

## **Safe and Effective Use of Pest Controls for Home Grounds and Animals**

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### **How to Use this Guide**

This 2009 Virginia Pest Management Guide provides the latest recommendations for the control of diseases, insects, and weeds for Home Grounds and Animals. This guide was written by the faculty in the Department of Entomology and the Department of Plant Pathology, Physiology, and Weed Science. The authors are located in the College of Agriculture and Life Sciences at Virginia Tech and the outlying Agricultural Research and Extension Centers.

The controls listed in this guide are mostly chemical in nature. Usually they are combined with some type of alternative control to be used in an integrated fashion with chemicals or in place of synthetic chemicals. The chemical controls in this guide are based on the latest pesticide label information at the time of writing the document. Because pesticide labels can change, you should read the label directions carefully before buying and using any pesticide. Regardless of the information provided here, you should always follow the latest product label when using any pesticide.

### **Help Is as Close as Your Local Extension Office**

<http://www.ext.vt.edu/offices> – or in the blue (government) pages of your telephone directory

Virginia Tech and Virginia State University are your land-grant universities. The land-grant university system was established by the 1862 and 1890 Morrill Acts which provided federal land that was sold to purchase a site and support the future operation of each state's "land-grant" college and experimental farm. The land-grant universities were created to benefit all people through their vast research and educational resources. To provide this opportunity to all people in all parts of the states, the land-grant university system was extended into each locality through the outreach programs established as the Cooperative Extension Service in 1914.

The unique Cooperative Extension partnership that exists between the USDA, the Commonwealth, and your locality means that individuals, families, businesses, institutions, and your community can find answers to many of their questions through your local Extension agent.

### **How Important Is Your Pest Problem?**

A pest is defined as anything that causes a nuisance, blight, or annoyance. Annoyances associated with pests include such examples as the discomfort caused by your pet's fleas, the destruction of your food supply by pantry pests, the overgrowth of your lawn and garden by weeds, the loss of your favorite shade tree to blight, the health hazard associated with ticks in your backyard, or the structural damage to your home caused by wood-infesting insects.

The first question you must ask yourself about any pest problem is whether it is worth controlling in the first place. These annoyances vary in their importance. The damage to your home is critical because it can be quite expensive and even dangerous; it demands a quick, effective control. Other pest-related annoyances are not as important because they might not be as costly or dangerous. Such low-priority problems don't always demand a quick and effective control. Some can even be ignored or eliminated by replacing the host plant. You must ask yourself—how important is your pest problem, and is it worth the effort to control it?

### **Can You Identify the Pest?**

If you decide that you must take some action, then you must first identify the pest you are trying to control. In most cases, you can't control a pest properly and effectively without properly identifying it. Most people can recognize a fly or dandelion, and by using a self-help book or other reference you can identify many other insects and weeds that inhabit your surroundings. For other pests, identification can be very difficult. This is especially true for the organisms and conditions which cause plant diseases. Some aren't even caused by living organisms. For example, some plant diseases are caused by non-living (abiotic) conditions such as air pollution, chemicals, heat, drought, excess water, cold, or poor site conditions.

If you decide that you need help with a pest problem, your Extension agent can help you identify the cause of your problem and prescribe a control. If the problem is especially hard to identify, your agent has the resources of Virginia Tech and Virginia

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State available to provide assistance. A specimen can be sent to Blacksburg for identification. In addition, your plants and soil can be tested to determine their nutrient balance. Once you have identified the pest problem, you can then attempt to control it if you so desire.

### Who Should Apply the Control?

Your next important choice is to decide who is going to control your pest problem. Is the job simple enough and are you confident enough to apply the control yourself, or should you hire someone? If you decide to control the pest yourself, you probably can skip the next section of this guide. But if you decide to hire a contractor, whether they apply herbicides to your lawn, or spray for roaches in your house, you should read the next section. For those “do-or-die” do-it-yourselfers, you should seriously consider hiring a professional if the job involves controlling wood infesting pests in your home or spraying trees in your backyard. These and some other jobs take special equipment and knowledge. There is a great likelihood that you will **not** be successful at applying controls to these areas—it could even cost you much more if you attempt it.

### How to Choose a Pest Control Company

Termites are chomping away at your house. Roaches are taking over your kitchen. Mouse droppings dot your dresser drawer. Gypsy moths are eating trees in your front yard. Your lawn needs a major overhaul. You’ve got a pest control problem and you’ve decided that it’s too serious for you to solve on your own. You’ve decided you need a professional applicator. If you find yourself in a situation like this, what can you do to be sure that the pest control company you hire will do a good job? Here are some questions you can ask:

1. ***Does the company have a good track record?***

Don’t rely on the company salesperson to answer this question; research the answer yourself. Ask your neighbors and friends; have any of them dealt with the company before? Were they satisfied with the service they received? Call the Better Business Bureau, Sheriff’s Office, the Virginia Department of Agriculture and Consumer Services (VDACS) - Office of Consumer Affairs or the VDACS Office of Pesticide Services (listed in the reference tables to follow), to check if they have received any complaints about the company.

2. ***Does the company have insurance? What kind of insurance? Can the salesperson show some documentation to prove the company is insured?***

Contractor’s general liability insurance, including insurance for sudden and accidental pollution, gives you as a homeowner a certain degree of protection should an accident occur while pesticides are being applied in your home. Contractor workmen’s compensation insurance can also help protect you should an employee of the contractor be injured while working in your home.

In Virginia, pest control companies are required to carry liability insurance. You should never contract with a company that is not insured.

3. ***Is the company licensed?***

In Virginia, all pest control companies are required to carry a pesticide business license. All employees are required to be trained and certified as either registered technicians or commercial applicators. In addition, these applicators are required to be recertified every two years. The law requires that a certified commercial applicator be available to supervise the application of pesticides in your home. This direct supervision requirement means that the supervisor must be in direct contact with the applicator, but he or she does not have to be on site.

Ask the company manager and the applicator to show you these credentials; both their pesticide business license and their current pesticide applicator’s certificate before signing the contract.

4. ***Is the company affiliated with a professional association?***

As a member of a professional association, these companies can keep up-to-date on the latest information on pest control methods, safety, training, research, and regulation. Most associations also have a code of ethics that members agree to abide by. The fact that a company chooses to affiliate itself with a professional association is evidence that they are concerned about quality and professionalism in their work.

For pest control operators (PCO’s or exterminators) these associations include the National Pest Management Association, the Virginia Pest Management Association, and several regional groups. Lawn care companies also belong to many local and regional associations. The national and state associations affiliated with these groups are the Professional Lawn Care Network (PLANET) and the Virginia Turfgrass Council (VTC). The Virginia Nurserymen’s Association is also affiliated with many landscape firms who apply pesticides for hire in Virginia. The addresses of these groups are listed in the reference tables to follow.

5. *Does the company stand behind its work? What assurances does the company make?*

You should think twice about dealing with a company unwilling to stand behind its work. Be sure to find out what you must do to keep your part of the bargain. For example, in the case of termite control treatments, a guarantee could be invalidated if you make structural changes to the treated building without notifying the pest control company. In addition, many companies require an annual inspection or maintenance contract to keep the guarantee valid. Read the fine print in your contract and ask questions.

6. *Is the company willing, and able, to discuss the treatment proposed for your home?*

Selecting a pest control service is just as important as selecting other professional services. Look for the same high degree of competence you would expect from a doctor or lawyer. The company should inspect your premises and outline a recommended control program, including what pests are to be controlled; the extent of the infestation; what pesticide formulations will be used in your home and why; what methods will be used in the application; what alternatives could be used instead; what special instructions you should follow to reduce your exposure to the treatment (such as vacating the house, emptying cupboards, removing pets, when you can reenter a treated area, etc.); and what you can do to minimize your pest problems in the future.

Contracts should be developed jointly with the customer. Any safety concerns should be noted and reflected in the choice of pesticides to be used. These concerns should include the health of occupants (including allergies), age of occupants (infants and elderly), or pets. You may want to get two to three bids from different companies—by value, not price. What appears to be a bargain may merit a second look. Don't always settle on the lowest bid, look for quality.

Even after you hire a company, you should continue to monitor the work closely and evaluate results. If you have any reason to believe that something has gone wrong with the pesticide application, contact the company and discuss it with them. If you are not satisfied and continued negotiation does not work, contact the VDACS Office of Pesticide Services for help. They are listed in the reference tables to follow. Don't let down your guard in these matters, document all details, and ask detailed questions. Often little misunderstandings about the outcome of a job can end up in court or can cause great distress because the parties involved didn't communicate properly at the onset. Make sure you understand all the details before you sign the contract, especially those concerning the risks of using pesticides.

Remember, your risk is related to the toxicity of the pesticide vs. the potential for exposure. Just because a pesticide is being sprayed in your home doesn't mean you are at great risk, if you minimize your exposure to the chemical. Make sure you know what is being done to minimize this risk before you commit to the treatment. If you need details on the chemicals being used, ask your contractor to review the product labeling and Material Safety Data Sheets (MSDSs) with you. If the contractor refuses, you should look elsewhere for service.

## **How do You Choose a Pest Control?**

If you have chosen to do the work yourself, you should know a little about choosing a pest control. Around the home, pests are often controlled without applying some of the common principles of pest control. Choosing a pest control can be a confusing and often a critical decision in the health of your plants and animals. When considering a pest control, you should follow these important rules:

- 1) Control a pest only when it is causing or is expected to cause more damage than is reasonable to accept.
- 2) Use a control strategy that will reduce the pest numbers to an acceptable level.
- 3) Cause as little harm as possible to everything except the pest.

## **What Are Your Pest Control Goals?**

Whenever you try to control a pest, you will want to achieve one of these three goals or a combination of them:

- 1) **prevention** - keeping a pest from becoming a problem. Prevention is possible where pests are predictable under certain circumstances.
- 2) **suppression** - reducing pest numbers or damage to an acceptable level. Suppression is a common goal in many situations. The intent is to keep the number of pests below an acceptable level to prevent damage, and;
- 3) **eradication** - destroying an entire pest population. Eradication is very difficult and often impossible in outdoor situations. It is usually the desired goal for indoor infestations.

Often, prevention and suppression are applied together to control a pest.

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### **Avoiding Harmful Effects**

Pest control involves more than simply identifying a pest and using a control measure. The treatment site, whether it is outdoors or inside a structure, usually contains other living organisms (such as people, animals, and plants) and non-living surroundings (such as air, water, structures, objects, and surfaces). All of these could be affected by the pest control measures you choose. Unless you consider the possible effects on the entire environment where the pest exists, your pest control effort could cause harm or lead to continued or new pest problems. Rely on your good judgment and when pesticides are part of the strategy, on the pesticide labeling.

Most treated sites are disrupted to some degree by pest control strategies. The actions of every type of organism or component sharing the site usually affect the actions and well-being of many others. When the balance is disrupted, certain organisms may be destroyed or reduced in number, and others—sometimes the pests—may dominate.

### **What about Integrated Pest Management (IPM)?**

Integrated Pest Management (IPM) is the combination of appropriate pest control tactics into a single plan (strategy) to reduce pests and their damage to an acceptable level. Using many different tactics to control a pest problem tends to cause the least disruption to the living organisms and non-living surroundings at the treatment site. Relying only on pesticides for pest control can cause pests to develop resistance to pesticides, can cause outbreaks of other pests, and can harm surfaces and non-target organisms. With some types of pests, use of pesticides as the only tactic will achieve very poor control. To solve pest problems, you must:

- identify the pest or pests and determine whether control is warranted for each,
- determine your pest control goal(s),
- know what control tactics are available,
- evaluate the benefits and risks of each tactic or combination of tactics,
- choose a strategy that will be most effective and will cause the least harm to people and the environment,
- use each tactic in the strategy correctly, and
- observe local, State, and Federal regulations that apply to the situation.

The strategy you choose will depend on the pest you have identified and the kind and amount of control you need.

### **Can You Take Advantage of Natural Controls?**

Some natural forces act on all organisms, causing the populations to rise and fall. These natural forces act independently of humans and may either help or hinder pest control. You may not be able to alter the action of natural forces on a pest population, but you should be aware of their influences and take advantage of them whenever possible. Natural forces that affect pest populations include: climate, natural enemies, natural barriers, availability of shelter, and supplies of food and water.

#### **Climate**

Weather conditions, especially temperature, day length, and humidity affect pest activity and rate of reproduction. Pests may be killed or suppressed by rain, freezing temperatures, drought, or other adverse weather. Climate also affects pests indirectly by influencing the growth and development of their hosts. A population of plant-eating pests is related to growth of its host plants. Unusual weather conditions can change normal patterns so that increased or decreased damage results.

