include weeds, insects, fungi, bacteria, viruses, rodents, or other plants or animals.

Pesticide is anything that is intended to prevent, destroy, repel, attract, or manage a pest. Pesticides also include plant growth regulators, plant defoliant, and plant desiccants.

Pesticide resistance is the term that describes the situation that occurs when a portion of a pest species is able to survive a pesticide dose that had previously controlled the species.

Pesticide assistant certificate means a document issued to a certified assistant.

Pesticide applicator certificate means a document issued to a certified applicator.

Photodegradation refers to the breakdown of pesticides by sunlight.

Phytotoxic chemical is a chemical that is toxic to plants and can cause damage or injury to them.

Point source contamination refers to those instances where a large amount of pesticide is released into a small area (accidental spill, pesticide fire, or improper disposal).

Pressurized products are aerosols, sprays, foams, or dusts packed in a pressurized container. They may be liquids, solids, or gases.

Product name may describe the formulation, use, active ingredient, and distinctive brand or trademark of a pest control product.

Registration number is usually written as “REGISTRATION NO. 00000 PEST CONTROL PRODUCTS ACT”. The higher the number, the more recently the product was registered.

Restricted pesticides are commercial type pesticides having certain limitations on the label.

Risk is the chance that someone or something will be harmed by a pesticide.

Runoff is the movement of water over a sloping surface. Pesticides may be mixed in the water or bound to soil particles that move with such water.

Soluble granules are solid materials (like granulars) that can be dissolved in a liquid.

Soluble powders are dry materials, similar to dusts, that are soluble in water.

Solutions are clear liquids composed of an active ingredient dissolved in a solvent.

Spray drift is the airborne movement of spray droplets away from a treatment site during application.

Surface water refers to water that is clearly visible on the earth's surface (ditches, streams, ponds, rivers, lakes, oceans, etc).

Tablets may be active ingredients alone, or active ingredients and formulants. They are formed into small blocks or spheres.

Tank mixes are mixtures of different pesticides blended in the same spray tank.

Toxicity is the harm a particular pesticide can cause to an organism.

Toxicological information provides information for medical personnel regarding the treatment of persons who have been poisoned, intoxicated, or injured by a pesticide.

Vapour drift is the movement of pesticide vapours in the air as a result of product evaporation from treated surfaces at any time during or after completion of a spray operation.

Volatilization is the process where solid or liquid substances evaporate into a vapour (gas).

Wettable powders consist of active ingredient plus a powder. They contain wetting and dispersing agents, and are mixed with water to form a suspension.

Appendix B

References

The following publications were used or reviewed in the preparation of this training manual.

British Columbia. 1992. Pesticide Applicators Course for Agriculture Producers. First Edition. Ministry of Agriculture and Fisheries.

British Columbia. 1987. Handbook for Pesticide Applicators and Dispensers. Fifth Edition. Pesticide Control Branch, Ministry of Environment.

Canadian Vegetation Management Alliance. 1992. Industry Standards and Good Practices for Vegetation Management. First Edition.

Crop Protection Institute. 1998. Certified Crop Protection Consultant Course Manual. The University of Guelph and The University of Saskatchewan.

Crop Protection Institute. 1990. Warehousing Audit Protocols and User Guide. Agrichemical Warehousing Standards Association.

Health Canada. 1995. Basic Knowledge Requirements for Pesticide Education in Canada: Vendor/Dispenser Core.

Health Canada. 1995. Basic Knowledge Requirements for Pesticide Education in Canada: Vendor/Dispenser Module for Commercial and Restricted Products.

National Fire Code of Canada (NFC). 1990.

Ontario Ministry of the Environment. 1998. Grower Pesticide Safety Course Manual.

