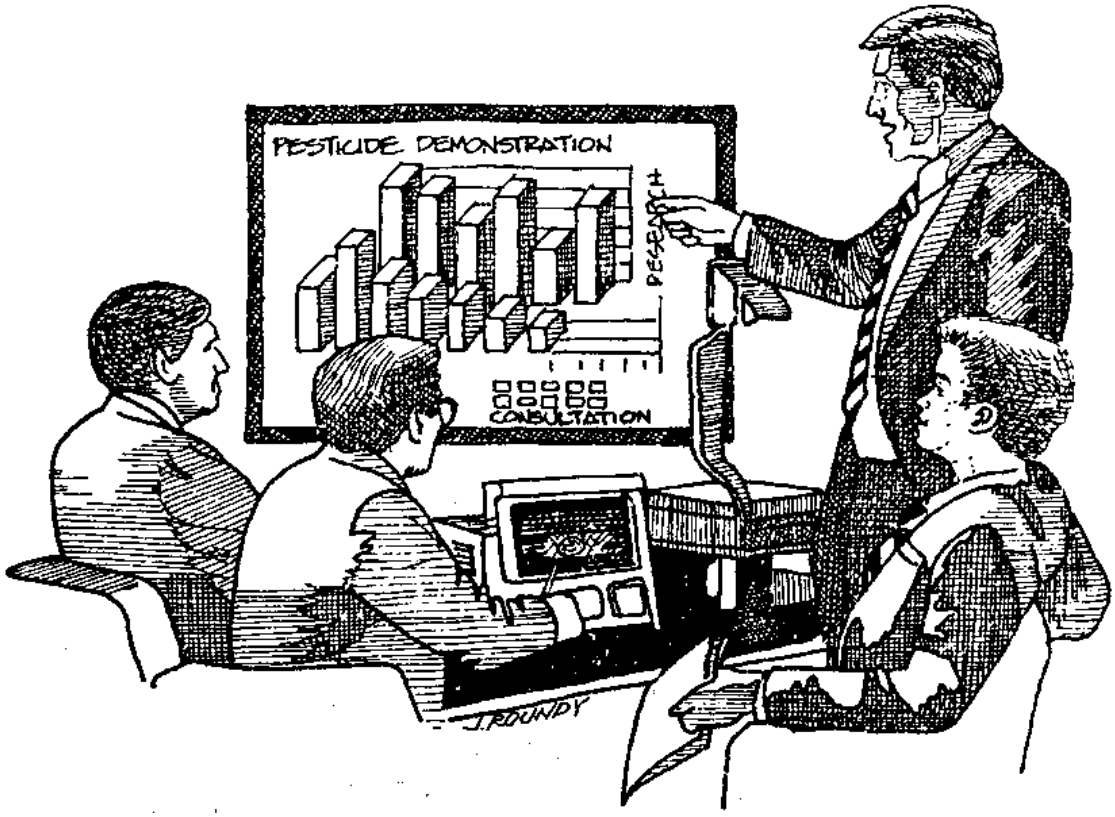
DEMONSTRATION, CONSULTATION, AND RESEARCH OF PEST MANAGEMENT

Study Guide for Pesticide Application and Safety
Category 10



Utah Department of Agriculture and Food
Division of Plant Industry
350 North Redwood Road
Salt Lake City, Utah 84114-6500
Revised May 2006
Format Revision 01/2009

STUDY GUIDE FOR DEMONSTRATION, CONSULTATION, AND RESEARCH OF PEST MANAGEMENT

The educational material in this study guide is practical information to prepare you to meet the written test requirements. It doesn't include all the things you need to know about this pest-control subject or your pest-control profession. It will, however, help you prepare for your test.

Contributors include the Utah Department of Agriculture and Utah State University Extension Service. This study guide is based on a similar one published by the Colorado Department of Agriculture. Materials for that guide were prepared by Colorado State Extension Service. Other contributors include: University Extension Service personnel of California, Kansas, Nebraska and Wyoming. The U.S. Department of Agriculture and U.S. Environmental Protection Agency, Region VIII Office.
The information and recommendations in this study guide are based on data believed to be correct, however, no endorsement, guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. Additional topics that may be covered in your examinations include First Aid, Personal Protective Equipment (PPE), Protecting the Environment, Pesticide Movement, Groundwater, Endangered Species, Application Methods and Equipment, Equipment Calibration, Insecticide Use, Application, Area Measurements, and Weights and Measures. Information on these topics can be found in the following books:

1. National Pesticide Applicator Certification Core Manual, Published by the National Association of State Departments of Agriculture Research Foundation.

The following individuals at Utah State University Extension contributed to the writing of this manual: F.R. Beard and H.M. Deer.

TABLE OF CONTENTS

This page should be blank.

I. INTRODUCTION

STUDY GUIDE

The demonstration, consultation, and research pesticide study guide provides basic information that applicators of restricted use pesticides (RUPs) need to meet the minimum federal and state standards for certification and recertification. The standards are set by the U.S. Environmental Protection Agency (EPA) and the Utah Department of Agriculture and Food (UDAF) in line with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended and the Utah Pesticide Control Act.

Pesticide handlers licensed in the demonstration, consultation, and research category include those who demonstrate or supervise demonstrations of RUPs. Such demonstrations include pesticide handling and application techniques. In additions, this license is for those who conduct field research with pesticides and, in doing so, use or supervise the use of RUPs.

Some examples of who should hold this license are Cooperative Extension specialists and county agents, agriculture education teachers, college and university teaching faculty, industry representatives and others who demonstrate pesticide products and methods used.
Others who should be licensed in this area are state, federal, university, commercial or industrial research scientists and other persons conducting field research using RUPs.

Excluded from this licensing requirement are persons conducting laboratory research and doctors of medicine or veterinary medicine utilizing RUPs in drugs or medication during their normal practice.

PESTICIDE PERSPECTIVE

Humans depend on living things to provide the essentials for survival. Destructive pests make the efficient production of these necessities very difficult. Other pest organisms constitute a threat to the health and comfort of people. Such pests must be managed to protect desirable plants and animals.

Plants or animals may be identified as a pest if they appear in unwanted places or their numbers are too great. For example, a weed is a plant growing where it is not wanted. In this context, a corn plant in a lawn is a weed and a rose in a cornfield is a weed. Some animals have been domesticated and provide us with food and fiber. Other animals provide recreation through human interaction, but if these animals are destructive or carry diseases then they are pests.

There are beneficial birds that eat destructive insects and many provide aesthetic enjoyment. Other birds their because of population numbers and/or excessive noise are regarded as public nuisances. Some insects destroy crops or transmit diseases, while others pollinate plants or serve as parasites or predators of undesirable insects. In general, those plants or animals that conflict with the immediate or long term needs and desires of humans are regarded as pests.

Chemical pesticides are commonly used to control pests. The goal of a pesticide application is to effectively manage the pest without threatening the safety of humans and the environment. Instances of inappropriate use or over application have resulted in the banning or limited availability of some pesticides. In some instances past mistakes have resulted in the development of better pesticides that are safer to use.

Using pesticides often means the difference between profit and loss. The use of pesticides has become almost indispensable to modern agriculture and to the consumer of agricultural products who expects agricultural products to be readily available at the market.

There is no indication that pesticides will be eliminated and they continue to be the most effective defense against pests. It is important that researchers continue to investigate the effects of pesticides on humans and the environment. There are numerous well funded groups concerned about environmental protection that will continue to publicly resist the use and misuse of pesticides.

Where safety concerns occur relative to the use of a pesticide, the advantages must outweigh the disadvantages for a pesticide's continued use. Such decisions require objective evaluation. At present, the safest way to use a pesticide is to assure that applicators and handlers carefully adhere to label instructions and apply pesticides only when appropriate.

Concern about the environment has added considerable stimulus to the development of pest management techniques that reduce the need for pesticides. The challenge is to accomplish pesticide use reduction without lowering yields or quality. This goal has been accomplished in a few instances and there is reason to believe that further progress will be made.

PESTICIDES AND ORGANISMS

Both the beneficial and harmful effects of pesticides are determined by how pesticides and organisms react to each other. To be effective a pesticide must normally penetrate the organism, move or be transported to the site of action, and there disrupt or alter a vital function of the pest. The manner in which the pesticide affects the vital function is called its mode of action. Penetration, transport, and mode of action involve interactions between the pesticide and the organism.

Interactions are also involved in the metabolism, accumulation, and elimination of pesticides by the organism, as well as in the biodegradation and biological magnification of pesticides. In addition, the ability of pesticides to kill or otherwise alter one organism, while not affecting another, and/or the organism's ability to develop a resistance to pesticides are dependent on differences in the interaction between pesticides and organisms.

D*ichloro-****d****iphenyl-****t****richloroethane* or DDT as it is better known is one example of how pesticide perceptions have changed throughout the history of their use. DDT and other persistent chlorinated hydrocarbons formed the basis for much of today's public awareness and the legislative action that controls current pesticide use.

DDT was the most well known organic insecticide and most widely used chemical for the control mosquitoes responsible for malaria, typhus, and other insect borne diseases. Today it is banned from use in the US. It is still manufactured and continues to be used to battle mosquitoes in other parts of the world.

Rachel Carson published the book *Silent Spring* in 1962. In her writings it was alleged that DDT

harmed bird reproduction by thinning egg shells and caused cancer in humans. *Silent Spring* caused a huge public outcry which eventually resulted in DDT being banned for use in the US. This event was one of the most important events that led to the environmental movement.

DDT was subsequently banned from agricultural use in many countries by the 1970s. DDT, perhaps, more than any other pesticide in history, is responsible for saving hundreds of thousands of lives, but is perceived to be too hazardous for use in the environment. The controversy surrounding DDT continues as tissue analysis has found this pesticide to be present in humans from all parts of the world.

PESTICIDE DISTRIBUTION

Pesticides are monitored in the environment by the US Environmental Protection Agency (EPA). The monitoring program includes fish, shellfish, wildlife, water, soil, food, and humans. In addition to the federal program, considerable monitoring is also done by state agencies, scientists from universities, and the chemical industry.

Extensive monitoring indicates that only a limited number of pesticides are generally found in environmental samples such as soil, water, air, and wildlife. However, articles written about pesticides in the environment often generalize about their occurrence, giving the false impression that all pesticides are involved.

Careful reading of these articles will usually reveal that they are based on studies involving DDT or another of the more persistent chlorinated hydrocarbon insecticides. The only samples that commonly contain pesticides are food crops that have been treated with these materials. These generally occur at levels below tolerance limits set by EPA.

Pesticide monitoring studies must be interpreted carefully, especially when dealing with amounts in the parts per billion or parts per trillion range.

The use of gas liquid chromatography and mass spectrometry has made possible the detection of extremely small amounts of some chemicals. However, identification of these chemicals is by no means certain unless confirmatory techniques are employed. This may be very hard and perhaps impossible at such low levels unless large samples are used. Also, at these levels it may not be possible to rule out accidental contamination of the sample, either at the time of collection, during storage, or in the analytical process.

The importance of confirming the identity of pesticides was illustrated recently when two chlorinated hydrocarbon insecticides, dieldrin and heptachlor, were apparently discovered in soil that had been collected and sealed in jars between 1909 and 1911, long before these chemicals had even been synthesized. Efforts to confirm the identity of these chemicals proved they were not pesticides but apparently naturally occurring constituents of the soil.