#### **Natural Enemies**

Birds, reptiles, amphibians, fish, and mammals feed on some pests and help control their numbers. Many predatory and parasitic insect and insect-like species feed on other organisms, some of which are pests. Pathogens often suppress pest populations. Enhancing your backyard to attract birds and other natural enemies of insects and other pests can help control these pests on desirable plants.

#### **Geographic Barriers**

Features such as mountains and large bodies of water restrict the spread of many pests. Other features of the landscape can have similar effects.

## **Food and Water Supply**

Pest populations can thrive only as long as their food and water supply lasts. Once the food source—plant or animal—is exhausted, the pests die or become inactive. The life cycle of many pests depends on the availability of water.

## **Shelter**

The availability of shelter can affect some pest populations. Overwintering sites and places to hide from predators are important to the survival of some pests. The rocks and logs in and around your garden are a good example of where some pests, such as slugs and snails, can seek shelter to protect themselves from the sun and predators.

## **What Are Applied Controls?**

Unfortunately, natural controls often do not control pests quickly or completely enough to prevent unacceptable injury or damage. Then other control measures must be used. Those available include:

- host resistance
- biological control
- cultural control
- mechanical control
- sanitation
- chemical control

**Host resistance** is the ability of a plant or animal to resist an attack by a pest. Some plants, animals, and structures resist pests better than others. Some varieties of plants, wood, and animals are resistant to certain pests. Use of resistant types, when available, helps keep pest populations below harmful levels by making conditions less favorable for the pests. Host resistance works in three ways: 1) chemicals in the host repel the pest or prevent the pest from completing its life cycle; 2) the host is more vigorous or tolerant than other varieties and thus less likely to be seriously damaged by pest attacks, and; 3) the host has physical characteristics that make it more difficult to attack.

**Biological control** involves the use of natural enemies—parasites, predators, and pathogens. You can supplement this natural control by releasing more of a pest's enemies into the target area, or by introducing new enemies that were not in the area before. Biological control usually does not eradicate a pest. The degree of control fluctuates. There is a time lag between a pest population's increase and a corresponding increase in natural control. But, under proper conditions, sufficient control can be achieved to eliminate the threat to the plant or animal to be protected. Biological control also includes methods by which the pest is biologically altered, as in the production and release of large numbers of sterile males and the use of pheromones (*sex attractants*) or juvenile hormones. Pheromones can be useful in monitoring pest populations. Placed in a trap, for example, they can attract the insects in a sample area so that pest numbers can be estimated. Pheromones also can be a control tool. Sometimes a manufactured copy of the pheromone that a female insect uses to attract males can be used to confuse males and prevent mating, resulting in lower numbers of pests. Applying juvenile hormones to an area can reduce pest numbers by keeping some immature pests from becoming normal, reproducing adults.

**Cultural controls** alter the environment, the condition of the host plant or animal, or the behavior of the pest to prevent or suppress an infestation. They disrupt the normal relationship between the pest and the host plant or animal and make the pest less likely to survive, grow, or reproduce. Common cultural practices include: rotating crops, cultivating the soil, varying the time of planting and harvesting, planting trap crops, adjusting row width, and pruning, thinning, and fertilizing cultivated plants.

**Mechanical controls** also alter the environment, the host plant or animal, and the pest through use of physical controls. Traps, screens, barriers, fences, nets, radiation, and electricity sometimes are used to prevent the spread of pests. Lights, heat, and refrigeration can alter the environment enough to suppress or eradicate some pest populations. Altering the amount of water, including humidity, can control some pests, especially insects and disease agents.

**Sanitation** practices help prevent and suppress some pests by removing the pests themselves or their sources of food and shelter. Urban and industrial pests can be reduced by improving cleanliness, eliminating pest harborage, and increasing the frequency of garbage pickup. Management of pests attacking domestic animals is enhanced by good manure management practices. Carryover of agricultural pests from one planting to the next can be reduced by removing crop residues, such as transplants and decontaminating equipment, animals, and other possible carriers before allowing them to enter a pest-free area or leave an infested area. The proper design of food-handling areas can reduce access and shelter for many pests.

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**Chemical control** (*the use of pesticides*) to destroy pests, control their activities, or prevent them from causing damage is commonplace. Some pesticides either attract or repel pests. Chemicals that regulate plant growth or remove foliage also are classified as pesticides. Disinfectants and other common household chemicals are classified as pesticides as well. Pesticides are generally the fastest way to control pests. In many instances, they are the only tactics available.

### Some Important Points about Pesticides

If you use this guide, then you most likely will use a chemical control. Most of the control recommendations in this guide are chemical because they have been shown through agricultural research to work in a safe, effective, and efficient manner. This is changing and is evident in some parts of the recommendations where alternative controls have been added as agricultural research shows that they can work under Virginia conditions. The authors will continue to add alternative controls to this guide as this information becomes available from research results produced by Virginia Tech, Virginia State and other nearby test sites.

The biggest advantage of using a pesticide is the speed at which the control works. In addition, pesticides are often the only controls available to the average consumer. Very often, home pest control products are purchased from local department and hardware stores. For indoor home pest controls, the grocery store is one of the biggest outlets for these products. The mainstream market is not yet fully open to alternative non-chemical controls. This is mostly because alternatives are not as easily packaged and marketed, may be more expensive, are not as quickly accepted by the public, and can have a short shelf life. There are outlets, mostly through mail order, to alternative controls. Some local garden centers are now stocking “organic” and other alternatives to “man-made” chemical pest controls. Information on the mail order companies specializing in these alternatives can be obtained from your local garden center or Extension office. However, some of the most effective alternative controls are not for sale at any store—they are simple remedies, mentioned earlier, that you can employ without special means. You have the ability to apply cultural controls, mechanical controls, sanitation, and host resistance. You should apply these powerful controls before or along with appropriate chemical controls to reduce the use of pesticides around your home.

Although pesticides are a controversial subject and are often viewed in a negative light by the general public, they do have their place in agriculture. Those of us who condemn all uses of pesticides and those of us who quickly decide to apply these chemicals without consideration of alternatives are guilty of not weighing the issue properly. There are situations where pesticides are necessary. There are just as many cases where they don’t need to be used as a “magic cure-all.” This is especially true around the home. In many cases, home pest problems can be solved without the use of pesticides.

The rest of this section is directed towards the safe and proper use of pesticides for those who have weighed the information so far and decided to use a chemical control. There are sections on the label, on environmental hazards, on prevention of exposure, on handling emergency situations, and on handling pesticides. In addition, there are a number of tables and sources listed to help you employ these chemicals more safely and efficiently. If there is any piece of advice that you should remember from using this guide, it is to **read the pesticide label**. The label is the key to the proper and safe use of all pesticide products.

### The Pesticide Label

If you decide to use a pesticide, you will most likely purchase these chemicals from a local outlet. Before you go to this outlet, please make sure you know what you are doing. You should already know what pest you are trying to control, how you are going to apply a pesticide (*the types of equipment and methods available to you for application*), and have established how important it is to control the pest.

With these factors in mind, you can go to your supplier and either ask for help or scan the shelves for the proper control. If you ask for help, make sure you read the product label carefully before you buy the chemical and not just go on the word of a clerk. There have been many situations where a person asked for advice at the store and came home with the wrong chemical. This is especially critical when you are shopping for a pesticide to apply on plants grown for food. Read the product label before you buy the pesticide to make sure you can use the chemical to control your pest problem. Is the product labeled for your crop or animal? If not, you cannot use it legally or safely. Read carefully for when to apply, how much to apply, and what type of equipment is needed to apply the chemical.

## What Formulation Is Best for Your Situation?

Pesticide products are usually sold in concentrated forms which require mixing before use. Concentrates are generally less expensive per treatment than ready-to-use formulations, but present other problems. Concentrates include wettable powders (W or WP), emulsifiable concentrates (E or EC), soluble powders (SP), and flowables (F). Do you have the means to mix, pour, and apply a concentrate safely? If you buy too much, which is usually the case with most homeowners using concentrates, keep in mind that you might have to store the toxic concentrate in your home indefinitely if you can't use the chemical within a short period of time. If you store many pesticides longer than a few years, they will deteriorate and become useless (yet still toxic). Are you prepared to possibly pay to have your chemical disposed of through a hazardous waste service? Although sometimes permitted by law, if you throw the waste chemical into the garbage you could create a hazard to others and the environment.

Other formulations are sold ready-to-use. These can be applied directly without mixing and include: solutions (S), aerosols (A), dusts (D), pellets (P), granules (G), and baits (B). You should purchase only enough pesticide to use in one season. Look for products with reduced packaging that are low in toxicity, that present low hazards to the environment, and which allow you to use them without having to handle, store, or dispose of concentrates. In addition, pick products which won't require you to purchase expensive application equipment in order to apply them. Some products are now sold in single dose packaging, which eliminates the problem of storing excess pesticide concentrates.

## What are the Parts of the Product Label?

The most important piece of information available to you is the pesticide product label. It is a legal document and is required to list all pertinent information about the product. You should become familiar with the different parts of the pesticide label. The information to follow corresponds to the numbers on the sample label to follow.

- 1.) **Product Name:** includes the name of the manufacturer (ChemCo), the product name (NoPest) and the function of the product (Insect Killer).
- 2.) **Ingredient Statement:** includes the amount of active ingredient by percent (8.0%) of the total product and identifies the ingredients by common name (delathion) and chemical name (1,2 phospho-(5)-4-chloromethane).
- 3.) **Toxicity Signal Word:** identifies the toxicity signal word (warning) which indicates that this product is moderately toxic to humans exposed to the chemical.
- 4.) **EPA Registration Number** (999-000) is a code number that identifies the product by number according to EPA's product registration database. The first number (999) is specific to the company and the second (000) identifies the product. This number is very helpful when identifying the product if other parts of the label become unreadable.
- 5.) **Precautionary Statements:**
  - Hazards to Humans and Domestic Animals:** warns the user how to protect themselves, what the hazards are to the eyes, the skin, the respiratory system or if swallowed. The label also prescribes first aid measures and information for a physician (Note to Physician). This information should be provided to your doctor if you are poisoned.
  - Environmental Hazards:** warn you about potential hazards to wildlife, to water from runoff and leaching, and to air from drift.
  - Physical or Chemical Hazards:** warn you that the product is flammable and may cause a fire if not handled properly.
- 6.) **Directions for Use:** indicate it is a violation of Federal (and State) law to use the product in a manner inconsistent with its label directions. Violation can mean fines and criminal penalties. It can also mean possible civil law suits from injured parties. Use directions also tell you how much to use, on what pest, and on what crops. These statements are critical since the product cannot be used on any other crops, especially food crops. Also the rates are very specific to the product. They should be followed closely. The label also warns you not to apply the product to unusual varieties including several named in a special note. Application on these varieties could injure or kill these plants.
- 7.) **Storage and Disposal:** indicates how to properly store the product and how to handle the product for disposal.
- 8.) Provides the **name and address of the manufacturer** and the **EPA Establishment Number** (EPA Est. No. 999-VA-1) which is important if the product is defective. It indicates which plant produced the product. Some products also include a lot number on the label.

# CHEMCo NoPest Insect Killer **1**

Makes up to 8 Gallons Spray

**Controls:** Aphids, Mites, Thrips, Mealybugs, Whiteflies, Scale, and many other listed pests on Roses, Flowers, Ornamentals, Shrubs, and Trees.

**Active Ingredients:** delathion (1,2 phosphor-(5)-4-chloromethane) ..... **8.0%**  
**Inert Ingredients:** ..... **92.0%**

**KEEP OUT OF REACH OF CHILDREN**

## WARNING **3**

Net Contents 8 FL. OZ.

**4** EPA Reg. No. 999-000

### Precautionary Statements **5**

#### HAZARDS TO HUMANS & DOMESTIC ANIMALS

**WARNING:** Applicator should wear long-sleeved shirt, long pants, goggles, chemical-resistant gloves, socks, and shoes. Causes eye irritation. Do not get in eyes. Avoid contact with skin or clothing. Harmful if swallowed. Avoid breathing vapor or spray mist. Wash thoroughly after handling. In case of eye contact, immediately flush eyes with fresh water for 15 minutes and get medical attention. If swallowed, promptly drink a large quantity of water and induce vomiting. Get medical attention immediately.

**Note to Physician:** Emergency Information—call (800) 555-5555. This product contains a cholinesterase inhibitor. If signs and symptoms of cholinesterase inhibition are present, atropine is antidotal. 2-PAM may also be given in conjunction with atropine.

