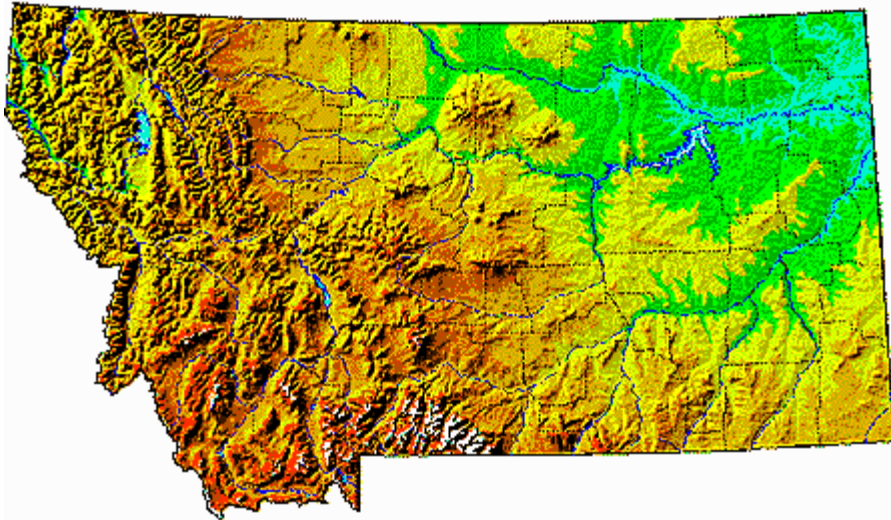


# MONTANA PRIVATE PESTICIDE CERTIFICATION *MANUAL*



**2008**

*MSU Pesticide Safety Education Program*  
*<http://www.pesticides.montana.edu>*



# *Montana Private Pesticide Certification Manual*

## *Fourth Edition*

Compiled & Written by: Cecil Tharp (MSU Pesticide Education Specialist), and Jessica Fultz, (MSU Pesticide Education Assistant). This edition has been edited from previous editions of this handbook which were written and compiled by Mr. Reeves Petroff.

*Special thanks to: Janet Kirkland, Montana Department of Agriculture.*

### ***For more information regarding the private applicator program contact:***

MSU Pesticide Safety Education Program  
PO Box 172900, Montana State University  
Bozeman, MT 59717-29000  
Phone: (406) 994-5067  
Fax: (406) 994-5589  
Email: ctharp@montana.edu  
Website: <http://www.pesticides.montana.edu>

### **For pesticide related violations, or information regarding the commercial applicator program contact:**

Montana Department of Agriculture  
PO Box 200201  
Helena, MT 59620-0201  
Phone: (406) 444-5400  
<http://agr.state.mt.us>

### **Emergency Phone Numbers:**

Rocky Mountain Poison and Drug Center: 1-800-222-1222  
(General Poisoning Information)

Pesticide Accident Hotline. (CHEMTREC). (800) 424-9300.  
(For help involving spills, leaks, and fires).

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**MSU Pesticide Safety Education Program**  
**PO Box 172900, MSU, Bozeman, MT 59717**  
**Phone: (406)994-5067 FAX: (406) 994-5589**  
**Email: [ctharp@montana.edu](mailto:ctharp@montana.edu)**  
**Website: <http://www.pesticides.montana.edu>**

# CHAPTER 1

## MONTANA PRIVATE APPLICATOR CERTIFICATION

### HOW TO GET THE MOST FROM THIS BOOKLET

1. Obtain and study this booklet before you attend any private applicator recertification sessions, or prior to conducting the private applicator initial exam.
2. Work through the practice exam questions at the end of each section.
3. Take a calculator with you when you go to take the private certification exam.
4. Keep this handbook as reference material for yourself even after you are certified.

### PRIVATE APPLICATOR TRAINING AND CERTIFICATION IN MONTANA

A pesticide is any chemical that is used to control pests. These pests include insects, plant diseases, weeds, and some mammals. Insecticides, fungicides, herbicides, and many other words that end in “-cide” are all types of pesticides.

The Environmental Protection Agency (EPA) classifies pesticides as either "general-use" or "restricted-use". *General-use pesticides* are less likely to harm the user or the environment when used according to label instructions. Anyone can buy and apply general-use pesticides. On the other hand, *restricted-use pesticides (RUP)* can harm the environment or the applicator when not used as directed. Licensing and certification are required for the purchase and application of restricted use pesticides (RUP). Restricted-use pesticides include: Tordon 22K™, Hoelon 3EC™, Furadan™, Warrior™, Phostoxin™ and many more herbicides and insecticides.

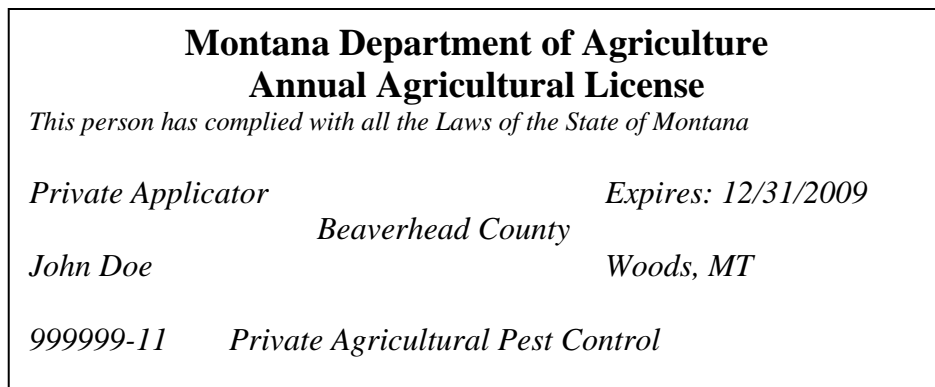
Restricted-use pesticides can only be used on property that is owned, rented, or leased by the licensed applicator applying the pesticides. Family members and employees of licensed applicators may purchase and apply restricted-use pesticides, but they must be trained and supervised by the applicator. Licensed private applicators are legally responsible for any problems as a result of their restricted-use pesticides. This person has complied with all the Laws of the State of applications made by family members or employees.

Both the Montana Department of Agriculture (MDA) and the Montana Cooperative Extension Service are responsible for the training, certification and licensing of private applicators in Montana. If you have any questions about private applicator certification in Montana, please contact the MSU Pesticide Safety Education Program (PSEP), (406) 994-5067, or visit the website at <http://www.pesticides.montana.edu>.

### INITIAL CERTIFICATION

To become certified for the first time, an “initial” applicator, must either attend an approved initial training program and take an un-graded open book exam, or pass an open book graded exam administered by an authorized representative of the MSU Pesticide Safety Education Program, usually the local county or tribal agricultural Extension agent. Exceptions occur for individuals who fail to cumulate enough re-

certification credits, thus allowing certification to lapse. Those individuals must pass a closed book graded exam within 12 months of their lapsed certification. A 70% score is needed to pass any graded exams to gain certification. After becoming certified, an *Application for a Farm Applicator Special Use Permit* is completed by the initial applicator and signed by the authorized representative. The initial applicator then mails this application, along with the appropriate fees, to the Montana Department of Agriculture. The Montana Department of Agriculture will then mail the applicator a license, also known as a farm applicator license (**Figure 1**).



**Figure 1.** An example of the Farm (Private) Applicator License an applicator receives when initially certified.

Once this license is received, the applicator should register the Applicator ID Number and Expiration Date with their local county or tribal Extension office. Your applicator ID Number is the set of numbers on the license that ends in -11. This will help Extension offices keep better track of applicator re-certification credits. The authorized representative may also issue a temporary permit to the applicator. The temporary permit will remain valid until the applicator receives their license in the mail. This must be kept with the applicator at all times when applying pesticides, filling out restricted use pesticide recordkeeping sheets, as well as attending recertification courses for applicator recertification credits.

## **STAYING CERTIFIED**

Montana is divided into five regions for private pesticide applicator training (PAT) (**Figure 2**). Each region has a five-year re-certification cycle with December 31<sup>st</sup> of the last year being the deadline for getting the required re-certification credits. In order to renew their private applicator certification, a private applicator must acquire six (6) private applicator re-certification credits, or points, before the end of their region's five-year re-certification cycle (Figure 2). These credits are available by attending programs accredited by the MSU Pesticide Safety Education Program. An applicator can also choose to take a closed book exam during the last year.

**Every certified private pesticide applicator is responsible for maintaining their license. They are also responsible for keeping track of the programs they attend. It is not wise to wait until the last minute before making a decision to attend re-certification training programs. There may be none available.**

An in-depth explanation of the private pesticide training program in Montana and schedule of training events are located at the MSU Pesticide Safety Education Program PSEP website: <http://www.pesticides.montana.edu/PAT/>.

Individual applicators may also request credits “after-the-fact” for meetings, conventions, or other events that have not been reviewed by the MSU Pesticide Safety Education Program. These programs must contain information that will increase the ability of private applicators to safely apply restricted-use pesticides. Credits may be awarded provided that a copy of the program agenda and proof of attendance is submitted to the MSU Pesticide Safety Education Program **within 30 days of the event**. There is no guarantee that credits will be forthcoming.

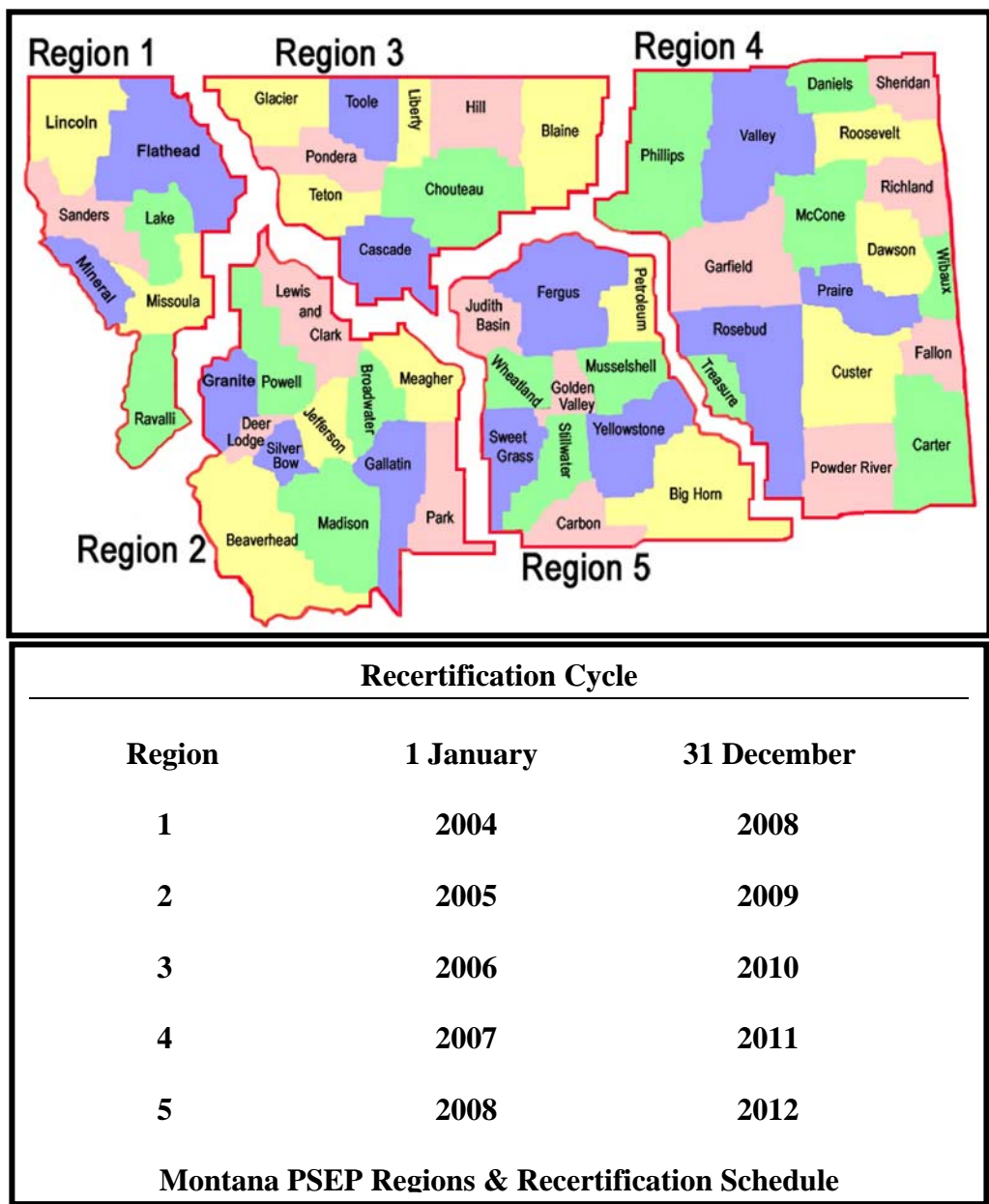


Figure 2. Montana’s five PSEP regions and re-certification cycles.

**FEES**

The fee for private pesticide applicators is currently \$50.00 and is distributed in the following manner:

- \$15.00 (30%) to Montana Department of Agriculture for administration.
- \$20.00 (40%) to MSU Extension to support the pesticide certification and training program
- \$15.00 (30%) to fund the waste pesticides and pesticide container disposal program.

The \$50.00 fee is prorated over the 5-year re-certification cycle. For example, an initial applicator applying for their license during the 2<sup>nd</sup> year of their district's cycle would pay \$40.00. The fees for applicators applying for their license during the 3<sup>rd</sup> year would be \$30.00. Fees during the 4<sup>th</sup> year would be \$20.00 and during the 5<sup>th</sup> year it would be \$10.00.

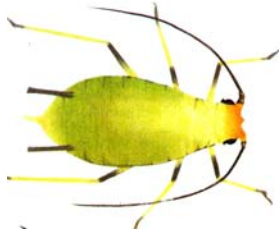
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## **Practice Questions For Chapter 1**

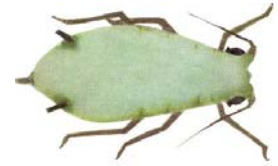
**(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. Name three types of pesticides?
2. Certification is required for the purchase of which classification of pesticide?
3. You need a private applicator certification to apply general use pesticides on an agriculture commodity on land that you own (True or False).
4. How many recertification credits are needed for an applicator to qualify for recertification at the end of their certification cycle?
5. What 2 digits will your applicator ID number end in?
6. If you allow your private certification to lapse, how could you re-qualify for private applicator certification within the 1<sup>st</sup> 12 months?
7. You may apply restricted use pesticides on land of your immediate neighbor with a private applicator restricted use pesticide license (True of False).
8. Who is your local contact for all of your private applicator pesticide certification needs?
9. If you were to be initially certified as a private applicator on June 18<sup>th</sup> 2007 in region 3, what would be your licensing fee?
10. When does your license expire if you are currently licensed in region 4?





# Chapter 2



## Pest Management

### TYPES OF PESTS

A pest can be defined as any organism that causes economic or aesthetic damage to humans or their property. There are four groups of pests:

- ⇒ **Diseases** (bacteria, viruses, fungi, parasitic microorganisms, and other microorganisms)
- ⇒ **Invertebrates** (insects, mites, ticks, spiders, nematodes, snails, and slugs)
- ⇒ **Weeds** (noxious and exotic weeds, and other undesirable plants)
- ⇒ **Vertebrates** (birds, reptiles, amphibians, fish, and rodents and other mammals)

Examples include exotic weeds that displace native vegetation, deer mice (*Peromyscus maniculatus*) that carry the deadly hantavirus, and gypsy moths (*Lymantria dispar*) that defoliate oak trees.

Pests can be classified as **key pests**, **occasional pests** or **secondary pests** (Table 1). At times the damage caused by these pests may have reached levels that require no action because costs of treating are greater than the profit gained. However, if a pest is detected and accurately identified steps preventing an increase in population and the ensuing damage can be taken.

Table 1. Pest classifications.

Key Pests	Occasional Pests	Secondary Pests
<p><i>Cause major damage on a regular basis.</i></p> <p><b>Example:</b> An 80 percent infestation of leafy Spurge can reduce livestock carrying capacity by 100 percent.</p> <p>Grasshoppers consume up to 25 percent of the available forage in the western United States annually.</p>	<p><i>Become intolerable on an irregular basis. Often as a result of changes in climate, environment, or human activity.</i></p> <p><b>Example:</b> Dry conditions can cause seed bugs to move from rangeland to areas of higher moisture like lawns, flower beds, swimming pools and houses.</p>	<p><i>Occur as a result of actions taken to control a key pest.</i></p> <p><b>Example:</b> Cheatgrass establishment in areas that have been sprayed for spotted knapweed.</p> <p>Ticks and fleas plague people after their natural hosts have been eliminated.</p>

### PEST MANAGEMENT APPROACHES

The goal of pest management is to maintain pest damage at economically acceptable levels. There are generally three approaches to manage pests:

- Prevention
- Suppression
- Eradication

The pest management approach chosen depends on the type of pest, the location of pest occurrence, and economics. The same pest may require a different approach depending on the situation. For example, the Mediterranean fruit fly is an established pest in Hawaii; therefore, prevention and suppression approaches are taken to reduce crop damage. Regulatory agencies in California and Florida, however, use eradication measures to prevent the Mediterranean fruit fly from becoming permanently established in these states. A combination of approaches usually enhances a pest management program.

**Prevention** is action that is taken to thwart the occurrence of a significant pest problem. Prevention is the most effective and economical approach to pest management. This approach may include either chemical or non-chemical pest management methods. General methods of prevention are:

- ⇒ Grow varieties of plants resistant to diseases or insects.
- ⇒ Plant weed- and disease-free seed and Use certified weed free hay, seed and mulch. Wash vehicles to prevent the spread of noxious weeds.
- ⇒ Contain pest infestations by restricting the encroachment of the pest onto adjacent pest-free lands.
- ⇒ Apply pre-plant or pre-emergence herbicides to reduce emerging weeds.
- ⇒ Quarantine imported plants and animals to prevent the introduction of foreign diseases and insects.

**Suppression** of pest populations through management efforts reduces pest numbers below an economic injury level (EIL) but does not completely eliminate the pest. Suppression can lower pest numbers allowing natural enemies to maintain control. Pesticide application can be used as a pest suppression technique. For example, post-emergence application of herbicides can reduce emerging weed populations. Spraying mature spotted knapweed plants with 2,4-D may not kill the mature plants, but it will limit seed production and possibly kill younger, more susceptible plants.

**Eradication** completely eliminates a pest from a designated area. In buildings or other small, confined spaces, a pest (e.g. cockroaches, rats, and mice) can be eliminated, and then effectively excluded from the area. Over larger areas, however, eradication is a radical approach that can be very expensive and often has limited success. Exotic or introduced pests that may threaten public health or economics require an eradication program mandated by governmental agencies. For example, if a new pest such as the Mediterranean fruit fly is detected in a fruit growing area, regulatory agencies may implement widespread actions to totally eliminate the pest before it becomes established to a point that it can no longer be eradicated.

## PEST MANAGEMENT METHODS

A variety of pest management methods can be implemented to prevent, suppress, or eradicate a pest. Whenever possible integrate several methods into a pest management program. Pest management methods include:

- Regulatory Actions
- Cultural & Mechanical Practices
- Biological Control
- Chemical Control

**Regulatory actions** are often employed to prevent immigration of foreign pests or to prevent the dispersal of already established pests. Government agencies use quarantine or eradication programs to eliminate pests that are a danger to the public's health, or would cause major damage to the environment. Imported plants and animals are often held in quarantine for a period of time to allow inspection for pests and diseases.