There is also evidence that polychlorinated biphenyls (PCBs) have been erroneously reported as DDT in environmental samples. Apparently PCBs, which were used in a variety of products ranging from plastics to industrial coolants, are widespread in the environment and can easily be mistaken for DDT if proper analytical procedures are not followed.

PESTICIDES IN WATER

Pesticides may enter water in several ways, including fallout from the atmosphere, drift from nearby applications, and movement from treated land by means of soil particles or runoff water. They may also be applied directly to water, either purposely or accidentally. Although quantitative information on the importance of these sources of contamination is limited, it seems likely that treated soil is the principal factor involved.

Most pesticides found in the environment are often bound tightly to soil particles or organic matter in the soil and are not readily soluble in water. These particles can move long distances by wind and water, so it is not surprising that pesticides are sometimes found far removed from the site of application. Although agricultural lands contribute to pesticide contamination of water, some of this pollution

originates from urban areas where pesticides are used in the home and garden.

Some of the contamination of the Great Lakes with DDT has been traced to city sewers. Pesticide contamination in the Red Cedar River in Michigan is reported to come mostly from waste water treatment plants, even though the river runs through areas of extensive agricultural development.

The pesticides most often found in water were some of the chlorinated hydrocarbon insecticides including dieldrin, endrin, heptachlor, lindane, BHC, and chlordane. Herbicides such as atrazine, alacore, prometon, and simazine are now the most common type of pesticide found in water.

PESTICIDES IN SOIL

Soils are important in determining what happens to a pesticide after application. Even though some pesticide volatilizes before reaching the soil or is intercepted by plants, a large portion eventually reaches the soil. As previously discussed, soil can serve as a reservoir from which pesticides may move to other areas by water or wind erosion.

Pesticides may also escape by evaporation from the soil surface into the atmosphere. Soil organisms may serve to transport pesticides from one area to another, usually because they serve as a food source for animals or birds.

The fact that soils and organisms in soils are largely responsible for the breakdown or inactivation of pesticides is of great importance. This neutralization of pesticides varies with soil type and climate and is in part the determining factor as to whether a particular pesticide should be used in a given area. Aside from purely environmental concerns, if a pesticide persists too long in soil, it may also damage future crops. Most pesticides do not move readily in soil because they are bound to soil particles, especially clay and organic matter. Consequently, they are usually found in the top few inches of soil. In rare instances some have been found at depths of several feet.

PESTICIDES IN WILDLIFE

It is not surprising to learn that pesticides found in wildlife are generally the same ones found in soil and water. Wildlife consume the food derived directly or indirectly from soil and water, and in some instances, pesticides will accumulate in wildlife at concentrations ranging up to thousands of times more than in soil and water. This process is bio-magnification and is known to occur with persistent chemicals that are readily soluble in fat. One of the best examples is DDT.

Dieldrin and heptachlor have also been implicated in bio-magnification, but other chlorinated hydrocarbon insecticides have not. Some of the highest residues of the chlorinated hydrocarbon insecticides have been found in birds of prey such as hawks and eagles. Fish eating birds are especially likely to contain residues of these insecticides. As might be expected, the insecticides most commonly found are DDT and dieldrin. These chemicals have been associated with lowered reproduction in several species of these birds. In fact, this is the principal reason that the use of DDT and dieldrin were severely restricted in the United States and other countries of the world.

The presence of pesticides in seed eating birds is generally much less than in birds of prey, and to date, there is little reason to believe there has been any effect on their reproduction. Birds have been killed by direct application of pesticides and by eating food contaminated with pesticides. This is not a general occurrence and, so far as is known, has not caused population declines that would threaten the existence of a species of seed eating bird.

PESTICIDES IN FOOD

Pesticides in food are monitored and controlled by two federal agencies, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA). Some state agencies are also involved in these activities.

EPA has the responsibility of establishing tolerances for pesticides in food. FDA monitors pesticides in foods that are prepared for the table.

This is commonly referred to as a "market-basket" or "total-diet" studies.

FDA determines the amount of pesticides in foods shipped in interstate commerce. It has authority to seize shipments that contain pesticide residues above tolerance levels and to initiate legal proceedings against the shipper.

FDA examines foods for contaminants other than pesticides, including such things as rodent hair, fecal pellets, and insect parts. Tolerances are established for these contaminants in food as well as pesticides. While consumers might be surprised to learn that a certain number of fecal pellets or insect legs are permitted in foods, perhaps they can take some comfort in knowing that current standards are much stricter than they were 20 or 30 years ago.

Pesticides have been largely responsible for these strict standards, and ironically, these standards are now a serious obstacle to the reduction of pesticide usage in certain situations. To the farmer, the use of pesticides may mean much more than simply increasing yield. If the quality of his crop is lowered by pest damage, he may not be able to market it at any price.

Every year, FDA determines the amount of pesticide chemicals in processed and raw agricultural products that are shipped interstate. This is a surveillance and regulatory program designed for the enforcement of tolerances set by EPA. Samples are collected throughout the year at producing, shipping, and destination points.

ENVIRONMENTAL CONCERNS

As we learn more about the behavior of pesticides in the environment, we find it necessary to devise more sensitive and discerning techniques to determine what their total impact will be. Invariably, man's innovations begin without a complete understanding of their consequences, such as the development of cars, airplanes, and the atomic bomb. Pesticides are no exception. The best we can do is to use all available knowledge, make allowances for unknown factors, and carefully estimate benefits and risks.

We will probably never be able to prove that any pesticide can be used without risk; proving a negative is generally impossible. But past experience and current EPA testing requirements give considerable assurance that risks will be minimal. During the past ten years, the time required to meet federal testing requirements has nearly doubled. There has also been a notable reduction in the appearance of new pesticides on the market and increased emphasis on finding ways to reduce the need for these chemicals.

The concern about the effects of pesticides on the environment is an extremely controversial issue debated by scientists, politicians, and the general public. One of the main reasons for this is that it's very hard to prove that a chemical is or isn't harmful, especially when it is present in small amounts and its effects cannot be clearly demonstrated outside the laboratory.

PESTICIDES AND PESTS

Pesticides include a variety of chemical products designed for the management of pests. The term pesticide refers to products such as herbicides and insecticides that are used to kill or control harmful organisms such as insects, weeds, or microorganisms. The following list includes numerous pesticides and the target pests they control.

Acaricide: mites and ticks
Adulticide: adult pests
Algicide: algae
Aphicide: aphids
Attractant: insects and vertebrates
Avicide: birds
Bactericide: bacteria
Defoliant: foliage removal
Desiccant: water removal from plant foliage
Disinfectant: microorganisms
Fumigant: insects, rodents, and weeds
Fungicide: fungi and other plant pathogens
Germicide: germs
Growth regulator: insects and plants
Herbicide: weeds
Hormone: insects and plants
Insecticide: insects
Larvicide: larval pests
Miticide: mites

Molluscicide: snails and slugs
Nematicide: nematodes
Ovicide: eggs
Pediculicide: lice
Pheromone: insects
Piscicide: fish
Predacide: predators
Repellent: insects and vertebrates
Rodenticide: rodents
Sanitizer: microorganisms
Silvicide: trees and woody vegetation
Slimicide: slime molds
Sterilant: microorganisms
Wood preservative: fungi and insects

PRECAUTIONARY STATEMENT

Pesticides offer both benefits and risks. Benefits can be maximized and risks minimized by reading and following the labeling. Pay close attention to the directions for use and the precautionary statements. The information on pesticide labels contains both instructions and limitations. Pesticide labels are legal documents and it is a violation of both federal and state laws to use a pesticide inconsistent with its labeling. The pesticide applicator is legally responsible for proper use. Read and follow the label instructions.

II. HANDLING PESTICIDES SAFELY

TOPIC **PAGE**

HANDLING PESTICIDES

The majority of pesticides are poisons that were manufactured to kill unwanted organisms. They should be stored, handled, and applied with care. Pesticides with a restricted use pesticide (RUP) designation present a particular hazard to humans and/or the environment and can only be used by licensed pesticide applicators. Special precautions are also required when using experimental pesticides because there is not an extensive record of use and the side effects have not been thoroughly investigated.

HUMAN TOXICITY

Pesticide toxicity values are a measure of the harmful effects on animals and indicative of how humans may react when exposed to the product. The toxicity values are not the only hazardous

factor associated with exposure to pesticides. A pesticide's active ingredients may be extremely toxic but the pesticide formulation may present very little hazard due to dilution, low volatility, specialized packaging, or restricted handling criteria.

A pesticide with a low toxicity may be quite hazardous because of the high volatility, prolonged or frequent exposure by applicators, a tendency to be mishandled, and/or a high concentration of active ingredients. In general, herbicides and fungicides are less toxic than insecticides or rodenticides. Pesticides with higher acute oral LD50 values are less toxic than pesticides with lower LD50 values. The LD50 value represents the quantity of active ingredient required to kill one half of the test animal population. The pesticide label is the best source of information for determining how to safely handle pesticides.

Many valuable chemical products, such as those used in the home and garden or in industry and agriculture, are potentially toxic to humans and can cause poisoning if misused. Some of these compounds will cause illness if intentionally or accidentally swallowed, inhaled, spilled on the skin, or splashed in the eyes. Before using any chemical product, be sure to read and understand the instructions on the container label.

When mixing, loading, or applying pesticides, applicators can be exposed through oral, dermal, occular, or respiratory routes. Oral exposure occurs when pesticide is swallowed. Spray droplets, mists, splashes, ruptured hoses, and accidental drinking or eating are examples of how this can happen. Under normal operating conditions this is considered the least likely route of exposure.
Several research projects have shown that for pesticide applicators the dermal route of exposure is many times more significant than the respiratory route of exposure. The extent to which dermal exposure occurs is much greater than respiratory. However, a dermally deposited pesticide is outside of the body which allows for cleaning and removal. A respiratory dose is inside the body and cannot be readily removed.

PERSONAL PROTECTIVE EQUIPMENT

The protective clothing worn when mixing, loading, or applying pesticides provides a barrier between the pesticide and the human body. Respirators and gas masks protect against oral and respiratory exposure by covering the nose and mouth and by filtering inhaled air. Gloves, boots, hats, and body coverings protect against dermal exposure. Glasses, goggles and face shields protect the eyes.

Respirators can be half face (cover nose and mouth) or full face (cover nose, mouth and eyes). Gas masks are full face and generally have replaceable filter cartridges. Pesticide users need cartridges specifically made for pesticides. Cloth masks or dust masks are not recommended, as they provide no protection against vapors. Full face respirators provide both respiratory and eye protection and are needed when irritating or highly toxic fumes and/or vapors are a concern.

Body coverings can be made of cotton, blended fabric, vinyl, neoprene, rubber, or lightweight synthetic garments. Almost any body covering provides some protection. Conventional work clothes, usually of cotton or blended fabric, provide protection when mixing, loading, or applying dry or dilute field concentrations of pesticides. They are not recommended during mixing and loading of liquid concentrates or liquid spray applications where contact is likely to occur.