**ENVIRONMENTAL HAZARDS:** This pesticide is toxic to fish. Use with care when applying in areas adjacent to any body of water. Keep out of lakes, ponds, and streams. Do not apply when weather conditions favor runoff or drift from treated areas. Do not contaminate water by cleaning equipment or disposal of wastes.

**PHYSICAL OR CHEMICAL HAZARDS:** Flammable. Keep away from heat or open flame.

**DIRECTIONS FOR USE:** It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

**READ ENTIRE LABEL. USE STRICTLY IN ACCORDANCE WITH LABEL PRECAUTIONS AND DIRECTIONS.**

**HOW TO USE:** Mix thoroughly and spray entire plant, covering both upper and lower leaf surfaces. This product is designed for outdoor use only by home gardeners. It has not been tested on rare unusual varieties; therefore, when these plants are present, it is advisable to test on a few plants before spraying large numbers. **Do not apply to plants to be used for food or feed. Rate to apply – Aphids and Grasshoppers on Roses, Flowers, Shrubs, and Trees as Listed:** Apply 2 TBSP. (1 fl. oz.) to 1 gal. water. Spray as aphids appear. Repeat if infestation occurs.

**All other Listed Pests on Roses, Flowers Shrubs, and Trees as Listed:** Apply 3 TBSP (1.5 fl. oz.) to 1 gal water. Spray when insects or mites are present or feeding damage is first noticed. Repeat if re-infestation occurs. For Mealybugs, Flower Thrips, Whiteflies, Mites, Scales, and other hard to control pests, spray 2-3 times about 7-10 days apart. Clean sprayer after each use by flushing with water. Do not use household bleach as a cleaning agent.

**CONTROLS:** Aphids, Bagworms, Beet Armyworm, Birch Leafminer, Budworms, Grasshoppers, Gypsy Moth (larvae), Holly Leafminer, Lacebugs, Leafrollers, Leafhoppers, Mealybugs, Sawflies, Scales (crawlers), Stinkbugs, Thrips, Tent Caterpillars, Two-spotted Spear Mites, Whiteflies.

**PLANTS:** Ageratum, Alyssum, Arbovitae, Aster, Azalea, Birch, Boston Ivy, Bottlebrush, Clendula, Camellia, Cottonwood, Crapemyrtle, Marigold, Oak, Petunia, Pyracantha, Rose, Snapdragon, Spruce, Stock, Yew, Zinnia.

**NOTE:** Do not apply to American Elm, Flowering Crabapple, Sugar Maple, Red Maple, Redbud, Begonia, and Weigela as foliage injury may occur.

**STORAGE AND DISPOSAL:** Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Do not contaminate food or foodstuffs. Do not store diluted spray. Do not reuse empty container. Wrap container and put in trash collection.

**NOTICE:** Buyer assumes all responsibility for safety and use not in accordance with directions.

ChemCo, Inc.  
123 South Main Street  
New Kenzee, VA 24000-0011  
Product 1234 Made in the USA  
Form 12300-E  
EPA Reg. No. 999-000  
EPA Est. No. 999-VA-1

2009 ©

## SAMPLE ONLY

**THE INFORMATION PRINTED IN THIS EXAMPLE SHOULD NOT BE USED IN PLACE OF THE INFORMATION PRINTED ON THE ACTUAL PESTICIDE LABEL.**

## Environmental Considerations

### Water Quality

Protecting our water resources is a very important issue these days. Both surface and groundwater can be very vulnerable to contamination from pesticides and fertilizers.

### Ground Water

Ground water supplies are held in and move through geological formations called aquifers. Your home most likely sits over a local aquifer which supplies drinking water to you and your neighbors through your well or public water authority. In Virginia, about 90% of rural residents depend on groundwater from these aquifers for drinking water.

Careless use of pesticides and fertilizers can contaminate ground water by leaching (seeping) into the soil and eventually coming into contact with the water table. If a pesticide is persistent (lasts more than one season in the environment), is highly water soluble, or is highly toxic, it can reach the ground water and contaminate it. This is especially possible if the soils in your area are sandy or gravelly in nature. In some areas of Virginia, geologic strata make the aquifers more vulnerable. These strata include the sandy areas of the coastal plains of eastern Virginia, the limestone (*Karst*) soils of the Blue Ridge Mountains of western Virginia, and the shale soils in the Highlands of southwestern Virginia. Other conditions which make ground water more vulnerable are excessive rainfall, irrigation, sinkholes, old wells, and other conduits to the aquifer. Even more dangerous are hot spots (point sources); sources caused by pesticide spills, backsiphoning\*, careless mixing, improper storage, and illegal disposal. Hot spots are the leading cause of groundwater contamination from pesticides. The pesticide label will indicate if the pesticide you select is especially hazardous in these situations. In addition, you should take special precautions to limit the use of pesticides and even more importantly the excessive use of fertilizers. Fertilizers have been found in much greater amounts in water supplies than pesticides.

*\*Backsiphoning is where pesticide is pulled back into a water source when a fill hose is allowed to come into contact with the mix water in a spray tank. Homeowners should make sure that their spigots have a backflow preventer attached to prevent this potential problem. These devices are available at your local hardware store for less than \$25.00. More importantly, make sure that there is an air gap present at all times between your water source and the spray tank or container you are filling!*

### Surface Water

Another hazard of pesticide and fertilizer use is the potential for runoff into surface waters. Surface waters are known to recharge the groundwater in some aquifers. So contaminated surface water can be a threat to both surface and underground water resources.

Some pesticide and fertilizer products have greater potential for runoff than other products. If you apply any pesticide or fertilizer before a rain, or if you water your lawn or garden heavily just after an application, there is a good chance you are going to wash off the pesticide or fertilizer you just applied. Again, choose your chemical wisely; the product label and the charts at the end of this section will indicate whether a particular chemical poses a risk to water resources. Limit your use of chemicals to just the necessary amounts to do the job. Be even more cautious if you live near a stream or lake. In many subdivisions and urban areas, storm drains empty directly into nearby bodies of water. Any runoff from your property is likely to follow these storm drains to a local river or lake.

Farmers along the Chesapeake Bay are employing grass filter strips and planted buffer zones to reduce runoff. The turf areas on your property act in a similar manner and can be very effective to prevent many harmful chemicals from running off your property. By properly maintaining these areas or by planting new areas on your property, you too can employ similar protection to the water resources in your area. Contact your local water conservation district or Extension office for help with applying these methods to your property.

### Air Quality

Pesticides can drift if applied under windy conditions or directed into the air. Pesticide drift is illegal and can be quite harmful to the plants, animals, people, and surfaces it contacts. For example, if you spray your lawn with 2,4-D or other phenoxy herbicides and these materials drift into a neighbor's yard or your garden, they can be quite damaging to desirable plants. Plants such as grapes, tomato, tobacco, ornamentals, flowers, garden vegetables, and fruit trees can be badly damaged by drift from these pesticides. Other herbicides also have the potential to cause extensive damage to non-target plants. Drift of insecticides and other toxic chemicals can poison animals and people. Some of the carriers and the pesticides themselves can also damage the surfaces they contact. Contact with painted surfaces, such as those on automobiles, can result in expensive damage. Contact with children's toys, swimming pools, and pet dishes all present exposure hazards to people and pets.

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Drift onto walkways can be tracked into homes and adjacent areas, or can come into contact with bare feet. There have been cases where herbicides were allowed to drift onto a sidewalk (from a spot application) and later tracked into nearby turf areas. Weeks later a path of dead grass appeared where the chemical was tracked into the adjacent lawn.

### Soils

The soil isn't just the "dirt" holding your plants in the ground. The soil is a very active environment which can play an important role in the breakdown of many chemicals. Nutrients important to the growth of plants are broken down in the soil to usable elements. The soil environment also holds and breaks down many pesticides. However, too much of a particular chemical can contaminate the soil environment to the extent where it is no longer "alive." In other cases, chemicals can move through the soil and damage nearby trees and other desirable plants. The soil/water environment allows chemicals to travel through the soil. Again, follow all label directions, add organic material to your soils to encourage biodegradation of pesticides and other chemicals, and reduce your pesticide use by employing alternative controls.

### Non-Target Organisms

Pesticides can be quite harmful to non-target animals and plants. We mentioned the potential damage to many plants earlier. Animals, both wild and domestic, can be harmed by careless pesticide use. Your backyard is home to many wild birds and animals. Many pesticides, especially insecticides, can directly and indirectly kill these animals. Birds in particular are very susceptible to pesticide poisoning. Careless use of some granular insecticides have been known to kill a large number of birds in one feeding. If you use granules, make sure you incorporate them into the soil by watering or burying them. Birds can also be poisoned when they come into contact with treated surfaces or by eating treated food sources. Avoid spraying ripened fruit or flowers; cover plants with netting to prevent birds from contacting or eating treated plants. Birds can also feed on poisoned insects or lose these sources of food when they are killed by insecticides. Applications of herbicides can change wildlife habitats to where they are no longer habitable. Be careful when applying all pesticides and consider the impact of these chemicals on wildlife.

Other non-target organisms such as fish, bees, and beneficial invertebrates (insects, earthworms, etc.) are also susceptible to poisoning from pesticides. By eliminating beneficial organisms, your pest control problem can actually get worse. Consider alternatives and keep your pesticide applications to a minimum. For more information on the impact of certain pesticides on wildlife and other non-target organisms, refer to the reference tables at the end of this section of the guide.

Pets and other domestic animals are just as vulnerable to pesticides. Be careful when applying flea and tick controls on pets to avoid overexposing them to these chemicals. Applying flea powders, collars, and spraying living quarters with the same insecticide can be unhealthy to your pet. Be cautious with repeated applications of organophosphate and carbamate insecticides. The label will indicate which products contain these chemicals or may warn you that these products are cholinesterase inhibitors. Over use of these chemicals can chronically poison your pet because they affect the animal's nervous system; they can inhibit an enzyme in an animal's (including humans) nervous system that is required to allow the system to work properly. Ask your veterinarian for advice and read the label to avoid this potential problem. Also make sure that your pet isn't exposed to other pesticide applications around your property, especially while your animal is being treated for fleas and ticks.

**If you have a question about pesticide poisoning of pets or other domestic animals, please contact your veterinarian. This is your most reliable source. The veterinarian may contact other sources for you. Be careful about using Internet sources or other unknown sources of information, especially regarding treatment. Another reliable source of toxicological information is the ASPCA Animal Poison Control Center at (888) 426-4435. A charge may apply.**

For assistance with wildlife poisonings or protection, contact your local Virginia Game Commission official.

## Preventing Exposure and Poisonings to Humans

We have discussed the many precautions necessary to protect the environment and non-target organisms. The most vulnerable organism associated with pesticide use is yourself—the applicator. The person applying pesticides has the potential to come into contact with concentrated formulations when handling these chemicals. Even if you use less concentrated forms, you still can contact these materials in a much larger amount than when they are released into the environment. It is for this reason that you must be especially careful to prevent contact. Remember, there is no hazard associated with pesticide use if you are not exposed to the chemical itself. Even with highly toxic pesticides, applicators can actually reduce their hazard to very low levels by preventing exposure.

## The Dose Makes the Poison

The potential for a pesticide to cause injury depends on several factors:

### Toxicity of the Active Ingredient

Toxicity is the measure of the inherent ability of a chemical to produce injury. Some pesticides, such as pyrethrins, have low human toxicity while others, such as parathion, are highly toxic.

A pesticide's toxicity is listed on the product label according to a three-tiered signal word rating system. Most consumer chemicals are rated as low to moderate toxicity. Labels using the signal word "caution" are rated as low toxicity pesticides. Those using the "warning" signal word are moderately toxic, and those using the "danger" signal word are highly toxic. Avoid using any pesticide marketed for agricultural or commercial use. These chemicals are marketed for farm use and usually are concentrates formulated to be mixed for application on large acreage. For these reasons, mixing these products can be hazardous. In addition, these chemicals may use the "Danger-Poison" signal word and if this is the case they can be extremely hazardous. Most consumers are not equipped to handle these pesticides. Acute toxicity is based on the following ratings:

**Table 1.1 - Toxicity Categories**

| Product Signal Word | Toxicity Category | Oral LD50 (mg/kg) <sup>1</sup> | Probable Adult Lethal Dose |
|---------------------|-------------------|--------------------------------|----------------------------|
| DANGER-POISON       | highly toxic      | 0-50                           | a few drops to 1 teaspoon  |
| WARNING             | moderately toxic  | 50-500                         | 1 - 2 teaspoons            |
| CAUTION             | slightly toxic    | 500-5000                       | 1 ounce - 1 pint (pound)   |
| CAUTION             | almost non-toxic  | more than 5000                 | 1 pint (pound)             |

<sup>1</sup>The amount in milligrams of chemical per kilogram of body weight to kill 50% of the test organisms in a toxicity test (usually white male rats) when administered orally (ingested).