*Example: There is a quarantine program in place to prevent the movement of Japanese beetles into un-infested areas in Montana. It is prohibited to move regulated items that may be hosts and possible carriers of the beetle into un-infested areas from infested areas without proper certification.*

**Cultural and Mechanical Control** manages pests by disrupting the pest behavior or using devices, machines to alter the pest's environment. These practices have often been overlooked because of the development of pesticides. As public interest in environmental issues expands, the impact of cultural and mechanical pest management practices is receiving greater attention. Some examples of these methods that influence the incidence of pest problems include:

- ⇒ **Cultivation.** Cultivation uses mechanical devices such as plows, disks, mowers, cultivators, and bed conditioners to physically destroy weeds or control their growth and disrupt soil conditions suitable for the survival of some microorganisms and insects
- ⇒ **Trapping.** Trapping uses mechanical devices or sticky surfaces to physically catch pests within an area or building.
- ⇒ **Exclusion.** Exclusion consists of using barriers to prevent pests from getting into an area.
- ⇒ **Cultural Control Practices.** Cultural practices consist of irrigation, aeration, fertilization, planting different crop varieties, planting pest resistant crops, timing of planting and harvesting, trap crops, mulching (with plastic, straw, shredded bark, or wood chips), mowing, grazing, pulling, tilling, cutting, fire, and by using cover crops.
- ⇒ **Sanitation.** Sanitation involves eliminating food, water, shelter, or other necessities important to the pest's survival.
- ⇒ **Modifying the Environment.** Environmental modifications by altering physical and environmental conditions such as water, air movement, temperature, light, and humidity can suppress pest outbreaks.

**Biological control** is the manipulation of one biological organism to control another organism. Many pests (native and non-native) can be managed by a number of natural enemies, naturally-occurring arthropods (insects, spiders, mites), and bacterial, fungal or viral pathogens. The balance of pest populations and their natural enemies can be significantly influenced by cultural practices and the use of chemicals. Populations of natural enemies can be enhanced by selective use of cultural practices or decimated by the indiscriminate use of pesticides. If successful, the importation and establishment of the natural enemy will result in a long-term reduction of the pest problem and repeated releases of the natural enemy will not be required. *Example: Ladybeetles used to control aphids.*

**Chemical controls (pesticides)** are any naturally derived or synthesized material that is applied to plants, the soil, water, harvested crops, structures, clothing and furnishings, or animals to kill, attract, repel, regulate, interrupt the growth and mating of pests, or to regulate plant growth. There are many pesticides for each type of pest:

- ⇒ **Diseases** - bacteria (bactericides), microorganisms (disinfectants / antimicrobials), fungi (fungicides)
- ⇒ **Invertebrates** - insects / related arthropods (insecticides), mites (miticides / acaricides), snails and slugs (molluscicides), nematodes / roundworms (nematicides)
- ⇒ **Weeds** - herbicides, defoliant (leaves or foliage to drop from plants)
- ⇒ **Vertebrates** - birds (avicides), predatory vertebrates (predacides), fish (piscicides), rodents (rodenticides)

Be sure to read not only the current pesticide label but also the Material Data Safety Sheet (MSDS) of the pesticide to be used. Off-label use can cause adverse effects to non-target species on- and off-site by drift or movement in soil and water.

*Chemical controls often harm non-target organisms.* Pesticide runoff can harm fish and other aquatic animals and plants in ponds, streams, and lakes. Aquatic life also can be harmed by careless tank filling or draining, and by rinsing or discarding used containers along or in waterways. Insecticides may poison beneficial parasites and predators near the target site as well as honey bees and native pollinating insects.



Reduce pollinator poisoning:

- ❑ **Use the least harmful pesticide formulation.** Granular formulations are the least dangerous to pollinators. Microencapsulated pesticides are the most hazardous because they can be taken back to the hive or nest like a pollen rain.
- ❑ **Do not apply insecticides when crop or weeds are in bloom.** Mowing of weed blooms will cause pollinators to forage elsewhere.
- ❑ **Minimize spray drift** by considering the appropriate nozzles and wind conditions.
- ❑ **Do not apply pesticides during midday.** Pollinators are foraging for pollen and nectar during the warm hours of the day. Evening applications are the best because pollinators are rarely foraging at this time.
- ❑ **Make sure hives and nests are moved or covered during application.**

Limiting pesticide use and selecting the least harmful pesticides is the best way to avoid the poisoning of valuable organisms. Pesticide labeling statements will alert you to a chemical's effect on non-target species.

*Resistance to chemical controls* occurs when there is an ability of an insect, fungus, weed, rodent, or other pest to tolerate a pesticide that once controlled it. Pesticide resistance develops when all the susceptible pest individuals in a population are killed by intensive pesticide use leaving only the resistant ones to reproduce. Resistance is an inherited trait that is passed on genetically from one generation of pests to the next. As the pesticide is repeatedly used, the percentage of resistant individuals will increase until most of the population is resistant. If a pest becomes resistant to a pesticide, it can become **cross-resistant** to another chemically related pesticide. At least 660 occurrences of common weed, insect, and disease-causing fungi have developed pesticide resistance.

Manage resistance by:

- ❑ Using pesticides only when needed
- ❑ Changing pesticide use patterns
- ❑ Using chemically unrelated pesticides (new or altered pesticides)
- ❑ Practicing crop rotation
- ❑ Using an Integrated Pest Management program

## INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is a pest management strategy that uses a balanced combination of biological, chemical, cultural, mechanical, and regulatory methods to reduce not only pest damage to economically acceptable levels but also to minimize human and environmental health risks of the management methods themselves. IPM improves the effectiveness of pest management methods while reducing some of the negative effects:

- ⇒ Promotes a balanced ecosystem and a healthy environment
- ⇒ Reduces pest management costs by reducing the use of ineffective pesticides
- ⇒ Maintains a good public image by considering a community's human and environmental health

IPM is a proactive strategy organized into five components: **1)** identify and monitor the pest, **2)** assess potential pest impacts, **3)** develop and evaluate a management plan, **4)** implement the management plan, and **5)** assess management results. A **record keeping system** is necessary for all IPM programs. Successful programs require keeping detailed records on the following:

- ❑ Pest control methods
- ❑ Environmental conditions
- ❑ Past, present, and future vegetation (crops)
- ❑ Pesticide use history
- ❑ Results of the pest management practices
- ❑ Relative yield results



**1) Identify and monitor** pest populations by scouting, trapping, or conducting surveys and inventories. In order to develop an IPM program, managers need to know which pests are present, where they occur (and equally important, where they do not occur) and their approximate infestation size and abundance. Never classify an organism as a pest or treat it as a pest until it is clearly determined to be one. Once you have accurately identified the organism as a pest, you can access information about its life cycle and behavior, the factors that favor development, and the recommended control procedures, increasing the success of the IPM program developed. Monitoring must occur regularly and must follow procedures specific to pest conditions. Effective monitoring of pest populations and their damage over time determines change in damage levels and geographic distribution and can lead to predictions of damage for the following year.

Pest inventories and surveys are observations made at a single point in time to detect the occurrence of one or more pest species within a management area. An *inventory* is defined as a cataloguing of the entire management area, whereas a *survey* is a sampling of a representative portion of a management area. Without knowing the extent of pest distribution, management can be random and the full management potential may not be fully realized. For example, the information gained from the inventory may help determine if a prevention, eradication, or suppression approach to pest management is taken.

**2) Assess potential pest impacts** using the information collected from monitoring pest populations to identify areas where pest impacts will be greatest. The presence of a pest does not indicate that a control method is required. Control is only necessary when pest populations are large enough to cause significant damage and the cost of the damage outweighs the cost of the control method. Models have been developed for a number of insects and plant diseases to predict the need for and timing of pesticide applications. The **economic threshold (ET)** is the number of pests per unit of area (population density) at which management methods should be employed to prevent the pest from reaching the economic injury level (EIL). **Economic Injury levels (EIL)** are the lowest pest population that will cause economic damage (**Figure 3**). To prevent producers from losing money from pest damages and control costs it is necessary to set the ET below the EIL. When a pest reaches a *critical density* as determined by ET and EIL control measures should be employed to prevent the populations from reaching the injury level (**Figure 4**).

$\text{Injury Level} = \frac{C}{VIDK}$
<p><i>C</i> = the cost of management per unit area  <i>V</i> = market value per unit area  <i>I</i> = injury amount caused per pest  <i>D</i> = the damage per injury amount  <i>K</i> = the reduction in pest attack by control</p>

Figure 3. An example equation of EIL.

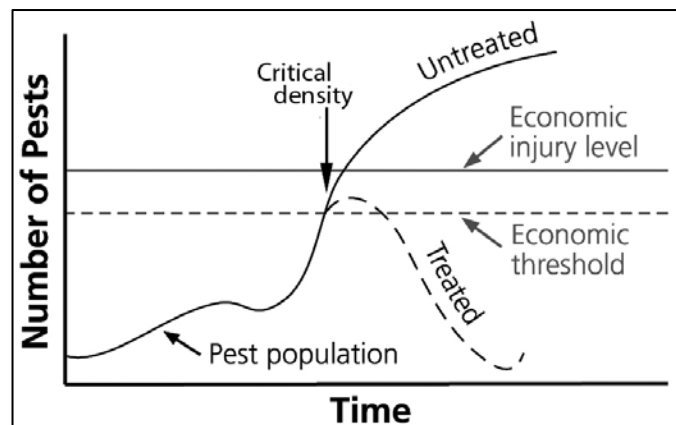


Figure 4. The economic threshold (ET) must be set below the economic injury level (EIL). When a pest reaches a critical density controls should be employed.

**3) Develop and evaluate the management plan** by deciding on the management approach(s) (prevention, suppression, or eradication) and the management method(s) (cultural/mechanical, biological, or chemical controls) that will be used to create an effective IPM program. Other methods besides pesticides are available to provide long and permanent control of a pest. Consider all methods when developing a management plan and evaluate the costs, benefits, and liabilities of each method. Government, researchers, universities, industry and special interest groups help identify the best available control options and ensure that they are biologically, economically and environmentally beneficial, as well as socially acceptable.

**4) Implement the management plan.** The plan will identify areas at greatest risk and determine the resources necessary to conduct the operation. Some resources may need to be acquired from in-house sources, support from co-operators, independent contractors or a combination. During implementation the response to the control / treatment of not only the pest, but also the crop, must continue to be monitored (by scouting, trapping or conducting surveys / inventories) regularly. Make sure to include all the steps of implementation in a **record keeping system**.

**5) Assessment of treatment results** will help determine the success of management plan. Consider all components of the IPM system including monitoring, economic thresholds, injury levels, and treatment options for overall effectiveness. A critical evaluation will tell you what worked and what didn't. It is important to note that a good evaluation is tied to a good **record keeping system** that helps you modify and continually fine-tune the IPM program. When evaluating an IPM program several questions are important:

- ❑ Did IPM work?
- ❑ What went wrong and what went right?
- ❑ Was the pest properly identified?
- ❑ Was the field sampling unbiased?
- ❑ What was the pest activity before and after implementation of IPM strategies?
- ❑ What changes to the system would make it better?
- ❑ Was the choice of control based on sound judgment or outside pressure?

## Practice Questions for Chapter 2

(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)

1. \_\_\_\_\_ is the pest management strategy which combines biological, chemical, cultural, mechanical, and regulatory principles to minimize pest populations.
2. The economic injury level is the threshold at which a management option should be used to avoid the economic threshold (True or False).
3. Ladybeetles used to control aphids is an example of \_\_\_\_\_ control.
4. Three pest management approaches are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
5. Mowing is a \_\_\_\_\_ control tactic to manage pests.
6. Four types of pests are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
7. Pesticide application is a pest suppression technique (True or False).
8. The ability of a pest to tolerate a pesticide more over time is termed “\_\_\_\_\_”.
9. Off target pesticide use can lead to \_\_\_\_\_ impacts.
10. If the state of Montana quarantined a farm, that would be a \_\_\_\_\_ control option.



# Chapter 3

## Pesticides

The manner in which a pesticide comes from the manufacturer is known as its formulation. There are three kinds of formulations: liquid, dry, and a gas. The same pesticide may be sold in more than one kind of product formulation and in various concentrations. The insecticide malathion is available as a liquid, a powder that is added to water, and as a dust. A pesticide is made up of 2 main ingredients:

- (1) Active ingredient (a.i.) is the part of a pesticide formulation that kills the pest.
- (2) Inert ingredients, or carriers, are often added with the active ingredients. The inert ingredients make a formulation better for storage, handling or application. Examples of inert ingredients include talc and clay for dry formulations, and water and alcohol-based solvents for liquid formulations.

A pesticide formulation is made up of one or more chemicals.

### DRY FORMULATIONS

**Wettable powders (WP):** The a.i. is combined with a finely ground dry carrier such as talc. WP's are then mixed with water for application as a spray. Examples: Sevin 50 W®. Advantages: Easy to store and transport, and offers lower toxicity to plants than liquid formulations. Disadvantages: Inhalation hazard when pouring and mixing, needs good and constant agitation (usually mechanical) in the spray tank, and is abrasive to many pumps and nozzles.

**Water soluble packets/bags (WSP, WSB):** Pre-weighted amounts of a dry formulation are packaged in water-soluble plastic bags that dissolve in water. Examples: Ammo WSB®, Thiodan WSB®. Advantages: Reduce handling hazards associated with highly toxic pesticides. Disadvantages: Packets dissolve when exposed to water. Bags or packets are usually premixed at a specific rate.

**Flowables (F or FL):** The finely ground active ingredient is suspended in a liquid and then mixed with water for application. Examples: Seed Treatments, Gaucho 480F, Bravo 720®, Furadan 4F®. Advantages: Easy to handle and apply. Seldom clogs nozzles. Disadvantages: requires agitation & may leave visible residue.

**Dry flowables or water dispersible granules (DF OR WDG):** Like WPs but the active ingredient is formulated on a granule instead of powder. Examples: Escort DF®, Escort XP®, Ally®, Amber®. Advantages: Easier to mix than WPs & less exposure to fine dusts. Disadvantages: Needs agitation & difficult to keep suspended in backpacks.

**Granules or pellets (G or P):** Most often used for soil applications. Examples include Spike 20P®, Counter 15G®. The active ingredient is coated onto or absorbed into large, coarse particles such as clay pellets or granules. Advantages: Ready to Use (RTU); no mixing & low drift hazard as particles settle quickly. Disadvantages: Dust from application equipment might present hazard to applicator. May need to be incorporated into the soil and may need moisture to activate.



- 1 Fill the spray tank 1/4 full of water and begin agitation. Add any compatibility adjuvants or other additives used to counteract hard water conditions or pH (water conditioners, ammonium sulfate, buffers).
- 2 Begin the **D-A-L-E-S** sequence:
- 3 Pre-mix **D**ry formulations in a small bucket before adding to the spray tank.
- 4 Add to tank and **A**gitate until the dry formulations are uniformly dispersed. Add water as needed.
- 5 Add **L**iquids (L).
- 6 **E**mulsifiable Concentrates (EC) and **S**urfactants go in last.
- 7 Top off the tank, continue agitation until the pesticides are properly mixed

## LIQUID FORMULATIONS

**Emulsifiable concentrate (E OR EC):** Liquid formulations containing the active ingredient, one or more solvents, and an emulsifier to aid in mixing with water. Examples: 2,4-D ester, Curtail M®, Treflan EC®, Fargo EC®. Advantages: Easy to handle, store and transport. Little agitation required & will not settle out or separate when equipment is turned off. Disadvantages: More of a hazard to non-target plants and animals & easily absorbed through skin of plants and animals. Solvents may cause rubber or plastic hoses and gaskets to deteriorate.

**Soluble liquid (S):** A liquid formulation in which the active ingredient readily dissolves in water. Consists of the active ingredient and additives. Examples: Tordon 22K®, Krenite S, Roundup®. Advantages: Will not separate or settle out when mixed with water. Disadvantages: Few in number.

## FORMULATION SELECTION, MIXING, & COMPATABILITY

The selection of the proper pesticide for your own personal needs is not just dependent on efficacy, control, or pricing. Other factors go into the selection of the perfect pesticide for your own use including the formulations selected & the corresponding safety and compatibility considerations of working with each formulation.

The formulation you select may have differing affects on the safety of the applicator and other people. Is the active ingredient you need to use available in a safer formulation. Dry formulations are more easily inhaled. Liquid formulations are more easily absorbed into the skin. In addition, formulations may affect non-target plant and animal species. For example the solvents and emulsifiers in emulsified concentrates may injure non-target species or crops. In addition, mixing pesticides may influence the pesticides properties directly, thereby reducing efficacy & control that may otherwise be present. Some pesticides should never be mixed, as doing so may cause personal harm or equipment failure. However, two or more pesticides may sometimes be mixed together to control more than one pest during a single application. However, some pesticides may be not mix well together. This may cause the pesticides to be ineffective. It may even damage equipment and plug up hoses.

Always read your label for non-target problems or compatibility issues for your pesticide of interest. ***Speak to your local county extension agent or chemical distributor for more information on your products compatibility.*** If information on compatibility is not available for your products of interest, you may test the compatibility of your pesticides prior to use. Always follow the D-A-L-E-S sequence when mixing any pesticides. This sequence is:

*Testing Compatibility using D-A-L-E-S* - **WARNING:** Always wear the labeled personal protective equipment (PPE) when mixing or pouring pesticides. Perform this test in a safe area away from food and sources of ignition. Pesticides used in this test should later be applied to a labeled site. Rinse all utensils and jars and dispose of the rinse water (called rinsate) onto a site listed on the pesticide label. Do not use utensils or jars for any other purpose after they have contacted pesticides. Mark these containers clearly.

*Step #1* - Use a clean, clear quart-size jar. Fill the jar to about ¼ full with water. Add pesticide(s) to the jars in the proper order (D-A-L-E-S). One teaspoon of a liquid formulation in one quart of water is roughly equivalent to 1 quart of pesticide in 50 gallons of water per acre. Use 1 ½ teaspoon of a WP for each pound recommended per acre. Add the remaining water.

*It is better to mix liquids with liquids or dry formulations with dry formulations. Small quantities of dry formulations often mix easier if pre-mixed with water in a small bucket first (called a slurry). When mixing into cold water, slurry dry herbicides first. Mixing of a dry product directly into contact with an oil-based adjuvant or oil-based EC formulations may cause encapsulation of the dry formulation. This may cause an uneven suspension of the pesticide formulation in the tank.*

*Step #2* Screw on the lid and shake the jar. Feel the sides of the jar. **If it is giving off heat then the mixture may be having a chemical reaction and the pesticides should not be combined.** If the mixture clumps, or if any solids settle to the bottom (except for wettable powders), the mixture probably is not compatible. If no negative signs are evident, then test the mixture on a small portion of the intended target area.

## ADJUVANTS

Adjuvants are additives that are added to a spray solution to improve the performance of the spray mixture (**Figure 5**).

There are two types of adjuvants: (1) surfactants and the (2) special purpose or utility adjuvants. Surfactants are often added to a solution to increase a pesticide's ability to be absorbed by the pest. The non-ionic surfactants (NIS) are composed of alcohols and fatty acids and are compatible with most pesticides. Non-ionic surfactants are all-purpose and the most widely recommended. The silicone-based surfactants are increasing in popularity due to their superior spreading ability. Some of these surfactants are a blend of nonionic surfactants (NIS). The use of oil-based surfactants in spray solutions is a common practice and is used mainly with grass herbicides. Pesticides mixed with oil-based surfactants can penetrate easier through a waxy leaf surface or through the tough shell of insects. Crop oil concentrates (COC) are a blend of petroleum-based oil and non-ionic surfactants (NIS). Because these surfactants are petroleum-based oils, they may damage non-target crops. On the other hand, methylated and esterified seed oils (MSO and ESO) come from natural seed oils (sunflower, soybean, corn, canola) and may be easier on nontarget plants because of their natural ingredients.

**Fertilizer-based Surfactants.** The addition of ammonium sulfate to spray mixtures may increase the control of a number of hard-to-kill broadleaf weeds like Canada thistle. Surfactants containing ammonium nitrogen may also increase the effectiveness of certain herbicides like Banvel® (dicamba), Roundup® (glyphosate), Poast® (sethoxydim), Pursuit® (imazethapyr), and 2,4-D amine. The fertilizer ties up hard water minerals and also increases herbicidal action by adjusting the pH on the leaf surface.