Appendix C

Pesticide Regulations

Citation

1 These regulations may be cited as the "Pesticide Regulations".

Interpretation

2 In these regulations

- (a) "Act" means the Environment Act;
- (b) "Administrator" means a person appointed pursuant to Section 3 of these regulations, and includes an acting Administrator;
- (c) "animal" includes vertebrates, invertebrates and micro-organisms whether wild, domestic, living or dead, but does not include humans;
- (d) "buffer zone" means an area where a pesticide shall not be directly applied;
- (e) "certification" means a type of pest management activity for which a person can become certified by obtaining a certificate of qualification;
- (f) "certified applicator" means a person who has obtained a certificate of qualification under these regulations to apply a pesticide;
- (g) "commercial applicator" means a person, other than a private applicator, who uses or supervises the use of a pesticide;
- (h) "commercial class" means a class of pesticides designated by the Federal Regulatory Authority;
- (i) "contamination" means
 - (i) any significant adverse effect which the Minister believes on reasonable and probable grounds is or may be causing harm to any part of the environment, or
 - (ii) the presence of a hazard to an organism, other than the target organism, which the Minister believes on reasonable and probable grounds is or may be

detrimental to the normal physiological functions of human, animal or plant life;

(j) "Department" means the Department of Environment and Labour;

(k) "Federal Regulatory Authority" means the Federal Minister responsible for regulating pest control products;

(l) "fumigant" means a chemical that, for uses regulated by the Federal Regulatory Authority, can exist in a gaseous state at a required temperature and pressure that is lethal to a given pest;

(m) "land" means surface land, land covered by water, subsoil, matter beneath the subsoil or any combination thereof, but does not include land inside a building or structure;

(n) "micro-organism" means a microscopic plant or animal, including a bacterium, virus, fungus, alga and protozoon;

(o) "Minister" means the Minister of Environment and Labour;

(p) "pest" means any plant, animal, micro-organism or any organic functions of a plant, animal, or micro-organism, including any insect, nematode, rodent, predatory animal, parasite, bacterium, fungus, weed, or other form of plant or animal life or virus, the Minister believes is or may be injurious, noxious or troublesome, but does not include a virus, parasite, bacterium or fungus in a living person or animal;

(q) "pesticide" or "pest control product" means

(i) any substance that is sold or represented for use in preventing, destroying, repelling, attracting, or mitigating, directly or indirectly, any pest,

(ii) any substance that is a pest control product within the meaning of the Pest Control Products Act (Canada) or is intended for use as a pest control product,

(iii) any substance that is a plant growth regulator, a defoliant or a plant desiccant,

(iv) a fertilizer within the meaning of the Fertilizers Act (Canada) that contains a substance referred to in subclauses (i), (ii), or (iii), or

(v) any other substance designated as a pesticide in the regulations, but does not include a substance that is intended for sale, sold or represented for use in potable water to prevent or destroy bacteria, parasites or viruses if the substance

is not a pest control product within the meaning of the Pest Control Products Act (Canada);

(r) "pesticide research" means a limited pest control program authorized by the Federal Regulatory Authority;

(s) "pesticide storage facility" means a facility that is used to store pesticides and meets the requirements prescribed in these regulations;

(t) "plant" means an organism which usually derives part of its sustenance by photosynthesis and part by root sorption, and includes a parasitic plant, tree, shrub, weed, grass, fern, moss or micro-organism;

(u) "private applicator" means a person who applies or supervises the application of a pesticide on property owned, leased, or rented

(i) by the applicator,

(ii) by an employer of the applicator, or

(iii) by another person, if the pesticide is applied without monetary compensation or reward to the applicator other than trading services;

(v) "restricted class" means a class of pesticides designated as a restricted class by the Federal Regulatory Authority;

(w) "sell" includes sale, offer for sale, expose for sale, display or advertise for sale, or have possession of for the purpose of sale or distribution;

(x) "treatment site" means the area to which a pesticide is applied;

(y) "vendor of a pesticide" means a person who for hire or reward, sells, supplies or distributes directly to a user, or stores a pesticide, but does not include a farmer or other person who stores a pesticide for their own use and not for resale or distribution.

Administrator

3 The Minister may appoint an Administrator to administer these regulations.

Exemption from regulations

4 These regulations do not apply to the use or sale of a germicidal, disinfectant, veterinary, or sanitizing product registered under the Pest Control Products Act (Canada).

Application of federal statutes

5 The requirements of these regulations are in addition to any applicable federal legislation, including the Fertilizers Act (Canada) and the Pest Control Products Act (Canada) and regulations made pursuant to those statutes.

Part I - Certificates of Qualification

Prohibitions

6 (1) No person shall apply a commercial class or restricted class pesticide unless that person holds a valid certificate of qualification.