Vinyl, neoprene, or rubber garments provide adequate protection if kept free of chemical contamination, but under hot and/or humid conditions they can be very uncomfortable and can lead to heat exhaustion or hyperthermia.

The lightweight synthetic garments can provide adequate protection if used in conjunction with a liquid proof apron during mixing and loading. These garments can have added coatings for additional protection when spraying more toxic pesticides.

Important points to keep in mind are that applicators often begin spray operations wearing minimal protective clothing and then add more at a later point thus covering the contaminated skin or garments; this may increase dermal absorption of the pesticide that is under the added protective clothing. Secondly, hot weather may increase the rate of dermal absorption when spray applicators tend to use less protective clothing.

Foot protection is always important when working with pesticides, especially when mixing and loading liquid concentrates and when walking through sprayed areas. Boots and shoes made of leather or canvas are not recommended when working with liquid pesticides as they absorb the liquids and hold them against the foot. They are difficult to decontaminate, and the continual wetting and drying causes cracking which makes pesticide penetration to the foot even easier.

Rubber boots are best for working with organophosphate insecticides while all waterproof boots are generally adequate for other pesticides. Boots should be worn with the pant legs on the outside to prevent pesticides from entering the top of the boot. Boots should be unlined for easy cleaning.

Gloves are helpful during all pesticide operations, but especially during mixing and loading of liquid concentrates. Canvas, cloth, or leather gloves should not be used for liquid operations for the same reasons as with canvas or leather boots. Lightweight plastic and rubber gloves provide some protection, but heavyweight waterproof gloves are recommended. Gloves should be unlined and have a cuff or anti-drip line so liquids do not run down the arm. Rubber gloves are recommended for organophosphate insecticides. Rubber or plastic gloves are suitable for most other pesticides.

Head protection should always be worn when working with pesticides especially during liquid spray operations. Billed caps provide some protection but not to the lower head, neck, and ear areas. Additionally, they absorb pesticides and are difficult to decontaminate.

Plastic hard hats with wide brims and non-absorbing liners are better. However, because of air circulation space over the head, they are not adequate protection when working with highly toxic mists and dusts.

Southwester style hats (those with a wide slanting brim longer in back than in front) are most often recommended. Generally they have brims that protect the front, side and back of the head and neck. A front brim is very beneficial protection against downward drift to the face. Waterproof hoods provide little face protection unless they have front brims.

Eye protection is important during mixing and loading operations with all pesticides especially liquids or where irritating fumes or vapors may be present. Full face respirators are recommended for eye protection against highly toxic pesticides. Face shields provide protection against pesticide splash but not dusts, mists, fumes, or vapors. Cup goggles will seal out splashes, mists, dusts, fumes, and vapors. Single lens goggles with hooded or baffled ports protect against splashes, mists, and dusts but not fumes or vapors.

All protective clothing must be kept clean and be decontaminated after use. Failure to do this can make exposure more severe than if no protective clothing were used. Contaminated protective clothing holds the pesticide against the skin frequently under hot moist conditions which can lead to increased rates of absorption.

Wash protective clothing in detergent and water and air dry preferably exposed to sunlight. Check the condition of protective clothing periodically and replace torn or perforated items. Change respirator cartridges as recommended by the manufacturer or whenever chemical odors are detected during use or when breathing becomes difficult because of filter plugging. Always have spare cartridges available. Wash the face piece, with the filters removed, in detergent and water, rinse thoroughly, and dry in a well ventilated area. Do not use alcohol or solvents to clean the face piece.

PESTICIDE COMPATIBILITY AND EFFICACY

It is often desirable to combine pesticides designed for different pests and apply them together in a single application. Often a wider variety of pest species may be controlled and greater effectiveness may be is achieved when pesticides are combined. Combinations of fungicides, insecticides, miticides, herbicides, growth regulators, liquid nutrients, and such are used to save time and labor.

When pesticides are used in combination without impairing the efficiency of the component chemicals or resulting in injury to the plants to which they are applied, the combination is said to be compatible. Mixtures that are incompatible can result in plant damage, undesirable physical properties, and/or reduced pest management.

Pesticide incompatibility results when one or more of the chemicals breakdown or loose their effectiveness. Physical incompatibility can result in the formation of a heavy precipitate or buttery mass, excess foaming, or poor distribution of the pesticide. Incompatibility can result in the settling of chemicals in the spray tank and the clogging of sprayer nozzles and screens.

Some pesticides are formulated together and marketed in prepackaged combinations. Others pesticides can be combined in the tank mix if not restricted by label directions. Care should be taken to follow label directions. When combining pesticides for the first time, a trial application should be performed to determine if the outcome is desirable.

IMPACTING NONTARGET ORGANISMS

From an ecological standpoint it is nearly impossible to apply a pesticide without causing a negative environmental impact. Herbicides, the most widely used of all pesticides, can be a problem for non-target plant organisms.

Gardens, desirable trees, flowering plants, and agricultural crops are frequently damaged because of herbicide drift or other off target movement caused by improper application of herbicides.

To reduce off target movement of herbicides:

-Apply herbicides when the wind is calm with only a light breeze blowing away from non-target plants.

-Use low spray pressure of 20 to 30 pounds per square inch.

-Use 15 to 20 gallons of spray solution per acre for ground applications.

-Release herbicide spray as close to target plants as possible for effective coverage.

-Use drift control agents as needed to avoid damage to nearby plants.

-When applying phenoxy herbicides, use amine salt formulations if temperatures are expected to exceed 80 degrees F.

-If ester formulations of phenoxy herbicides must be used, apply low volatile ester formulations only when air temperatures are expected to stay below 85 degrees F. for several hours following the application.

-Highly volatile ester formulations of 2,4-D and other ester phenoxy herbicides release vapors or fumes rapidly at about 80 degrees F. and less volatile ester formulations vaporize at about 90 degrees F. Amine formulations are less volatile and safer to use at higher temperatures.

Non-target soil areas can also be contaminated by improper herbicide applications. Water and/or soil movement of soil herbicides can injure or kill desirable vegetation down slope.

The contamination of streams or drainage ditches may injure plants or animals for many miles downstream. Aquatic animals are easily

injured by some pesticides and label directions often include special precautions for applications near water.

Herbicides should not be applied to sloping land areas if desirable non-target plants are located on down slopes. Herbicides applied to treatment areas may also damage trees and other plants with roots located under or adjacent to treatment sites.

Honeybees are insects than can easily be injured by pesticide applications. Bees are valuable as honey producers and pollinators, but they also are susceptible to many of the insecticides used by agricultural producers and homeowners. Some insecticides will kill bees at the time of application and for several days following the treatment.

Prevention of bee losses is a joint responsibility of the spray operator, the agricultural producer, and the beekeeper. Bees should be moved from the area if toxic materials are to be used on plants the bees are visiting. Before spraying is done, the beekeeper should be notified in advance to remove the bee colonies.

Strategies to protect bees include:

-Late evening and early morning applications will reduce bee kills.

-Sprays generally are less hazardous to bees than dusts.

-Emulsifiable concentrates are less toxic than wetable powders.

-Granular materials seldom are used in ways that would harm bees.

-Ground sprayer treatments are usually less toxic to bees than aircraft applications.

-Spraying or dusting while bees are active in the fields will increase bee kills.

-Treatments near hives when bees are clustered outside the hives increases bee kills.

-Drift to neighboring fields in blossom or to adjacent blossoming weeds and wildflowers can result in substantial bee kills.

DISPOSAL OF CONTAMINATED MATERIALS

Empty pesticide containers, personal protective equipment, and pesticide application equipment often have hazardous pesticide residues. They need to be thoroughly cleaned. Discarded items that could be salvaged for reuse should be damaged to the point that they cannot be reused.

CROPS TREATED WITH EXPERIMENTAL COMPOUNDS

Crops treated with experimental pesticides may not be sold for consumption unless an EPA tolerance has been established for the crop-pesticide combination. Usually after all data has been collected, the crop must be destroyed.

No one should be allowed remove samples from the experimental plots for personal use. Not enough is known about these experimental compounds to allow exposure of people to the potential hazards.

DISPOSAL OF UNUSED EXPERIMENTAL COMPOUNDS

All experimental pesticides should be clearly labeled and stored safely until disposal. The best way to dispose of unused experimental pesticides is to return them to the manufacturer. When agreeing to cooperate in a research project using such pesticides, limit the quantity of pesticide on hand to the amount scheduled for application and make arrangements for excess pesticide disposal.

HAZARDOUS WASTE DISPOSAL

Hazardous waste disposal involves storage, handling, transport, and record keeping from the point of origination to the final site of disposal.

In the disposal of hazardous waste:

-If hazardous waste is disposed of illegally the penalties can range up to a million dollars for a corporation and a quarter of a million dollars for an individual.

-If the disposal company hired to get rid of waste goes bankrupt, responsibility for cleaning up abandoned dump sites can fall to the customers responsible for the waste.

-The costs of cleaning up sites where the dumpers of illegal waste cannot be identified will be paid for from a public fund financed by fees charged future waste disposers.

PESTICIDE CONTAINER DISPOSAL

Disposal of empty pesticide containers should be done according to the instructions on the pesticide label. Containers that are to be triple rinsed should also be damaged to prevent reuse. After triple rinsing they should be destroyed by crushing or puncturing. After containers have been properly triple rinsed, they can be disposed of with other refuse. When pesticide containers are burned, the smoke can be dangerous. Empty containers from 2,4-D and other growth regulating materials should not be burned.

Triple Rinsing

1. Empty the container into the tank. Let it drain 30 seconds.
2. Fill the container one-fifth to one-fourth full of water.
3. Replace the closure and rotate the container for about 30 seconds. Invert the container so the rinse reaches all the inside surfaces.
4. Drain the rinse water from the container into the tank. Let the container drain for 30 seconds.
5. Repeat steps 2 through 4 two more times for a total of three rinses.

PESTICIDE SAFETY

Applicators should be aware that using experimental pesticide compounds pose a potentially serious hazard. The hazards may not be understood and/or the risks may not have been researched and identified. Pesticide poisoning from a product without the appropriate first aid treatments on the label could be fatal. The appropriate emergency medical response may be incorrect or delayed because of the experimental status of the pesticide.

III. INTEGRATED PEST MANAGEMENT

HISTORY OF INTEGRATED PEST MANAGEMENT

The use of multiple strategies in pest control is not a recent concept. Integrated pest control techniques have been utilized since humans first began to congregate in groups near fresh water and fertile soil. When food and other beneficial crops were first farmed, pest populations began to attack the crops and the people. The localization of preferred crops or hosts has encouraged pest concentration and elevated pest problems.

Early farmers learned from trial and error to use a variety of cultural practices in pest control. Some of these strategies included soil tillage to expose insects, crop rotation to interrupt pest growth cycles, planting at optimal times for optimum plant growth and minimal pest populations, burning crop refuge to prevent over-wintering by pests, plant pruning and removal to reduce pest infestation, planting of trap crops to draw pests away from food crops, and applying sulfur solutions or dusting crops with sulfur to repel pests.

As the labor pool increased and the farming tools advanced, the number of acres under cultivation increased significantly, as did the need for more aggressive and effective pest management strategies. By the late 1800s some inorganic pesticides were being used. In the 1940s, ***D****ichloro-****d****iphenyl-****t****richloroethane*, (DDT) and other pesticides were used almost exclusively and traditional cultural practices that relied on other non-chemical control measures received little attention.