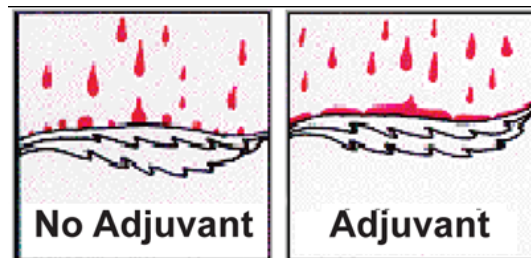


Figure 5. Adjuvants improve performance of a spray mixture.

**Special Purpose or Utility Adjuvants** are used to correct certain problems with mixing and application. These problems include: hard water, pH levels, drift, and compatibility problems between pesticides and liquid fertilizers. These adjuvants include acidifiers, buffering agents, water conditioners, anti-foaming agents, compatibility agents, dispersants, and drift control agents.

## **WATER MINERALS / pH VERSUS PESTICIDE PERFORMANCE**

Certain mineral and pH levels in spray water can affect many pesticides. Mineral ions such as calcium and magnesium, commonly found in hard water, can weaken some herbicides like Roundup® (glyphosate), Poast® (sethoxydim), Pursuit® (imazethapyr), and Liberty® (glufosinate). The use of water-conditioning additives and some ammonium sulfate-based adjuvants can be used to offset these hard water problems. Extreme pH levels in the spray mixture can also cause some pesticides to break down prematurely. The organophosphate insecticides can breakdown in a matter of hours or minutes in alkaline situations (pH above 7). By contrast, the sulfonyl urea (SU) herbicides tend to break down more rapidly where the pH is below 7 (acidic). At a high pH, 2,4-D tends to become more negatively charged. This can slow its absorption into plants.

As a general rule-of-thumb, the optimum pH for spraying most herbicides is slightly acidic (pH 5 to 7). The exception is sulfonyl urea (SU) herbicides which break down in acidic environments. Use buffering or acidifying adjuvants to stabilize the spray tank pH. *Always read the pesticide label to determine if there are any hard water or pH effects that may affect your pesticide application.*

## **SAFE STORAGE PESTICIDES**

Pesticides are best stored in a separate building, room, or enclosure. The storage area must keep the pesticides cool, dry and out of direct sunlight. Read the label for any storage requirements. **DO NOT store pesticides in your home or in livestock barns!** These steps will help ensure the safety of you and your family when storing pesticides.

- #1. Store pesticides in a locked and posted facility to keep out children or other untrained people.
- #2. Store pesticides where flooding damage will be unlikely and away from sensitive areas such as houses, play areas and ponds.
- #3. Store sacks, cartons and fiberboard boxes containing pesticides where they won't get wet.
- #4. Lock all entrances to the storage area.
- #5. Mount weatherproof signs stating "**Danger — Pesticides, Keep Out!!**".
- #6. Keep an adequate supply of clean water and soap close to, but not in, the storage area. A shovel, dustpan, broom, and proper type of fire extinguisher are other essential items.
- #7. Do not store pesticides near food for human consumption, animal feed, fertilizer, seed, veterinary supplies, or other stored products.
- #8. Store pesticides only in the original container with the label plainly visible. Never store pesticides in anything used as a food, feed or drink container, even for a short time.
- #9. Never provide pesticides to anyone unless that person is a family member or an employee and they are applying pesticides for you.
- #10. Make sure you have provided them with the proper training to handle pesticides correctly.

? *What if my container gets damaged?* If a pesticide container becomes damaged, transfer its contents to a container that held the same product or better yet, contact the manufacturer and ask for an empty container. Label the new container immediately. If you cannot salvage the old label, contact the manufacturer, obtain another label from the internet or write the exact contents directly on the container or on a tag attached to the container. Unlabeled pesticides are worthless and dangerous. Contact your local Montana Department of Agriculture Field Office for proper ways to use and dispose of surplus or

questionable pesticides.

## **PESTICIDE SPILLS** (*WHAT IF IT HAPPENS TO YOU!*)

Should an accidental spill occur, first remember to protect you and others from harm by decontaminating oneself if contaminated, before placing the appropriate personal protective equipment on (see your product label). After this precaution, follow these easy steps to clean up the spilled pesticide. These are called the “**Three Easy C’s**”.

1. **Control** the spill by stopping the source of the spill. For example, if the spill is due to a broken hose, close the valve or temporarily patch the hose to stop the leak. Remember to use the appropriate personal protective equipment (PPE) when doing this. If the source of the spill is a container leak, place the leaking container in a larger, leak proof container.
2. **Contain** the spill so that it does not spread and get into water sources. Build a dam or barrier around the spill with dirt or other absorbent materials.
3. **Clean up** the spill immediately. Absorbent materials like kitty litter, sawdust or floor sweeping compounds should be spread on the spill area to soak up the pesticide. Next, contaminated material must be shoveled into a leak proof container for proper disposal. Do not flush the area with water or use a cleaning solution until talking with trained personnel. This helps avoid the risks of chemical reaction and possible groundwater contamination.

Call the Montana Department of Agriculture, (406) 444-5400, to report any spills in *excess of 5 gallons or 100 pounds* of total pesticide mix. Find out what, if any, reports need to be filed. They will be able to identify what safety steps are necessary to thoroughly decontaminate the ground and how to properly dispose of the contaminated materials. To help prevent exposure during cleanup, workers should *wear the appropriate personal protective equipment (PPE)*. To help prevent exposure in the future, cleanup work clothes and personal protective equipment should be cleaned before work resumes. Finally, take corrective measures to help ensure that another pesticide spills will not occur.

**Practice Questions for Chapter 3**  
**(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. What 2 major ingredients do all pesticides have described on the product label?
2. An insecticide labeled Furadan 4F is what type of formulation?
3. What advantages does this have?
4. Emulsified concentrates have what disadvantage towards equipment?
5. When mixing chemicals what is the acronym of the procedure used?
6. List 3 sources that one may consult prior to performing a pesticide compatibility test?
7. What is added to a pesticide solution to increase the pesticides ability to be absorbed by the pest?
8. What is the optimum pH for spraying most pesticides?
9. The 3 C's of pesticide spills are?
10. Always report pesticide spills of 3 gallons or more (True or False).



# Chapter 4

## Toxicology

### ACUTE TOXIC EFFECTS *(Nearly always the result of an accident or careless handling)*

Since human beings are living organisms, pesticides can also harm or kill people. With some pesticides *it only takes a few drops in the mouth or on the skin to cause damage. Others are less toxic, but prolonged, unprotected exposure can also cause harm over time.*

For labeling purposes, oral, skin, eye and inhalation tests are conducted on laboratory animals to determine a pesticide's acute toxicity level. Based on this testing, one of four words must be noted on a pesticide label to indicate acute toxicity.

These are called signal words and indicate the acute toxic level of a pesticide (**Table 2**). Since the toxicity category and signal words are based on the total formulation, certain products may have the same active ingredient but may bear different signal words in different formulations.

### CHRONIC TOXICITY EFFECTS


Chronic toxicity occurs when a person is *regularly* exposed to small amounts of pesticides over time. Chronic toxicity to a pesticide takes longer to occur and symptoms may not show up until days or years after you are first exposed. Chronic toxicity may cause long-term health effects to include cancer, tumors, mutations, and birth defects. You may be exposing yourself to small amounts of pesticides and not even know it! This can happen when mixing, loading, applying a pesticide or by working in fields after pesticides have been applied. Chronic toxicity effects are often the result of not wearing the personal protective equipment recommended on the label, or improper cleaning of contaminated clothes or equipment. The view that a chemical is 'SAFE' because it is labeled with the signal word **CAUTION**, and does not cause severe acute effects, often leads to applicator complacency towards the chronic toxicity effects that may show up days or years later.

A systemic effect is a delayed illness or injury to the body. Systemic effects usually affect the circulatory system, the nervous system, the kidneys or the liver. Most systemic effects are commonly associated with the chronic effects of pesticides. Examples of systemic effects include: blood disorders (anemia or an inability to clot), nerve or brain disorders (paralysis, excitation, trembling, blindness, or brain damage), skin disorders (rash, irritation, and ulceration), lung and respiratory disorders (emphysema and asthma), liver and kidney disorders (jaundice and kidney failure). Allergic effects are harmful effects that some people develop when they are exposed to a pesticide. It usually takes more than one exposure for a

Table 2. Signal words found on pesticide labels.

SIGNAL	TOXICITY RATING	LETHAL DOSE 160 lb. human <sup>2</sup>
Danger <sup>1</sup>	Highly toxic OR Highly corrosive	Few drops to 1 Teaspoon.
Warning	Moderately toxic	1 Teaspoon to 1 Tablespoon.
Caution	Least toxic	1 Tablespoon to a pint or greater.

<sup>1</sup> Sometimes the word 'Danger' appears with the word 'Poison' and the skull and crossbones symbol for extremely toxic pesticides. Danger by itself usually relates to the pesticide's capacity to cause serious skin or eye damage.



<sup>2</sup> Remember that a 40 lb. child could be poisoned by one-fourth the amount required for an adult. Always store pesticides in their original containers and keep away from children, livestock, pets and anyone not trained in pesticide use.

person's body to develop a response that results in an allergic reaction. This process is known as sensitization. Once a person's body is sensitized to a substance, an allergic reaction may occur and could include: systemic effects (asthma or even shock), and skin irritation (rash blisters, or open sores).

## **PESTICIDES AND THE BODY** (*Pesticides can enter the body by four main routes*)


1. **Dermal** or skin exposure occurs when pesticides get on your skin and are absorbed by your body. Dermal absorption accounts for about 90% of the exposure pesticide users receive from pesticides. In general, oil-based pesticides, such as emulsifiable concentrates (EC), are absorbed most readily. Water-based formulations are obviously absorbed more readily than dry materials unless the dry materials are mixed with water. Also, pesticides enter the body more readily through scrapes and cuts than through unbroken skin. Hot, sweaty skin also absorbs pesticides faster than cool, dry skin. If a pesticide gets on your skin: *Immediately remove all contaminated clothing; Wash the exposed area with lots of water and soap; Use a brush and soap to remove residues from under your fingernails; If your hair is contaminated, shampoo well; Put on fresh, clean clothes; See a physician if you feel ill.*

2. **Oral** exposure occurs when a pesticide is accidentally ingested or swallowed. This commonly occurs when pesticides are illegally stored in **unlabeled bottles or food containers** and then accidentally swallowed or fed to animals. Ingestion occurs most often with improper storage of pesticides. Often children are victims of this route of exposure. Oral exposure can occur because of an equipment failure, blowing through a plugged nozzle with your mouth, or smoking and eating without washing your hands after using a pesticide. Oral exposure may also occur when many airborne spray particles are inhaled and trapped in the secretions of the upper respiratory tract. They can then be swallowed. When a large amount of pesticide is swallowed, the decision you must make is whether or not to induce vomiting or to dilute the pesticide. Read the Statement of Practical Treatment (First Aid) section of the label and get immediate medical attention. Never induce vomiting if the victim is unconscious. The victim could choke.

3. **Inhalation** exposure is when you breathe in pesticide vapors or dusts. Inhalation exposure can occur from smoking when handling pesticides, inhaling vapors and mists produced during application, or inhaling vapors and dusts when mixing and pouring pesticides. When pouring pesticides into mixing containers, air is forced out of the container and carries some of the pesticide particles with it. These particles can be inhaled. Make sure you read the label to determine if a respirator is required for the pesticides you are using!

4. **Eyes** are particularly absorbent to pesticides and some pesticides can cause irreversible damage to your eyes. If you splash any chemical into your eyes, wash them out immediately with plenty of cool, clean water for at least 15 minutes. Seek medical attention immediately. **NEVER WEAR CONTACTS LENSES WHEN WORKING WITH PESTICIDES.**

## **PESTICIDE POISONING**

	<p style="text-align: center;"><b>Pesticide poisoning symptoms are often similar to the flu!</b></p> <p><b>Mild Symptoms:</b> Headache, fatigue, loss of appetite, dizziness, weakness, nervousness, nausea, perspiration, diarrhea, loss of weight, thirst, moodiness, and irritation of skin, eye, nose and throat. <b>Moderate Symptoms:</b> Nausea, trembling, muscular in-coordination, excessive salivation, blurred vision, constricted throat or chest, labored breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, mental confusion, perspiration, rapid pulse and cough. <b>Severe Symptoms:</b> Vomiting, loss of reflexes, inability to breathe, muscle twitching, constricted pupils, convulsions, unconsciousness, thirst, fever and rapid breathing.</p>
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You should learn to recognize the symptoms of pesticide poisoning. Quick action may prevent additional

exposure and minimize injury. The pesticide label may also note specific signs and symptoms for that particular pesticide. The **signs and symptoms** of pesticide poisoning will vary with the pesticide, the exposure time, and the individual. The symptoms of pesticide poisoning may also be confused with the symptoms of *heat stroke*, *heat exhaustion*, *food poisoning*, *asthma*, *flu* and other *illnesses*. So, be aware that your symptoms may not be the result of exposure to a pesticide. If you think you have been exposed to a pesticide, always alert your physician.

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### **Practice Questions for Chapter 4** **(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. Signal words are based upon chronic toxicity estimates.
2. The least toxic pesticides will be labeled with what signal word?
3. How much pesticide is often enough to kill the average person labeled with the Danger / Poison signal word?
4. What type of toxicity may cause mutations, birth defects, and cancer?
5. Pesticides may enter the body through what 4 routes?
6. How long should you wash your eyes if you get any pesticide residual in them?
7. If you develop a severe headache, nausea, and blurred vision in the field on a very hot day while applying chemicals, you should rest, cool down, and then continue spraying (True or False).
8. Children around the house are at high risk of which mode of entry with pesticides?



# Chapter 5

## FIRST AID



### PESTICIDE EXPOSURE

At times, the application of first aid becomes necessary due to pesticide exposure during or after the application of pesticides. If any symptoms exist during or within 24 hr of pesticide application get medical advice immediately. Do not wait until the symptoms worsen, as irreversible damage could be occurring the longer you wait. In addition, symptoms may spiral quickly to the point where you cannot get yourself to a medical facility due to convulsions, inability to control muscle movements, or unconsciousness. When seeking medical advice always have the product label with you. Valuable information regarding the pesticide will be needed by the emergency technicians including: 1) active ingredients, 2) EPA registration number, and 3) product/formulation.

First aid is the initial efforts taken while help is on the way. Taking action immediately is often the difference between life and death. Always protect yourself first if assisting someone exposed to pesticides. Wear the proper PPE as indicated by the product label prior to entering contaminated situations, including fields, or taking contaminated clothing off of exposed individuals.

**Pesticide Contamination Response.** Once you are assured protection, transport the exposed individuals from the contaminated situation before removing contaminated clothing. Apply artificial respiration if the individual is not breathing (if contaminated, clean the facial area prior). Contact emergency response professionals immediately in life threatening situations (chest pain, unconsciousness, labored breathing, cardiac arrest), and always contact *the pesticide poison control center (1-800-222-1222)* as soon as possible. Decontaminate the individual as soon as possible. See decontamination. Continually be sure that the individual is breathing until emergency support arrives. If breathing stops, begin artificial respiration.

#### *Decontamination of Pesticides on the Skin:*

- 1) Remove all contaminated clothing
- 2) Wash the affected area with soap, before rinsing well and drying.
- 3) If the skin has chemical burns rap in a loose cloth, and do not apply ointments, greases, or powders.
- 4) Discard of all clothing.

#### *Decontamination of Pesticides in the Eye:*

- 1) Hold the eyelid open and rinse with water across eye for 15 minutes.
- 2) Flush under the eyelids as well.
- 3) Cover the eye with a clean cloth and seek medical attention.
- 4) Do not use any artificial drops of any kind.

### ***Decontamination of Pesticides Inhaled:***

- 1) Warn others of danger.
- 2) Have the exposed individual lie down and loosen clothing.
- 3) Keep victim warm and quiet.
- 4) Protect victims head if convulsions begin.
- 5) Monitor breathing – if it stops give artificial respiration.
- 6) Keep the chin up to ensure breathing.

***Decontamination of Pesticides Swallowed.*** Consult the product label to see whether one should induce vomiting or not. This is the most important decision to make with swallowed pesticides. If vomiting is induced:

- 1) Make sure the victim is kneeling forward or lying on the side.
- 2) Give the victim 2 glasses of water.
- 3) Put your finger at the back of the throat.
- 4) Give patient 2 – 4 table spoons activated charcoal in 8 ounces of water

Prevention is always the best first aid. Always read the labels of the pesticides you are using and have a plan-of-action ahead of time in the event that an accident occurs. Read the labels first to find out if any special first aid equipment is required for that pesticide. In general, medical attention should be obtained if any feeling of discomfort, illness or unusual appearance occurs. Remain alert to symptoms of pesticide poisoning as the symptoms may be delayed up to 12 or 24 hours after exposure. Also, remember to present the pesticide label to medical staff. The label contains specific instructions for doctors to use in treating pesticide-poisoning emergencies. **The label is probably the most important piece of information a physician can have.** All pesticides have the potential to cause bodily harm. Always read the label before using a pesticide and become familiar with basic first aid procedures for that product.

## **HEAT STRESS**

The danger of not only pesticide exposure, but heat stress increases significantly when applying pesticides. The use of restrictive personal protective equipment often exacerbates the heat stress an applicator is already enduring by impeding the body's natural cooling systems. At times, the body cannot keep up with this increasing level of heat, and heat exhaustion or heat stroke follows.

The symptoms of heat stress are similar to pesticide poisoning, with mild forms of heat stress causing dizziness, nausea, weakness, impaired judgment, headache, and heavy sweating. More severe forms of heat stress, including heat stroke, often cause staggering, convulsions, and lack of sweating (clammy skin). More than 10% of individuals with heat stroke die. Often, heat stroke causes permanent damage to an individual's body temperature regulating system.

The early symptoms of heat stress are very similar to pesticide poisonings, and steps should be taken to decide which problem is prevalent in the situation before applying first aid. If the individual has been complaining of thirst or been in unusually hot conditions, strongly consider heat stress as the culprit.

An individual suffering heat stress should move to a cool location and decontaminate as necessary. They should then cool themselves by rinsing their head with water, and drinking plenty of fluids immediately. If the individual is uncoordinated, unconscious, vomits, or goes into convulsions call for immediate emergency assistance.

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## **Practice Questions for Chapter 5**

**(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. What illness can be mistaken for pesticide poisoning?
2. What should you have with you anytime you conduct first aid procedures, seek medical advice or seek medical attention?
3. If an individual is unconscious in the field from pesticide exposure what should one do prior to entry into the field?
4. You should call the poison control center if someone stops breathing (True or False).
5. Ointments should be applied immediately after skin burns from chemical exposure (True or False)?
6. Always induce vomiting to individuals who swallow pesticides (True or False)?
7. If an individual is suffering heat stroke, what steps should you take?
8. A pesticide residual has entered your eye, what main step should you take?
9. Where can you find a detailed description of first aid procedures for any exposure?
10. Heat stroke is a temporary condition (True or False)?



# CHAPTER 6

## HOW TO PROTECT YOURSELF

### PROTECT YOUR BODY! READ THE LABEL AND WEAR THE PERSONAL PROTECTIVE EQUIPMENT (PPE) THAT IS REQUIRED!

The majority of all accidents using pesticides are exposures to the skin. Most of these exposures result in a rash-type outbreak, ranging from a minor irritation to painful burning. Skin exposures may also lead to more serious poisonings. Over time, enough low toxicity pesticides can be absorbed by the skin and cause damage to the nervous and respiratory systems. This type of poisoning often goes unnoticed. Another exposure, even a small one, may then bring on serious complications such as lung failure. Take particular care to protect your skin from contact with all pesticides, regardless of the toxicity rating.