(2) No person shall sell or store for gain or reward a commercial class or restricted class pesticide unless that person holds a valid certificate of qualification.

Certificates of qualification

7 (1) The Minister or an Administrator may issue the following classes of certificates of qualification:

- (a)** Class I - Vendor's Certificate which authorizes the holder to sell, supply, or distribute a pesticide directly to a pesticide user or to store, for hire or reward, a commercial or restricted pesticide;
- (b)** Class II - Structural Certificate which authorizes the holder to use a pesticide, other than a herbicide or fumigant, for the prevention or control of pests in or around a structure, excluding plant pests in a greenhouse;
- (c)** Class III (A) - Forestry Certificate which authorizes the holder to use a pesticide by ground application including site preparation, brushing, crop tree release, thinning, insect control, disease control and vertebrate control in a forest management operation, forest seed orchard, outdoor nursery, or plantation;
- (d)** Class III (B) - Greenhouse Certificate which authorizes the use of a pesticide, other than the use of a restricted class fumigant gas in a greenhouse during the storage, display or production of an agricultural crop including vegetables, ornamental trees, mushrooms and forest tree seedlings and the use of pesticides on areas immediately surrounding a greenhouse;
- (e)** Class III (C) - Industrial Vegetation Certificate which authorizes the use of a herbicide by ground application to control weeds in an industrial area including a roadside, powerline, pipeline, right-of-way, railway, well site, equipment yard, or non-crop land;
- (f)** Class III (D) - Landscape Certificate which authorizes the use of a pesticide, other than a restricted class fumigant gas, for the maintenance of ornamentals, shrubs, flowers and turf on outdoor residential, recreational, commercial and public land, including the use of a pesticide in an outdoor nursery for propagation of landscape and garden plants;

(g) Class IV - Mosquito and Biting Fly Certificate which authorizes the use by ground application of an insecticide for control of mosquitoes or biting flies;

(h) Class V - Aquatic Vegetation Certificate which authorizes the use of a herbicide by ground application for the control of aquatic weeds in standing or running water in areas left exposed during periods of low water, including the use of a herbicide in a lake, river, irrigation canal, or ditch;

(i) Class VI - Fumigation Certificate which authorizes the use of a fumigant for soil fumigation or fumigation in an enclosed structure, including a grain bin, elevator, building, railcar, truck, or closed vault;

(j) Class VII - Aerial Certificate which authorizes the use from an aircraft of a pesticide on any land or water;

(k) Class VIII - Agriculture Certificate which authorizes the use of a pesticide, other than a restricted class fumigant gas, by ground application for the protection of an agricultural crop or livestock, including use for control of noxious weeds, birds and rodent control in a farm pond with no outflow, use on a Christmas tree plantation, use on livestock and poultry pests, use in farm seed treatment, use for soil fumigation and use around farm buildings associated with crop and livestock production, but not including use in a greenhouse or commercial seed treatment;

(l) Class IX - Business Operator's Certificate which authorizes the holder to carry on a commercial pesticide business or enter into contracts to handle, use, store or sell to a user a commercial class or restricted class pesticide; and

(m) Class X - Special Certificate which authorizes the use of a pesticide for a purpose not included in Classes II to VIII.

(2) A limited class [may] be created by the Minister or an Administrator for the application of a pesticide restricted to a certain activity within one certification class.

(3) A Class III or Class VIII certificate of qualification may be issued by the Minister or an Administrator to a private applicator or a commercial applicator.

(4) Subject to subsection (3), a certificate of qualification under subsection (1) may only be issued to a commercial applicator.

Application process

8 (1) An applicant for a certificate of qualification shall complete an application in a form approved by an Administrator.

- (2) An applicant for a certificate of qualification shall complete an examination and achieve a minimum standard of performance established by the Minister.
- (3) A certificate of qualification shall be valid for a period of 5 years from the date of issuance with the exception of a Class IX Certificate which shall be valid for 1 year from the date of issuance.
- (4) The holder of a certificate of qualification may be retested once in every 5-year period from the date of the issuance of the initial certificate of qualification.
- (5) A certificate of qualification shall entitle the holder to perform only those uses that the class of certificate of qualification authorizes the holder to perform and no other uses.
- (6) No certificate of qualification issued pursuant to these regulations is transferable.
- (7) Unless agreed otherwise in writing by an Administrator, no person shall apply for a certificate of qualification under these regulations unless that person is at least 18 years of age.