The greater the dose of a specific chemical (the amount absorbed), the greater the risk of injury. Dose is dependent on the absolute amount of the pesticide absorbed relative to the weight of the person. Therefore, small amounts of a pesticide might produce illness in a small child while the same dose of the same chemical in an adult might be relatively harmless.

### Route of Absorption

Swallowing a pesticide usually creates the most serious problem. In practice, however, the most common route of absorption of pesticides is through the skin (dermal). The most toxic pesticides have resulted in death when absorbed through this route of exposure. This is why it is very important to wear protective clothing.

### Duration of Exposure

The longer you are exposed to a pesticide, the higher the level in the body. There is a point at which an equilibrium will develop between the intake and the output. Then, the level will no longer continue to increase. However, this point may be either above or below the known toxic level.

### Physical and Chemical Properties

The distribution and rates of breakdown of pesticides in the environment significantly alter the likelihood that injury might occur.

### Population at Risk

Persons who run the greatest risk of poisoning are those whose exposure is highest, such as users who handle or apply pesticides. However, the general public also faces the possibility of exposure.

### Avoiding Exposure

Exposure is the key to creating a hazard with any toxin. Pesticides are no different. Without exposure you can't be poisoned. So avoiding exposure is the most important thing a pesticide applicator can do to protect themselves. To protect yourself, you should wear protective clothing and limit your handling of pesticides as much as possible. Purchasing formulations which pose less risk in handling are worth the extra expense over a formulation which is harder to handle. Using a "measure and pour spout" device, now available in many garden centers, is a way to avoid exposure when measuring and pouring concentrates; the most hazardous stage for applicators. **Before using any device of this type for pesticide application, make sure it works properly.** Some types are prone to leaking. Test the device with water before using pesticides. If it leaks, return it to the place of purchase.

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To protect yourself, you should wear the following protective clothing and equipment:

### Eye Protection

You should wear chemical splash-proof goggles anytime you are mixing pesticides or where spray can come into contact with your eyes. Your eyes are one of the most vulnerable parts of your body to pesticide exposure. Most chemicals are eye irritants. You can purchase a pair of these types of goggles at most hardware stores. The cost is under \$10.00.

### Gloves

You should never handle a pesticide without using a pair of **unlined** chemical-resistant gloves. Gloves should be resistant to chemical permeation (chemical entering through the glove surfaces). Look for gloves made of nitrile or neoprene that will cover the upper forearms. Dispose of nitrile and neoprene gloves after one week of use. If you can't find these types of gloves, purchase a similar pair of vinyl gloves. Dispose of vinyl gloves after each use, because they can be permeated by chemical residues very easily. **Do not use** cloth or leather gloves. **Do not use** natural rubber or latex rubber gloves unless it is an emergency situation. Chemicals can penetrate rubber gloves within a very short period of time and some people have allergic reactions to latex. A good set of gloves can be purchased at most hardware stores for less than \$10.00 per pair.

### Clothing

For most pesticides **marketed for home use**, you don't need any special clothing. However, you should read the label carefully to confirm this point. At minimum, you should wear a long-sleeved shirt, long pants, socks, and shoes. You should **never** apply a pesticide in typical summer attire such as shorts and T-shirt. Remember, most pesticide exposure is through the skin. You should protect your skin at all costs. If you use coveralls, make sure they are approved for chemical use. If they are cloth, make sure you launder them after each use; separately from the family wash (see specific instructions below).

### Boots

You should wear chemical-resistant boots (preferably neoprene pull-over boots) anytime you must walk through sprayed areas or where concentrate or spray can come in contact with your shoes or feet. You should **not** wear leather or cloth shoes because if they become contaminated, these items **cannot** be cleaned to rid them of pesticide residues.

### Other Devices

If you are mixing concentrates, you should consider using an apron. Aprons made of nitrile, neoprene, or vinyl provide an extra measure of protection when mixing and can prevent contamination of clothing you might need to wear for a long period during application.

### A Word About Respirators:

Although professional applicators routinely use respirators to protect themselves, mostly because they work with pesticides daily, they are usually trained in the use of these devices. Respirators don't all fit the same. In addition, they must be properly stored and maintained to work well. If you have a beard, they won't work at all. Most home use pesticides do not call for respirator use. If the pesticide you are using indicates you should use a respirator, it might **not** be a chemical designed for consumer use. **Do not use pesticides designed for agricultural and commercial use around your home. You are asking for trouble if you do!**

Again, remember these recommendations are general in nature. Please read the pesticide label to determine the type of protective devices you need to wear.

## ***Cleaning Up Yourself and Your Pesticide Contaminated Clothing After an Application***

### **Wash Yourself Thoroughly to Remove Residues from Your Skin**

After using a pesticide, you should take steps to decontaminate yourself. Rinse off your shoes and gloves. Remove them and your contaminated clothing in a mud room or garage and clean up immediately. Put your contaminated clothing in a plastic garbage bag. Be sure to mark this bag and seal it to prevent others from coming into contact with the contaminated items. If you spilled concentrates or heavily soaked your clothes with dilute pesticides, you should throw them in the garbage using the same bag. Otherwise, the bag of clothing should be set aside for later laundering—**separately from your family wash.**

You should immediately shower and shampoo thoroughly. Use plenty of hot water and soap. Dry off and take the towel you use to dry with to the laundry for washing as well (don't leave it in the bathroom for others to use!). Go back outside to check if you put everything away properly, including your boots, gloves, aprons, and goggles. These items should also be cleaned properly before you store them or use them again. Make sure you wear chemical-resistant gloves when handling and cleaning these items. Wash any areas of your skin or clothing after cleaning these items if they come in contact with the contaminated items or wash water.

## **Laundering Your Pesticide-Contaminated Clothing**

Introducing pesticide contaminated clothing into your family laundry presents a special hazard to you and the other members of your household. The pesticides on these pieces of clothing can be transferred to other clothing during the washing process. Please follow the instructions below carefully to prevent exposing you or your family to pesticide residues in the laundry.

**Laundering Information for Pesticide-Contaminated Clothing** - Before laundering, read the pesticide label to determine which chemicals are more toxic. Clothing contaminated with highly toxic and concentrated pesticides must be handled most carefully because pesticides are easily absorbed through skin. Clothing contaminated by moderately toxic pesticides do not warrant such drastic measures. Hazards are less pronounced in handling clothing exposed to low-toxicity pesticides.

**Discard any clothes that have been completely saturated with any concentrated pesticides.**

**Laundering Recommendations (Cotton or Denim Fabric)** - Wash contaminated clothing separately from the family wash. Pesticide residues are transferred from contaminated clothing to other clothing when they are laundered together.

Pre-rinsing contaminated clothing before washing will help remove pesticide particles from the fabric. Pre-rinsing can be done by:

- 1) Pre-soaking in a suitable container prior to washing to dislodge the particles;
- 2) Pre-rinsing with agitation in an automatic washing machine, and;
- 3) Spraying/hosing garments outdoors.

Clothing worn while using slightly toxic pesticides may be effectively laundered in one machine washing. It is strongly recommended that multiple washings be used on clothing contaminated with pesticides to draw out excess residues. Always wear chemical-resistant gloves when **handling contaminated clothing** to prevent pesticide absorption into the body.

Washing in hot water removes more pesticide from the clothing than in other water temperatures. Avoid cold water washing. Although cold water washing might save energy, cold water temperatures are relatively ineffective in removing pesticides from clothing.

Laundry detergents, whether phosphate, carbonate, or heavy-duty liquids, are similarly effective in removing emulsifiable concentrate pesticide formulations. Emulsifiable concentrate formulations are oil-based, and heavy-duty liquid detergents are known for their oil-removing ability.

Laundry additives, such as bleach or ammonia, do not contribute to the removal of pesticide residues. Either of these additives may be used, if desired, but caution must be used. Bleach should never be added to or mixed with ammonia, because they react together to form a **very toxic chlorine gas**. **Be careful! Do not mix ammonia and bleach.**

If several garments have become contaminated, wash only one or two garments in a single load. Wash garments contaminated by the same pesticide(s) together. Launder, using a full water level to allow the water to thoroughly flush the fabric.

Clothing exposed to pesticides should be laundered daily. This is especially true with highly toxic or concentrated pesticides. It is much easier to remove pesticides from clothing by daily laundering than attempting to remove residues that have accumulated over a period of time.

Pesticide carry-over to subsequent laundry loads is possible because the washing machine is likely to retain residues, which are then released in following laundry loads. It is important to rinse the washing machine with an "empty load," using hot water and the same detergent, machine settings, and cycles used after laundering contaminated clothing.

*Line-drying is recommended for these items. Although heat from an automatic dryer might create additional chemical breakdown of pesticide residues, many pesticides break down when exposed to sunlight. This also eliminates the possibility of residues collecting in the dryer.*

**Laundering Recommendations (Vinyl-coated Fabric, Neoprene, or Rubber)** - Laundering this type of outer protective clothing is different from other types. It should be pan-washed in warm water (less than 110°F) using a good detergent. Double or triple washing of heavily contaminated outer protective clothing is desirable. Rinse through two water changes and hang up to air dry. Outer protective clothing should be washed after each exposure or use.

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**Gloves** must be thoroughly pan-washed inside and out using a good detergent with several rinses. Remember, gloves must be clean inside because they will be in contact with your skin. Wash **chemical-resistant boots** similarly to gloves.

The **respirator requires** special care. Wash inside with a cloth, detergent, and warm water. Change filters according to instructions on the original container. Keep the respirator in a plastic bag, original container, or some other suitable container when it is not being used. Keep the respirator properly adjusted to your face. Filters and prefilters should be kept sealed in a plastic bag when not in use. Filters should be changed regularly according to ratings and amount of use.

**Goggles** should be washed with a mild detergent so as not to scratch the lenses. Give all of your protective clothing and equipment the best of care. They may save your life.

### ***Chemical Emergencies***

#### ***What happens if you spill a pesticide?***

Every pesticide spill situation varies, but there are some basic procedures you can follow to protect you and your family if a spill emergency occurs. Spills occur due to breakage of glass containers, tipping open containers during mixing and handling, and sometimes from poor storage conditions. Avoid these situations and you will avoid most spill emergencies.

Some measures you can take to reduce the hazards of a spill include:

- Review your pest control priorities to determine if you need to use or store a pesticide in the first place.
- Don't buy large containers or glass containers which break more easily.
- Avoid liquid formulations if possible.
- Use ready-to-use products to avoid storing or handling concentrates.
- Don't store pesticides in your living areas or where vapors from a spill can enter your home in some way.
- Don't place containers where they will be easily knocked onto the floor and broken.
- Don't store containers where heat or cold will cause chemicals to react or rupture containers.
- Don't store containers where they will become wet or damaged.

The following diagram provides a 10-step process that works for most home and garden chemicals. If you have any doubts, contact the chemical manufacturer, your local Extension agent, or the groups listed in the Virginia Pesticide Information Directory (to follow).

# SPILLS

## Immediate steps

|   |  |
|---|--|
|  <p><b>1 Isolate Area</b><br/>Keep people and pets away. Barcade or evacuate area if necessary.</p>  | <p><b>If a liquid—absorb until dry</b></p> <p><b>6</b> Contain liquid along edge. Sweep absorbant from edge toward the middle.</p>    |
|  <p><b>2 Ventilate Area</b><br/>Do not breath vapors! Open doors and windows. Set-up portable fan.</p>   | <p>Carefully place absorbant or spilled dry product in disposable container.</p> <p><b>7</b></p>    |
|  <p><b>3 Keep Fire Sources Away</b></p>  | <p>Scrub spill area with concentrated detergent using broom</p> <p><b>8</b> Absorb and pick-up according to steps 6 and 7. Discard soiled materials. Scrub lightly splashed items. Scrub out corners and crevices.</p>  |
| <p><b>STOP</b></p> <p>If spill involves more than 2 product containers<br/>OR<br/>If you have any doubts, STOP at this point and contact<br/><b>CHEMTRIC at (800) 424-9300</b></p>  | <p>Dispose of sweepings, broken product containers, broom, other contaminated wastes in accordance with recommendations of local and state authorities.</p> <p><b>9</b></p>   |
| <p><b>Clean Up</b></p>  <p><b>4</b> Put on rubber or neoprene gloves and overshoes.</p>  <p><b>5</b> Ready fire fighting equipment.</p> | <p>Wash gloves, overshoes, and shovels with strong detergent solution. Change clothing and wash in detergent.</p> <p><b>10</b></p>   |

## Chemical Spill Kit

Here is a list of supplies you will need to handle most chemical spills. Try to keep these items handy if you store pesticides in your home.