Always read the product label to understand what the minimum personal protective equipment (PPE) requirements are for your pesticide of interest (**Figure 6**). **Remember:** Even the least toxic pesticides require that applicators wear clean, long pants and long sleeved shirts free of holes and tears. The MSU Pesticide Safety Education Office currently recommends an increased level of vigilance by private applicators, by going above the requirements of the label if possible. Some easy ways to accomplish this are by wearing disposable Tyvek coveralls as opposed to laundering your own cotton clothing; or wearing disposable surgical nitrile gloves with pesticides that do not mandate the use of gloves. These are cheap, inexpensive ways to ensure your own protection, while minimizing any residues that you may take home to your own home and family. If the product label does recommend personal protective equipment, it often refers to:

**Gloves.** At least 98% of all accidental skin exposures can be avoided by wearing extra-long, *unlined* gloves designed specifically for pesticide use. **DO NOT USE** Cotton, canvas, or leather gloves. These gloves can never be cleaned or decontaminated. **DO NOT** use dishwashing, or latex gloves. These gloves are not designed to withstand chemical penetration.

Use chemical-proof gloves made of materials such as nitrile, viton, or neoprene. Read the pesticide label! Some labels are very specific on the type of gloves and glove material that you are required to use. Make sure the gloves reach almost to the elbow and make sure your gloves fit properly. Destroy and discard leaky gloves immediately. If shirtsleeves become saturated with a pesticide, remove the clothing and wash the skin with lots of soap and water. A pair of disposable, surgical nitrile gloves may often be worn underneath the long rubber gloves. This serves as an additional barrier in case of rips in rubber gloves.

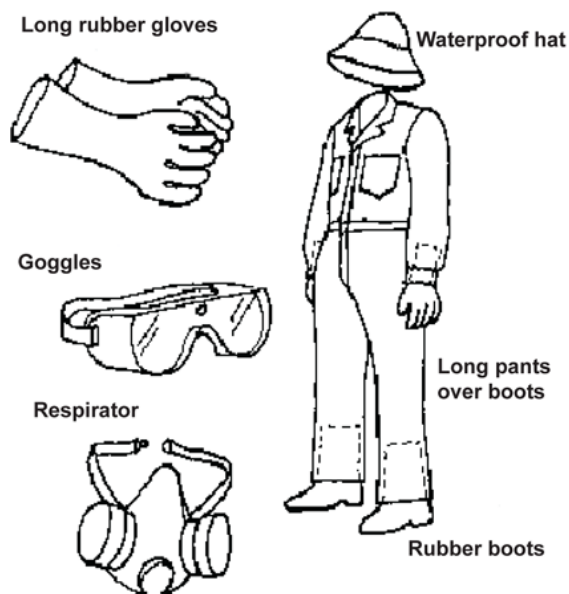


Figure 6. Personal Protective Equipment.

**Coveralls.** When working with pesticides, it is best to wear more layers of clothing to cover as much of your skin as possible. Disposable Tyvek suits, which are fairly inexpensive, are superior to cotton pants or coveralls. Tyvek suits eliminate the risk of contamination of washers, or accumulation of residues on clothing. These un-laminated Tyvek suits also are fairly breathable and comfortable, unlike many other laminated suits which are recommended for the highly toxic pesticides. Another method of increasing protection is to add starch or a water/soil repellent finish to cotton coveralls. Aerosol products such as Scotchgard® Fabric Protector are available for home application. Starch can also be applied when laundering pesticide-contaminated clothing. A moderately heavy application of these finishes offers the same level of protection to splashes or spills as do the uncoated Tyvek coverall. Chemical-proof coveralls can be added over regular work clothes for added protection from pesticides with the signal words DANGER-POISON, DANGER and WARNING. Poly laminated Tyvek, PVC-coated fabrics and coveralls made of nitrile are best suited for more toxic products. Again, let the pesticide label be your guide! For maximum protection, hooded coveralls provide added safety for the head, neck, and ears. Elasticized sleeves, wrists, and ankles and bound or sealed seams also increase protection. Again, let the label be your guide when selecting coveralls. Whenever clothing becomes saturated with a pesticide, you should remove the saturated clothing, wash the area with soap and water and put on clean clothing.

**Aprons.** Chemical-proof aprons offer protection from spills and splashes of concentrates during mixing and loading. They are always worn over regular work clothes or coveralls and should cover the area from the knees to the chest. Some styles come with attached sleeves or separate sleeves for arm protection. Other aprons split below the waist to tie around the legs. Disposable apron materials are similar to coverall materials. Unlined, chemical-resistant footwear is essential for moderately and highly toxic pesticides. Common boot materials are PVC, natural rubber, neoprene, butyl, and nitrile. In all cases, it is NEVER a good idea to wear leather or canvas footwear when applying any pesticide!

**Head.** Wear a chemical-resistant hat or hooded coveralls where there might be the possibility of contaminating your head, face or neck. Your protective hat should be wide-brimmed to prevent any high splashes from landing on your face or neck. The headband should be plastic and not leather or any other fabric that can absorb pesticides.

**Eyes.** If you do not wash out your eyes immediately after an accidental chemical exposure, eyesight can be permanently lost within 2 minutes. A pair of indirectly vented goggles will provide protection for your eyes. If foggy lenses are a concern, a full-face shield will protect the eyes just as well as goggles and will cover exposed areas of the face. Keep an eye-washing station set up or keep a personal eyewash bottle handy to flush out your eyes. Always wear eye protection when the pesticide label requires it and always wear eye protection when mixing. Remember, mixing is a time when pesticides are being poured directly from their containers. They are more concentrated and more likely to splash during this time.


**Lungs.** Your lungs are much more absorbent than is your skin. Whenever there is a risk of inhaling vapors, fumes, or dust, wear a respirator with a particle cartridge or canister designated for pesticides. Most pesticide labels will list the kind of respirator that is required for that pesticide.

## **CLEANING PPE**

When cleaning Personal Protective Equipment (PPE), always wear chemical resistant gloves. All PPE should be thoroughly cleaned with warm water and detergent after each use. A simple formulation of 5 capfuls of ammonia per 1 gallon of hot water neutralizes most chemicals very effectively. Wash gloves and boots before you take them off to help prevent contamination while you remove them. Disposable garments, such as surgical nitrile gloves and disposable un-laminated Tyvek suits may be cleaned briefly before discarding. All other items, hang outside in a well-ventilated, sunny place to air dry for 24 hr.



Sunlight helps to degrade pesticide molecules. Some plastic or rubber items, such as gloves, footwear, and coveralls, must be washed twice. Simply clean the outside surfaces and then again after turning the items inside out. Rigid items (as hats or helmets) should be washed by hand. Store PPE separately away from stored pesticides, or areas where pesticides were handled.

 **IMPORTANT NOTE!** *Because the pesticide label has the force of law, failure to wear specified protective clothing is a violation of federal law.*

**LAUNDERING PESTICIDE-CONTAMINATED CLOTHING.** The first step in laundering any pesticide-contaminated clothing is to check the pesticide label for the signal word and any special laundering instructions. Clothing that is saturated with a highly toxic pesticide should be discarded using the disposal directions found on the pesticide container label. Pesticide-related hazards are less pronounced when handling clothing exposed to low toxicity pesticides with the signal word **CAUTION**. Clothing contaminated with moderate to highly toxic pesticides with the signal words **WARNING**, **DANGER** or **DANGER-POISON** must be handled most carefully.

**NEVER wash pesticide contaminated clothing with the regular family wash.** Always wear chemical-proof gloves when handling pesticide-contaminated clothing. Even when loading it into the washer. Make sure that the person doing the laundering knows that the clothing was exposed to pesticides. Make sure they have access to the pesticide labels. Other items to keep in mind when laundering:

- 1) **Separate pesticide-contaminated clothing** from other items of the family laundry and store in separate containers.
- 2) **Wear chemical-proof gloves** when handling pesticide-soiled clothing. Do not use these gloves for any other household task. Wash the gloves before removing them.
- 3) **Wash clothing as soon as possible after each day's use.** The concentration of pesticide in fabric builds with each exposure, and is more difficult it is to remove later on.
- 4) **Always pre-treat.** Use a pre-wash product, soak in water, hose down out-of-doors, or use a pre-wash cycle.
- 5) **Launder separately from other clothing.** Residues do transfer from contaminated clothing to uncontaminated clothing during the washing cycle. Since a combination of pesticides makes removal of each pesticide more difficult, wash together only garments that are contaminated with the same pesticide. Use a full tub of water even if you have a small load. The more room there is for water and soap to circulate around the clothing, the more pesticide residues will be removed.
- 6) **Use hot water** for laundering pesticide-contaminated clothing. Strive for a water temperature of at least 120°F, and preferably 140°F. Rinse temperature is not as important.
- 7) **Choose a phosphate (powdered) detergent or a heavy-duty liquid detergent.** Heavy-duty liquid detergents are particularly effective in removing oily formulations such as emulsifiable concentrates (EC), and are insensitive to water hardness. Phosphate-powdered detergents are particularly effective but are sensitive to hard water. In areas where the level of water hardness is above 500 parts per million (ppm), additional amounts of phosphate-powdered detergent must be used to obtain the same level of residue removal.

- 8) **Increase the amount of detergent used** if a soil/water repellent finish (such as Scotchgard®) was applied to the fabric to increase wearer protection. Use a quarter more detergent than what is recommended on the detergent package or on the pesticide label.
- 9) **Use a normal (12 minute) wash cycle.** The mechanical action of agitation increases dislodgement of pesticides. Too many items in the washtub or too low water volume, or both, decrease agitation and pesticide removal. **DO NOT** use a suds-saver feature for laundering pesticide-contaminated clothing.
- 10) **Dispose of clothing contaminated with highly toxic pesticides (DANGER or DANGER/POISON).**

Prior to using the washer, line drying is recommended. This is because many pesticides break down in sunlight. When washing highly contaminated pieces of clothing, wash at least 3 times, and always clean the washer after each use by swabbing down the inside of the washer tub, and running an empty cycle with detergent and hot water.

*If you use pesticides often you should purchase a separate washing machine and use it only for cleaning pesticide contaminated clothing. Remember: Washers do not eliminate all chemical residuals from the washer itself!*

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## Practice Questions for Chapter 6

(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)

1. Where do you find instructions on the proper PPE to wear with any pesticide?
2. Can short sleeve shirts be worn legally by themselves, during any application of any pesticides?
3. What is one easy way to minimize chemical residuals you bring back to your home, with pesticides labeled “CAUTION”?
4. An un-laminated disposable Tyvek suit will protect you from the most dangerous pesticides available (True or False).
5. List 4 chemically resistant material used in gloves?
6. Wide rimmed cowboy hats or caps are ok to use during pesticide applications (True or False).
7. Should pesticides labeled as Danger / Danger Poison be washed in the washer?
8. Prior to washing pesticide contaminated clothing, what should one do with the clothing for 24 hr?
9. An apron is often used at what stage of a pesticide application?
10. If you use pesticides often, what strategy would be the most effective in reducing the amount of pesticide residual that you bring to your home?

# CHAPTER 7

## ENVIRONMENTAL CONCERNS WITH PESTICIDES



### PROTECT THE ENVIRONMENT

If you use a pesticide you must consider how it will affect the environment.

- 1) How will this pesticide affect the immediate environment where it is being used?
- 2) What are the dangers that the pesticide will move off-site and cause harm to other parts of the environment?

All pesticides can harm the environment when used improperly. When using pesticides, follow the directions on all pesticide labels and use good judgment. Pesticide labels will give you information on how to prevent any harm to the environment.

The Environmental Protection Agency (EPA) looks closely at the effects of pesticides on the environment. Labels will list a pesticide's potential to contaminate surface or ground water and then give you directions on how to avoid it. Labels may also state a pesticide's toxicity to birds or aquatic invertebrate animals. Whenever you spray a pesticide into the environment, you must consider the sensitive areas in or near the pesticide application site. Sensitive areas include:

- 1) Surface water or areas where ground water is close to the surface.
- 2) Areas near schools, playgrounds, hospitals, and other institutions.
- 3) Areas near the habitats of endangered species and/or honeybee sites, wildlife refuges, or parks.
- 4) Areas near ornamental gardens, food or feed crops, or other sensitive plantings.

Are there environmental conditions that might cause the pesticide to move offsite? Does the way you spray reduce the risk of environmental contamination? Always take special precautions to avoid direct application to any sensitive area.

### PESTICIDE MOVEMENT IN AIR (*Pesticides move in many ways!*)

Pesticides often move in air, by small droplets produced by pesticide application equipment that move easily with wind.

**Drift.** Pesticide movement away from the release site in the air is called drift. Drift can be in the form of pesticide droplets, vapor, dust, or even pesticide-bound soil that is blown or transported out of the target area. There are two forms of drift that you should be aware of: physical drift and chemical drift. The most common form of *physical drift* is the movement of spray droplets outside the target area and is influenced by:

- 1) **Droplet size.** A small nozzle tip opening combined with a high spray pressure produces more small droplets that can drift.
- 2) **Spray Tip Height.** The more distance between the spray tip and target, the greater the impact wind has on drift.



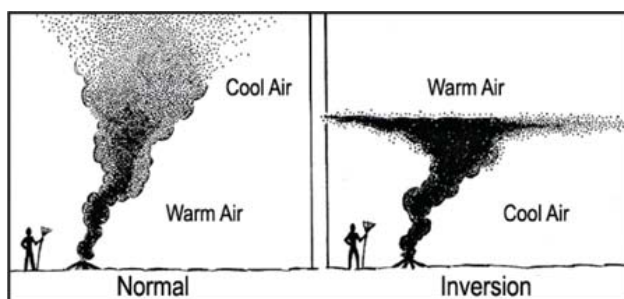
- 3) **Operating Speed** – At faster speeds, small droplets are trapped in the area behind the sprayer.
- 4) **Wind Speed** – While not important in the drift formation, wind has the greatest impact on the movement of small droplets.
- 4) **Temperature/Humidity** – In temperatures over 77° F with low relative humidity, larger droplets become smaller due to evaporation. Smaller droplets can then move more readily with wind.
- 5) **Pesticide Properties and Spray Output Volumes** – Before applying pesticides, always read the label for certain restrictions and recommended volumes. Always use higher output volumes when practical.

A second form of drift is called chemical or *vapor drift*. Vapor drift, also called volatilization or vaporization, occurs when a liquid pesticide is heated by the air and turns into a gas. The volatilized pesticide can easily drift offsite in the form of a gas.

*Always consult the pesticide label for temperature restrictions. For example, twice as much 2,4-D ester will volatilize at 80 degrees F than at 70 degrees F. When there are no label restrictions, it is wise never to spray pesticides when the air temperature will exceed 85 degrees.*

Do not spray during *temperature (air) inversions*, a condition in which colder air next to the ground is trapped by a layer of warmer air above (**Figure 7**). Pesticides in the air are trapped and can move by the slightest wind. Inversions may occur during the passage of a cold front or by high-pressure areas.

A good spray drift management program includes using common sense, good judgment, and a well-trained applicator. In general when considering drift:



**Figure 7.** Pesticides are trapped near the ground by an inversion.

- 1) Do not apply pesticides in windy or gusty conditions greater than 10 MPH.
- 2) Do not spray when wind is likely to drift onto bodies of water or to other sensitive areas. Choose an application method and a formulation that is less likely to cause drift.
- 3) Use drift control adjuvants.
- 4) Apply pesticides early in the morning or late evening. Temperatures are cooler, and wind speed is the lowest.
- 5) Avoid spraying at temperatures above over 85° F.
- 6) Follow label instructions regarding temperature, humidity, and proximity to sensitive locations.
- 7) Service and calibrate your equipment regularly. Small leaks under pressure can produce very fine droplets.

## PESTICIDE MOVEMENT IN WATER

Pesticides may move through the water by many different means. Those means include runoff, leaching, spills, leaks, back-siphoning, residue on clothing, or improper disposal of pesticides. This section will describe each of those means in detail.

When water moves across the land at a faster rate than it can be absorbed by the soil, it is called **runoff**. Since pesticides can attach to soil particles, runoff water can then carry the pesticides to sensitive areas. Too much irrigation, rain, and poor timing of pesticide applications can add to the surface water. This leads to pesticide runoff. Runoff can also occur if a pesticide is applied to a water-saturated soil (**Figure 8**).

The movement of pesticides through the soil is called **leaching**. Leaching depends on how tight a pesticide will bind to a soil particle. How fast a pesticide will leach also depends on the type of soil (sand, silt or clay), organic matter in the soil and soil permeability. Pesticides can form strong chemical bonds to clay and silt and are less likely to leach. Water also moves more slowly through these soils, allowing more time for pesticides to bind to soil and be degraded. By contrast, pesticides generally don't bind very well to coarse, sandy soils. These soils have large pore spaces that allow water and pesticides to move rapidly between soil particles during rainfall or irrigation (**Figure 8**).

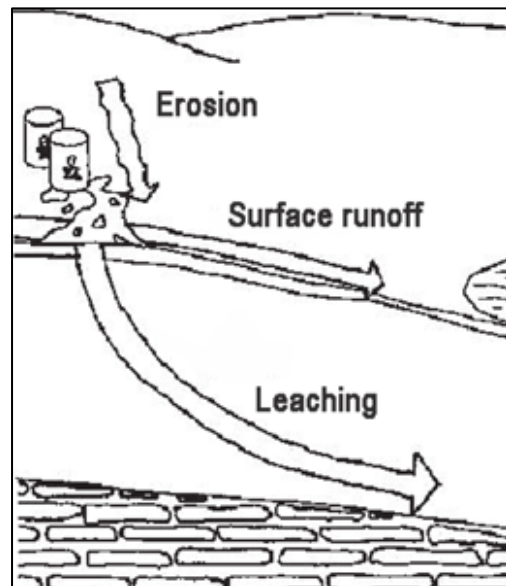


Figure 8. Erosion, run-off, and leaching can lead to pesticide movement in to sensitive areas.

Spills, leaks, and back-siphoning from nearby mixing, loading, storage, and equipment cleanup sites often may cause unwanted environmental effects. Often **spills and leaks** are often high volumes of concentrated product which quickly will leach into groundwater if not cleaned rapidly. **Back-siphoning** occurs when chemical from the pesticide tank actually back-siphons into a well or other source of water through the water line. (**Figure 9**). Spills, leaks, or back-siphoning induces high volumes of concentrated products to wells, or groundwater, often making it undrinkable.

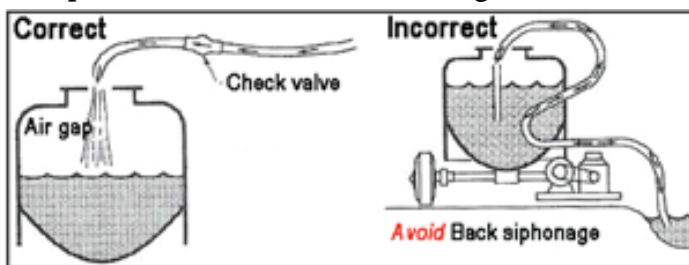


Figure 9. How to reduce back siphoning.

Pesticides can also move away from the application site when they are on or in objects that move offsite. Pesticides may stick to shoes or clothing, to animal fur, or to blowing dust that can be transferred to other areas. A big problem is when pesticide applicators bring home pesticide-contaminated clothing and equipment. **Residues** can rub off on carpeting, furniture, laundry items, and onto pets and people.

## HARMFUL EFFECTS ON NON-TARGET PLANTS & ANIMALS

Pesticides may also harm living things other than the target pests. Insecticide applications made at the wrong time can kill bees and other pollinators in or near the target site. Herbicides may destroy an animal's food source. Make sure you read the warnings and directions on the pesticide label to avoid harming non-target organisms. Drift also can kill beneficial parasites and predators near the target site. Pesticide runoff may harm fish and other aquatic animals. Plants in ponds, streams, and lakes can also be affected. Aquatic life also can be harmed by careless tank filling or draining, and by rinsing or discarding used containers along or in waterways. Pesticide labeling statements will alert you to a pesticide's effect on non-target species.