The earliest use of the phrase "integrated pest management" (IPM) with respect to pest control appears to date back to 1954. The Utah State University (USU) website defines IPM as the strategic approach to crop production that seeks to effectively suppress pest populations while minimizing pest control costs and environmental disruption.

Further, the USU website explains that the typical IPM approach integrates numerous control tactics and pesticide treatments are made only when necessary. Treatment decisions are based on information derived from crop scouting, crop economics, elements of pest biology, agro-ecology, host-plant genetics, toxicology, and weather.

A slightly different definition of IPM is available on the website of the National Science Foundation Center for Integrated Pest Management and states that IPM is the coordinated use of pest and environmental information along with available pest control methods, including cultural, biological, genetic, and chemical methods to prevent unacceptable levels of pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

When pesticides were initially marketed, there were few if any regulations or restrictions. Pesticides used during the first half of the 1900s were inexpensive and proved so effective that producers exhibited little interest in alternative pest control measures. The public's recognition of secondary pest problems or health concerns was slow to occur and pesticide use increased dramatically over the next few decades.

Pesticides became the primary control measure for pests of all kinds. The public unknowingly used early pesticides without understanding aspects of unsafe handling. Today, safety is one of the most expensive components involved in the development of new pesticide products

Pesticides continue to be one of the most important tools for public health, in the protection of our food supply, for seed and soil treatment, in the control of weeds, for the protection of plants and animals, and in numerous aspects of post harvest protection.

Pesticides are a necessary component of modern agriculture and they will continue to have an essential role in food and fiber production in the future. However, it would be a serious mistake to depend on pesticides without employing IPM principles in the defense against pests.

It is apparent from the analysis of animal tissue and groundwater that some of the earlier pesticide applications negatively impacted the environment. Inappropriate and/or excessive use introduced problems of pesticide resistance, destruction of natural controls, outbreaks of secondary pests, reduction of pollinators and other beneficial species, caused environmental contamination, and resulted in some health hazards.

INTEGRATED PEST MANAGEMENT PERSPECTIVE

The unilateral use of any control measure, be it pesticides or the introduction of an insect resistant plant variety, can have unexpected and undesirable consequences. IPM when used correctly will reduce problems such as pests developing pesticide resistance, pest resurgence, secondary pest outbreaks, and the reliance on pesticides.

IMP offers a multidimensional approach using a range of biological, cultural, mechanical, and chemical pest control techniques to keep pests below damaging economic levels without significantly disrupting the ecosystem. The basic premise is that no single arbitrary control method will be successful because of the remarkable adaptive powers of insects, weeds, and plant pathogens and because of the many variables related to location, season, cropping patterns, and individual pests.

The key ingredient of IPM is information. The dynamics of the pest populations must be known to predict the pest's occurrence, its population levels, and the potential economic damage. The biology of the pest organism must be understood. The pest's natural enemies need to be identified, the host plants or animals of the pests must be determined, and the interrelationship of the pest with the environment must be closely evaluated.

IPM can predict the interaction between various control techniques and strategies, and on the environment in which they are used. IPM evaluates the effects of weather conditions, crop status, and cultural practices such as irrigation, cover crop management, and harvesting methods.

Modern IPM is not a new and separate strategy in crop and health protection. It is an evolutionary process in pest management that involves some new conceptual approaches using computers with effectively proven pest management techniques that have been used for hundreds of years.

The understanding of host-to-pest interactions has evolved to the point that an integration of pest management tactics for multiple pests is necessary and feasible. Given the inadequacies of single method or single discipline approaches and their potential for undesirable environmental and legal effects, IPM is the solution.

Pesticides are powerful tools in the multiple strategies utilized in successful pest management. Pesticides will continue to be the most effective method of killing large populations of pests.

URBAN INTEGRATED PEST MANAGEMENT

In the 1980's, some pioneering advocates of IPM began applying IPM principles and practices to urban sites. Since that time, IPM systems have been developed for several urban sites such as schools, parks, hospitals, and nursing homes.

The application of IPM for pest control in public schools has received much attention. It is the IPM strategies developed with child safety in the forefront that have altered pest management guidelines in other public locations.

IPM has been marketed as a safer and less expensive control measure. Public school IMP programs rely on commonsense procedures that reduce, and where possible eliminate, the food, water, and shelter that attracts pests to the school. Since children spend so much time in school, schools are considered to be sensitive Areas.

Some of the control measures emphasized in IPM are directed at regularly cleaning all cafeterias, lockers, desks, and cabinet areas when food is stored. Liter should be removed daily, garbage cans and dumpsters are emptied frequently, and trash containers are regularly cleaned.

The IPM program emphasizes prevention and if a problem arises, the pests are correctly identified before more aggressive control measures are applied. When necessary, school IPM strategies include the judicious and careful use of pesticides.

School IPM strives to create a safe learning environment for children who are sensitive to certain pesticides. Pest treatments are commonly applied at floor or ground level and given the tendency for young children to crawl, play, and explore these surfaces the opportunity for exposure is quiet high.

PROTECTING SCHOOL CHILDREN

The Environmental Protection Agency website on IPM describes the importance of protecting children in schools from pests and pesticides. The website provides the following information.

Pesticides are powerful tools for controlling pests. However, pesticides need to be used carefully and judiciously, especially when used in sensitive areas where children are present. Children are more sensitive than adults to pesticides. Young children can have greater exposure to pesticides from crawling, exploring, or other hand-to-mouth activities.

Put simply, integrated pest management is a safer, and usually less costly option for effective pest management in a school community. A school IPM program uses common sense strategies to reduce sources of food, water and shelter for pests in your school buildings and grounds. An IPM program takes advantage of all pest management strategies, including the judicious and careful use of pesticides when necessary.

Since children spend so much of their day at school, integrated pest management provides an opportunity to create a safer learning environment - - to reduce children's exposure to pesticides as well as eliminate pests. EPA is encouraging school officials to adopt IPM practices to reduce children's exposure to pesticides.

Integrated Pest Management (IPM) is a safer and usually less costly option for effective pest management in the school community. A school IPM program employs commonsense strategies to reduce sources of food, water and shelter for pests in your school buildings and grounds. IPM programs take advantage of all pest management strategies, including judicious careful use of pesticides when necessary.

IV. FEDERAL AND STATE PESTICIDE LAWS

TOPIC **PAGE**

HISTORY OF PESTICIDE LEGISLATION

The use of chemical pesticides increased significantly near the end of the 19th century. At that time only a few simple formulations existed and pesticide products were made by many small companies and often prepared by the farmers after mail ordering the basic active ingredients.

Congress became concerned about the sale of substandard or fraudulent pesticides and in order to protect the farmer the Federal Insecticide Act of 1910 was passed. This act specified the ingredient percentages for Paris green and lead arsenate as well as other pesticides in use at that time. The legislation was primarily a consumer protection act for the farmer.

In 1947, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) was enacted. This act required pesticides to be registered with the United States Department of Agriculture (USDA) and required that they be labeled according to established standards. This law assumed that the pesticide user was a rational person and with sufficient label information, proper pesticide selection and use would occur. The focus of the original law was on the efficacy of the pesticide and not on the negative impacts on non-target species and the environment.

In 1970, the Environmental Protection Agency (EPA) was formed and assigned the responsibility of enforcing the FIFRA. EPA was also given the authority to establish tolerances for pesticide residues in edible foods, feed, and their packaging materials. The Food and Drug Administration (FDA) was charged with enforcing those tolerances by testing these items for chemical residues.

The Federal Environmental Pesticide Control Act (FEPCA) was passed in 1972. It was the most detailed and comprehensive pesticide legislation in history. The act recognized the need to protect the general public and environment from the potentially harmful effects of pesticides.

At the core of the FEPCA was the requirement that the EPA deny the registration of a pesticide unless it could be determined that it would not cause unreasonable adverse effects on the

environment when used in accordance with widespread and commonly accepted practices. The unreasonable adverse effect was further described as any unreasonable risk to humans or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.

As a result of the FEPCA, EPA had to conduct balanced risk versus benefit analyses for all pesticide uses. Congress recognized that pesticide use inherently causes some risk because of the use of biologically active chemicals, but congress wanted that risk balanced against benefits derived from using pesticides.

Amendments to the FEPCA in 1975 reemphasized the Congressional decision that risk alone would not be sufficient reason to deny or cancel the registration of a pesticide, but rather both risks and benefits must be thoroughly examined in reaching a regulatory decision.

In 1988, FEPCA amendments required a change of the EPA's responsibilities and funding requirements for the indemnification, storage, and disposal of suspended/canceled pesticides. Further, the legislation provided for a substantial acceleration of the pesticide re-registration activity, and imposed statutory time limits for processing certain types of pesticide registration activities. The amendments also authorized collection of fees to support some of these new activities.

The 1988 Amendments expanded the EPA's authority to regulate the storage, transportation, and disposal of pesticides according to labeling requirements. Under the new law, the EPA could also require registrants and distributors to recall suspended and canceled pesticide products.

In 1996, the Food Quality Protection Act (FQPA) became law. EPA now regulates pesticides under two major federal statutes. Under FIFRA, EPA registers pesticides for use in the United States and prescribes labeling and other regulatory requirements to prevent unreasonable adverse effects on health or the environment.

Under the Federal Food, Drug, and Cosmetic Act (FFDCA), EPA establishes tolerances, known as maximum legally permissible levels, for pesticide residues in food. The tolerance is the maximum amount of residue of that pesticide allowed on the crop at the time it is harvested or offered for sale.

To establish the tolerance level, EPA scientists study and analyze the manufacturer's data. Permissible tolerance levels are established well below any level that possibly could cause harm. In most instances, it would require at least 100 times the amount of residue allowed to create any potential harm to people who consume the products.

Tolerances are enforced by the Department of Health and Human Services/Food and Drug Administration (HHS/FDA) for most foods and by the USDA’s Food Safety and Inspection Service (USDA/FSIS) for meat, poultry, and some egg products.

The FQPA represented a major breakthrough, amending both major pesticide laws to establish a more consistent, protective regulatory scheme, grounded in sound science. This legislation continues to be an important consumer protection resource for pesticide safety enforcement.

The FQPA mandates a single, health based standard for all pesticides in all foods; provides special protection for infants and children; expedites approval of safer pesticides; creates incentives for the development and maintenance of effective crop protection tools for American farmers; and requires periodic reevaluation of pesticide registrations and tolerances to ensure that the scientific data supporting pesticide registrations will remain up to date in the future.

LAWS AND REGULATIONS

Laws governing the use and the users of pesticides are designed to protect humans and the environment. FIFRA and the Utah Pesticide

Control Act, Chapter 14, are the principal statutes governing the commercial distribution, use, and application of pesticides in Utah. The following information presents some selected provisions of FIFRA and is intended solely for general information.