Supervisory restrictions

- 9 (1) A private applicator who is a certified applicator in Class III or VIII may directly supervise a non-certified applicator where
- (a) the non-certified applicator performs the same use as authorized in the certificate of qualification held by the certified applicator; and
 - (b) the non-certified applicator is at least 18 years of age.
- (2) A commercial applicator who is a certified applicator may directly supervise a non-certified applicator where
- (a) the certified applicator holds a valid Class II, III, or VIII certificate of qualification;
 - (b) the certified applicator is present at the treatment site at all times while the non-certified applicator is applying a pesticide; and
 - (c) an Administrator is notified when the supervision of the non-certified applicator will occur.
- (3) A non-certified applicator may only be supervised by a commercial applicator under subsection (2) for one 30-day period.
- (4) A certified applicator referred to in subsections (1) and (2) is responsible for all actions respecting the application of pesticide by the non-certified applicator.

Business operator

10 The holder of a valid Class IX Business Operator's Certificate shall ensure that

- (a)** a person who is employed by the business operator and who is responsible for handling or applying a commercial class or restricted class pesticide has a valid certificate of qualification;
- (b)** a commercial class or restricted class pesticide is sold only to
 - (i)** an applicator or business who holds a valid certificate of qualification, or
 - (ii)** a person who has hired another person who holds a valid certificate, qualification;
- (c)** any activity of a person employed by the business operator complies with the pesticide label instructions for the proper and safe use of pesticides; and
- (d)** any instruction to a person employed by the business operator is in accordance with the Act, these regulations or any other requirements set forth by an Administrator.

Records

11 An Administrator may require the holder of a Class IX Business Operator's Certificate to submit a record of the application or sale of a pesticide.

Part II - Pesticide Approvals

Approvals

12 (1) Pesticide application activities that require an approval under the Act are designated in the Activities Designation Regulations.

(2) Unless authorized in writing by an Administrator, an applicant for an approval shall apply at least 60 days prior to the intended starting date of the application of the pesticide.

(3) An approval holder shall keep and maintain equipment or supplies readily available to minimize the impact of any release of a pesticide.

(4) An approval holder shall notify an Administrator before commencing a spray program under an approval.

(5) An approval holder shall adhere to weather condition restrictions stipulated on an approval respecting the application of a pesticide.

- (6) An approval holder shall ensure that the approval or a copy of the approval is available at the loading, mixing, or application area when the pesticide is being used.
- (7) All boundaries of a treatment site where pesticide is used or applied and buffer zones shall be marked or identified so that they are known and visible to the applicator.
- (8) An approval holder for aerial spraying of a pesticide shall either personally accompany, or provide a contractor or agent to accompany, a pilot on a pre-spray aerial inspection of a treatment site to ensure that the pilot is fully aware of the area to be sprayed, any buffer zones involved and the property boundaries of the treatment site.
- (9) An approval holder shall keep and maintain a record of the information the Minister or an Administrator requires of each pesticide used or applied.
- (10) Where there is no evidence that an adverse effect may occur or will occur, the Minister may waive or modify in writing the requirements prescribed in subsections (5), (6), (7), (8) and (9).

Part III - General

Public notification

- 13 (1)** An approval holder shall undertake a public information and notification program as a term and condition of the issuance of an approval.
- (2) Except for spot treatments to a utility corridor, utility right-of-way, street or highway right-of-way, no person shall apply a pesticide under an approval by any method unless the person gives public notification through a local newspaper or other means approved by the Administrator at least 20 days before the application commences identifying where and when the pesticide will be applied.
- (3) No person shall apply a pesticide under a pesticide research program unless that person
- (a) posts signs approved by an Administrator identifying that pesticide research is on at the treatment site before the application commences; and
 - (b) keeps the signs referred to in clause (a) in place for 20 days after the last application at the treatment site.
- (4) No person shall apply a pesticide under an approval for crop tree release, site preparation or forest insect control unless
- (a) at least 30 days before the application commences, the person