## PESTICIDE BREAKDOWN

Certain activities in the soil will degrade most pesticide residues into less toxic compounds. Those activities include:

- 1) **Degradation** by fungi, bacteria, and other microorganisms.
- 2) **Chemical degradation** by non-living processes (soil pH). Under alkaline conditions, where the pH is greater than 7, many organophosphate and carbamate insecticides degrade rapidly. Under acidic conditions, where the pH is less than 7, some herbicides will degrade. This is especially true for the sulfonyl urea (SU) herbicides like Ally™ and Escort™.
- 3) **Photodegradation** is the breakdown of pesticides by sunlight.

## DISPOSAL OF PESTICIDES AND CONTAINERS

Before selecting a pesticide, know your target pest and make sure that the site you are going to spray is listed on the pesticide label. Determine the size of the application area and mix only enough pesticide for the particular job. *Preventing a pesticide surplus is the best way to prevent a disposal problem.* Use your calibration and mixing formulas to help you.

For example, if your sprayer's application rate is 30 *gallons per acre (GPA)* and you have a 20-acre field to spray, you would then need a total solution of 600 gallons (pesticide and water). If the label rate is 1 pint per acre, you will be adding 20 pints of pesticide to water to make a 600-gallon solution (20 acres x 1 pint per acre). You need to purchase at least 20 pints or 2.5 gallons of the pesticide (20 pints ÷ 8 pints per gallon). Just make sure that when you spray the field your sprayer is still set up to apply 30 GPA.

If you have mixed too much pesticide for a job, use any extra tank mix or rinse water on areas with similar pest problems. In some cases, small amounts of excess pesticide can be diluted and reapplied to the treated area. Just make sure that you do not exceed labeled rates.

To dispose of large quantities of pesticide, contact your local Extension office or the Montana Department of Agriculture for assistance in properly disposing of excess pesticides in an environmentally safe manner.

So-called empty pesticide containers are not really empty. Even after they have been properly rinsed, they still contain small amounts of pesticides. According to Montana law, pesticide containers need to be triple rinsed within 48 hours of being emptied prior to disposal. The rinse water should be added back to the sprayer tank and used on a labeled site. Otherwise, the rinse water must be treated as a surplus pesticide and disposed of properly. Rinse water should never be dumped on the ground. Use the following triple-rinse procedure to prepare containers for disposal:

- 1) Empty the container into the spray tank and drain in a vertical position for 30 seconds
- 2) Refill the container one-fifth to one-fourth full with water.
- 3) Rinse thoroughly, pour into the spray tank and drain in a vertical position for 30 seconds.
- 4) Repeat steps 2 and 3 until the container has been rinsed three times.
- 5) Puncture or render the container useless.

**Disposal of containers.** Montana pesticide containers that are not triple-rinsed cannot be accepted at a sanitary landfill. Rinsed containers should not be used for any other purposes except where the label allows the container to be reused or recycled. It is illegal to burn pesticide containers in Montana. Private applicators in Montana may bury triple-rinsed containers on their own land as long as the containers have been triple rinsed and that no harm to the environment will occur. Never bury containers in places where pesticide residues may get into ground or surface water. Contact the Montana Department of Agriculture for more information on disposing of pesticide containers.

The Montana Department of Agriculture has a program to collect any unused pesticides. This program is offered as a service by the Montana Department of Agriculture to permit the economical disposal of old and unusable pesticides. Part of an applicator's \$50 certification fee actually will be compensated towards the charges incurred by an applicator using the program. This non-regulatory program takes no legal action against individuals disposing of canceled pesticides. Contact the Montana Department of Agriculture, (406) 444-5400 for more information.

## **MANAGEMENT PRACTICES FOR ENVIRONMENTAL SAFETY**

**Use Prevention** - Use pesticides only when necessary and only in amounts that will adequately control the pest. When possible, select the least toxic pesticides that have minimal persistence in the environment. Integrated Pest Management (IPM) is a recommended alternative to a purely chemical pest control.

**Identify the vulnerability of the soil** - Well-drained or sandy soils low in organic matter have a high potential for leaching and groundwater contamination. Clay soils have a high potential for runoff and surface water contamination.

**Keep pesticides away from water sources**, including wells. Maintain a buffer of at least 100 feet to all water sources and do not allow pesticide to runoff into any water source.

**Become familiar with pesticides that leach** - Check the pesticide label for warnings about a pesticide's leaching potential.

**Consider the vulnerability of the area** – What is the leaching potential of the soil? What is the depth to the water table? Sinkholes, ground squirrel burrows and large soil fractures can allow surface water to quickly reach groundwater.

**Follow the directions on the pesticide label to avoid groundwater contamination.** If you do not follow the label directions, you not only risk legal action, you also risk contaminating the groundwater. Always read pesticide labels carefully.

**Apply the pesticide at the appropriate time** - Information on proper timing of pesticides is available from the product label. Fewer applications are required if they are timed relative to a pest's life cycle.

**Measure the pesticide properly and carefully** -Avoid the temptation to use more pesticide than the label directs. It only increases the cost of pest control, the resistance of pests to chemical controls, and the risk of groundwater contamination.

**Check and calibrate equipment often** -Small leaks under pressure produce fine droplets that contribute to drift. Know how to accurately calibrate a sprayer and mix pesticides.

**Prevent back siphoning of pesticide-contaminated water into the water source.** To prevent backflow, keep the end of the fill hose above the water level in the spray tank, or install a backflow device (such as an air gap or check valve) on the filling pipe. In Montana, the use a backflow prevention device or other procedures (air gap, check valve, etc) is required to prevent contamination of water resources.

**Maintain records of pesticide use** - Maintain records of all pesticides applied. Remember, you are required to keep records of all restricted-use pesticides that you apply. Make sure you follow the proper format for keeping records of restricted-use applications.

**Be wary of rainfall or irrigation after pesticide applications** - Rainfall or irrigation can introduce recently applied pesticides into ground water. This is especially critical for clay soils that are subject to rapid runoff or sandy soils that can contribute to leaching.

**Store and dispose of pesticides properly** -Store pesticides in their original containers in a cool, well-ventilated, secured and protected location away from pumps and water sources. Triple-rinse or pressure rinse pesticide containers and dispose of rinse water to a site listed on the pesticide label. Follow the label for proper disposal of leftover pesticide so it does not cause groundwater problems. Buy and mix only what you need.

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## Practice Questions for Chapter 7

(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)

1. List 3 ways in which pesticides break down.
2. List 4 ways that pesticides can move within water.
3. What happens to water droplets as heat rises?
4. Name 2 forms of pesticide drift?
5. How do you prevent back-siphoning?
6. You may bury properly rinsed containers on your own land (True or False)?
7. What 6 factors influence physical drift?
8. What is the best way to reduce a pesticide disposal problem?
9. How many times should you rinse pesticide containers?
10. You can re-use pesticide containers only if you are a certified private applicator (True or False).

# CHAPTER 8

## CALIBRATION & MIXING

To apply pesticides properly, the correct amount of a pesticide must be mixed with the correct amount of *diluent* (*dill-you-ent*). A diluent is anything used to dilute a pesticide concentration before application. In most cases this is WATER unless a label specifies otherwise. Before you can figure out the correct proportions to mix, you must first determine a sprayer's application rate. This process is called calibration. Calibration is a series of steps to determine how much liquid a sprayer will apply per acre. How much liquid a sprayer will apply depends on the types of nozzles installed on



the sprayer, sprayer pressure, sprayer design, and sprayer speed. The best way to figure the application rate is to conduct a calibration test (a trial run over a small area). You can then determine the actual application rate in gallons applied per acre (GPA). Once the actual application rate is known, the acres that a full tank or part of a tank will cover can be determined. Based on pesticide label instructions, we then can determine the proper amount of pesticide to add to the tank.

Prior to calibrating a sprayer, make sure nozzles are all made of the same material. Some materials, like brass, wear faster than stainless steel. Thoroughly clean all nozzles, screens and filters to ensure uniform application. Make sure that all nozzle tips produce a uniform spray pattern and deliver roughly the same volume of liquid. Finally, select an operating or field speed appropriate for the conditions of your equipment. When spraying, be sure to maintain the same field speed and pressure you used when you calibrated your equipment.

### THE CALIBRATION TEST STRIP METHOD

The calibration test strip method can be used to calibrate almost any piece of pesticide application equipment. It is a simple procedure and requires that the applicator have a calculator, know how to divide, know how to multiply, and know how to determine area. Area is nothing more than length multiplied times width. Also know that there are 43,560 ft<sup>2</sup> in one acre.

**Step 1: Establish a test strip.** A test strip is a given area that can be any size, but usually is established according to equipment setup. For boom, broadjet, and granular application equipment, the test strip area is the effective swath width (W), in feet times, a known distance (L), in feet; (area = length x width). Then divide by 43,560 ft<sup>2</sup> to determine test area acres. For hand sprayers, the test area is established based on the capability of the equipment to spray a test area without stopping to pump the sprayer.

**\*\*Example 1 :** Swath width is 40 feet. Test strip distance is 200 feet.

→The area of the test strip in feet is 8,000 ft<sup>2</sup> (40 x 200).

→**Test area is 0.184 acres.** (8,000 ft<sup>2</sup> ÷ 43,560 ft<sup>2</sup>). Remember there are 43,560 ft<sup>2</sup> in one acre.

**\*\*Example 2:** A 2-gallon hand sprayer needs to be calibrated.

→A test strip of 15 feet by 15 feet is established.

→The test strip area is 225 ft<sup>2</sup> (15 x 15). **Test area is 0.0052 acres.** (225 ft<sup>2</sup> ÷ 43,560 ft<sup>2</sup>).

**Step 2: Measure the amount of liquid applied to the test strip.** Collect liquid from the sprayer for the same amount of time it takes to spray the test strip at field speed. Or, you can refill the tank back to a set mark to determine how much liquid is applied to the test strip. Remember, in most cases, **ONLY WATER** is used for the calibration of liquid sprayers.

*\*\*From Example 1:* Swath width is 40 feet. Test strip distance is 200 feet.

→It takes 27 seconds to drive the test strip at field speed.

→The sprayer is stopped and for 27 seconds, 5 ½ gallons of liquid is collected from the nozzles.

*\*\*From Example 2:* While timing yourself, you spray the 15 feet x 15 feet test strip with water.

→You spray into a 5 gallon bucket for the same amount of time and collect 46 ounces.

→Since you want Gallons Per Acre, you need to convert to gallons.

→Simply divide 46 ounces by 128 ounces in a gallon. You collected 0.359 or 0.36 gallons.

**Step 3: Set up a simple ratio.** By using the calibration strip method, you can spray a small area, measure the gallons it takes and then convert it to a per acre basis. We can do this by using a simple ratio: Test strip gallons is to test strip acres; as gallons is to one acre. Simply put:

$$\text{Gallons applied to test strip} / \text{Test Strip Acres} = \text{Gallons Per Acre (GPA)}$$

**Step 4: Summary of steps 1 – 3 (Obtaining GPA).**

*\*\*From Example 1:* Test strip distance is 200 feet. The area of the test strip in ft is 8,000 ft<sup>2</sup> (40 x 200). Test area is 0.184 acres. (8,000 ft<sup>2</sup> ÷ 43,560 ft<sup>2</sup>). It takes 27 sec to drive the test strip at field speed. The sprayer is stopped and for 27 seconds, 5 ½ gallons of liquid is collected from the all the nozzles at the prescribed sprayer pressure.

$$\rightarrow \text{Test Strip Gallons} / \text{Test Strip Acres} = \text{GPA} \rightarrow 5.5 \text{ gallons} / 0.184 = \underline{\underline{\mathbf{29.89 \text{ or } 30 \text{ GPA}}}}$$

*\*\*From Example 2:* A 2-gallon hand sprayer needs to be calibrated. A test strip of 15 ft by 15 ft is established. The test strip area is 225 ft<sup>2</sup> (15 x 15) or 0.0052 acres. (225 ft<sup>2</sup> ÷ 43,560 ft<sup>2</sup>). While timing yourself, you spray the test strip with water. Using the same pressure, you spray into a 5-gallon bucket for the same amount of time. A total of 46 ounces is collected. In gallons, you collected 0.359 or 0.36 gallons (46 ounces ÷ 128 ounces in one gallon).

$$\rightarrow \text{Test Strip Gallons} / \text{Test Strip Acres} = \text{GPA} \rightarrow 0.36 \text{ gallons} / 0.0052 \text{ acres} = \underline{\underline{\mathbf{69.2 \text{ or } 69 \text{ GPA}}}}$$

## **BACKPACK & HAND HELD SPRAYERS**

Use the procedure as noted above. Keep in mind that the accurate calibration of handheld and backpack sprayers is more difficult. This is because speed and sprayer pressure are hard to keep constant. Always try to keep both pressure and spraying technique consistent between calibration and actual application.

## BROADJET SPRAYERS

Broadjet or boomless sprayers enable a wide swath to be sprayed without using a series of nozzles across a boom. Calibration of these sprayers is easy, as there are generally only one or two nozzles.

**\*\*Example 3:** A Boom Buster Model 437 spray nozzle covers 30 feet of swath. The test strip distance is 200 feet. The area of the test strip in feet is  $6,000 \text{ ft}^2$  ( $30 \times 200$ ). It takes 34 seconds to drive the test strip at field speed. A total of 10.4 gallons was collected from the nozzle for 34 seconds.

$$\rightarrow \text{Test Strip Gallons} / \text{Test Strip Acres} = \text{GPA} \rightarrow 10.4 \text{ gallons} / 0.138 \text{ acres} = \underline{\underline{75.4 \text{ or } 76 \text{ GPA}}}$$

## UNEVEN DISTRIBUTION OF SPRAY (Boom sprayers with multiple nozzles)

The calibration of multi-nozzle boom sprayers is complicated by the fact that if any one nozzle is providing more or less liquid, then the pattern of the pesticide application may be affected.

To verify that all nozzles are spraying the same volume of liquid, collect liquid from under each nozzle for a standard amount of time. Then take the average flow of all the nozzles. If the flow of any nozzle varies by more than five percent *on either side* of the average of all the nozzles, then those nozzles should be cleaned or replaced. It is easy to find five percent. First, find a 10% error by simply taking the average and move the decimal place one place to the left. Now divide that number in half to find a five percent error.

**\*\*Example:** Suppose there are six nozzles on a boom and you collected liquid from under each nozzle for 35 seconds:

Nozzle	1	2	3	4	5	6	=	40 oz.	seconds:
ounces	40	40	41	39	38	42		average	

Average nozzle output is 40 ounces ( $240 \text{ ounces} \div 6 \text{ nozzles}$ ) Ten percent is then four ounces. A five percent error for 40 ounces is two ounces (half of four ounces is two ounces). The error range is 38 and 42 ounces. All nozzles fall within the acceptable five percent on either side of the average. To find 10% of 40.0 move the decimal place 1 to the left  $\rightarrow 4.0$ . Then to find 5% take  $\frac{1}{2}$  of 10%  $\rightarrow 4 / 2 = 2$ .

## DRY PESTICIDE APPLICATION (Pellets and Granular Formulations).

The technique for calibrating dry pesticide application equipment is similar in many ways to calibrating liquid spray equipment. The difference being that granular application equipment must be calibrated with the actual pesticide formulation. So always wear the label-prescribed Personal Protective Equipment (PPE) when calibrating dry pesticide application equipment.

**\*\*Example 4:** A granular spreader makes a 10-foot wide swath. A 20-foot long plastic sheet is placed on the ground. At the desired field speed the equipment is operated across the plastic. Granules are swept up from the plastic and weighed. Four ounces of dry granules are collected. Since this is a dry formulation, and there are 16 ounces in a dry pound, 0.25 pounds is collected ( $4 \text{ ounces} \div 16 \text{ ounces per dry pound}$ ).

Step 1: Test area is  $200 \text{ ft}^2$  ( $10 \text{ ft} \times 20 \text{ ft}$ ) or 0.0046 acres ( $200 \text{ ft}^2 / 43,560 \text{ ft}^2$ )

Step 2: A total of 0.25 pounds of granules are applied to the test area

Step 3: Test Strip lbs / Test Strip Acres = lb per acre  $\rightarrow$

$$0.25 \text{ lbs applied in test strip} / 0.0046 \text{ acres in test area} = 54.3 \text{ lb applied per acre}$$



## ADJUSTING OUTPUT

If you calibrate your sprayer at a certain speed or pressure, make sure you use the same speed and pressure when you apply the pesticide. Pesticide labels can be very specific as to what is required to improve pesticide performance, pesticide uptake and for drift prevention. You may have calibrated your sprayer only to find that its GPA is either too high or too low according to label directions.

**Speed.** As you slow down, you apply more. As you speed up, you apply less. The decision to use speed, and the adjustments that need to be made, should be done before you mix and begin spraying. If you adjust “on the fly” you may be applying the pesticide in excess of the labeled rate or at too low a rate for good pest control (**Figure 10**).

**Nozzles.** Larger nozzle tips (larger nozzle tip openings or orifices) increase volume, while smaller ones reduce the output and volume. The changing of nozzle tips usually alters the pressure of the system requiring an adjustment of the pressure regulator. Be aware that changes in nozzle tip size will also affect droplet size and spray pattern. Low-volume nozzle tips will generally increase the number of small droplets, thereby increasing the chance of drift. Whenever you change nozzle tips, recalibrate the sprayer and refigure the new output.

**Pressure.** In order to double output using pressure, you will need to increase pressure by four times as much. Increasing pressure can lead to drift problems, the increased incidences of equipment failure, improper coverage and improper placement of the pesticides. It is best to use pressure to fine tune a sprayer’s output and use speed or different nozzles for major adjustments.

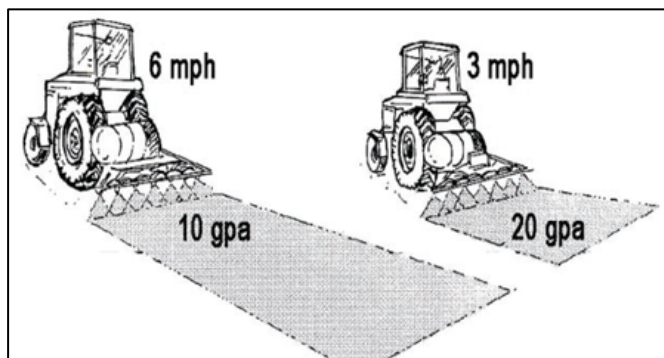


Figure 10. Speed changes the amount of pesticide applied.

## CALCULATIONS FOR MIXING PESTICIDES

When preparing to apply pesticides, it is most important to mix the correct amount of a concentrated pesticide with a diluent, usually water. But first, you should also have a working knowledge of basic weights and measures (**Table 3**).

Table 3. Table of weights and measures.

HAVE	→ + by ← X by	WANT		WHY
Pints	8	Gallons	8 pints = 1 gallon	<b>EXAMPLES</b>
Quarts	4	Gallons	4 quarts = 1 gallon	2 gallons X 8 = 16 pints
Fluid ounces	128	Gallons	128 ounces = 1 fluid gallon	0.75 gallons X 4 = 3 quarts
Fluid ounces	32	Quarts	32 fluid ounces = 1 quart	0.5 gallons X 128 = 64 fl. ounces
Fluid ounces	16	Pints	16 fluid ounces = 1 pint	3 qt X 32 = 96 fl. ounces.
Tablespoons	2	Fluid Ounce	1 tablespoon = 0.5 fluid oz.	2 pints X 16 = 32 fl. ounces.
Teaspoons	3	Tablespoons	3 teaspoons = 1 tablespoon	2 fl. ounces X 2 = 4 tablespoons
Drops	60	Teaspoons	60 drops = 1 teaspoon	2 tablespoons X 3 = 6 teaspoons
Square Feet	43,560	Acres	43,560ft <sup>2</sup> = 1 acre	2 tablespoons X 60 = 120 drops
Dry ounces	16	Dry Pounds	16 dry oz. = 1 dry pound	0.10 acre X 43,560 ft <sup>2</sup> = 4,356 ft <sup>2</sup>

## HOW MUCH PESTICIDE TO ADD TO THE TANK

The accurate mixing of pesticides is dependent upon two major factors: (1) the area covered, usually in acres, and (2) the proper product or labeled rate as determined from the pesticide label - 1 pint/acre, 1 quart/acre, etc.