- chemical resistant gloves (2 pairs made from nitrile or neoprene—if you can't get these, rubber or vinyl will work but be careful since some chemicals can permeate (dissolve and enter through the glove surfaces) these materials easily)
- chemical resistant boots (1 pair made from neoprene rubber, or vinyl—again be careful about permeation)
- absorbent material (1 large bag of kitty litter or other commercially available absorbent)
- detergent (strong household type such as Tide or All will work; trisodium phosphate (TSP) will work more effectively but be careful because this material can burn you)
- disposable pail (a 5-gallon bucket will work—this is a good place to store most of the items in a spill kit)
- disposable plastic bags (2 heavy-duty garden type bags)
- broom (household type with natural bristles)
- scoop or shovel
- fire extinguisher (10 lb.—rated for chemical fires (A B & C type fires))

## What happens if you or a member of your family is exposed to or poisoned by a pesticide?

Pesticide poisonings can occur through careless handling, through accidental ingestion, and by contact with treated surfaces, containers, and application equipment. Many accidents can be prevented by careful handling, storage, and selection of safer products. Never store or leave pesticides where children, uninformed adults, or pets can contact them. Never leave a sprayer unattended or allow others to enter a treated area until the sprayed area is safe to reenter according to the label instructions.

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### Follow these directions if an exposure occurs

- **Follow the first aid recommendations on the label.** Often quick action on the scene can do more to help a victim than can be done by waiting for emergency personnel to arrive. Remember, the first aid instructions are usually directed to the layman at the scene. Your response to these recommendations could save a life or prevent long term injury. This is especially important when chemicals splash into the eyes—fast action to rinse out an eye during the first 15-20 minutes can prevent possible permanent damage. One word of caution—be careful to avoid exposure to yourself when handling a poisoned victim.
- **Call your physician immediately.** If your family physician is not available, the patient should be taken to the nearest physician or hospital emergency room along with the container of the poisoning agent (pesticide container with the intact label). Make sure you put the container in a plastic bag and warn all emergency personnel of the situation to protect them from possible exposure to the pesticide on the victim, the container, or at the site.
- If necessary, the physician will call the nearest poison control center for further information on the suspected poisoning agent, treatment, and prognosis.
- **If you have questions specific to a possible poisoning, you can call a Poison Control Center for information. Please refer to the list below for Poison Control Centers and other emergency contacts.**

## Poison Information and Treatment Resources For Virginians

### Regional Poison Control Centers

Provide 24-hour information and consultation services by Poison Information Specialists and board-certified Medical Toxicologists. Located in hospitals equipped for all toxicologic (poison) emergencies.

**CHARLOTTESVILLE, VA.**  
**Blue Ridge Poison Center**  
University of Virginia Health System  
Box 800774  
Charlottesville, VA 22908-0774  
**(800) 222-1222**  
[www.healthsystem.virginia.edu/inter-net/brpc/](http://www.healthsystem.virginia.edu/inter-net/brpc/)

**CHARLESTON, W.V.**  
**West Virginia Poison Center**  
3110 McCorkle Ave., S.E.  
Charleston, WV 25304  
**(800) 222-1222**  
[www.wvpoisoncenter.org/](http://www.wvpoisoncenter.org/)

**WASHINGTON, D.C.**  
**National Capital Poison Center**  
George Washington University Hospital  
3201 New Mexico Ave., NW  
Suite 310  
Washington, DC 20016  
**(800) 222-1222**  
[www.poison.org](http://www.poison.org)

**CHARLOTTE, N.C.**  
**Carolina Poison Center**  
Carolina Medical Center  
P.O. Box 32861  
5000 Airport Ctr. Parkway, Suite B  
Charlotte, NC 28232-2861  
**(800) 222-1222**  
[www.ncpoisoncenter.org](http://www.ncpoisoncenter.org)

**RICHMOND, VA.**  
**Virginia Poison Center**  
Medical College of Virginia Hospitals  
Virginia Commonwealth University  
1250 East Marshall St.  
P.O. Box 980522  
Richmond, VA 23298-0522  
**(800) 222-1222**

For a complete list of Poison Control Centers on the World Wide Web go to: [www.1-800-222-1222.info](http://www.1-800-222-1222.info)

### National Poison Control Center

Toll-Free Number for all U.S.:

**(800) 222-1222**

Calls to this number will be routed to the closest  
Regional/Area Poison Control Center.

Website for the American Association of Poison Control Centers is:

[www.aapcc.org/](http://www.aapcc.org/)

## **Applying the Correct Amount in the Right Place**

Applying the correct amount of pesticide on target is critical for proper pest control. Using the right equipment for the job is the first important step towards achieving this task. Your choice of equipment can be as simple as using an aerosol or granular applicator supplied with the product, or as complex as using an estate sprayer for a large area. In each situation, the application equipment must be in good working order and calibrated to put down the correct amount. Ask your Extension agent for publications and assistance with calibration of larger pieces of equipment and backpack sprayers.

### ***Proper Measuring and Mixing***

To mix a concentrated formulation of a pesticide, you must first determine (according to label directions) how much concentrate to dilute with water or some other diluent. You can use the conversion charts and other pieces of information in the Reference Tables (to follow) to help you with some measurements. Determining the correct amount to mix is usually just a combination of simple math and knowing the units of measurement.

For example, the product label says, "For the control of aphids on tomatoes, mix 8 fluid ounces of pesticide concentrate into 1 gallon of water and spray the foliage until wet." By filling your sprayer with water and testing the output on your garden, you know that your six tomato plants require only one quart of dilute pesticide to cover their foliage. So you need only 2 fluid ounces of pesticide concentrate mixed in one quart of water to do the job. Why? Because a quart is one-fourth of a gallon, and 2 fluid ounces mixed into a quart make the same strength spray recommended by the label, but in a quantity that can be used all at once.

Consumers can solve similar problems by using careful math, good measurements, and use of the reference information here and in the tables at the end of this section of the guide.

### ***Helpful Hints***

If you need to determine the size of a square or rectangular area, such as a lawn for herbicide application, measure and multiply the length times the width. For example, an area 10 feet long by 8 feet wide contains 80 square feet of area. Common area measurements may involve square yards (1 square yard = 9 square feet) or square feet (1 square foot = 144 square inches).

If you need to determine the volume of a space such as a room, measure and multiply the room's length, width, and height. For example, a space 10 feet long, 8 feet wide, and 8 feet high contains a volume of 640 cubic feet. You would use this procedure for instance, for an aerosol release to control cockroaches.

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Most home-use pesticides are measured in terms of volume. Some common equivalents include:

|                     |   |                            |
|---------------------|---|----------------------------|
| 1 gallon (gal.)     | = | 128 fluid ounces (fl. oz.) |
|                     | = | 4 quarts                   |
|                     | = | 8 pints                    |
|                     | = | 16 cups                    |
| 1 quart (qt.)       | = | 32 fl. oz.                 |
|                     | = | 2 pints                    |
|                     | = | 4 cups                     |
| 1 pint (pt.)        | = | 16 fl. oz.                 |
|                     | = | 2 cups                     |
| 1 cup               | = | 8 fl. oz.                  |
| 1 tablespoon (tbsp) | = | 1/2 fl.oz.                 |
|                     | = | 3 teaspoons (tsp)          |
| 1 teaspoon (tsp)    | = | 1/6 fl.oz.                 |

In measuring teaspoons or tablespoons of pesticide, use only level spoonfuls, and never use the same measuring devices for food preparation.

The following table provides examples to help you convert label information to your specific use situations. "Amount" can be any measure of pesticide quantity. However, the same unit of measure must be used on both sides of the chart. For example, 8 fluid ounces per gallon of water is equivalent to 2 fluid ounces per quart of water.

Not all dosage rates are included in the examples given here. For rates not included, remember that, for pesticides not diluted with water, proportionally change both the quantity of pesticides and the area, volume, or number of items treated. For example, one-half pound per 1,000 square feet is equivalent to one-quarter pound per 500 square feet. For a pesticide that is diluted with water, proportionally change the quantity of pesticide, the quantity of water, and the area, volume, or number of items treated. For example, one-half pound of pesticide in 1 gallon of water applied to 1,000 square feet is equivalent to 1 pound of pesticide in 2 gallons of water applied to 2,000 square feet.

There is a point at which measurements needed for smaller quantities of pesticides are too minute to be accurately measured with typical domestic measuring devices. In such cases, the user can either mix the larger volume, realizing that there will be leftover material; obtain a more accurate measuring device, such as a graduated cylinder or a scale which measures small quantities; or search for an alternative pesticide or less concentrated formulation of the same pesticide.

**Table 1.2 - Conversion Table**

| <b>Pesticide Label Says Mix</b>     |                |               | <b>Amount of Pesticide Per</b> |                       |                      |
|-------------------------------------|----------------|---------------|--------------------------------|-----------------------|----------------------|
| <b>Amount Pesticide</b>             | <b>Per</b>     |               | <b>1 qt. water</b>             | <b>1 pt. water</b>    |                      |
| 8 units                             | 1 gal. water   | <b>equals</b> | 2 units                        | 1 unit                |                      |
| 16 units                            | 1 gal. water   | <b>equals</b> | 4 units                        | 2 units               |                      |
| 32 units                            | 1 gal. water   | <b>equals</b> | 8 units                        | 4 units               |                      |
| 128 units                           | 1 gal. water   | <b>equals</b> | 32 units                       | 16 units              |                      |
| <b>Pesticide Label Says Apply</b>   |                |               | <b>Amount of Pesticide Per</b> |                       |                      |
| <b>Amount Pesticide</b>             | <b>Per</b>     |               | <b>20,000 sq. ft.</b>          | <b>10,000 sq. ft.</b> | <b>500 sq. ft.</b>   |
| 1 unit                              | 1,000 sq. ft.  | <b>equals</b> | 20 units                       | 10 unit               | 1/2 unit             |
| 2 units                             | 1,000 sq. ft.  | <b>equals</b> | 40 units                       | 20 units              | 1 unit               |
| 5 units                             | 1,000 sq. ft.  | <b>equals</b> | 100 units                      | 50 units              | 2 1/2 units          |
| 10 units                            | 1,000 sq. ft.  | <b>equals</b> | 200 units                      | 100 units             | 5 units              |
| <b>Pesticide Label Says Release</b> |                |               | <b>Cans Per</b>                |                       |                      |
| <b>Aerosol Cans</b>                 | <b>Per</b>     |               | <b>20,000 cu. ft.</b>          | <b>10,000 cu. ft.</b> | <b>5,000 cu. ft.</b> |
| 1                                   | 10,000 sq. ft. | <b>equals</b> | 2                              | 1                     | don't use            |
| 1                                   | 5,000 sq. ft.  | <b>equals</b> | 4                              | 2                     | 1                    |
| 1                                   | 2,500 sq. ft.  | <b>equals</b> | 8                              | 4                     | 2                    |

**Table 1.3 - Table of Weights, Measures, and Dilutions**

**Weights:**

28.35 grams = 1 ounce  
 16 ounces = 1 pound = 453.6 grams  
 1 pint of water = 1.04 pounds  
 1 gallon of water = 8.34 pounds  
 1000 micrograms = 1 milligram  
 1000 milligrams = 1 gram = 0.035 ounce avoirdupois  
 1000 grams = 1 kilogram = 2.2 pounds

**Volume And Liquid Measure:**

3 teaspoons = 1 tablespoon = 14.8 cubic centimeters (cc)  
 2 tablespoons = 1 fluid ounce = 29.6 cc  
 8 fluid ounces = 16 tablespoons = 1 cup = 236.6 cc = 1/2 pint  
 2 cups = 32 tablespoons = 1 pint = 473.1 cc = 16 fluid ounces  
 2 pints = 64 tablespoons = 1 quart = 946.2 cc = 0.946 liter  
 4 quarts = 256 tablespoons = 1 gallon = 3785 cc  
 1 gallon = 128 fluid ounces = 231 cubic inches = 3785 cc  
 1 milliliter (ml) = 1 cubic centimeter = 0.034 fluid ounces  
 1000 milliliters = 1 liter = approximately 1 quart, 1 fluid ounce  
 1 liter of water = 1 kilogram  
 1 bushel soil = 1.25 cubic feet

**Land Measure:**

43,560 square feet = 1 acre = 0.404 hectare  
 1 mile = 5280 feet = 1609.35 meters  
 10 millimeters = 1 centimeter = 0.3937 inches  
 100 centimeters = 1 meter = 39.37 inches

**Length Of Row Required For One Acre:**

| Row Spacing | Length or Distance       |
|-------------|--------------------------|
| 24 inch     | 7260 yards = 21,780 feet |
| 30 inch     | 5808 yards = 17,424 feet |
| 36 inch     | 4840 yards = 14,520 feet |
| 40 inch     | 4356 yards = 13,069 feet |
| 42 inch     | 4149 yards = 12,446 feet |
| 48 inch     | 3630 yards = 10,890 feet |

**Dilutions:**

|                          |  |
|--------------------------|--|
| 1 part per million (ppm) | = 1 milligram per liter<br>= 1 milligram per kilogram<br>= 0.0001 percent<br>= 0.013 ounce by weight in 100 gal        |
| 1 percent                | = 10,000 parts per million<br>= 10 grams per liter<br>= 1.29 ounces by weight per gallon<br>= 8 pounds per 100 gallons |

**Temperature:**

To change temperature in degrees Celsius to temperature in degrees Fahrenheit, multiply Celsius by 9/5 and add 32.  
 Example: 30 degrees Celsius = 30 x 9/5 + 32 = 86 degrees Fahrenheit.