- (i) posts signs approved by an Administrator identifying when and where the pesticide will be applied,
- (ii) ensures that the signs referred to in subclause (i) contain a space for coloured fluorescent decals which shall be applied to the signs when spraying commences at the treatment site, and
- (iii) ensures that the signs referred to in subclause (i) are placed on all access roads leading to the treatment site and at the edge of the treatment site;

(b) at least 30 days before the application commences, the person delivers a written notice approved by an Administrator to the owner or occupier of any dwelling, business, school, public building, or any other inhabited structure which is located within 500 m of the treatment site, identifying when and where the pesticide will be applied; and

(c) at least 20 days before the application commences, when the total area under an approval or the area of the individual treatment site exceeds 200 ha, the person publishes a notice approved by an Administrator through a local newspaper identifying when and where the pesticide will be applied.

(5) If the applicant can provide reasons which are considered acceptable to the Minister or an Administrator, the Minister or the Administrator may waive, modify, or alter the notice requirements provided in this Section.

(6) No person shall remove or alter any sign required to be posted under these regulations unless authorized by these regulations or by an Administrator.

(7) Subject to subsection (9), no sign posted under these regulations shall be removed for a period of 7 days after the last application at the treatment site.

(8) Unless agreed in writing by an Administrator, any sign posted pursuant to an approval under these regulations must be removed by the approval holder no later than November 1st in the year that the approval was issued unless there is a conflict with subsection (7) in which case the approval holder shall remove any signs immediately after 7 days have elapsed from the last application at the treatment site.

(9) Unless agreed in writing by an Administrator, every person who for hire or reward applies a commercial class or restricted class pesticide to a lawn, tree or other area that surrounds a domestic residence, an apartment, a commercial building, or that is located in a public area, shall

(a) post a sign approved by an Administrator indicating that a pesticide application has taken place on the treatment site immediately after the last application of the pesticide; and

(b) not remove a sign posted under clause (a) for a period of 24 hours after the last application at the treatment site.

Prohibitions

14 (1) No person shall apply, handle, use, abandon or dispose of any pesticide, a mixture containing a pesticide or seeds treated with a pesticide unless the handling, use, abandonment or disposal is conducted in conformance with the product directions or limitations shown on the manufacturer's product label or in a manner approved by the Minister or an Administrator.

(2) Despite subsection (1), no person shall apply, handle, use, abandon or dispose of a pesticide, a mixture or a device containing a pesticide or a material treated with a pesticide in a manner that results or may result in contamination of the environment.

Pesticide research

15 Any pesticide research shall be reported by the researcher to an Administrator in writing 15 days before application commences under the pesticide research authorization.

Filling/flushing

16 No person shall fill, flush or clean a sprayer or equipment used for or in association with the application of a pesticide in a manner that results or may result in contamination.

Contingency plan

17 The Minister or an Administrator may require contingency plans respecting a release of a pesticide to be prepared for approval by the Minister or the Administrator by a person who holds a Class IX certificate of qualification or by an approval holder who applies a commercial class or restricted class pesticide.

Pesticide containers

18 (1) No person shall dispose of a container that was used to hold a commercial class or restricted class pesticide except

(a) at a container collection site; or

(b) in a manner approved by the Minister or an Administrator.

(2) All pesticides shall be stored in the labelled containers supplied by the manufacturer unless otherwise authorized in writing by an Administrator.

Buffer zones

19 Where the Minister believes on reasonable and probable grounds that a treatment site may be sensitive to the application of a pesticide, the Minister may require a buffer zone be set aside in which no spray is to be directly applied, may determine the size of the buffer zone to be maintained, and may outline how the buffer zone is to be marked or identified.

Cancelled registered pesticides

20 (1) Where the registration of a pesticide has been cancelled under the Pest Control Products Act (Canada), the person to whom the pesticide was registered shall

- (a) collect or accept return of all such pesticide supplied by the person to others; and
- (b) dispose of all such pesticide in a manner acceptable to an Administrator.

(2) No person shall use, apply, display, or sell a pesticide if its registration has been cancelled under the Pest Control Products Act (Canada).

Protected water area

21 No person shall apply a pesticide within a protected water area designated under Section 106 of the Act unless the person complies with any regulations regarding the use of pesticides within the protected water area.