**Step 1.** Determine how much area that can be sprayed with a given volume in the spray tank. The area is usually expressed in acres. You must first know your sprayer's application rate in **gallon per acre (GPA)**.

$$\frac{\text{Spray tank volume}}{\text{GPA}} = \text{Acres treated}$$

**Example:** Your sprayer is calibrated to 25 GPA and you are going to use a full 500 gallon tank.

$$\frac{\text{Spray tank gallons}}{\text{GPA}} = \frac{500}{25} = 20 \text{ acres}$$

**Example:** Your sprayer is calibrated to 25 GPA and you are going to use a full 250 gallon tank.

$$\frac{\text{Spray tank gallons}}{\text{GPA}} = \frac{250}{25} = 10 \text{ acres}$$

**Example:** Your sprayer is calibrated to 35 GPA and you are going to use 2 gallons of a 500 gallon tank.

$$\frac{\text{Spray tank gallons}}{\text{GPA}} = \frac{2}{35} = 0.057 \text{ acres}$$

This formula can also be used to fill out your restricted-use application records. One requirement is that you fill out the area sprayed. For example, suppose your sprayer is calibrated at 25 GPA and you just sprayed 500 gallons of a pesticide and water solution. By using the formula, you can determine you have sprayed 20 acres.

*Or suppose you know you have a 20-acre pasture and your sprayer is calibrated at 25 GPA. If you back-multiply, you will find that you need 500 gallons of solution to cover that 20-acre pasture. (20 acres x 25 GPA).*

**Step 2.** Once you have determined how many acres you can spray with a given volume, you then can determine how much pesticide you need to add to the spray tank.

**ACRES X LABELED RATE = HOW MUCH PESTICIDE YOU NEED TO ADD TO TANK**

Example: A pesticide label calls for a rate of 1 pint/acre to be applied for the control of perennial noxious weeds. The sprayer to be used is calibrated to apply 25 Gallons Per Acre (25 GPA). A 20-acre field is to be broadcast sprayed with 500 gallons of a pesticide and water mix (500 gallons ÷ 25 GPA = 20 acres).

$$20 \text{ ACRES } \times 1 \text{ PINT/ACRE} = 20 \text{ PINTS}$$

You will then be adding 20 pints in a 500-gallon mixture. There are 8 pints in a gallon so you will need to add 2 ½ gallons of pesticide to the tank (20 pints ÷ 8 pints per gallon). Fill the tank with half the desired volume of water. Add the pesticide, surfactants, and then add water until you have reached the desired volume in the spray tank

Example: Suppose you have that a backpack that can treat 0.057 acres with 2 gallons of water (2 gallons ÷ 35 GPA = 0.057 acres). The label recommends a 1-pint per acre rate to control a particular pest. One pint equals 16 ounces so:

$$\rightarrow 0.057 \text{ acres} \times 16 \text{ oz.} = 0.912 \text{ or } 1 \text{ ounce of pesticide added to water to make 2 gallons of mix.}$$

The above formula will also help you fill out your restricted-use application records. Another requirement is that you document how much ***undiluted restricted-use pesticide*** is used. If you just sprayed 20 acres and you accurately mixed at the labeled rate of 1 pint per acre, then you most likely sprayed out 20 pints of the undiluted pesticide.

## Practice Questions for Chapter 8

(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)

1. A sprayer applies 3 gallons of liquid to a calibration strip that is 66 feet wide and 66 feet long. What is the application rate of this sprayer in Gallons Per Acre (GPA)?
2. A backpack sprayer applies 96 ounces to a test strip that is 20 feet wide and 20 feet long. What is the application rate of this sprayer in Gallons Per Acre (GPA)? Hint: You will need to convert to gallons. Round up your calculations to the nearest whole number. Hint: there are 128 ounces in a gallon and 43,560 square feet in an acre.
3. A broadjet sprayer has a swath width of 40 feet. A test strip distance of 200 feet is established. The strip is sprayed with water and it is determined that it takes 5 gallons of water to spray the test strip. What is the application rate of this sprayer in Gallons Per Acre (GPA)? Hint: there are 43,560 square feet in an acre. Round up your answer to the nearest whole number.
4. You need to spray a 16 acre pasture. Your sprayer's application rate is 25 Gallons Per Acre (GPA). You will be using a pesticide at a labeled rate of 1.5 pints per acre. How many pints will you add to the spray tank to spray this 16-acre pasture?
5. Your sprayer applies 0.46 gallons of water over 400 square feet. You are spot treating for weeds with a restricted-use herbicide. By law, you need to stop and fill out your records when you have sprayed 1/10th of an acre (0.10 acres). How many gallons of a pesticide/ water solution will you need to mix to treat 0.10 acres. Hint: There are 43,560 square feet in an acre. Round up all calculations to the nearest whole number.
6. You need to spray an area that is 100 feet by 100 feet with a sprayer that applies 45 Gallons Per Acre (GPA). The label directs you to use 1.5 quarts per acre. How many OUNCES of the pesticide will you add with water to completely spray this area? Hint: There are 32 ounces in a quart. Round your final answer down to the nearest whole number.



## Chapter 9

# READING AND UNDERSTANDING THE PESTICIDE LABEL

**“The pesticide label is your *prescription* for using a pesticide. It contains necessary information for the safe and effective use of a particular pesticide. Under the Federal Fungicide, Insecticide and Rodenticide Act (FIFRA), every pesticide label is considered a legal document!”**

So no harm will result from the improper use of pesticides, every pesticide applicator has the responsibility to read, understand, and follow information found on the label. Handling pesticides in a manner that is not consistent with the label instructions is not only illegal it can also endanger the health of the applicator, other people, animals, plants, or the environment.

Review the Tordon 22K™ sample label on the next few pages. Every pesticide label will contain the following sections. It is your responsibility to be familiar with each of these sections when applying pesticides.

**#1 Classification.** The Environmental Protection Agency (EPA) classifies pesticides as either "general-use" or "restricted use". If a pesticide is restricted-use, a restricted-use box will be at the top of the label and will explain why the pesticide is classified that way. Tordon 22K™ is a restricted-use herbicide because it can injure susceptible, non-target plants. The fumigant Phostoxin™ is classified as a restricted-use fumigant because of its toxicity.

**#2 Pesticide product name.** The name by which the pesticide is marketed is known as the brand or product name. Because active ingredients have complex chemical names, many are given a shorter common name. Only common names that are officially accepted by the Environmental Protection Agency (EPA) may be noted on the pesticide label. Tordon 22K™ is the brand or trade name for the herbicide containing the active ingredient picloram. Picloram is the common name for the chemical structure 4-amino-3,5,6-trichloropicolinic acid. The manufacturer's name may also be noted here.

**#3) Type of pesticide.** The label must indicate the type of pesticide or what types of pests that it will control. Example: insecticide, herbicide, fungicide, etc. Tordon 22K™ is a restricted-use herbicide. Remember! You need to keep records of all restricted-use pesticide applications. This includes restricted-use herbicides like Tordon 22K.

**#4) Ingredients.** Each pesticide label must include the active and inert ingredients in the formulation. Remember! The active ingredient is the chemical part of a pesticide formulation that actually kills the pest. Inert ingredients are added to formulations as filler, to aid in storage and do not contribute directly to controlling the pest. Both active and inert ingredients are expressed as a percentage. Always check the percentage of active ingredients when comparing pesticides. Two pesticide products with the same active ingredient, but in differing concentrations, may show some difference in the amount of control that is gained.

**#5) The EPA registration number (EPA Reg. No.)** indicates that the pesticide has been registered by EPA. It can then be legally sold or applied according to label directions. The EPA registration is not a guarantee of the pesticides safety. You are required to record the EPA registration number on your records of all restricted-use pesticides that you apply. Do not confuse the EPA registration number with the EPA establishment number. The EPA establishment number (EPA Est. No.) identifies the facility where the pesticide was manufactured and is NOT required on your records.

**#6) Signal Words.** The signal word indicates the approximate toxicity of the pesticide formulation. Tordon 22K™ has the signal word CAUTION meaning the product is slightly toxic or may cause slight eye or skin irritation. Keep out of reach of children is required to be on all pesticide containers.

**#7) Precautionary statements.** Precautionary statements identify the potential hazards to humans, animals and the environment. This section also explains how risks can be minimized or avoided. Personal Protective Equipment or PPE that is required to handle or apply the pesticide is noted in this section. You must wear the personal protective equipment (PPE) that is listed on the label. There are also warnings as to the pesticide risks to wildlife, birds, fish, bees or to the environment, and any special fire, explosion, or chemical hazards the product may pose. User safety recommendations are also noted in this section of the label.

**#8) Statement of practical treatment (First Aid).** The statement of practical treatment lists the first aid treatments that should be given to someone who becomes injured as a result of pesticide exposure. There may also be a *Note to Physicians* to provide emergency medical personnel with poison treatment information. This information includes antidotes, and an emergency phone number to call for further information. Make sure that the pesticide label goes along with any pesticide poisoning victim when they are taken to a medical facility.

**#9) Environmental statements.** The potential risks to the environment from the use of the pesticide are noted in this section. This section also lists ways that the risks can be minimized or avoided. The Tordon 22K™ label is very clear on what conditions are to be avoided to prevent environmental contamination:

For example: “This pesticide is toxic to some plants at very low concentrations”.  
or → “Do not allow run-off or spray to contaminate wells, or irrigation ditches”.  
or → “Do not spray over permeable soils”.

**#10) Directions for use.** Remember, it is a violation of federal law to use any pesticide in a manner inconsistent with its labeling. A pesticide can only be used on those sites named in this section of the label. You may not use higher dosages or more frequent applications than is allowed. You must follow all directions for use, safety, mixing, diluting, storage and disposal. The use directions and instructions are not recommendations. They are requirements!

**#11) Agricultural Use Requirements.** The Worker Protection Standard (WPS) was passed into law to protect employees on farms and in forests, nurseries and greenhouses from exposure to both general and restricted-use agricultural pesticides. The WPS covers workers who are exposed to pesticides in the production of agricultural products. If you are producing an agricultural crop and using a pesticide with labeling that refers to the Worker Protection Standard, then you must also comply with the standard as noted on the label. Contact your local Montana Department of Agriculture representative to determine if you need to comply with the Worker Protection

Standard. Some pesticide uses are not covered by the WPS, even when the Agricultural Use Requirements section is on the labeling. For example: Pesticides used for the control of vertebrate pests on pastures and/or rangelands, and on rights-of-way are not covered by the Worker Protection Standard.

This section will also state the amount of time that must pass before any workers are allowed to re-enter treated areas without wearing the appropriate PPE. This is known as the Restricted Entry Interval or REI. Also noted may be other intervals between pesticide application and harvest of food crops.

A **Non-agricultural Use Statement** may also appear with instructions for those applicators exempt from the Worker Protection Standard.

**Storage and Disposal.** All pesticide labels contain general instructions for the appropriate storage and disposal of the pesticide and its container. Nevertheless, always store pesticides in their original containers. Regardless of the circumstances, never store pesticides in containers that can be mistaken as food or feed containers.

**General Use Instructions.** This section is generally the largest section of the label and states: (1) the pests that the manufacturer claims the product will control; (2) the crop, animal, or site that the product can be applied to; (3) when, where, how, and in what form the product should be applied; (4) the proper equipment to be used; (5) the correct rate or dosage; (6) mixing directions; (7) compatibility with other often-used products; and (8) the minimum time between the applications. Mixing instructions may also be noted here.



**This label is for training purposes only. It is not a complete label!**

**RESTRICTED USE PESTICIDE** #1  
May Injure (Phytotoxic) Susceptible, Non-Target Plants. Retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. Commercial certified applicators must also ensure that all persons involved in these activities are informed of the precautionary



**Specialty Herbicide** #3  
\*Trademark of Dow AgroSciences LLC

For use in areas west of the Mississippi River for the control of susceptible broadleaf weeds and woody plants on rangeland and permanent grass pastures, fallow cropland, spring seeded wheat, barley and oats not underseeded with a legume, non-cropland, and on Conservation Reserve Program (CRP) acres

Active Ingredient:  
picloram: 4-amino-3,5,6-trichloropicolinic acid, potassium salt ..... 024.4% #4  
Inert Ingredients ..... 075.6%  
Total Ingredients ..... 100.0%

Acid Equivalent  
picloram: 4-amino-3,5,6-trichloropicolinic acid - 21.1% - 2 lb/gal

EPA Reg. No. 62719-6 #5

Keep Out of Reach of Children #6  
**CAUTION PRECAUTION**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

**Precautionary Statements** #7

**Hazards to Humans and Domestic Animals**

Causes Moderate Eye Irritation. Avoid contact with eyes or clothing. Prolonged or frequent repeated skin contact may cause allergic skin reactions in some individuals.

**Personal Protective Equipment (PPE)** #7  
Applicators and other handlers must wear:  
• Long-sleeved shirt and long pants  
• Waterproof gloves  
• Shoes plus socks

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

**User Safety Recommendations**  
Users should:  
• Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.  
• Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.  
• Users should remove PPE immediately after handling this product.  
• Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

**First Aid** #8  
If in eyes: Flush eyes with plenty of water. Call a physician if irritation persists.

**Environmental Hazards** #9  
This pesticide is toxic to some plants at very low concentrations. Non-target plants may be adversely affected if pesticide is allowed to drift from areas of application. Do not contaminate water when disposing of equipment washwaters.

Picloram is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination.

**Notice:** Read the entire label. Use only according to label directions. Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" elsewhere on this label.

In case of emergency endangering health or the environment involving this product, call 1-800-992-5994. If you wish to obtain additional product information, visit our web site at www.dowagro.com. Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

**Directions for Use** #10

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

**Agricultural Use Requirements** #11  
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.  
  
Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.  
  
PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:  
• Coveralls  
• Waterproof gloves  
• Shoes plus socks



#11

### Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

**Entry Restrictions for Non-WPS Uses:** For applications on rangeland, permanent grass pastures, and non-cropland, do not enter or allow worker entry into treated areas until sprays have dried, unless applicator and other handler PPE is worn.

### Storage and Disposal

Do not contaminate water, food, feed or fertilizer or disposal. Open dumping is prohibited.

**Storage:** If this product is exposed to subfreezing temperatures, the active ingredient may crystallize and settle out of solution. Under these conditions the product should be warmed to at 40°F and agitated well to dissolve any crystallized material prior to use.

**Pesticide Disposal:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**Container Disposal (Plastic): Do not reuse container.** Triple-rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

#12

## General Information

#13

### Maximum Use Rates

**Non-cropland Areas:** Total use of Tordon 22K, including retreatments or spot treatments, must not exceed 2 quarts per acre per annual growing season.

**Rangeland and Permanent Grass Pastures:** For control of noxious weeds, Tordon 22K may be applied at up to 2 quarts per acre per annual growing season as a broadcast treatment. Spot treatments may be applied at the equivalent broadcast rate of up to 2 quarts per acre.

### Precautions for Avoiding Injury to Non-target Plants

- Do not contaminate water intended for irrigation or domestic purposes. Do not treat or allow spray drift or run-off to fall onto banks or bottoms of irrigation
- Tordon 22K should not be applied on residential or commercial lawns or near ornamental trees and shrubs
- Do not move treated soil to areas other than those treatment sites for which Tordon 22K is registered for use.
- **Sprayer Clean-Out**

To avoid injury to desirable plants, equipment used to apply Tordon 22K herbicide should be thoroughly cleaned before reusing to apply any other chemicals.

1. Rinse and flush application equipment thoroughly after use. Dispose of rinse water in non-cropland area away from water supplies.
2. Rinse a second time, adding 1 quart of household ammonia for every 25 gallons of water. Circulate the solution through the entire system so that all internal surfaces are contacted (15 to 20 minutes). Let the solution stand for several hours, preferably overnight.
3. Flush the solution out the spray tank through the boom.
4. Rinse the system twice with clean water, recirculating and draining each time.
5. Nozzles and screens should be removed and cleaned separately.

### Precautions for Avoiding Injurious Spray Drift

Applications should be made to avoid spray drift since very small quantities of spray, which may not be visible, may seriously injure susceptible crops during both growing and dormant periods. To minimize spray drift, use low nozzle pressure; apply as a coarse spray; and use nozzles designed for herbicide application that do not produce a fine droplet spray. Do not use a thickening agent with Microfoil or Thru-Valve booms, or other systems that cannot accommodate thick sprays.

### Mixing Instructions

Mix the required amount of Tordon 22K in water and apply as a coarse, low pressure spray using ground equipment or aircraft. Use enough spray volume to provide uniform coverage of the weeds.

**Use With Surfactants:** Addition of wetting or penetration agents is not usually necessary when using Tordon 22K. However, under certain conditions, such as drought, addition of a surfactant may improve efficacy.

**Mixing with Water:** To prepare the spray, add about half the desired amount of water in the spray tank. Then with agitation, add the recommended amount of Tordon 22K and other registered tank mix herbicides. Finally, with continued agitation, add the rest of the water and additives such as surfactants or drift control and deposition aids.

### Do Not Mix With Dry Fertilizer.

**Mixing With Sprayable Liquid Fertilizer Solutions:** Tordon 22K is compatible with most non-pressurized liquid fertilizer solutions; however, a compatibility test (jar test) should be made prior to mixing. **Note:** Foliar applied liquid fertilizers used as diluent for Tordon 22K can cause yellowing or leaf burn of crop foliage.

**Tank Mixing:** Tordon 22K may be applied in tank mix combination with labeled rates of 2,4-D or other products provided (1) the tank mix product is labeled for the timing and method of application for the use site to be treated; and (2) tank mixing is not prohibited by the label of the tank mix product.

**Tank Mix Compatibility Testing:** A jar test is recommended prior to tank mixing to ensure compatibility of Tordon 22K and other pesticides or carriers. Use a clear glass jar with lid and mix the tank mix ingredients in their relative proportions. An incompatible mixture is indicated by separation into distinct layers which do not readily remix when agitated and/or the presence of flakes, precipitates, gels, or heavy oily film on the jar.

### Application Methods

#### Ground or Aerial Broadcast

Use Tordon 22K as a broadcast treatment by ground or aerially to control listed broadleaf weeds and woody plants. Apply Tordon 22K as a coarse low-pressure spray at the recommended rates in a spray volume of 2 or more gallons per acre by air or 10 or more gallons per acre by ground.

**Spot Treatment:** Apply in a total spray volume of 20 to 100 gallons per acre. To prevent misapplication, spot treatments should be applied with a calibrated boom or with hand sprayers. Do not exceed maximum application rates for Tordon 22K for a given treatment site.

**Hand-Held Sprayers:** Hand-held or backpack sprayers may be used for spot applications of Tordon 22K if care is taken to apply the spray uniformly and at a rate equivalent to a broadcast application.

## General Requirements for Non-Cropland Areas

Use Tordon 22K to control susceptible broadleaf weeds and woody plants on non-cropland areas such as roadsides or other rights-of-way, fence rows, and around farm buildings. Up to 2 quarts of Tordon 22K per acre may be applied.

**Maximum Use Rates for Non-cropland Areas:** Total use of Tordon 22K, including retreatments or spot treatments, must not exceed 2 quarts per acre per annual growing season.

Use Tordon 22K on rangeland and permanent grass pastures to control susceptible broadleaf weeds and woody plants including, but not limited to those shown in the following tables.

Many annual weeds at the seedling stage can be controlled at the rate of 1 pt per acre. Where a rate range is recommended, choose the higher rate for dense weed infestations, and for more dependable, longer-lasting control. Lower rates will perform best when applied under favorable conditions and at the optimum growth stage, but may provide a lower level of control and require retreatment. For best results treat when weeds are small and actively growing in the spring before full bloom, however, certain weeds may also be treated in late summer to fall. Treatments during full bloom or seed stage of some weeds may not provide acceptable control.