**Abbreviations:**

Formulations:

A = aerosol  
 AS = aqueous suspension  
 D = dust  
 E or EC = emulsifiable concentrate  
 ES = emulsifiable suspension  
 F = flowable  
 G = granules or granular  
 L = liquid  
 MTF = multiple temperature formulation

S = solution  
 SP = soluble powder  
 W or WP = wettable powder  
 WD = wettable dust  
 SL = soluble liquid  
 WDL = water dispersible liquid  
 WDG = water dispersible granule  
 LC = liquid concentrate  
 LS = liquid suspension

## Pesticide Calibration Tables

**Table 1.4 - Travel Speed Chart**

| Time Required in Seconds to Travel |        |        |        |
|------------------------------------|--------|--------|--------|
| Miles per Hour                     | 100 ft | 200 ft | 300 ft |
| 1                                  | 68     | 136    | 205    |
| 2                                  | 34     | 68     | 102    |
| 3                                  | 23     | 46     | 68     |
| 4                                  | 17     | 34     | 51     |
| 5                                  | 14     | 27     | 41     |
| 6                                  | 11     | 23     | 34     |
| 7                                  | 10     | 20     | 29     |
| 8                                  | 9      | 17     | 26     |
| 9                                  | 8      | 15     | 23     |
| 10                                 | 7      | 14     | 21     |

1 mph = 88 feet per minute

1 mph = 1.466 feet per second

Speed in mph = Number of 35-inch steps per minute/30

**Table 1.5 - Equivalent Quantities of Dry Materials (Wettable Powders) For Various Quantities of Water**

| Water                | Quantity of Material             |                                 |                                      |                                  |                                  |                                  |
|----------------------|----------------------------------|---------------------------------|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|
| 100 gal <sup>1</sup> | 1.0 lb                           | 2.0 lb                          | 3.0 lb                               | 4.0 lb <sup>1</sup>              | 5.0 lb                           | 6.0 lb                           |
| 50 gal               | 8.0 oz                           | 1.0 lb                          | 1.50 lb                              | 2.0 lb                           | 2.50 lb                          | 3.0 lb                           |
| 5 gal <sup>1</sup>   | 0.80 oz<br>(3 tbsp) <sup>2</sup> | 1.60 oz                         | 2.40 oz                              | 3.20 oz <sup>1</sup>             | 4.00 oz                          | 4.8 oz                           |
| 1 gal                | 0.16 oz<br>(2 tsp) <sup>2</sup>  | 0.32 oz<br>(3 tsp) <sup>2</sup> | 0.48 oz<br>(1 1/2 tbsp) <sup>2</sup> | 0.64 oz<br>(2 tbsp) <sup>2</sup> | 0.80 oz<br>(3 tbsp) <sup>2</sup> | 0.96 oz<br>(3 tbsp) <sup>2</sup> |

<sup>1</sup>**Example:** If a recommendation calls for a mixture of 4 pounds of wettable powder to 100 gallons of water, it would take 3-1/4 ounces to 5 gallons of water to give 5 gallons of spray mixture of approximately the same strength.

<sup>2</sup>**Note:** Wettable pesticide materials vary considerably in density. Therefore the teaspoonful (tsp) and tablespoonful (tbsp) measurements in this table are approximate but not exact dosages by weight. However, we believe that they are within the bounds of safety and efficacy for mixing small amounts of spray.

**Table 1.6 - Equivalent Quantities of Liquid Materials (Emulsifiable Concentrates, etc.) for Various Quantities of Water**

| Water                | Quantity of Material                 |                                    |                                    |                                    |                                    |                                    |
|----------------------|--------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 100 gal <sup>1</sup> | 1/2 pt                               | 1.0 pt                             | 2.0 pt                             | 3.0 pt                             | 4.0 pt <sup>1</sup>                | 5.0 pt                             |
| 50 gal               | 4.0 fl oz                            | 8.0 fl oz                          | 1.0 pt                             | 24.0 fl oz                         | 1.0 qt                             | 2 1/2 pt                           |
| 5 gal                | 0.40 fl oz<br>(1 tbsp) <sup>2</sup>  | 0.80 fl oz                         | 1.60 fl oz                         | 2.40 fl oz                         | 3.20 fl oz                         | 4.0 fl oz                          |
| 1 gal <sup>1</sup>   | 0.08 fl oz<br>(1/2 tsp) <sup>2</sup> | 0.16 fl oz<br>(1 tsp) <sup>2</sup> | 0.32 fl oz<br>(2 tsp) <sup>2</sup> | 0.48 fl oz<br>(3 tsp) <sup>2</sup> | 0.64 fl oz<br>(4 tsp) <sup>2</sup> | 0.80 fl oz<br>(5 tsp) <sup>2</sup> |

<sup>1</sup>**Example:** If 4 pints of a liquid concentrate is recommended to 100 gallons of water, 4 teaspoons of the chemical in 1 gallon of water will give a mixture of approximately the same strength.

<sup>2</sup>Approximate figure.

## **Decontaminating Sprayers**

If you use your sprayer for herbicide application (such as spraying herbicides like 2,4-D on your lawn) and later use it to apply an insecticide application on your garden or shrubs, you could kill those vegetables and ornamentals. You cannot totally decontaminate a sprayer of phenoxy herbicides. For this type of situation you should buy two sprayers; one for herbicides and another for other pesticide applications. You should clearly mark these sprayers accordingly. For other herbicides and for spraying less sensitive plants, you can use the same sprayer after cleaning it properly.

### ***Cleaning a Sprayer***

Immediately after application, you should flush the sprayer with water and spray this water on a site that is listed on the label. Rinse several more times with water; the last time immediately before reuse. Most pesticide formulations can be removed by repeated washing with water.

## **Storage**

Pesticide storage in the home should be kept to a minimum. Often, buyers of home pesticides are tempted to purchase concentrated formulations because they cost less per dosage to mix and use. Unfortunately, most of us never think about the rest of the bottle. As a result, we often end up storing these chemicals somewhere in our homes or in an outside shed where the chemical will freeze or heat up and be rendered useless within a few years. You should:

- Select products that are ready-to-use or are marketed with limited packaging and in amounts to only carry you through the current use season.
- Store pesticides in a locked cabinet away from children and pets. The storage cabinet should be separated from other household items and should never be located in the living areas of the home. Never put pesticides in a cabinet with, or near, food, medical supplies, or cleaning materials.
- Always store pesticides in their original containers. Labels should be protected to prevent damage and to remain readable. Never transfer pesticides into other containers unless the original container is damaged. Never use drink bottles or other containers that children and others may associate with something to eat or drink. If you must transfer chemicals because of a broken container, make sure you remove the original label and place it on the replacement container. Always refasten child-proof closures and lids.
- Avoid storing pesticides in places where flooding is possible, or in open places where they might spill or leak into the environment. If you have any doubt about the content of a container, dispose of it after following the directions below.

## **Disposal**

The best way to dispose of a small, excess amount of pesticide is to use it—apply it according to label directions. If you cannot use it, ask a neighbor whether he or she can use it. If all the pesticide cannot be used, first check with your local solid waste management authority to determine whether your community has a household hazardous waste collection program or any other program for handling disposal of pesticides. Several communities in Virginia have sponsored these programs in the past. If you live on a farm or have purchased an old farm and have left over pesticides that were left from previous farming operations, you should contact your local Extension agent to determine if your locality is holding a pesticide waste collection program for leftover farm chemicals.

- Do not pour leftover pesticides down the sink or into the toilet. Chemicals in pesticides could interfere with the operation of wastewater treatment systems and pollute waterways because many municipal systems cannot remove all pesticide residues.
- An empty pesticide container can be as hazardous as a full one because of residues remaining inside. When empty, a pesticide container should be triple rinsed and disposed of according to the pesticide label directions.
- Do not puncture or burn pressurized product containers—they could explode.
- If you have any doubts about proper pesticide disposal, contact your solid-waste management agency, or other sources of assistance referenced on the pesticide label.

## Reference Tables

### ***Literature Cited***

The information used in the above sections and the tables to follow were developed from a variety of sources. A few of the major sources included:

1. Anonymous. 1995. Citizen's Guide to Pest Control and Pesticide Safety. EPA730-K-95-001 Sept, 1995. USEPA, Prevention, Pesticides and Toxic Substances (7501C), Washington, D.C. 50pp. (many of the above sections were adapted from this guide)
2. Stinson, E. R. and Bromley, P. T. 1991. Pesticides and Wildlife: A guide to reducing impacts on animals and their habitat. Virginia Cooperative Extension and Virginia Department of Game & Inland Fisheries, VCE Pub. 420-004, Blacksburg, Va. 44pp.

**Table 1.7 - Toxicity Data for Pesticides Used in Home Grounds and Animals**

| <b>Fungicides</b>                  |               |              |              |              |                |                   |             |             |
|------------------------------------|---------------|--------------|--------------|--------------|----------------|-------------------|-------------|-------------|
| <b>Pesticide (Brand Name)</b>      | <b>Humans</b> | <b>Soils</b> | <b>Water</b> | <b>Birds</b> | <b>Mammals</b> | <b>Earthworms</b> | <b>Fish</b> | <b>Bees</b> |
| benomyl (Benlate)                  | L             | 240          | M            | M            | L              | EH                | H           | N           |
| captan                             | L             | -            | L            | L            | L              | -                 | H           | H           |
| chlorothalonil (Daconil)           | L             | 30           | L            | L            | L              | -                 | H           | N           |
| copper sulfate                     | L             | -            | M            | L            | -              | EH                | H           | N           |
| mancozeb (Dithane M-45)            | L             | 70           | L            | L            | L              | L                 | L           | M           |
| maneb (Maneb)                      | L             | -            | -            | L            | L              | L                 | H           | N           |
| thiram (Arasan, Thiram)            | L             | -            | L            | M            | L              | -                 | H           | M           |
| sulfur (many names)                | N             | -            | -            | N            | N              | -                 | N           | N           |
| <b>Herbicides</b>                  |               |              |              |              |                |                   |             |             |
| <b>Pesticide (Brand Name)</b>      | <b>Humans</b> | <b>Soils</b> | <b>Water</b> | <b>Birds</b> | <b>Mammals</b> | <b>Earthworms</b> | <b>Fish</b> | <b>Bees</b> |
| 2,4-D amine (2,4-D)                | M             | 10           | M            | M            | M              | L                 | N           | N           |
| DCPA (Dacthal)                     | L             | -            | H            | L            | L              | L                 | L           | -           |
| dicamba (Banval, others)           | L             | 14           | H            | L            | L              | L                 | L           | N           |
| glyphosate (Roundup, Kleenup)      | L             | 47           | N            | L            | L              | L                 | L           | N           |
| MCPA                               | L             | 120          | H            | M            | L              | L                 | L           | N           |
| MCPP (mecoprop)                    | L             | 60           | H            | M            | L              | L                 | L           | -           |
| pendimethalin (Halts)              | L             | 120          | L            | L            | L              | L                 | L           | N           |
| triclopyr                          | L             | 60           | H            | L            | L              | L                 | L           | -           |
| <b>Insecticides</b>                |               |              |              |              |                |                   |             |             |
| <b>Pesticide (Brand Name)</b>      | <b>Humans</b> | <b>Soils</b> | <b>Water</b> | <b>Birds</b> | <b>Mammals</b> | <b>Earthworms</b> | <b>Fish</b> | <b>Bees</b> |
| acephate (Orthene)                 | L             | 10           | L            | M            | M              | -                 | N           | H           |
| Bacillus thuringiensis (BT, Dipel) | N             | -            | N            | N            | L              | N                 | N           | N           |
| carbaryl (Sevin)                   | L             | 10           | M            | L            | L              | EH                | M           | H           |
| chlorpyrifos (Dursban)             | M             | 30           | M            | H            | M              | M                 | H           | H           |
| diazinon (Spectracide)             | M             | 40           | M            | H            | M              | M                 | H           | H           |
| dicofol (Kelthane)                 | L             | -            | M            | H            | L              | -                 | H           | N           |
| disulfoton (Di-Syston)             | H             | 5            | M            | H            | H              | -                 | M           | M           |
| lindane (Lindane)                  | M             | -            | M            | H            | M              | -                 | H           | H           |
| malathion (Cythion)                | M             | 1            | L            | M            | M              | -                 | H           | H           |
| metaldehyde (Deadline, Slug-Geta)  | L             | -            | -            | L            | L              | -                 | N           | -           |
| pyrethrum (Pyrethrin)              | L             | -            | L            | L            | L              | -                 | EH          | N           |
| rotenone                           | M             | -            | L            | M            | M              | -                 | H           | N           |
| soap, insecticidal (Safer Soap)    | N             | -            | L            | N            | N              | -                 | L           | N           |