The intent of FIFRA is to protect humans and the environment. It seeks to insure this protection by providing for the controlled use of pesticides. The law contains provisions on pesticide registration, classification, labeling, distribution, use, and other topics. Those sections pertaining to pesticide users broadly address the three key issues of user categories, certification, and penalties for violations

FIFRA recognizes the two pesticide user categories of private and commercial applicators. A private applicator is defined as being a certified applicator who uses or supervises the use of a restricted use pesticide (RUP) to produce an agricultural commodity on property he or she owns or rents, on an employer's property, or on the property of another person if there is no compensation other than trading personal services.

A commercial applicator is any person who uses or supervises the use of RUPs for any purpose other than producing an agricultural commodity. Utah recognizes the third category of a noncommercial applicator. The noncommercial applicator is any person working as an individual or as an employee for a firm or government agency who uses or demonstrates the use of any RUP and who neither qualifies as a private applicator nor requires a commercial applicator's license.

Two points about these definitions are especially important. First, in order to use or supervise the use of RUPs, a person must be certified as a licensed pesticide applicator and secondly, supervising use is construed to mean that the certified applicator need not be physically present during the application procedure but is available if and when needed.

FIFRA clearly states that using a pesticide in a manner inconsistent with its labeling is unlawful. Some procedures are specifically exempted under this provision and they include:

1. Applying a pesticide at any dosage, concentration or frequency less than that specified on the labeling.
2. Apply a pesticide against a target pest not listed on the label if the application is to a plant, animal, or site listed on the labeling.
3. Use any appropriate equipment or method of application that is not prohibited by the labeling.
4. Mix a pesticide or pesticides with a fertilizer if the mixture is not prohibited by the labeling.
5. Mix two or more pesticides if all of the dosages are at or below the rates recommended by the labeling.

RECORD KEEPING REQUIREMENTS

Since May 10, 1993, the United States Department of Agriculture (USDA) has required certified private applicators to maintain records of federal RUP applications. The records must be maintained for two years following the pesticide application. In addition, since August 1995, the record information must have been recorded no later than 14 days following the pesticide application. The records must contain:

1. The brand or product name of the federal restricted use pesticide and the product's EPA registration number.
2. The total amount applied.
3. The size of the area treated.
4. The crop, commodity, and stored product or site.
5. The location of the application.
6. The month, day, and year of the application
7. The certified applicator's name and certification number.

A certified applicator who violates any provision of the regulation will, for the first offense, be subject to a fine of not more than $500. For later offenses, he or she will be subject to a fine of not less than $1,000 for each violation.

Commercial applicators shall keep and maintain records of each pesticide application. This is for RUPs and non-RUPs and must include the following information.

1. The name and address of the property owner.
2. The location of the treatment site if it is different from number 1 above.
3. The month, date, and year when the pesticide was applied.
4. The brand name of pesticide, EPA registration number, rate of pesticide applied per unit area, and total amount of pesticide used.
5. The purpose of the pesticide application.
6. The name, address, and license number of the certified applicator who applied the pesticide.

Such records shall be kept for a period of two years from the date of application of the pesticide and shall be available for inspection by the Utah commissioner of agriculture at reasonable times. Upon request, the commissioner shall be furnished a copy of such records by the commercial applicator.

Noncommercial applicators shall keep and maintain records of each application of RUPs and must include the following information.

1. The name and address of the property owner.
2. The location of the treatment site if it is different from number 1 above.
3. The month, date, and year when the pesticide was applied.
4. The brand name of pesticide, EPA registration number, rate of pesticide applied per unit area, and total amount of pesticide used.
5. The purpose of the pesticide application.
6. The name, address, and license number of the certified applicator who applied the pesticide.

Such records shall be kept for a period of two years from the date of application and shall be available for inspection by the commissioner at reasonable times. Upon request, the commissioner shall be furnished a copy of such records by the commercial applicator.

TYPES OF PESTICIDE REGISTRATION

The amended FIFRA legislation requires that all pesticides be registered and classified as either general or restricted use. This includes all pesticides used in and around homes, swimming pools, businesses, public buildings, and recreation areas, as well as those used in agriculture.

With an application for pesticide registration, a manufacturer must submit data to the Pesticide Division of EPA showing that the product, when used as directed:

- Is effective against the pest listed on the label.
- Will not injure humans, animals, or crops or damage the environment.
- Will not result in illegal residues on feed and food.

This data is then carefully analyzed and evaluated by various scientific experts.

STATE REGISTRATIONS

The Utah Department of Agriculture and Food is authorized, subject to the Utah Administrative Rulemaking Act, to:

1. Declare as a pest any form of plant or animal life (other than man and other than bacteria, viruses, and other micro-organisms on or in living man or other living animals) that is injurious to health or the environment;

2. Determine, in accordance with the regulations made known by the EPA under Section 25(c)(2) of FIFRA, whether pesticides registered for special local needs under the authority of Section 24C of FIFRA are highly toxic to man;

3. Determine, consistent with EPA regulations, which certain pesticides or amounts of substances contained in these pesticides, are injurious to the environment;

4. Adopt a list of restricted use pesticides for the state or designated areas within the state if it determines, upon substantial evidence presented at a public hearing and upon recommendation of the pesticide committee, that restricted use is necessary to prevent damage to property or the environment; or

5. Adopt any regulation (not inconsistent with federal regulations made known under FIFRA) deemed necessary to administer and enforce this chapter, including but not limited to, regulations relating to the sale, distribution, use, and disposition of pesticides as deemed necessary to prevent damage and to protect the public health.

EXPERIMENTAL USE PERMIT

The amended FIFRA legislation requires an Experimental Use Permit (EUP) for those wishing to accumulate the information necessary to register a pesticide not registered by EPA or to register a new use for a previously registered pesticide.

Most EUPs are obtained by the person wishing to register the pesticide. In most instances, this is the company producing or formulating the pesticide. University Experiment Stations and Extension Service personnel who evaluate unregistered pesticides generally utilize the experimental-use permit obtained by the pesticide manufacturer.

No EUP is required to test a substance or mixture of substances to determine its value for pesticidal purposes or to determine its toxicity or other properties if the user does not expect to receive any benefit from the pest control. In addition to laboratory and greenhouse trials, this also affects:

1. Land use where tests are conducted on a cumulative total of not more than ten acres, provided that any food or feed crop involved in or affected by such tests is destroyed or consumed by experimental animals, unless a tolerance or exemption from a tolerance has been established.

2. Aquatic use where tests are conducted on a total of not more than one surface-acre of water, provided the waters affected by such tests are not used for irrigation, drinking, water supplies, or body contact recreation purposes. No tests may be conducted in any areas where fish, shellfish, or other plants and animals are taken for recreational or commercial purposes and used for food or feed, unless a tolerance or exemption from a tolerance has been established.

3. Animal treatments conducted only on experimental animals. No animals may be treated if they may be used in food or feed, unless a tolerance or exemption from a tolerance has been established.

No EUP is needed for a substance or mixture of substances that under the Federal Food, Drug, and Cosmetic Act is defined as a new drug, new animal drug, or animal feed.

The application for an EUP is made on forms provided by EPA and should be made as far in advance of the intended date of use as possible. The Utah Department of Agriculture and Food requires notification by the manufactures as to time, place, and the amount of EUP products used in Utah. No state EUP permit or registration is required, just notification.
The administrator of EPA issues the permit after it is determines that the conditions and regulations of FIFRA have been and will continue to be met.

Permits are effective for a specified time, normally one year. The quantity of pesticide allowed in the experimental program is specified and may be limited to certain states listed in the permit. If no temporary or permanent tolerance

or exemption from a tolerance is granted, food or feed commodities must be destroyed after testing.

PUBLICATION

Any time an EUP is granted by EPA, a notice is printed in the Federal Register. EPA also may publish notice of an application for an EUP in the Federal Register prior to granting or denying the permit so that interested persons may comment.

LABELING EXPERIMENTAL COMPOUNDS

Pesticides under an EUP can be distributed or sold only to participants in an experimental program. All pesticides shipped or used under an EUP must be labeled with the directions and conditions for use set by the administrator of EPA. These labels and directions must include:

-All information prescribed for regular pesticide labels, except that a registration number and the previously registered use patterns will not appear.

-The registration number of the manufacturer or formulator.

-"For Experimental Use Only" prominently exposed.

-The experimental-use permit number.

-"Not for Resale."

DATA REPORTING

The EUP holder shall supervise the test program and evaluate the results of testing from each site of application. He also must report any adverse effects from use of or exposure to the pesticide. Most EUPs are held by the company wishing to register the pesticide, so the company is responsible for reporting to EPA. If Extension Service and Experiment Station personnel or others are testing the experimental pesticide, they must provide reports to the company holding the permit. The kinds of information they report generally are determined in collaboration with the company before they conduct the test.

SPECIAL LOCAL NEEDS

Section 24C of the amended FIFRA legislation permits a state to register pesticides formulated for distribution within that state to meet special local needs. However, the EPA must certify the state as capable of exercising adequate controls to assure that such registrations will be in accord with the purposes of FIFRA.

The purpose of state registrations is to cut the time, expense, and red tape involved in registering a pesticide for a special local use. The pesticide may be needed to treat a pest infestation that is a problem in that state but that is not sufficiently widespread to warrant the expense and difficulties of federal registration.

When there is an existing or expected local minor pest problem the state may register pesticides if they meet the following conditions.

-There is no EPA registered pesticide for the use in question.

-There is an EPA registered pesticide, but it is not available or cannot be obtained in a sufficient quantity.

-There is an EPA registered pesticide that normally would be suitable when used according to label instructions but that will not be safe or effective under local conditions.

All states have some limitations in what they can register, but they may not register the following items:

-Pesticides containing active or inert ingredients not contained in any EPA registered products.

-Any pesticide products or uses affected by suspension or cancellation action based on human health, environmental, or efficacy considerations.

-Pesticide products and/or uses formerly denied registration by EPA.

EPA certification of a state is an all or nothing authorization. A state may be certified to issue one or more types of registration depending on its scientific expertise, registration procedures, and legal authority.

Utah has been granted certification to register pesticide products for changed use patterns such as changing a ground application to an aerial application or for added uses. The most recent information with regard to Utah's authorizations is available from the Utah Department of Agriculture and Food, Division of Plant Industry.

If the administrator of EPA disapproves a state registration, the disapproval cannot remain in effect for more than 90 days. If not disapproved, it becomes a federal registration for that state only and is then subject to EPA actions such as suspension and cancellation procedures.

Special local need registrations may be sought by commodity groups, extension service personnel, and others. The pesticide manufacturer or formulator must be willing to register or add the use in question to the product's label for use in the state. It is necessary for those making the request to work with the manufacturer or formulator in developing the necessary information to support the request for registration.

EMERGENCY USES

Section 18 of the amended FIFRA legislation makes it illegal to use a pesticide for any unregistered purpose. There may be situations in which a registered pesticide is not available for a certain use. For example, an outbreak of a previously minor pest may occur in a crop and there may be no registered pesticide available for use on that crop for that pest.

Section 18 also provides for emergency use of pesticides in such situations. A state may obtain permission to use an unregistered pesticide if there is no registered pesticide is available to control the pest problem. FIFRA provides for the following three types of exemptions.

1. Specific Exemption

When a pest outbreak has occurred or is about to occur and there is not a registered pesticide for that use or purpose, a request for an EPA exemption to use a certain pesticide to control it may be made by the state lead agency. In Utah it is the Utah Department of Agriculture and Food.