Weeds Controlled		
Weed Species	Broadcast Application (Rate/acre)	Specific Use Directions
<b>Annual and Biennial Weeds:</b>		
starthistle, purple starthistle, yellow	1-2 pt Tordon 22K	Apply when there is adequate soil moisture and weeds are actively growing.
thistles, including, bull musk plumeless scotch	<b>Fall:</b> 1/2-3/4 pt Tordon 22K <b>Spring:</b> 1/2-3/4 pt Tordon 22K + 1 lb ae 2,4-D	<b>General:</b> Apply at the rosette stage before bolting in the spring or in the fall prior to soil freeze up. <b>Bolted Musk Thistle:</b> Apply before flowering at the rate of 1/2-1 pt of Tordon 22K + 1 lb ae of 2,4-D/acre.
<b>Perennial Weeds:</b>		
daisy, ox-eye knapweed, diffuse knapweed, spotted knapweed, squarrose thistle, Canada	1-2 pt Tordon 22K	<b>General:</b> Lower rates in rate range may require annual spot treatments. Control with lower rates may be improved by tank mixing with 1.0 lb ae per acre 2,4-D. <b>Diffuse or spotted knapweed:</b> Optimum application from rosette to mid-bolting stage or to fall regrowth.
bindweed, field knapweed, Russian ragwort, tansy skeletonweed, rush spurge, leafy St. Johnswort	2-4 pt Tordon 22K	<b>General:</b> Annual retreatment of these species will be required at rates at low end of rate range. Control at low end of rate range may be improved by tank mixing with 1 lb ae/acre 2,4-D. <b>Leafy Spurge:</b> Apply at true flower stage of growth or apply to fall regrowth. Re-apply when level of control falls below 80 percent.

## Warranty Disclaimer

Dow AgroSciences warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

## Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted

on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of Dow AgroSciences or the seller. All such risks shall be assumed by buyer.

## Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at Dow AgroSciences' election, one of the following: (1) Refund of purchase price paid by buyer or user for product bought, or (2) Replacement of amount of product used. Dow AgroSciences shall not be liable for losses or damages resulting from handling or use of this product unless Dow AgroSciences is promptly notified of such loss or damage in writing. In no case shall Dow AgroSciences be liable for consequential or incidental damages or losses. The terms of the Warranty Disclaimer above and this Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of Dow AgroSciences or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or this Limitation of Remedies in any manner.  
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Label Code: D02-111-009  
Replaces Label: D02-111-008  
EPA Accepted: 12-30-98

## Practice Questions for Chapter 9

(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)

1. In what part of the product label would you find the proper protective equipment you should wear when applying a pesticide?
2. What is the EPA registration number for Tordon 22K (refer to product label on previous page)?
3. Can you spray Tordon 22K in a riparian area? What section would you find the answer to this question?
4. If applying spot treatments of Tordon 22K, what should your sprayers GPA output be?
5. Where do you find the restricted entry interval for any product?
6. The \_\_\_\_\_ ingredients actually are what kills a target pest?
7. Pesticides are classified as either \_\_\_\_\_-use or \_\_\_\_\_-use pesticides.
8. It is possible to tank mix Tordon 22K with 2, 4-D (True or False)?
9. The \_\_\_\_\_ indicates the approximate toxicity of the pesticide.
10. The maximum amount of Tordon 22K in non-cropland areas that can be applied within one field season is \_\_\_\_\_?



# CHAPTER 10

## HOW TO AVOID MAKING COSTLY MISTAKES

To minimize excessive costs as well as unnecessary environmental and personal safety risks an applicator can start by following a few basic steps. These steps can be separated into 5 stages including preparation of the sprayer, handling & mixing, during field applications, equipment cleaning and storage, and transporting pesticides.

### PREPARING THE SPRAYER

Prior to entering a field to spray, an applicator should prepare their sprayer for the application. Only clean water should be used in the sprayer, without any silt or sand present in the system. This may clog nozzles and screens, and at times pesticides may also bind to the sediment lowering the efficacy of the chemical. Due to this, an applicator should:

- \*Rinse out the sprayer; remove and clean all nozzles, nozzle screens and strainers.
- \*Check all lines, valves, seals and the tank both after filling the sprayer with water and during calibration. Make sure there are no leaks in the spray system. For the operator's safety, replace weather-cracked or worn hoses.
- \*Re-adjust the nozzle height, angle, and spacing as suggested by the nozzle manufacturer or as specified on the pesticide label.
- \*Not operate pumps at speeds or pressures higher than what the manufacturer recommends.
- \*Restrain all power take-off pumps from rotating by chains or torque bars, and keep all shields in place.
- \*Not use ground speeds that are too high for existing field conditions. Booms bouncing up and down or back and forth can cause application rates to vary by 50 percent. Also, such bouncing can damage the spray booms or the frame of the sprayer.

### HANDLING AND MIXING

When mixing, air is forced out of the mixing container or spray tank and carries some of the pesticide particles with it. These particles can be inhaled. Keep in mind that splash back often occurs at this stage, making your skin, and eyes vulnerable as well. While mixing, pesticides are often concentrated much higher than in a field spray situation. Simple steps should be taken when handling and mixing pesticides.

- #1) Read the product label** for personal protective equipment required when mixing.
- #2) Wear goggles.** Goggles are easy to use, offer few drawbacks, and are re-usable. Always wear goggles when mixing to avoid contamination of your eye from splash-back from mixing or spills.
- #3) Mix in a well ventilated area.** If the solvent in the pesticide is toxic or flammable (or both), be sure the mixing operation is performed in an area where ventilation is adequate.

**#4) Wear respirators if needed.** Many types of solvents used in the pesticide formulation process are very dangerous to breathe. They can cause a "high," dizziness, or even unconsciousness. They can also cause permanent damage to the kidneys, liver, and nervous system in workers exposed to the vapors for a prolonged time. This is especially true for the emulsifiable concentrates (EC).

**#5) Wear a chemically resistant apron** when mixing. A chemically impermeable apron often saves applicators time and worry when pesticide spills occur. Often, chemicals may simply be cleaned off of a chemically resistant apron without removal of all permeable clothing that would have been saturated.

**#6) Wear chemically resistant gloves.** The skin absorbs pesticides at various rates (**Figure 11**). Dermal absorption rates are based on a numerical scale with one (1) the lowest skin absorption rate value. The majority of skin exposure from pesticides is to forearms and hands. While the absorption rates are the lowest for these areas, there can be a chronic toxic effect over time.

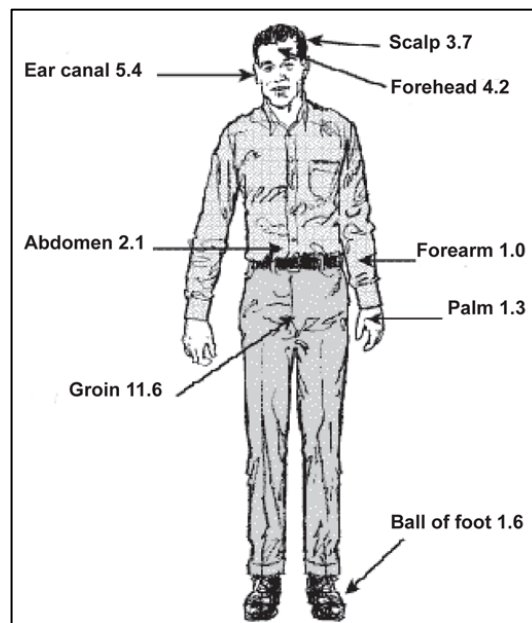


Figure 11. Skin absorption rates of pesticides.

## FIELD APPLICATIONS

Calibrating your sprayer will minimize any environmental affects, as well as save you money. Calibrate your sprayer often, preferably on an annual basis. Once your spray rig is calibrated, follow these simple steps to ensure a trouble-free application:

- \*\*Make sure you add the correct amount of pesticide to your spray tank based on the labeled rate and your sprayer's application rate.
- \*\*Never spray during high winds (drift) or high temperatures, or low humidity situations.
- \*\*Whenever possible, do not spray near beehives, lakes, streams, pastures, houses, schools, playgrounds, hospitals or sensitive crops. Always spray downwind from the sensitive area.
- \*\*Make sure that any drift from the sprayer will be blown away from the next area to be treated. This will minimize the amount of pesticide that will be come in contact with the operator.
- \*\*To minimize drift, use the lowest sprayer pressure and lowest boom height possible without causing distortion in spray pattern. Use spray tips that produce medium to large droplets. Add drift prevention adjuvants (if pesticide label permits) where drift is likely.
- \*\*Watch out for clogged nozzles and changes in nozzle patterns. If nozzles clog or other troubles occur in the field, shut the sprayer off and move to an unsprayed area before working on it. If nozzles must be cleaned in the field, wear your PPE and use a soft brush or a toothpick for cleaning.

### **Never try to unclog a nozzle by blowing through it!**

In conclusion always check the pesticide label for re-entry and pre-harvest intervals. The re-entry interval (REI) is the time between a pesticide application and when workers can safely re-enter a field. The longer the REI, the safer it is to enter a sprayed field without wearing the appropriate safety equipment. The pre-

harvest interval (PHI) is the time between a pesticide application and harvest of the crop. The longer the pre-harvest interval, the more time pesticide residues on crops can be broken down naturally.

## **EQUIPMENT CLEANING AND STORAGE**

Clean the inside and outside of mixing, loading, and application equipment immediately after use. Wear personal protective equipment (PPE), including rubber boots, a rubber apron, goggles, and possibly a respirator. The cleanup process is important because many chemicals will rapidly corrode some metals. They may also react with pesticides that will be used later. This could possibly cause a loss of effectiveness and possible crop damage.

To clean a sprayer, mix about two pounds of detergent per 40 gallons of water in the tank. Circulate this mixture throughout the bypass or agitator nozzles for 30 minutes and then apply to a labeled site. If herbicides such as 2,4-D were used in the sprayer, rinse with an ammonia or charcoal solution. You can legally spray out the wash and rinse water as long as it is to a site listed on the label. Make sure that no puddling takes place. To make an ammonia rinse, fill the sprayer tank one-third to one-half full. Then add two quarts of household ammonia for every 25 gallons of water. Circulate the solution and allow a small amount to flow through the nozzles. Allow the remaining solution to stand overnight to neutralize any herbicide remaining in the equipment. Then spray the solution through the nozzles onto a site listed on the pesticide label. After rinsing with detergent or ammonia, flush thoroughly with clean water.

When the sprayer is to be stored for a long time, add one to five gallons of lightweight oil (about one gallon of oil per 40 gallons of water) before the final flushing. As the water is pumped from the sprayer, the oil will leave a protective coating on the inside of the tank, pump and plumbing. To prevent corrosion, remove nozzle tips and screens and store them in a can of light oil, such as diesel fuel or kerosene. Close the nozzle openings to keep dirt or insects from entering the spray boom. Be sure the pump is drained thoroughly to prevent freezing. Add a small amount of oil and rotate the pump four or five revolutions by hand to completely coat the interior surfaces.

Follow directions in the owner's manual regarding the proper procedures for storing engine-equipped sprayers. Before storing the sprayer, all lines, hoses, valves and the pump should be inspected for damaged parts or leaks. Damaged parts should be replaced before the sprayer is stored.

## **TRANSPORTING PESTICIDES SAFELY**

When transporting pesticides, the following precautions should be taken:

- #1) Carry pesticides in the cargo compartment and never in the passenger compartment. Steel beds are the best since they can be more easily cleaned if a spill should occur.
- #2) Never place pesticides near passengers, pets, fertilizers, seed, food, or feed. If a spill occurs, it will be difficult to decontaminate the passenger compartment.
- #3) All containers should be tightly closed and have legible labels.
- #4) Secure containers so they will not roll or slide.
- #5) Protect all containers from moisture and temperature extremes.
- #6) Never leave vehicle unattended when the pesticides are unsecured. The legal responsibility for the injury of curious children and careless or mischievous "adults" is yours.

#7) After transportation, all pesticide containers should be inspected for damage and leaks. The vehicle should also be inspected for contamination.

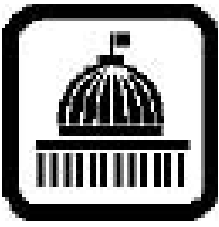
#8) Consider locks for the tank openings to prevent vandalism.

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## **Practice Questions for Chapter 10**

**(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. The majority of skin exposures while mixing are to the \_\_\_\_\_.
2. How should you protect your eyes when mixing chemicals?
3. How often should you clean your application equipment and when should you do so?
4. What is the PHI?
5. What is the worst combination of wind, temperature, and humidity for applying pesticides?
6. The legal responsibility for injury caused to children is the pesticide manufacturer (True or False).
7. You are mixing a chemical that causes skin, eye, and lung irritation (DANGER/POISON). What minimal personal protective equipment should you wear when mixing.
8. Where should you unplug a sprayer?
9. What type of spray nozzles will reduce drift?
10. Silt or sand in the spray tank can cause what 2 problems?



# CHAPTER 11

## PESTICIDE LAWS & REGULATIONS

The Federal Insecticide, Fungicide and Rodenticide Act, or FIFRA, is the main law that regulates pesticides in the United States. Under FIFRA, the U.S. Environmental Protection Agency (EPA) reviews and approves all pesticides including the labeling of pesticides. Section 2 (ee) of FIFRA allows the applicator of a pesticide to apply the pesticide under certain conditions not specified on the label. As long as you are not in violation of any state or tribal laws, you can:

- #1) Apply a pesticide at any dosage, concentration, or frequency less than that listed on the label.
- #2) Apply a pesticide against a target pest not listed on the label as long as the application is to a site that is listed on the label.
- #3) Mix two or more pesticides, if all of the dosages are at or below the recommended rates.
- #4) Use any method of application or equipment that is not prohibited by the labeling.
- #5) Mix a pesticide, or pesticides with a fertilizer, as long as the mixture is not prohibited by the label. Conduct a compatibility test before you mix.

The Environmental Protection Agency (EPA) can charge both civil and criminal penalties against any persons or companies that violate any portion of FIFRA. Farm (private) applicators can be given a written warning and/or a fine of up to \$500 for the first offense and up to \$1,000 for subsequent offenses. Criminal penalties are more serious violations of the law. They are usually decided in the courts and apply to those applicators that knowingly violate the provisions of FIFRA. Typical, FIFRA violations pertaining to private applicators includes:

- #1) Selling a restricted-use pesticide (RUP) to a person not certified to purchase such products.
- #2) Using a pesticide in a manner inconsistent with its labeling such as storing pesticides in unauthorized containers, applying pesticides at rates that exceed the label directions (lack of calibration or improper mixing).
- #3) Altering, defacing or detaching a pesticide label.
- #4) **Failure to keep required records** or to allow inspection, copying or sampling.



## RECORDKEEPING

All certified private pesticide applicators must keep records for each restricted-use pesticide (RUP) that they apply. While there is no standard form for keeping restricted-use-pesticide (RUP) records, there is a standard format. If you use a restricted-use pesticide, you have up to 14 days from the time of the application to record the following information. You must maintain these records for two (2) years following the application. This is for *each* restricted-use pesticide (RUP) treatment applied on the *same* day. Following are a list of required elements that must be recorded within 14 days of all restricted use pesticide applications.

- #1) **The applicator's name and certification number.** Montana private applicator's license numbers end with -11. If the application was made by someone who is not certified but under the supervision of a certified private applicator, then record the name and number of the certified applicator supervising the application.
- #2) **The month, day, and year of the application.**
- #3) **The location** of the application. Record the actual location of the treated area, not the address of the farm or business. Your goal is to be able to identify the exact area of the application two years later if requested. The law allows you to use legal property descriptions, maps or written descriptions, USDA maps, or any method that you want to accurately pinpoint the sprayed area.
- #4) **The size** of the area treated should be recorded in a unit of measure normally expressed on the pesticide label; acre, linear feet, bushel, cubic feet, square feet, number of animals, etc. For special applications such as alternate middles, weed wicks or band applications, record the total area covered.

*Example #1: If an 80-acre field is treated using a band application, the entire 80 acres would be recorded as the "size of area treated." Knowing your sprayer's calibration will help you determine the size of the area treated.*

*Example #2: If your sprayer is calibrated to apply 30 Gallons Per Acre (GPA) and you have sprayed out 300 gallons of a pesticide/water solution, this means you have sprayed 10 acres. Or suppose you are using a backpack sprayer that is calibrated at 80 GPA. If you have sprayed out 5 gallons of solution, the area you have sprayed is 0.0625 acres following this simple equation:*

$$0.0625 \text{ acres} = \frac{5 \text{ gallons}}{80}$$

- #5) **The crop, commodity, stored product, or site** to which the pesticide was applied. Refer to the pesticide label. Labels can be very specific as to what sites can be treated. Remember, the application site must be listed on the label!
- #6) **The total amount** applied. Record the total quantity of undiluted product used -- not the quantity after water or other substances were added. This does not refer to percent of active ingredient. Do not enter "labeled rate" on your records. Use the pesticide label for reference and record the amount in quantities similar to language on the label. For example, if the label

states the pesticide is to be measured in pints or ounces, then record the amount in those measurements. Again, knowing your sprayer's calibration will help you determine the total amount applied.

*Example #1: Your sprayer is calibrated to apply 30 GPA and you have sprayed out 300 gallons, this means you have sprayed 10 acres (300 ÷ 30). If the pesticide rate you used was 1 pint per acre then you have applied 10 pints of concentrated pesticide per 300 gallons of solution with the following easy calculation:*

$$10 \text{ pints} = \frac{300 \text{ gallons}}{30 \text{ GPA}} \times 1 \text{ pint per acre}$$

If you are using a backpack sprayer you may have to do a little more math. You will also need to know some common conversions such as there are 32 ounces in a quart, etc.

*Example #2: Your backpack is calibrated to apply 80 GPA and you have sprayed out 5 gallons of a pesticide solution. The labeled pesticide rate is 1 quart per acre (32 ounces). You have applied 2 ounces of undiluted product.*

$$2 \text{ ounces} = \frac{5 \text{ gallons}}{80 \text{ GPA}} \times 32 \text{ ounces}$$

- #7) The **brand or product name** of the restricted-use pesticide. The brand or trade name is the name under which the product is sold. The common name is the name of the active ingredient found in the pesticide formulation. For example, Tordon 22K is the brand name or trade name of picloram, the common name for the active ingredient found in Tordon 22K.
- #8) **The Environmental Protection Agency (EPA) Registration Number** found on the label. The registration number is not the same as the EPA Establishment Number that is also located on the label and tells where the pesticide was manufactured.

**SPOT TREATMENTS.** A spot treatment is the use of a restricted-use-pesticide (RUP) on the same day to a total area treated less than  $1/10^{\text{th}}$  of an acre (4,356  $\text{ft}^2$ ). This could be  $1/10^{\text{th}}$  of an acre of weeds within a 5-acre pasture. Record all **8 required criteria** for a normal application when conducting a spot treatment. However, you are required to record it as a spot application under the location.

*Example: Suppose your sprayer is calibrated to 50 GPA. You have sprayed out 5 gallons of an herbicide mixture to control spotted knapweed in the north half of field 6 (a 10 acre pasture). The total area that you sprayed was 0.1 acres (5 gallons ÷ 50 GPA). You would note the following in your records under location: "Spot application for noxious weeds in north half of field 6."*

**ACCESS TO YOUR RUP RECORDS.** The only individuals to have access to your restricted use pesticide applications are the U.S. Department of Agriculture-authorized representatives who present identification, State-authorized representatives who present identification, and/or licensed health care professionals, USDA representatives, and State regulatory representatives with credentials.

## WORKER PROTECTION STANDARD

The Worker Protection Standard (WPS) was passed into law to protect employees who work in areas treated with both general and restricted-use pesticides. It was also designed to protect employees who handle pesticides in the production of agricultural crops. Under the Worker Protection Standard, employers must provide certain protections to their employees and, in some instances, to themselves. While owners are not required to provide these protections to themselves or their immediate families, they are required to follow the label and are strongly encouraged to protect themselves from needless exposure to pesticides. They must also wear personal protective equipment and follow reentry intervals into treated areas whenever listed on the pesticide label.