Part IV - User Pesticide Storage Facilities

User pesticide storage

22 (1) Part IV of these regulations applies to a private individual or the owner, operator or person responsible for a commercial business who stores a commercial class or restricted class pesticide in excess of 25 l in liquid form or 25 kg in solid form, whichever is applicable, for their own use or business use in a user pesticide storage facility, but does not store the commercial class or restricted class pesticide for resale.

(2) No private individual or owner, operator or person responsible for a commercial business described in subsection (1) shall store a commercial class or restricted class pesticide unless the following conditions are met:

- (a) the pesticide is stored in a facility that prevents the uncontrolled release of the pesticide;
- (b) a list of pesticides stored in the facility and the estimated quantities normally held in storage is, upon request, supplied to the chief of the local fire department or the chief's designate;

(c) a placard is affixed and maintained on the outside of each door leading into the room where the pesticide is stored bearing the words "WARNING - CHEMICAL STORAGE - AUTHORIZED PERSONNEL ONLY" or words to like effect in block letters which are clearly visible; and

(d) emergency telephone numbers are displayed in the facility, including telephone numbers of the fire department, hospital, poison control centre, Department, police and Emergency Measures Organization.

Part V - Vendor Pesticide Storage Facilities

Vendor pesticide storage

23 (1) Part V of these regulations applies to the owner, operator or person responsible for a commercial business who for hire or reward, or for resale, stores a commercial class or restricted class pesticide in a vendor pesticide storage facility.

(2) Any person storing commercial class or restricted class pesticides for hire or reward, or for resale, must do so in a facility that meets a standard established, approved or recognized by the Minister under subsection 8(2) of the Act.

Storage approval

24 (1) No person shall construct a new vendor pesticide storage facility or extend or modify an existing pesticide storage facility to store a commercial class or restricted class pesticide for hire or reward, sale, resale, or wholesale distribution unless the person receives an approval from an Administrator.

(2) An approval under subsection (1) shall be processed under the Approvals Procedure Regulations.

General restriction on facility location

25 No person shall construct or extend a vendor pesticide storage facility

(a) within 30 m of the bank of any surface watercourse or the ordinary high water mark of any surface watercourse, whichever distance is greater, unless approved in writing by an Administrator; or

(b) within 60 m of a well or surface watercourse used as a private water supply, unless approved in writing by an Administrator.

Construction requirements

26 (1) The construction requirements described in this Section are in addition to all applicable federal, provincial, and municipal laws and regulations, including building, fire, and electrical codes and regulations.

(2) No person shall construct a vendor pesticide storage facility unless the following conditions are met:

- (a)** in the area where pesticides are stored, the floor surface shall be made of steel, concrete or other similar durable material which is impervious to an absorbable liquid;
- (b)** flooring in the area where pesticides are stored shall have a smooth surface and be capable of being cleaned and decontaminated of any pesticide stored in the facility;
- (c)** in the area where pesticides are stored, there shall be a continuous, non-combustible curb on the floor which is integral with the floor and is at least 10 cm in height around the perimeter of the area and is capable of retaining liquids;
- (d)** in the area where pesticides are stored, there shall be no floor drains, catch basins, sumps or other openings in the floor;
- (e)** the facility shall have adequate ventilation by either natural or mechanical means to the outside atmosphere to prevent the accumulation of toxic or flammable vapours;
- (f)** there shall be at least 2 entrances and exits to the facility located on opposite sides of the facility if the floor area of the facility exceeds 200 m²;
- (g)** there shall be a separate room or area at or near the area in which the pesticides are stored that contains adequate washing facilities for personal decontamination; and
- (h)** a source of running water shall be readily available in or adjacent to the area where pesticides are stored.

Storage requirements

27 No owner, operator or person responsible for a vendor pesticide storage facility shall store a commercial class or restricted class pesticide unless

- (a)** the area where the pesticides are stored is a separate locked room or compartment that is partitioned from the floor to the ceiling with building materials that conform with fire and building codes and has no openings except those required for ventilation and entrances;

- (b) all permanent storage racks or shelves are constructed of non-combustible material that can be easily cleaned;
- (c) all pesticides are stored according to the label storage requirements provided by the manufacturer;
- (d) all pesticides are stored at least 10 cm above the floor;
- (e) all herbicides, insecticides and fungicides are stored separately from each other in the facility;
- (f) all pesticides are separated from any flammable materials by a fire resistant barrier or enough space to minimize risk of combustion of the pesticides;
- (g) all pesticides are stacked in a manner that enables the pesticides to be readily inspected; and
- (h) foodstuffs, including feed, are not stored in the facility.