Information must be supplied that includes the nature, scope and frequency of the problem; the pest involved; which pesticide or pesticides will be used and in what amounts; the economic benefits anticipated; and an analysis of possible adverse effects.

The specific exemption will only be good for a specified amount of time and for a designated area. Reports must be filed when the treatment is complete.

2. Quarantine or Public Health Exemption

This exemption may be granted to prevent the introduction or spread of a foreign pest into or throughout the United States or to prevent a public health problem.

No pesticide that has been suspended by EPA may be used. The procedure for requesting this exemption is the same as that outlined above under Specific Exemption.

3. Crisis Exemption

A crisis exemption may be used if it is found that there is no readily available pesticide registered to control or eradicate the pest and that there is not time to request and get approval for a specific exemption.

No pesticide that has been suspended or canceled may be used. The administrator of EPA must be notified by telephone within 36 hours of application. Within ten days of the use, the state must file information similar to that required for the specific exemption described above.

EPA GUIDELINES FOR PESTICIDE REGISTRATION

The EPA’s website on pesticide registration describes the registration process in detail and has separate review processes for conventional,

biopesticides, and antimicrobials. The website provides the following information.

Pesticide registration is the process through which EPA examines the ingredients of a pesticide; the site or crop on which it is to be used; the amount, frequency and timing of its use; and storage and disposal practices. EPA evaluates the pesticide to ensure that it will not have unreasonable adverse effects on humans, the environment and non-target species. A pesticide cannot be legally used if it has not been registered with EPA's Office of Pesticide Programs.

The process of registering a pesticide begins with submission to EPA of an application package. EPA's review of this application includes assessment of the hazards to human health and the environment that may be posed by the pesticide. Depending on the class of pesticide and the priority assigned to it, the review process can take several years. Biopesticides and reduced risk conventional pesticides often can complete the process much faster, in as little as a year in some cases.

V. UTAH PESTICIDE SAFETY EDUCATION PROGRAM

TOPIC **PAGE**

PURPOSE OF PROGRAM

The Utah Pesticide Safety Education Program (PSEP) is responsible for the training of pesticide applicators to become certified or recertified. In 1972, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) was amended to require that all pesticides be registered with the EPA and that they be classified as either general use or restricted use.

The application of a restricted use pesticide (RUP) is restricted to applicators that have been certified through a regulatory process to buy, use, and/or supervise the use of restricted use pesticides. These pesticide applicators are called certified applicators and they may be either commercial (for hire), noncommercial (part of their job requirement), or private (used

on their own or rented agricultural land with no direct compensation received).

The certification process involves the passing of examinations to receive a license and participation in periodic training activities to maintain that license for certification. The Utah Department of Agriculture & Food (UDAF) is responsible for licensing the pesticide applicators who certify or recertify in Utah.

All licensed applicators must pass two or more written examinations for initial certification. Commercial and noncommercial applicators must pass closed book examinations, while private applicators must pass opened book examinations.

After initial certification, applicators may recertify by participating in approved training programs where they can earn one continuing education unit (CEU) for each hour of attendance. Commercial and noncommercial applicators must earn 24 CEUs within each three-year period and private applicators must earn nine CEU within each three-year.

If the required re-certification CEUs are not earned with in the three year period, at least one written examination must be passed for recertification. If a licensed applicator allows his or her certification to expired, the process of certification is similar to that of a new applicator seeking certification.

APPLICATOR CATEGORIES

Pesticides are substances or mixtures of substances used to kill, destroy, repel, or regulate pests such as insects, rodents, birds, weeds, unwanted plant growth, molds, fungi, bacteria, and other microorganisms.

Pesticides are chemicals that have biological activity against the pest to be controlled, and they can be toxic to humans, animals, or the environment if sufficient dose and exposure occur from improper use or disposal.

Both federal and state laws make users of pesticides responsible for properly applying their pesticides according to label directions and for properly disposing of excess pesticides and their containers.

Utah's pesticide applicators are categorized in one or more of the categories defined below, based on the application site and the type of work they perform.

1. Agricultural Pest Control Categories

A. Plant Category

This category includes applicators using pesticides to control pests in the production of agricultural crops including, but not limited to, field crops, vegetables, fruits, pasture, rangelands, and non-crop agricultural lands.

B. Animal Category

This category includes applicators using pesticides on animals including, but not limited to, beef and dairy cattle, swine, sheep, horses, goats, poultry, and to places on or in which animals inhabit. Doctors of veterinary medicine or their employees engaged in the business of applying pesticides for hire, publicly representing themselves as pesticide applicators or engaged in large scale use of pesticides, are included in this category.

2. Forest Pest Control Category

This category includes applicators using pesticides in forests, forest nurseries, and forest seed-producing areas.

3. Ornamental and Turf Pest Control

This category includes applicators using pesticides to control pests in the maintenance and production of ornamental trees, shrubs, flowers and turf. This includes controlling pests on home foundations, sidewalks, driveways, and other similar locations.

4. Seed Treatment Category

This category includes applicators using pesticides on seeds.

5. Aquatic Pest Control Categories

A. Surface Water Category

This category includes applicators applying pesticides to standing or running water, excluding applicators engaged in public health-related activities included in R68-7-6(8).

B. Sewer Root Control Category

This category includes applicators using pesticides to control roots in sewers or in related systems.

6. Right-of-Way Pest Control Category

This category includes applicators using pesticides in the maintenance of public roads, electric power lines, pipelines, railway rights-of-way, or other similar areas.

7. Structural and Health Related Pest Control Category

This category excludes any fumigation pesticide application and is limited to applicators using pesticides in, on, or around food handling establishments; human dwellings; institutions, such as schools and hospitals; industrial establishments, including warehouses, storage units and any other structures and adjacent areas, public or private; to control household pests, fabric pests, and stored-product pests and to protect stored, processed and manufactured products. This category includes vertebrate pest control in and around buildings.

8. Public Health Pest Control Category

This category includes state, federal, or other governmental employees or persons working under their supervision applying or supervising the use of RUPs in public health programs for the management and control of pests having medical and public health importance.

9. Regulatory Pest Control Categories

A. Category

This category is limited to state and federal, employees or persons under their direct supervision, who apply pesticides in a mechanical ejection device, or other methods to control regulated pests.

B. Category

This category is limited to state and federal, employees or persons under their direct supervision, who apply pesticides in a protective collar, or other methods to control regulated pests.

10. Demonstration, Consultation and Research Pest Control Category

This category includes individuals who demonstrate or provide instruction to the public in the proper use, techniques, benefits and methods of applying RUPs. This category includes, but is not limited to agricultural field representatives, extension personnel, commercial representatives, consultants and advisors, and persons conducting field research with RUPs. In addition, they shall meet the specific standards that may be applicable to their particular activity.

11. Aerial Application Pest Control Category

This category includes applicators applying pesticides by aircraft. Aerial applicators are required to be certified in the Aerial Application Pest-Control Category and any other categories of intended application.

12. Vertebrate Animal Pest Control Category

This category includes applicators applying pesticides in the control of vertebrate pests outdoors, such as rodents, birds, bats, predators or domestic animals.

13. Fumigation/Stored Commodities Pest Control Category

This category includes applicators using fumigants to control pests in soils, structures, railroad cars, stored grains, manufactured

products, grain elevators, flour mills, and similar areas and items.

14. Wood-Preservation Pest Control Category

This category includes applicators who apply wood-preservative pesticides to wood products, such as fence posts, electrical poles, railroad ties, or any other form of wood products.

15. Wood Destroying Organisms Pest Control Category

This category includes applicators using pesticides to control termites, carpenter ants, wood-boring or tunneling insects, bees, wasps, wood-decaying fungi and any other pests destroying wood products.

UTAH PESTICIDE SALES

In Utah, all pesticides that are sold or used must be registered by the EPA and the Utah Department of Agriculture and Food (UDAF). This requirement is found in the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Utah Pesticide Control Act (UPCA) of 1979.

Both of these laws state that pesticides must be used according to label directions. Therefore, use inconsistent with the labeling is a violation of both federal and state laws. Fines, license revocation, and imprisonment are penalties for pesticide misuse.

The FIFRA defines pesticides as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest." The definition is broad and because of it there are numerous pesticide types, formulations, and products.

Currently, the EPA has approximately 20,000 products registered as pesticides that are formulated from about 850 different active ingredient chemicals, manufactured or formulated by more than 2,300 different companies, and distributed by about 17,200 distributors.

Pesticides must be poisons or they would not be able to perform their intended function which is to kill or repel pests. Poisons can have both risks and benefits. Risks can include poisoning of the applicator, non-target animals and plants, or the environment. Benefits can include reduced losses to pests, lowered production costs, and protection of public health.

Pesticide users want to maximize the benefits while minimizing the risks. The best way to accomplish this is to use pesticides only according to label directions including using a pesticide only on sites listed on the label and using the proper application equipment.

Pesticide label directions have been examined and approved by regulatory agencies. When pesticide label directions are followed, proper pest control should be achieved and hazards avoided.

When pesticide label directions are not followed the results are less predictable and likelihood of hazards increases. Almost all poisonings and other pesticide accidents can be traced back to failure to adequately follow label directions.

Another reason pesticide users should follow label directions is to protect the continued availability of the pesticide. If pesticides are misused, regulatory agencies, injured parties, and others will demand further restrictions on use or even cause the pesticide’s registration to be revoked.

Continued availability of a pesticide is dependent upon the pesticide user's willingness to follow label directions. When persons choose to use a pesticide, they are assuming legal responsibilities as defined by law, but also assume user responsibilities to not endanger the continued availability of the pesticide.

STANDARDS OF COMPETENCE

Utah's licensed pesticide applicators must show competence in the use and handling of pesticides according to the hazards involved in their particular classification by passing the tests and becoming certified. UDAF issues the license allowing the applicator to purchase and apply RUPs under the categories indicated on the license. Utah's standards for certification of applicators as classified in R68-7-4 have been established by the EPA and such standards shall be a minimum for certification.

A certified applicator will have general knowledge of proper pesticide use including the receipt, handling, storage, transportation, mixing, application, and disposal of pesticides, while following all necessary safety precautions. The individual must be able to read and understand all label information, including application and use directions, formulations, storage, and disposal hazards, precautionary statements, and statements of practical treatment.

This applicant will:

Have a basic understanding of pest biology;

Be able to recognize and accurately diagnose pest infestations;

Recommend and/or use the proper chemical(s) for their control;

Possess basic arithmetic skills appropriate to pesticide use and equipment calibration;

Have a working knowledge of the use and maintenance of all necessary application equipment;

Be familiar with pesticide toxicities, types of exposure, harmful effects, and signs and symptoms of poisoning;

Be able to assess the treatment site to minimize or prevent the potential adverse effects of the pesticides on the surrounding environment; and

Be aware of, and able to comply with, federal, state, and local laws and regulations regarding pesticide use, including record keeping requirements.