**Table 1.7 - Toxicity Data for Pesticides Used in Home Grounds and Animals (cont.)**

| <i>Fungicides</i>      |   |       |       |                                  |         |            |      |      |
|------------------------|---|-------|-------|----------------------------------|---------|------------|------|------|
| Pesticide (Brand Name) | Humans  | Soils | Water | Birds                            | Mammals | Earthworms | Fish | Bees |
|                        | Humans: based on oral LD50 in rats                            |       |       | EH: Extremely high hazard rating |         |            |      |      |
|                        | Soils: half-life in soils (number of days)                    |       |       | H: High hazard rating            |         |            |      |      |
|                        | Water: highest of either runoff or leaching potential         |       |       | M: Moderate hazard rating        |         |            |      |      |
|                        | Birds: based on LD50 to most sensitive species                |       |       | L: Low hazard rating             |         |            |      |      |
|                        | Mammals: based on oral LD50 in rats                           |       |       | N: No hazard rating              |         |            |      |      |
|                        | Earthworms: based on test results                             |       |       |                                  |         |            |      |      |
|                        | Fish: based on oral LC50 on most sensitive species            |       |       |                                  |         |            |      |      |
|                        | Bees: based on article to follow on bee hazards by R. D. Fell |       |       |                                  |         |            |      |      |
|                        | (-): means data unavailable                                   |       |       |                                  |         |            |      |      |

## Virginia Pesticide Information Directory

This directory is intended for use by persons who need assistance with general and emergency pesticide-related information. We hope that it will save time and money by directing you to the proper government and industry sources.

The pages to follow are broken down into **EMERGENCY** and **GENERAL INFORMATION**. In the blank lines provided, please take time to list your local phone numbers for these sources. In the case of an emergency, it might save a life or avoid added expense and inconvenience. Keep a copy of this guide, with this directory section marked, near your phone for future reference.

**For emergency information about an agricultural chemical, please refer to a current product label or call CHEMTREC at (800) 424-9300.**

## Emergency Information

**Poisonings For Treatment:** If poisoned, have someone take you immediately to your nearest emergency room with the label of the container.

The blanks below are supplied for recording the name and telephone number of the nearest poison control center. Please refer to the Regional and Area Poison Control Centers listed previously.

**My nearest poison control center is located at:**

---



---

**Phone Number:** \_\_\_\_\_

### Emergency Information

|   |  |  |
|---|--|--|
| <b>Spills, Leaks, Exposure, Fire, accidents and other related emergencies</b> | CHEMTREC (for assistance) Chemical Transportation Emergency Center<br>Industry assistance with clean-up procedures, etc.<br><a href="http://www.chemtrec.com/">www.chemtrec.com/</a> | <b>(800) 424-9300</b><br>(call day or night) |
|---|--|--|

|   |  |                       |
|---|--|-----------------------|
| <b>Accidents Or Incidents</b><br>that constitute a threat to any person, public safety and health or the environment must be reported to: | Virginia Department of Agriculture and Consumer Services Office of Pesticide Services Field Operations | <b>(804) 371-6560</b> |
| <b>For Assistance With Spills And Emergencies</b><br>take time to jot down your local emergency numbers in the space provided             | State Police<br><br>Fire Department<br><br>Ambulance   | <br><br><br><br><br>  |

**911**

## General Information

|   |  |  |
|---|--|--|
| <b>General Information</b>  | <b>Virginia Tech<br/>Your Local Extension Office</b><br><i>http://www.ext.vt.edu/offices/</i>  | <b>(540) 231-6543</b>  |
|   | <b>Virginia Tech Pesticide Programs</b><br>Blacksburg, VA 24061-0409<br><i>http://www.vtpp.ext.vt.edu/</i><br><i>http://vtpp.org/</i>  |  |
| <b>Regulatory Information</b><br>including permit or license information  | <b>Virginia Dept. of Agriculture and Consumer Services</b><br>Office of Pesticide Services<br>102 Governor Street, P.O. Box 1163<br>Richmond, VA 23218<br><i>http://www.vdacs.virginia.gov/pesticides/</i>           | <b>(804) 371-6558</b>  |
| <b>Disposal Information</b><br>(Follow label directions first, call for help only after reading label carefully.) | <b>Department of Environmental Quality<br/>Air, Waste and Water Division</b><br>629 East Main Street, P.O. Box 10009<br>Richmond, VA 23219<br><i>http://www.deq.virginia.gov/</i>                                    | <b>(804) 698-4000<br/>(800) 592-5482</b>   |
| <b>Pesticide Information</b><br>Dealing with pesticide chemistry and toxicology                                   | <b>National Pesticide Information Center (NPIC)</b><br>Ag Chemistry Extension<br>Oregon State University<br>333 Weniger Hall<br>Corvallis, OR 97331-6502<br><i>http://npic.orst.edu/</i><br><i>npic@ace.orst.edu</i> | <b>(800) 858-7378 (also TDD)<br/>(800) 858-7377<br/>7 days/week<br/>9:30 AM-7:30 PM ET</b>   |
| <b>Citizen's Assistance</b> general consumer-related information and complaints                                   | <b>Virginia Dept. of Agriculture and Consumer Services<br/>Division of Consumer Protection</b><br>1100 Bank Street, P.O. Box 1163<br>Richmond, VA 23218<br><i>http://www.vdacs.virginia.gov/consumer/</i>            | <b>(800) 552-9963<br/>(outside Richmond area)<br/>(804) 786-2042<br/>(Richmond area)<br/>Monday - Friday<br/>8:15 AM - 5:00 PM</b> |
| <b>Citizen's Assistance</b><br>general consumer-related information and complaints                                | <b>U.S. Consumer Product Safety Commission</b><br>Washington, D.C. 20207-0001<br><i>http://www.cpsc.gov/</i>   | <b>(800) 638-2772<br/>(800) 638-8270-TTY 24/7</b>  |

|  |  |  |
|--|--|--|
| <b>Animal Poisonings Assistance (Emergency Services)</b>   | <b>Virginia - Maryland Regional College Of Veterinary Medicine</b><br>Virginia Tech (0442)<br>Blacksburg, VA 24061<br><a href="http://www.vetmed.vt.edu/">http://www.vetmed.vt.edu/</a>                  | <b>(540) 231-4621</b><br>(Your veterinarian may contact this number 24 hours a day for consultation.)<br><b>540-231-7666 (SWITCHBOARD)</b> |
|  | <b>Animal Poison Control Center</b><br><a href="http://www.napcc.asPCA.org/">http://www.napcc.asPCA.org/</a>   | <b>(800) 548-2423</b><br><b>(888) 426-4435</b>   |
| <b>Toxicology Information</b>  | <b>Virginia Department of Health Toxic Substances Information</b><br>109 Governor Street, P.O. Box 2448<br>Richmond, VA 23218<br><a href="http://www.vdh.virginia.gov/">http://www.vdh.virginia.gov/</a> | <b>(804) 864-8182</b>  |
| <b>For Information</b><br>on drinking water regulations and pesticides in drinking water                             | <b>EPA Safe Drinking Water Hotline</b><br><a href="http://www.epa.gov/safewater/">http://www.epa.gov/safewater/</a>  | <b>(800) 426-4791</b><br>Monday - Friday<br>9:00 AM - 5:30 PM  |
| Also try EPA's Home Page for more consumer information on pesticides at <a href="http://www.epa.gov">www.epa.gov</a> |  |  |

## Professional Associations

### National Pest Management Association Inc. (NPMA)

10460 North Street  
Fairfax, VA 22030  
(703) 352-6762  
<http://www.pestworld.org/>

### Professional Land Care Network (PLANET)

950 Herndon Parkway  
Suite 450  
Herndon, VA 20170  
(703) 736-9666  
(800) 395-2522  
<http://www.landcarenetwork.org/>

### Virginia Nursery and Landscape Association

383 Coal Hollow Rd.  
Christiansburg, VA 24073-6721  
(800) 476-0055  
(540) 382-0943  
<http://www.vnla.org/>

### Virginia Pest Management Association (VPMA)

P. O. Box 7161  
Fredericksburg, VA 22404-7161  
(540) 374-9200 or (877) 875-8722  
<http://www.vpmaonline.com/>

### Virginia Sod Growers Inc.

604 Hull St.  
Richmond, VA 23224  
(804) 233-4972

### Virginia Turfgrass Council (VTC)

P. O. Box 5989  
Virginia Beach, VA 23471  
(757) 464-1004  
<http://www.vaturf.org>

This directory neither endorses those private groups listed or was intended to exclude groups who may be appropriate but were not listed. Those who feel that they should be included are welcome to call or write for inclusion in future revisions: Virginia Tech Pesticide Programs (0409), Blacksburg, VA 24061. (540) 231-6543. For a more complete list of pesticide related sites on the World Wide Web, please refer to the Virginia Tech Pesticide Programs Home Page at [www.vtpp.ext.vt.edu](http://www.vtpp.ext.vt.edu) (or <http://www.vtpp.org>).

## **Protecting Honey Bees**

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The poisoning of honey bees and other beneficial insects by pesticides can be a serious problem. Honey bees provide a valuable service to agriculture because they are the most important pollinators of cultivated crops. They also produce honey and beeswax. Efforts should be made to protect honey bees whenever pesticides are used. The protection of honeybees has become even more critical in recent years because of increased colony loss due to mite parasites and Colony Collapse Disorder (CCD)

### **Causes of Bee Poisoning**

1. Most bee poisoning occurs when insecticides are applied to crops in bloom. This includes crop plants such as sweet corn, which is routinely sprayed when in tassel. Honey bees collect pollen from corn tassels.
2. The application of insecticides to fields with weeds that are in bloom. The spring application of insecticides to alfalfa fields with flowering weeds is a particular problem in Virginia.
3. Drift of toxic sprays or dusts onto adjoining crops or weeds that are in bloom.
4. The contamination of flowering ground-cover crops in orchards when spray applications are made.
5. The contamination of water. This includes water collected by bees for drinking and cooling the hive as well as contact with contaminated water or dew on foliage or flowers.
6. The use of systemic insecticides and the possible contamination of nectar and pollen. This is a concern with the use of neonicotinoid insecticides, such as clothianidin, imidacloprid, and thiamethoxam, although more research is needed.

The most serious problems occur when bees collect contaminated pollen or nectar and carry these materials back to the hive. Insecticidal dusts (particularly Sevin) and encapsulated insecticides are especially dangerous because they adhere to foraging bees and may be collected and stored in the hive with pollen. Such materials can cause serious bee kills within the hive for many months.

### **Ways to Reduce Bee Poisoning**

1. When using pesticides that are hazardous to bees, notify the beekeeper so that he may move or protect his hives.
2. Do not apply insecticides that are toxic to bees to crops in bloom.
3. Use insecticides that are less toxic to bees when such choices are consistent with pest control recommendations (see the table of relative toxicities).
4. Choose the least hazardous formulations when possible. Dusts and encapsulated insecticides are more toxic than sprays of the same material. Wettable powder sprays tend to have a longer residual effect (and are more toxic) than emulsifiable concentrate sprays. Granular applications are usually the safest method of treatment around bees.
5. Avoid drift of toxic sprays onto ground-cover plants, weeds, and crops in nearby fields.
6. Control weeds in fields and avoid direct insecticide applications to flowering weeds whenever possible.
7. If ground-cover plants in orchards are in bloom, mow before spraying.
8. Apply insecticides when bees are not actively foraging, either in the late evening or early morning. This is particularly important with crops such as corn where evening applications avoid many problems since pollen release occurs in the morning. In general, evening applications are least hazardous.
9. Avoid direct treatment over colonies.