The following WPS requirements do not need to be met by owners or members of their immediate family, but must be provided to any worker or handler they may hire:

- Pesticide information posted at a central location.
- Pesticide safety training.
- Decontamination sites.
- Emergency assistance available.
- Notice about pesticide applications.
- Monitoring of handler's actions and health.
- Specific handling instructions.
- Duties related to early entry: training and instructions and decontamination sites.

If you produce an agricultural crop then you may need to obey the Worker Protection Standard. Contact your local Montana Department of Agriculture field office to determine if you need to comply with the Worker Protection Standard.

## MONTANA PESTICIDE LAWS AND REGULATIONS

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) established the laws and regulations governing pesticides in the U.S. It also decides the actions necessary to enforce those laws and regulations. Individual states are given the main enforcement authority when they have adopted adequate state laws and regulations governing pesticides. While state laws and regulations may not be less restrictive, they may be more restrictive than the federal laws and regulations. The Montana Department of Agriculture has established a cooperative agreement with the Environmental Protection Agency (EPA) and has assumed the primary responsibility of regulating pesticides in Montana. The two main laws and regulations that govern the use of pesticides in Montana are the *Montana Pesticides Act (MPA)* and the *Administrative Rules of Montana (ARM)*.

**Under the Montana Pesticide Act.** Any pesticide used in Montana must be registered with the Montana Department of Agriculture, and any private applicator in Montana can lose their certification and may be fined if they commit any of the following:

- Sell or give away pesticides.
- Do not keep records of restricted-use pesticides or make false records of restricted-use applications.
- Apply or recommend that any pesticide be used in a manner inconsistent with the pesticide's labeling.

- Make false statements in regards to investigations involving pesticide misuse.
- Use pesticides in a manner inconsistent with the pesticide labels and labeling.

Under the Montana Pesticides Act, certified (licensed) private pesticide applicators can apply *restricted-use pesticides* to ground that they own, rent, or lease, apply *general-use pesticides* to ground that they own, rent, or lease and that of their immediate neighbor as long as it is not done commercially (no money is involved). Certified private pesticide applicators CANNOT: apply pesticides commercially; apply restricted-use pesticides on land that they do not own, rent, or lease; sell or give away pesticides; give their permit to non-family members or non-employees to buy restricted-use pesticides (RUP).

#### **Under the Administrative Rules of Montana.**

- #1) No applicator, family member or employee can purchase or use a restricted-use pesticide without a license in hand.
- #2) Restricted-use pesticides can be applied by a certified applicator's family members or employees but only under DIRECT supervision by the certified applicator.
- #3) All empty pesticide containers must be triple-rinsed, power rinsed, or rinsed by procedures approved by the Montana Department of Agriculture within 48 hours of the time that the container is rendered empty.
- #4) The rinse water from triple-rinsing can be used to as diluent for future pesticide applications as long as all pesticides being used are the same or compatible. Rinsewater can also be used to dilute pesticide mixes as long as the mixing of different pesticides is not prohibited by the label, and the application site is listed on the label.
- #5) Rinsewater (rinsate) can be temporarily stored for one year and the rinsewater container must be labeled with the following information: (1) date rinsewater was placed in container, (2) active ingredient, (3) company name, trade name, formulation and EPA Registration number for each product, (4) signal word of each pesticide, (5) name of the applicator.
- #6) Rinsewater must be used or disposed of in a manner that prevents any agricultural, environmental or human health problems.
- #7) All rinsed pesticide containers, except containers authorized for refilling, must be punctured or rendered useless, and disposed of within 90 days.
- #8) Any person rinsing pesticide containers must adhere to the Personal Protective Equipment (PPE) standards set forth on the labels of the pesticides being rinsed.
- #9) Pesticide containers cannot be burned in Montana.
- #10) All pesticide spills must be contained, confined and cleaned up.
- #11) Spills exceeding 5 liquid gallons of a spray mixture or 100 pounds of a dry formulation must be reported to the Montana Department of Agriculture.
- #12) Any applicator using water to mix, load or clean pesticide equipment must use a backflow device or other procedures (air gap, check valve, etc) to prevent contamination of water resources.

## **OTHER MONTANA LAWS GOVERNING PESTICIDE USE**

The Montana Agricultural Chemical Ground Water Protection Act (MACGWPA) is administered by both the Montana Department of Agriculture and Department of Environmental Quality. The Montana Department of Environmental Quality (DEQ) is responsible for the adoption of ground water quality standards for agricultural chemicals whose presence has been verified in ground water.

**Montana Water Quality Act (MWQA).** Under the Water Quality Act, it is unlawful to pollute any state waters, or to place or cause to be placed any wastes, in a location where they will cause pollution of state waters. The Montana Constitution defines state waters as all surface, underground, flood, and atmospheric waters within the boundaries of the state. Exempt from this definition of state waters are ponds or lagoons used for treating, transporting, or impounding pollutants; or irrigation or land application disposal waters used up and not returned to state waters. You would be in violation of the Montana Water Quality Act if pesticide runoff from a field that you just sprayed entered into a river or stream.

**Montana Solid Waste Laws.** The Montana Solid Waste Management Act prohibits the disposal of any solid waste in any location not licensed as a solid waste disposal site by the Montana Department of Environmental Quality (DEQ). Refuse is defined as "all putrescible and non-putrescible solid industrial wastes." In this context, some pesticides are included within the definition. Under the Montana Solid Waste Laws it is illegal to burn pesticide containers other than in an approved facility. Any person found violating this act is guilty of a misdemeanor.

## **Practice Questions for Chapter 11**

**(Answers are in the “Answers to Chapter Questions” section: pages 59 - 63)**

1. What is the main law in the U.S. that regulates pesticides in the U.S.?
2. How much time do you have before a private applicator must record their restricted use pesticide applications?
3. If you spilled 1 liquid gallon of pesticide you must report this to the Montana Department of Agriculture (True or False).
4. Rinsate can be temporarily stored for how long?
5. You are calibrated to spray 80 GPA, and you applied 8 gallons of the mixed product. You have just sprayed how many acres? Does this qualify as a spot application?
6. Time, month, day, and year are mandatory when recording restricted use Pesticides (True or False).
7. You must post all pesticide applications at a central location for your immediate family if they work on your farm operation (True or False).
8. What type of pesticide can you apply on land of your immediate neighbor with a restricted use license?
9. How long do you need to keep your records for your restricted use pesticide applications?
10. What part of the worker protection standards are mandatory regardless of family relation, employee status etc..

# ANSWERS TO CHAPTER QUESTIONS

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## ANSWERS TO CHAPTER 1 (MONTANA PRIVATE APPLICATOR CERTIFICATION)

1. Insecticides, Fungicides, and Herbicides
  2. Restricted Use Pesticides
  3. False: Only Restricted Use Pesticides
  4. 6 recertification credits
  5. 11
  6. by passing a closed book graded examination
  7. False: Only general use pesticides
  8. Contact your local county extension office
  9. \$40
  10. December 31<sup>st</sup>, 2011
- 

## ANSWER TO CHAPTER 2 (PEST MANAGEMENT)

1. Integrated Pest Management
  2. False: Economic threshold is the threshold at which a management option should be used to avoid the economic injury level.
  3. Biological
  4. Suppression, Eradication, and Prevention
  5. Cultural
  6. Diseases, Vertebrates, Invertebrates, Weeds
  7. True
  8. Resistance
  9. Non-target
  10. Regulatory
- 

## ANSWER TO CHAPTER 3 (PESTICIDES)

1. Active and Inert Ingredients
  2. Flowable
  3. Easy to handle and apply; Seldom clogs nozzles
  4. Hazard to non-target plants and animals. Easily absorbed through skin of plants and animals, and may cause rubber or plastic hoses, gaskets to deteriorate.
  5. D-A-L-E-S
  6. Product label, your local county extension agent, or your chemical distributor for more information on pesticide compatability.
  7. Adjuvants
  8. 5 – 7
  9. Control, Contain, and Clean the Spill
  10. False: 5 gallons or more
-

## ***Continued answers to Chapter Questions***

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### **ANSWER TO CHAPTER 4 (TOXICOLOGY)**

1. False (Acute)
  2. Caution
  3. Few Drops – 1 Teaspoon
  4. Chronic
  5. Eye, Dermal, Oral, Mouth (Ingestion or Inhalation)
  6. 15 minutes (minimum)
  7. False: Leave the field immediately. These may be the symptoms of pesticide poisoning prior to vomiting, loss of consciousness, and inability to breath (not worth the risk).
  8. Oral (from ingestion of improperly stored pesticides)
- 

### **ANSWER TO CHAPTER 5 (FIRST AID)**

1. Heat stress; Heat Stroke
  2. Product Label
  3. Wear your personal protective equipment (PPE)
  4. False: Initiate artificial respiration and call for emergency assistance.
  5. Never
  6. False: Read the Product Label
  7. Place individual in a cooler environment, rinse head with ambient temperature water, drink plenty of fluids, dial for emergency assistance, decontaminate as necessary.
  8. Flush eye with water for 15 minutes
  9. Product label
  10. False: (Heat stroke often may cause permanent damage to the bodies thermoregulatory system).
- 

### **ANSWER TO CHAPTER 6 (HOW TO PROTECT YOURSELF)**

1. Product label
  2. No: Even the pesticides with low toxicity recommend long sleeve shirts.
  3. Wear a disposable Tyvek suit
  4. False: Wear only laminated, sealed suits such as poly-laminate tyvek, PVC coated fabrics, coveralls made of nitrile.
  5. Neoprene, Viton, Nitrile, Rubber
  6. False: Never use cotton or straw materials that accumulate pesticide residues over time, and are seldom washed.
  7. No
  8. Hang on a dryline for 24 hr in sunlight
  9. Mixing pesticides
  10. Have a separate washer for pesticides only.
-



## *Continued answers to Chapter Questions*

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### **ANSWER TO CHAPTER 7 (ENVIRONMENTAL CONCERNS WITH PESTICIDES)**

1. Degradation, Chemical degradation, photodegradation
  2. Runoff, leaching, residue on clothes, spills leaks including backsiphoning
  3. Smaller droplets or volatilization: worsens drift
  4. Physical and chemical / vapor drift
  5. Keep hose above water line or install a backflow device.
  6. True
  7. Droplet size, spray tip height, operating speed, wind speed, temperature/humidity, pesticide properties, and spray output volume.
  8. Preventing a pesticide surplus
  9. 3 times
  10. False: Absolutely not
- 

### **ANSWERS TO CHAPTER 8 (CALIBRATION & MIXING)**

1. A sprayer applies 3 gallons of liquid to a calibration strip that is 66 feet wide and 66 feet long. What is the application rate of this sprayer in Gallons Per Acre (GPA)?  
  
1<sup>st</sup>: First, convert to square feet.  $\rightarrow 66 \times 66 \text{ ft} = \underline{4,356 \text{ square feet}}$ .  
2<sup>nd</sup>: Convert square feet to acres.  $\rightarrow 4,356 \div 43,560 = \underline{0.10 \text{ acres}}$   
3<sup>rd</sup>: Then make the calculation:  $3 \text{ gallons} \div 0.10 \text{ acres} = \underline{30 \text{ GPA}}$
  2. A backpack sprayer applies 96 ounces to a test strip that is 20 feet wide and 20 feet long. What is the application rate of this sprayer in Gallons Per Acre (GPA)? Hint: You will need to convert to gallons. Round up your calculations to the nearest whole number. Hint: There are 128 ounces in a gallon and 43,560 square feet in an acre.  
  
1<sup>st</sup>: Convert to square ft.  $\rightarrow 20 \text{ ft} \times 20 \text{ ft} = \underline{400 \text{ square ft}}$   
2<sup>nd</sup>: Convert square ft to acres  $\rightarrow 400 \text{ square ft} \div 43,560 \text{ square ft} = \underline{0.0092 \text{ acres}}$   
3<sup>rd</sup>: Convert ounces to gallons to get GPA  $\rightarrow 96 \text{ ounces} \div 128 \text{ ounces per gal} = \underline{0.75 \text{ gallons}}$   
4<sup>th</sup>: Then make the calculation:  $0.75 \text{ gallons} \div 0.0092 \text{ acres} = \underline{81.5 \text{ or } 82 \text{ GPA}}$
  3. A broadjet sprayer has a swath width of 40 feet. A test strip distance of 200 feet is established. The strip is sprayed with water and it is determined that it takes 5 gallons of water to spray the test strip. What is the application rate of the sprayer in Gallons Per Acre (GPA)? Hint: There are 43,560 square ft in an acre. Round you answers to the nearest whole number.  
  
1<sup>st</sup>: Convert to square ft  $\rightarrow 40 \text{ ft} \times 200 \text{ ft} = \underline{8,000 \text{ square ft}}$   
2<sup>nd</sup>: Convert square ft to acres  $\rightarrow 8,000 \text{ square ft} \div 43,560 \text{ square ft} = \underline{0.184 \text{ acres}}$   
3<sup>rd</sup>: Then make the calculation:  $5 \text{ gallons} \div 0.184 = \underline{27.12 \text{ or } 27 \text{ GPA}}$
-

## Continued answers to Chapter Questions

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4. You need to spray a 16 acre pasture. Your sprayer's application rate is 25 gallons per acre (GPA). You will be using a pesticide at a labeled rate of 1.5 pints per acre. How many pints will you add to the spray tank to spray this 16-acre pasture?

1<sup>st</sup>: Simply multiply the 16 acres x 1.5 pints per acre → 16 acres x 1.5 pints = 24 pints.  
2<sup>nd</sup>: To convert pints to gallons → 24 pints ÷ 8 pints per gallon = 3 gallons

5. Your sprayer applies 0.46 gallons of water over 400 square feet. You are spot treating for weeds with a restricted use herbicide. By law, you need to stop and fill out your records when you have sprayed 1/10<sup>th</sup> of an acre (0.10 acres). How many gallons of a pesticide / water solution will you need to mix to treat 0.10 acres. Hint: There are 43,560 square ft in an acre.

*Answer: The question is asking how much solution you need in your spray tank. You are given information to determine the GPA for your sprayer and you are given the acres you need to spray, 0.10 acres. Remember, the formula Volume in gallons ÷ GPA = Acres? To find the answer, first determine GPA and then back multiply.  
Remember: 400 square ft is 0.0092 acres from problem #2.*

1<sup>st</sup>: Determine GPA: 0.46 gallons ÷ 0.0092 acres = 50 GPA  
2<sup>nd</sup>: Back multiply 50 GPA x 0.10 acres = 5 gallons of solution (pesticide with water).

If you are spot treating for weeds using a restricted use herbicide, then for every 5 gallons of solution that you were spraying out, you will need to stop and fill out your records. You would note this as a spot treatment.

6. You need to spray an area that is 100 ft by 100 ft with a sprayer that applies 45 Gallons Per Acre (GPA). The label directs you to use 1.5 quarts per acre. How many ounces of the pesticide will you add with water to completely spray this area? Hint: There are 32 ounces in a quart.

1<sup>st</sup>: Determine acres by first obtaining square ft → 100 ft x 100 ft = 10,000 square ft  
2<sup>nd</sup>: Then convert square feet to acres → 10,000 square ft ÷ 43,560 square ft = 0.23 acres  
3<sup>rd</sup>: Determine volume needed in tank to spray 0.23 acres → 45 GPA x 0.23 acres = 10.35 gal  
4<sup>th</sup>: Verify acres with calibration → 10.35 gallons ÷ 45 GPA = 0.23 acres  
5<sup>th</sup>: Determine how much to add to 10.35 gallons of water  
→ 0.23 acres x 1.5 quarts (48 ounces) = 11.04 or 11 ounces in 10.35 gal of water

Note: 10.35 gallons is 10 gallons plus 45 ounces → 0.35 gallons x 128 ounces in a gallon

## *Continued answers to Chapter Questions*

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### **ANSWERS TO CHAPTER 9 (READING & UNDERSTANDING THE PESTICIDE LABEL)**

1. On the product label: Section titled “Precautionary Statements”
  2. EPA registration # - 62719-6
  3. No: Section titled Environmental Hazards
  4. 20 – 100 GPA
  5. Agricultural Use Requirements
  6. Active
  7. General or Restricted
  8. True
  9. Signal Word
  10. 2 quarts per acre
- 

### **ANSWERS TO CHAPTER 10 (HOW TO AVOID MAKING COSTLY MISTAKES)**

1. Hands and forearms
  2. Wear goggles
  3. After every application: Immediately
  4. Post Harvest Interval
  5. High wind, low humidity, high temperature
  6. False: The owner of the pesticide is responsible
  7. Respirator, Chemically Resistant Apron & Gloves, Goggles, Long Sleeve Shirt, Long Pants
  8. In an unsprayed area
  9. Nozzles which spray medium to large droplets
  10. Lower pesticide efficacy by binding to pesticides, also plugs nozzles and screens
- 

### **ANSWERS TO CHAPTER 11 (PESTICIDE LAWS AND REGULATIONS)**

1. FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act)
  2. 2 weeks
  3. False: 5 gallons
  4. 1 year
  5. 0.10 acres or 1/10<sup>th</sup> of an acre: yes, spot treatment
  6. False: Time is not mandatory
  7. False: Only workers that are not your immediate family
  8. General Use Only
  9. 2 years
  10. Parts On the product Label
-



STATE OF MONTANA  
DEPARTMENT OF AGRICULTURE

AGRICULTURAL SCIENCES DIVISION

APPLICATION FOR A FARM  
APPLICATOR SPECIAL USE PERMIT

For Year Ending December 31, 20

License No.

AGENTS USE ONLY

Initial Exam Score .....  
Initial Training ..... Yes No  
If Yes Quiz Score .....  
Recert Training ..... Yes No  
Recert Exam Score .....  
Agent Signature: \_\_\_\_\_

PLEASE PRINT OR TYPE

APPLICANT NAME \_\_\_\_\_  
Last First Middle Initial

TELEPHONE \_\_\_\_\_  
Area Code Phone Number

MAILING ADDRESS \_\_\_\_\_  
Street or Box No. City County of Residence State Zip

\$50.00 FEE FOR A 5 YEAR PESTICIDE FARM APPLICATOR LICENSE

\_\_\_\_\_ AGRICULTURAL PEST CONTROL (Includes Restricted: Insecticides, Herbicides, Fungicides, Rodenticides, etc.)

\_\_\_\_\_ SODIUM CYANIDE CAPSULES FOR USE IN M-44 DEVICES (Special training is required for this use)

\_\_\_\_\_ AQUATIC HERBICIDES (Special training is required for this use)

\_\_\_\_\_ LIVESTOCK PROTECTION COLLAR (Special training is required for this use)

OPTION: I HEREBY REQUEST THE DEPARTMENT TO ISSUE TWO (2) CREDENTIALS FOR THE PURCHASE AND USE OF RESTRICTED PESTICIDES ON LANDS UNDER MY ADMINISTRATION FOR MY FAMILY MEMBERS OR EMPLOYEES.

I hereby certify that the information on this application is true and correct, and agree to comply with all the provisions of the Montana Pesticides Act, and rules adopted thereunder.

DATE \_\_\_\_\_ SIGNATURE \_\_\_\_\_

MAIL TO: DEPARTMENT OF AGRICULTURE  
AGRICULTURAL SCIENCES DIVISION  
P.O. BOX 200201  
HELENA, MT 59620-0201

DEPARTMENT OFFICE USE ONLY

DO NOT WRITE IN THIS SPACE

DATE RECEIVED: \_\_\_\_\_  
AMOUNT RECEIVED: \_\_\_\_\_  
CK. or M.O. No.: \_\_\_\_\_  
COLLECTION REPORT: \_\_\_\_\_  
COLLECTION DATE: \_\_\_\_\_

PRIVATE APPL \_\_\_\_\_  
DISPOSAL \_\_\_\_\_  
COUNTY ( ) \_\_\_\_\_  
M.S.U. \_\_\_\_\_