CERTIFICATION AND LICENSING

	TYPE OF APPLICATOR		
	Private	**Noncommercial**	**Commercial**
Certification required for:	RUP[1] Only	RUP[1] Only	All Pesticides
Certification is for:	3 Years	3 Years	1 to 3 Years
New certification by:	Written Exams	Written Exams	Written Exams
Recertification by:	Exams or CEUs[2]	Exams or CEUs[2]	Exams or CEUs[2]
Supervision of unlicensed applicators is allowed:	Yes	No	No

[1]Restricted Use Pesticides [2]Continuing Education Units

VI. UNDERSTANDING PESTICIDE LABELS

TOPIC **PAGE**

READ THE LABEL FIRST

Pesticides may pose a risk to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms. At the same time, pesticides are often useful because of their ability to control disease causing organisms, insects, weeds, or other pests. The pesticide label is the guide to using pesticides safely and effectively. The label contains pertinent information that should be read and understood before using pesticides.

Pesticide labeling provides the directions for proper use of a pesticide product, describes special precautions or hazards specific to the formulation, and offers first aid and clean up guidelines in the event of an accident. Printed information on and attached to the pesticide container by the manufacturer make up the labeling. Labeling may include leaflets, brochures, or other materials the manufacturer provides and intends to be sold with the pesticide product.

Pesticide users are required by law to comply with all of the instructions and directions included on pesticide labeling. Applicators must read, understand, and follow label directions. The best way for pesticide handlers to minimize pesticide exposure is to read and follow the label directions. It is a violation of Federal law to use a pesticide product in a manner inconsistent with its labeling.

The pesticide label is a binding legal agreement between three parties. The three parties include the EPA, the product registrant, and the product user. The label warrants that when the product is used under the exact directions listed, it will not damage non-target species and will control the pests listed. Further, when a pesticide is used under the exact directions on the label the legal liability is borne by the registrant.

A pesticide that endangers human health or has other hazardous environmental impacts is registered as a restricted use pesticide (RUP). The application of RUPs is restricted to applicators that have been certified through a regulatory process. RUPs are for retail sale and use only by certified applicators, or persons under their direct supervision, and only for those categories covered by the certified applicator's license.

When a pesticide is registered as restricted, the label will state "Restricted Use Pesticide" in a box at the top of the front panel. Below this heading may be a statement describing the reason for the restricted use designation. Unclassified pesticides, also known as "General Use," have no designation on the product label.

PARTS OF THE PESTICIDE LABEL

The information on pesticide labels is grouped under easily recognized headings. By law, some of the information on a label must include precise terminology and appear in specific locations. Other information may or may not be required and the location on the label may vary with the manufacturer.

Manufacturers have a brand name for each product. Some times these names are referred to as trade names. Most companies register the brand name as a trademark and do not allow other companies to use that name. The brand or trade name is the one used in advertisements and by company salespeople. The brand name appears on the front panel of the label and can be easily identified.

Some manufacturers use different brand names for pesticides with slightly different active ingredients. Other companies use a brand name with only minor variations for formulations and/or concentrations using similar active ingredients. A few companies will sell an almost identical pesticide under different brand names depending on the application. Buyers should read the label's ingredient statement to determine the active ingredients in a product.

The common name is often listed in the ingredient statement. Not all pesticides have a common name, so then the chemical name is listed in the ingredient statement. Pesticides have complex chemical names; therefore, most have a less complex name. Only common names that are officially accepted by the EPA may be used in the ingredient statement on the pesticide label. The official common name may be followed by the chemical name in the list of active ingredients. Identifying pesticides by there common or chemical names will assure that the correct active ingredient is used.
The chemical name is the detailed name that identifies the chemical components and structure of the pesticide. This name is frequently listed in the ingredient statement on the label and must be use if there is not an EPA approved common name.

The pesticide label must list what the active ingredients are and the amount of each ingredient as a percentage of the total product. The ingredient statement must include the official common name and/or chemical name for the active ingredient. The inert ingredients do not have to be identified, unless they are considered to be hazardous. The label must list the percentage of inert ingredients.
The combined percentages of active and inert ingredients must equal 100 percent.

The EPA registration and establishment numbers are used to track a pesticide in case of poisoning, claims of misuse, or liability claims. An EPA registration number indicates that the pesticide label has been approved by the EPA. Most products will contain two sets of numbers in the registration number. The first set identifies the manufacturer or company and the second set identifies the product. The establishment number indicates the manufacturer and location, by state, where the product was produced.

The manufacturer of a product must include the name and address of the company on the label. In addition, the front panel of the pesticide label must indicate the original volume or quantity included in the container. This is typically expressed as gallons, quarts, pints, or fluid ounces for liquids and pounds or ounces for dry materials. Liquid formulations will often list the pounds of active ingredient per gallon of formulation.

The front panel of many pesticides will identify what kind of pest the product controls and the type of formulation. Examples of the

kind of pesticide include herbicide, insecticide, fungicide, termiticide, or rodenticide. Examples of the type of formulation include emulsifiable concentrate (EC), wetable powder (WP), flow-able (F), granular (G), or dust (D).

Precautionary statements are an important part of the front panel information. Some pesticides have a signal word or signal words and symbol combined to indicate danger or hazard.

If a signal word is present it will be DANGER, WARNING, or CAUTION, and must appear in large capitol letters. Pesticides are not required to have a signal word on the label if they meet the EPA requirements of being relatively nontoxic to humans or the environment. These requirements are found in section 25(b) of FIFRA. In some cases the words POISON and DANGER will appear with a picture of a skull and crossbones. The signal words indicate the level of acute toxicity to humans. The signal word DANGER or the combination of DANGER and POISON indicates the greatest acute toxicity.

Signal words are based on the formulation of the pesticide product. They indicate hazards from any active ingredient and/or inert ingredients such as carriers and solvents. Signal words indicate the risk of acute effects from oral, dermal, inhalation, and ocular exposure. Signal words do not indicate the dangers from delayed or chronic effects.

Pesticide labels must include instructions on how to best respond in the event of exposure. This information is shown under the headings of “First Aid” or “Statement of Practical Treatment.” The specific instructions vary depending on the toxicity of the pesticide and the potential hazards.

Additionally, each pesticide label has precautionary statements that provide instructions and information that protects humans and the environment. The specific types of precautionary statements vary, but there are typical listings.

If the pesticide is hazardous to humans and/or domestic animals, then the specific details will appear under the heading “Hazards to Humans and Domestic Animals.” If the specific hazard is to groundwater, aquatic animals, fruit trees, bees, wildlife, or other ecological organisms, then the label will describe the hazard under the “Environmental Hazards” heading.

If the pesticide is flammable, explosive, caustic, unstable, or otherwise dangerous, then the heading “Physical or Chemical Hazards” will identify the hazard and list the handling restrictions and any special storage requirements.

Following the precautionary statements will be the requirements for “Personal Protective Equipment” (PPE). The PPE identified on the label is the minimal requirements to legally handle and use the pesticide. Depending on the pesticide, the minimum PPE required is sometimes different for mixing, applying, and/or cleaning activities.

The section on “Directions for Use” lists the specific directions for product use, including, dilution, mixing, spraying, storage, clean up, and/or disposal. The directions for use will describe any restrictions involving target pests, application sites, and the re-entry intervals and pre-harvest intervals following pesticide treatment. Pesticides used in agricultural applications have a set of instructions under the “Directions for Use” section that describes the Worker Protection Standard (WPS) for those employees that will work with and in close proximity to the pesticide.

The entry statement may be printed in a box under the heading "Entry" or "Worker Protections," or it may be in a section with a title such as "Important," "Note," or "General Information." If the entry interval applies only to certain uses or locations, the heading may indicate that limitation. For example, the heading might be "Agricultural Use Restrictions."

All pesticide labeling contains some instructions for storing the pesticide. Pesticide labeling also contains some general information about how to dispose of excess pesticide and the pesticide container in ways that are acceptable under federal regulations. State and local laws vary, however, so the labeling usually does not give exact disposal instructions.

SAMPLE PESTICIDE LABELS

The following pages have portions of four labels. Each of the labels is incomplete and should not be used as references in the handling or applications of pesticides. Pesticide applicators in Utah receive certification and licensing in order to purchase, handle, and use restricted use pesticides. Commercial applicators must also be licensed to apply pesticides products without the RUP designation.

Brand Name → **TRIPLET[R] SF**

Not A Restricted Use Pesticide

SELECTIVE HERBICIDE

Selective Broadleaf Weed Control for Turfgrasses including use on Sod Farms. To Control Dandelion, Clover, Henbit, Plantains, Wild Onion, and Many Other Broadleaf Weeds.

Also for Highways, Rights-of-Way, and Other Similar Non-Crop Areas.

Common Names → **Contains 2,4-D, Mecoprop-p and Dicamba**

Active Ingredients →

ACTIVE INGREDIENTS:

Dimethylamine Salt of 2,4-Dichlorophenoxyacetic Acid*. . 30.56%

Chemical Names →

Dimethylamine Salt of (+) – R – 2 – (2-Methyl-4-Chlorophenoxy) propionic Acid** **8.17%**

Dimethylamine Salt of Dicamba (3,6-Dichloro-o-anisic Acid)* 2.77%**

Inert Ingredients → **INERT INGREDIENTS 58.50%**

TOTAL **100.00%**

Isomer Specific AOAC Method, Equivalent to:

*2,4-Dichlorophenoxyacetic Acid . . . . . 25.38%, 2.38 lbs./gal.

**(+)-R-2-(2-Methyl-4-Chlorophenoxy)propionic Acid . 6.75%, 0.63 lbs./gal.

***3,6-Dichloro-0-anisic Acid . . . . . 2.30%, 0.22 lbs./gal.

Not A Restricted Use Pesticide →

Not For Use By All Applicators

FOR USE BY PROFESSIONAL TURF MAINTENANCE PERSONNEL, LANDSCAPING, OR COMMERCIAL APPLICATORS ONLY. NOT FOR SALE TO OR USE BY HOMEOWNERS.

KEEP OUT OF REACH OF CHILDREN

DANGER Signal Word → **DANGER – PELIGRO**

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

SEE INSIDE BOOKLET FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND STATEMENT OF PRACTICAL TREATMENT

EPA Registration Number →

EPA REG. NO. 228-312

NET CONTENTS **10** GALS.

EPA EST. NO. 228-IL-1

EPA Establishment Number →

MANUFACTURED BY
RIVERDALE CHEMICAL COMPANY
BURR RIDGE, IL 60527-0866

Brand Name

Furadan 4F

insecticide/nematicide

Registered As RUP

RESTRICTED USE PESTICIDE

Code 279

Due to acute oral and inhalation toxicity for retail sale to and application only by certified applicators or personnel under their direct supervision.

Common Name

Chemical Name

ACTIVE INGREDIENT:
*Carbofuran 44.0%
INERT INGREDIENTS 56.0%
TOTAL 100.0%
*2, 3-Dihydro-2, 2-di ıate.
This product contains

DANGER – POISON Signal Words With Skull & Crossbones

Keep Out Of Reach Of Children

EPA Reg. No. 279-28 EPA Est. 279-

Danger – Poison
Peligro

Statement of Practical Treatment

See Below for Additional Precautionary Information.