## Relative Toxicity of Pesticides to Honey Bees by Laboratory and Field Tests

### Group I. Highly Toxic

Severe losses may be expected if these pesticides are used when bees are present at treatment time or within a day **thereafter**.

|                  |                 |                   |                           |                         |                   |
|------------------|-----------------|-------------------|---------------------------|-------------------------|-------------------|
| Abamectin        | Baytex          | Delegate, Radiant | Fury                      | Orthene                 | Spectracide       |
| Acramite         | (fenthion)      | (spinetoram)      | (zeta-                    | (acephate)              | Steward           |
| (bifenazate)     | Baythroid       | Denim (emamec-    | cypermethrin)             | Parathion               | (indoxacarb)      |
| Actara, Centric, | (cyfluthrin)    | tin benzoate)     | Gardona                   | Pay Off                 | Sumithion         |
| Platinum, Helix, | BHC             | Dibrom            | (tetrachlorvinphos)       | (flucythrinate)         | (fenitrothion)    |
| Cruiser, Adage   | Bidrin          | (naled)           | Guard Star                | Phosdrin                | Supracide         |
| (thiamethoxam)   | (dicrotophos)   | De-fend, Dimate   | (permethrin) <sup>1</sup> | (mevinphos)             | (methidathion)    |
| Address          | Capture, Annex, | (dimethoate)      | Guthion                   | Phosphamidon            | Swat              |
| (acephate)       | Brigade         | Diazinon          | (azinphos-methyl)         | Poncho,                 | (bonyl)           |
| Admire           | (bifenthrin)    | (spectracide)     | Imidan                    | Titan, Clutch           | Synthrin          |
| (imidicloprid)   | Carzol          | Dimecron          | (phosmet)                 | (clothianidin)          | (resmethrin)      |
| Advantage        | Cidial          | (phosphamidon)    | Karate                    | Pounce                  | Tameron           |
| Afugan           | (phenthoate)    | Dursban, Eradex   | Lannate D                 | (permethrin)            | (methamidophos)   |
| (pyrazophos)     | Clutch          | (chlorpyrifos)    | (methomyl)                | Proaxis                 | Temik             |
| Ambush           | (clothianidin)  | Ectrin            | Lindane                   | (gamma-                 | (aldicarb)        |
| (permethrin)     | Commodore       | (fenvalerate)     | Lorsban                   | cyhalothrin)            | TEPP              |
| Ammo (Fury)      | (lambda-        | Endigo            | (chlorpyrifos)            | Proclaim                | Vapona            |
| (>.025 lb/acre)  | cyhalothrin)    | Envidor           | Malathion                 | (emamectin)             | (dichlorvos)      |
| (cypermethrin)   | Curacron        | (spirodiclofen)   | (Malathion G)             | Provado                 | Venom             |
| Apollo           | (profenofos)    | EPN               | Matacil                   | (imidachloprid)         | (dinotefuran)     |
| (clofentezine)   | Cygon           | Ethyl guthion     | (aminocarb)               | Pydrin                  | Warrior           |
| Arsenicals       | (dimethoate)    | (azinphos-ethyl)  | Mesuroil                  | (fenvalerate 0.1        | (lambda-          |
| Asana            | Cymbush         | Famphos           | (methiocarb)              | lb/A) <sup>2</sup>      | cyhalothrin)      |
| (esfenvalerate)  | Cythion         | (famphur)         | Methyl parathion          | Pyramite                | Zectran           |
| Avaunt (Advion)  | (malathion)     | Ficam             | Monitor                   | Rebelate                | (mexacarbate)     |
| (indoxacarb)     | Danitol         | (bendiocarb)      | (methamidophos)           | (dimethoate)            | Zephyr (Agri-Mek) |
| Avid             | (fenopropathin) | Folimat           | Nemacur P                 | Resmethrin              | (abamectin)       |
| (avermectin)     | Dasanit         | Fipronil          | (phenamiphos)             | Scout                   |                   |
| Azodrin          | (fensulfothion) | Furadan F         | Nexter                    | (tralomethrin)          |                   |
| (monocrotophos)  | DDVP            | (carbofuran)      | (pyridaben)               | Sevin                   |                   |
| Baygon           | (dichlorvos)    |                   | Nudrin                    | (carbaryl) <sup>3</sup> |                   |
| (propoxur)       |                 |                   | (methomyl)                |                         |                   |

<sup>1</sup>Can be applied to ground in front of beehives for the control of small hive beetles.

<sup>2</sup>Can be applied in the late evening at rate of 0.1 lb/A or less.

<sup>3</sup>Some formulations of Sevin XLR are rated as moderately toxic.

### Group II. Moderately Toxic

These can be used around bees if dosage, timing, and method of application are correct, but should not be applied directly on bees in the field or at the colonies.

|                 |                        |                  |              |                  |                        |
|-----------------|------------------------|------------------|--------------|------------------|------------------------|
| Abate           | Bolstar                | (terbufos)       | Korlan       | Oil sprays       | Trigard                |
| (temophos)      | (sulprofos)            | Decis, Battalion | (ronnel)     | (superior type)  | (cyromazine)           |
| Acramite        | Calypso                | (deltamethrin)   | Larvin       | Pirimor          | Thimet                 |
| (bifenazate)    | (thiacloprid)          | Di-Syston        | (thiocarb)   | (pirimicarb)     | (phorate) <sup>2</sup> |
| Agritox         | Carzol                 | (disulfoton)     | Metasystox   | Pyramat          | Thionex                |
| (trichloronate) | (formetanate)          | Dyfonate         | (demeton-s-  | Rhonthane (RDE)  | (endosulfan)           |
| Assail          | Chlordane              | (fonofos)        | methyl)      | SpinTor          | Trithion               |
| (acetamiprid)   | Ciodrin                | endrin           | Metasystox R | (Conserve SC)    | (carbophenothion)      |
| Banol           | (crotoxyphos)          | Esteem           | (oxydemeton- | (Entrust)        | Vydate                 |
| (carbanolate)   | Coumaphos <sup>1</sup> | (pyriproxyfen)   | methyl)      | (spinosad)       | (oxamyl)               |
|                 | (Agridip, Asunthol)    | Ethodan          | Mocap        | Systox (demeton) |                        |
|                 | Counter                | (Ethion)         | (ethoprop)   |                  |                        |

<sup>1</sup>Checkmite (coumaphos) strip can be used in beehives to treat for varroa mites and small hive beetles.

<sup>2</sup>Thimet EC should only be applied during late evening.

### Group III. Relatively Nontoxic

These can be used around bees with a minimum of injury

|                                  |   |                                     |                                      |   |                                  |
|----------------------------------|---|-------------------------------------|--------------------------------------|---|----------------------------------|
| Acaraben<br>(chlorobenzilate)    | <i>Bacillus thuringiensis</i><br>(Accoate, Biotrol, Dipel, Thuricide) | Dinocap<br>(Karathane)              | Kanemite<br>(acequinocyl)            | Ovotran<br>(ovex)                       | sabadilla<br>Saphos<br>(menazon) |
| Acarol<br>(bromopropylate)       | Calypso<br>(thiacloprid)  | Dylox<br>(trichlorfon)              | Kelthane<br>(dicofol)                | Pentac<br>(dienochlor)                  | Savey<br>(hexythiazox)           |
| Agri-Mek<br>(avermectin)         | Chlorantraniliprole   | Ethrel<br>(ethephon)                | Mavrik<br>(fluvalinate) <sup>1</sup> | Plictran [mitacid]<br>(cyhexatin)       | Spur<br>(fluvalinale)            |
| Allethrin                        | Chloroparacide<br>(chlorbenside)                                      | Esteem<br>(pyriproxyfen)            | methoxychlor<br>(Marlate)            | Pynamin                                 | Surround<br>(kaolin)             |
| Altosid<br>(methoprene)          | Confirm<br>(tebufenozide)   | Fujimite<br>(fenpyroximate)         | Morestan<br>(oxythioquinox)          | Pyrellin<br>(rotenone/<br>pyrithrin)    | tetram                           |
| Amitraz                          | Cyd-X<br>(CM granulovirus)  | Fulfill<br>(pymetrozine)            | Murvesco<br>(fenson)                 | pyrethrum<br>(natural)                  | Trigard<br>(cyromazine)          |
| Apollo<br>(clofentezine)         | cyrolite  | <i>Heliothis polyhedrosis</i> virus | Neemix (Align)<br>(azadirachtin)     | rotenone                                | Vendex<br>(fenbutatin oxide)     |
| Applaud, Centaur<br>(buprofezin) | Dessin<br>(dinobuton)   | Intrepid<br>(methoxyfenozide)       | Neotran                              | ryania                                  | Zeal<br>(etoxazole)              |
| Aza-direct<br>(azadirachtin)     | Dimilin<br>(diflubenzuron)  | Isomate                             | nicotine<br>Omite<br>(propargite)    | Rynaxypyr<br>(chlorantranilip-<br>role) |                                  |

<sup>1</sup>Fluvalinate is used in Apistan strips to treat beehives for varroa mites. It is illegal to use Mavrik in hives.

### Fungicides

As a general rule, fungicides are safe to use around honey bees.

|                           |                                    |                              |                                      |                                    |                           |
|---------------------------|------------------------------------|------------------------------|--------------------------------------|------------------------------------|---------------------------|
| Afugan<br>(pyrazophos)    | Captan<br>copper oxides            | Dithane D-14<br>(nabam)      | Mancozeb<br>Morocide<br>(binapaeryl) | Polyram<br>(metriam)               | Procure<br>(triflumizole) |
| Arasan<br>(thiram)        | copper oxychloride sulfate         | Du-Ter<br>(fentin hydroxide) | Mylone<br>(dazomet)                  | Rovral<br>(iprodione) <sup>2</sup> | Vitavax<br>(carboxin)     |
| Benlate<br>(benomyl)      | copper sulfate<br>cupric hydroxide | Dyrene<br>(anilazine)        | Phygon<br>(dichlone)                 | sulfur<br>Syllit<br>(dodine)       | Zerlate<br>(Ziram)        |
| bordeaux mixture          | (Kocide)                           | ferbam                       | Plantvax<br>(oxycarboxin)            | Terraguard <sup>1</sup> ,          | Zineb                     |
| Bravo<br>(chlorothalonil) | Cyprix<br>(dodine)                 | Karathane<br>Maneb           |                                      |                                    |                           |

<sup>1</sup> May increase the toxicity of neonicotinoid insecticides to honeybees if used together.

<sup>2</sup> May cause loss of honeybee larvae. Use with caution where bees are foraging.

### Herbicides, Defoliants and Dessicants

|                          |                           |                         |                          |                           |                          |
|--------------------------|---------------------------|-------------------------|--------------------------|---------------------------|--------------------------|
| Atrex<br>(atrazine)      | Bladex<br>(cyanazine)     | diquat<br>DSMA          | IPC<br>(propham)         | Pendimethalin<br>(Prowl)  | Sinbar<br>(terbacil)     |
| Alanap<br>(naptalam)     | cacodylic acid<br>Caparol | Endothal<br>(endothal)  | Karmex<br>(diuron)       | Phenmedipham<br>(Betanal) | Surflan<br>(oryzalin)    |
| Amiben<br>(chloramben)   | (prometryn)<br>Cotoran    | Eptam<br>Folex          | Kerb<br>(proamide)       | Pramitol<br>(prometone)   | Sutan<br>(butylate)      |
| Amitrol                  | (fluometuron)             | (desmedipham)           | Lasso<br>(alachlor)      | Princep<br>(simazine)     | Tordon<br>(picloram)     |
| Ammate                   | 2,4-D                     | Glyphosate              | Lorox<br>(linuron)       | Probe<br>(methazole)      | Treflan<br>(trifluralin) |
| Balan<br>(benefin)       | Daconate<br>(MSMA)        | Gramoxone<br>(paraquat) | MCPA                     | Ramrod<br>(propachlor)    |                          |
| Banvel<br>(dicamba)      | dalapon<br>2,4-DB         | Herbisan<br>(EXD)       | Paarlan<br>(isopropalin) | Ronstar<br>(oxadiazon)    |                          |
| Betanal AM<br>(bentanex) | 2,4-DP<br>(dichlorprop)   | Hyvar<br>(bromacil)     | paraquat                 | Sencor<br>(metribuzin)    |                          |