Access to site

28 No person shall own, operate or be responsible for a vendor pesticide storage facility unless

- (a) the facility has sufficient outside lighting to be of use to emergency service personnel;
- (b) any windows in the facility are locked to prevent unauthorized access when authorized personnel are not present;
- (c) the facility has doors that remain closed and locked at all times when authorized personnel are not present; and
- (d) access to the facility is restricted only to authorized personnel.

Safety measures

29 (1) No person shall own, operate or be responsible for a vendor pesticide storage facility unless

- (a) protective clothing including gloves, hats, coveralls, boots, eye protection, a first aid kit and a respirator appropriate for use with the pesticide being stored are readily available, are properly maintained, and functional at all times at the facility and are free from pesticide contamination;
- (b) eye wash and emergency showers are readily available at the facility;

(c) the chief of the local fire department or the chief's designate is provided annually with a list of pesticides stored in the facility and the estimated quantities normally held in storage and the chief or the designate is notified of any significant changes in stocks which occur during the year;

(d) a placard is affixed and maintained on the outside of each door leading into the room where the pesticide is stored bearing the words "WARNING - CHEMICAL STORAGE - AUTHORIZED PERSONNEL ONLY" or words to like effect in block letters which are clearly visible; and

(e) emergency phone numbers are displayed in the facility including the telephone numbers of the fire department, hospital, poison control centre, Department, police and Emergency Measures Organization.

(2) Every owner, operator or person responsible for a vendor pesticide storage facility shall ensure that "no smoking" signs are prominently displayed in an area where pesticides are being stored.

(3) No person shall use an open flame to conduct welding, burning, cutting, melting, heating or any other activity in a vendor pesticide storage facility unless appropriate safety measures are taken.

(4) Every owner, operator or person responsible for a vendor pesticide storage facility shall post or make readily available to employees or other persons any material safety data sheets that have been compiled and supplied by the manufacturer of the pesticide.

(5) No owner, operator or person responsible for a vendor pesticide storage facility shall place a pesticide in that facility unless it is equipped with

(a) a fully-operative fire alarm system;

(b) fire extinguishers which are approved by the fire department and are placed in strategic positions in and around the pesticide storage facility; and

(c) materials for containment and clean-up as required by an Administrator.

(6) Unless an Administrator directs otherwise in writing, every owner, operator or person responsible for a vendor pesticide storage facility shall ensure there is unobstructed access to the facility for emergency equipment and personnel.

Maintenance and inspection of facility

30 (1) Every owner, operator or person responsible for a vendor pesticide storage facility shall

- (a) comply with all relevant legislation respecting pesticide storage and the use of personnel protection equipment and clean-up techniques;
- (b) inspect monthly the facility and repair or replace any parts that may be damaged or defective; and
- (c) immediately secure any container or package found leaking a pesticide and clean up the area.

(2) Every owner, operator or person responsible for a vendor pesticide storage facility shall keep and make available for review upon request by an inspector, a book or report of monthly inspections and any action taken under subsection (1).

(3) The book or report described in subsection (2) shall be kept while the facility is in operation and for 2 years after operations cease.

Abandonment

31 (1) No owner, operator or person responsible for a vendor pesticide storage facility shall abandon that facility or any part of that facility unless the person notifies an Administrator in writing at least 6 months before the date of the proposed abandonment.

(2) No owner, operator or person responsible for a vendor pesticide storage facility shall abandon that facility unless the facility is left in a condition approved by an Administrator.

(3) Unless approved in writing by an Administrator, an abandonment pursuant to subsection (1) does not relieve the owner, operator or person responsible for a vendor pesticide storage facility from any requirement contained in the Act, regulations made pursuant to the Act, or in an approval issued with respect to that facility.

Part VI - Effective Date

32 (1) Subject to subsection (2), these regulations shall come into force on, from and after April 11, 1995.

(2) With respect to private applicators, clauses 7(1)(c), (d), (e), (f), and (k), and clause 10(b) shall come into force on, from and after December 1, 1996.