STATEMENT OF PRACTICAL TREATMENT

If swallowed: Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person. Get medical attention.
If inhaled: Remove to fresh air. Call a physician immediately.
If in eyes: Flush with water for at least 15 minutes. Get medical attention.
If on skin: Wash skin immediately with soap and water.
Antidote
Note to Physician: Carbofuran is an N-methyl carbamate and a reversible cholinesterase inhibitor. Do not use oximes such as 2-PAM. Start by giving 2 mg. atropine intramuscularly. According to clinical response, continue until signs of atropinization occur (dry mouth or dilated pupils). If in eye, instill one drop of homatropine.
For Emergency Assistance Call (800) 331-3148.

Precautionary Statements

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

Danger

PPE

Poisonous if swallowed or inhaled. May be fatal or harmful as a result of skin or eye contact or by breathing spray mist. Causes cholinesterase inhibition. Warning symptoms of poisoning include weakness, headache, sweating, nausea, vomiting, diarrhea, tightness in chest, blurred vision, pinpoint eye pupils, abnormal flow of saliva, abdominal cramps, and unconsciousness. Atropine sulfate is antidotal.

Personal Protective Equipment:

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category C on an EPA chemical resistance category selection chart.
Applicators and other handlers must wear: Long-sleeved shirt and long pants; Chemical-resistant gloves, such as Barrier Laminate or Butyl Rubber, or Nitrile Rubber or Neoprene Rubber or Polyvinyl Chloride or Viton; Shoes plus socks; Protective eyewear when mixing or loading, when performing maintenance or repairs (such as repairing/replacing hoses, cleaning, replacing or unplugging nozzles) on contaminated equipment or equipment containing residual carbofuran, or when cleaning the equipment or vehicle containing, or contaminated with carbofuran. For exposure in enclosed areas: A respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or a NIOSH approved

TopPro CHLORPYRIFOS PRO 2

INSECTICIDE -- ORGANOPHOSPHATE

For control of various pests on golf course turf, turf, and ornamental plants around industrial plant sites and road medians, fire ant treatment on nursery stock, and as a non-structural wood treatment.

Registered As RUP →

RESTRICTED USE PESTICIDE

For retail sale and use by Certified Applicators or persons under their direct supervision and only for uses covered by Certified Applicator's Certification. .

ACTIVE INGREDIENT: Chlorpyrifos (0,0-diethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate) 24.66%

INERT INGREDIENTS: 75.34%

TOTAL: 100.00%

Contains 2 pounds of Chlorpyrifos per gallon. Contains petroleum distillates

EPA Reg. # 51036-152 EPA Est. # 51036-GA-1 AD 040802

WARNING Signal Word →

KEEP OUT OF REACH OF CHILDREN

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

First Aid →

FIRST AID -- ORGANOPHOSPHATE

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present after the first 5 minutes, continue rinsing eye. Call a poison control center or doctor for treatment advise.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

NOTE TO PHYSICIAN: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. Atropine only by injection is an antidote. This product is an organophosphorus ester that inhibits cholinesterase.

See Additional Precautionary Statements Elsewhere On Label

PRECAUTIONARY STATEMENTS .

Hazards To Humans And Domestic Animals →

Hazards To Humans And Domestic Animals

May be fatal if swallowed. Harmful if absorbed through skin or inhaled. Wash thoroughly with soap and water after handling. Causes substantial but temporary eye injury. Avoid contact with skin, eyes, or clothing. Avoid breathing of vapors or spray mists. Do not get in eyes or on clothing. Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals. Keep away from food, feedstuffs, and water supplies. Have the product label with you when contacting a poison control center or doctor, or going for treatment.

Worker Protection Standard →

PERSONAL PROTECTIVE EQUIPMENT

WPS USES: Applicators and other handlers who handle this pesticide for any use covered by the Worker Protection Standard [40 CFR Part 170] - in general, only agricultural plant uses are covered - must wear:

1. Coveralls over short-sleeved shirt and short pants
2. Chemical-resistant gloves, such as barrier laminate or viton
3. Chemical-resistant footwear plus socks
4. Protective eyewear (goggles, faceshield, or safety glasses with front, brow, and temple protections).

NON-WPS USES: Applicators and other handlers who handle this pesticide for any use NOT covered by the Worker Protection Standard must wear:

1. Long-sleeved shirt and long pants
2. Chemical-resistant gloves, such as barrier laminate or viton
3. Shoes plus socks
4. Protective eyewear (goggles, faceshield, or safety glasses with front, brow, and temple protections)

Registered As RUP

RESTRICTED USE PESTICIDE

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

Brand Name

Tordon* 22K

Specialty Herbicide

Common Name Followed By Chemical Name

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

Active Ingredient:

Picloram: 4-amino-3,5,6-trichloropicolinic acid, potassium salt 24.4%
Inert Ingredients 75.6%
Total Ingredients 100.0%

Acid Equivalent

Picloram: 4-amino-3,5,6-trichloropicolinic acid - 21.1% - 2 lb/gal
*Trademark of Dow AgroSciences LLC
EPA Reg. No. 62719-6

CAUTION Signal Word

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION

PRECAUTIONARY STATEMENTS

PPE

Hazards to Humans and Domestic Animals
Causes Moderate Eye Irritation
Avoid contact with eyes or clothing. Prolonged or frequent repeated skin contact may cause allergic skin reactions in some individuals.
Personal Protective Equipment (PPE)
Applicators and other handlers must wear: Long-sleeved shirt and long pants, water proof gloves, and shoes plus socks. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

This

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the WPS (40 CFG 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Environmental Hazards

Users should:

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

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

Environmental Hazards

VII. EDUCATIONAL OVERHEADS – POWERPOINT TEMPLATES

Demonstration, Consultation, and Research

The Demonstration, Consultation, and Research Pest Control Category is different from other Utah pesticide certification categories because of its educational and investigative emphasis. This category is for pesticide professionals who demonstrate or provide instruction to the public in the proper use, techniques, benefits and methods of applying a Restricted Use Pesticide (RUP). It is for persons conducting field research, agricultural field representatives, commercial representatives, consultants and advisors, and extension personnel working with pesticides that are registered as RUPs. Individuals who certify in this category in Utah must also certify in at least one addition category.

The application of RUPs is restricted to applicators that have been certified through a regulatory process to buy and use restricted use pesticides. Individuals working in this category of pesticide application have directly interaction with other pesticide handlers. The educational and investigative nature of this pesticide certification means that information and/or recommendations are shared. It is very important that up to date and accurate information be disseminated.

The Utah Department of Agriculture and Food have identified several unlawful acts that frequently occur. Some of these actions include the following:

Used, or supervised the use of a pesticide which is restricted to use by "certified applicators" without having qualified as a certified applicator;

Used or caused to be used any pesticide in a manner inconsistent with its labeling or rules of the department if those rules further restrict the uses provided on the labeling;

Applied pesticides onto any land without the consent of the owner or person in possession thereof; except, for governmental agencies which must abate a public health problem.

To allow, through negligence, an application of pesticide to run off, or drift from the target area to cause plant, animal, human or property damage.

SHEETS FOR OVERHEAD PREPARATION

The following pages are formatted with important educational information for pesticide applicators. Each page is designed so that demonstrators, consultants, and researchers can produce overheads from the sheets and share the information with pesticide applicators.

Definition of Pesticide

A pesticide is any substance or mixture of substances that is intended to prevent, repel, destroy, or mitigate a pest, or is intended to be used as a plant regulator, defoliant, or desiccant.

Food and Drug Administration's Ranking of Food Dangers

1. **Food borne diseases (salmonella, shigella)**

2. **Nutritional imbalances and malnutrition**

3. **Environmental hazards (lead, mercury)**

4. **Naturally occurring toxins (aflatoxin B, arsenic)**

5. **Pesticide residues**

6. **Food additives**

Pesticide Container Labeling Requirements

1. **Brand or trade name**
2. **Name and address of manufacturer**
3. **EPA registration and establishment numbers**
4. **Statement of active and inert ingredients**
5. **Precautionary statements**
6. **Antidotal and first aid instructions**
7. **Directions for use**
8. **Required personal protective equipment**
9. **Limits on how the product may be used**
10. **Re-entry and pre-harvest intervals for treated areas**

The Federal Insecticide, Fungicide, And Rodenticide Act (FIFRA) and The Utah Pesticide Control Act

Allow An Applicator To:

1. **Apply a pesticide at any dosage, concentration, or frequency less than that listed on the labeling. In Utah, minimum application rates for termiticides are regulated by law.**
2. **Apply a pesticide against a target pest not listed on the label if the application is to a plant, animal, or site listed on the labeling.**
3. **Use any appropriate equipment or method of application that is not prohibited by the labeling.**
4. **Mix a pesticide or pesticides with a fertilizer if the mixture is not prohibited by the labeling.**
5. **Mix two or more pesticides if all of the dosages are at or below the rates recommended by the labeling.**

Incorrect Pesticide Practices

1. **Leaving containers within easy reach of children and irresponsible persons.**
2. **Failing to read and follow the label instructions.**
3. **Careless or incorrect disposal of used containers.**
4. **Storage of unused pesticide in unlabeled substitute containers.**
5. **Failing to follow basic hygiene practices before, during, and after pesticide use.**
6. **Failure to use the correct personal protective equipment.**
7. **Coming in contact with pesticide drift resulting from improper application.**
8. **Failing to properly store**

unused pesticide product.

IX. PROTECTING GROUNDWATER AND ENDANGERED SPECIES

INTRODUCTION

Federal and state efforts to protect groundwater and endangered species have resulted in special requirements and restrictions for pesticide handlers and applicators. Pesticides that are incorrectly or accidentally released into the environment can pose a threat to groundwater and endangered species. Whether pesticides are applied indoors or outdoors, in an urban area or in a rural area, the endangered species and groundwater must be protected and state and federal agencies rigidly enforce this requirement.

The need for special action by the pesticide handler/applicator depends on site location. Groundwater contamination is of special concern in release sites where groundwater is close to the surface or where the soil type or the geology allows contaminants to reach groundwater easily. In the case of endangered species, special action is normally required in locations where the species currently live or in locations where species are being reintroduced. The product labeling is the best source to determine if pesticide use is subject to groundwater or endangered species limitations.

The U.S. Environmental Protection Agency (EPA) establishes the specific limitations or instructions for pesticide users in locations where groundwater or endangered species are most at risk. These limitations and instructions may be too detailed for inclusion in pesticide labeling. In such cases the labeling will direct the applicator or handler to another source for instructions and restrictions. The legal responsibility for following instructions that are distributed separately is the same as it is for instructions that appear on the pesticide labeling.

PROTECTING
GROUNDWATER

Groundwater is water located beneath the earth's surface. Many people think that groundwater occurs in vast underground lakes, rivers, or streams. Usually, however, it is located in rock and soil. It moves very slowly through irregular spaces within otherwise solid rock or seeps between particles of sand, clay, and gravel. An exception is in limestone areas, where groundwater may flow through large underground channels or caverns. Surface water may move several feet in a second or a minute. Groundwater may move only a few feet in a month or a year. If the groundwater is capable of providing significant quantities of water to a well or

spring, it is called an aquifer. Pesticide contamination of aquifers is very troubling, because these are sources of drinking, washing, and irrigation water.

Utah has implemented a comprehensive and coordinated approach to protect groundwater from pesticide contamination. Formulation of the Utah Groundwater and Pesticide State Management Plan is a cooperative effort between federal, state, private agencies, producers, and user groups. It provides a basis for continuing future efforts to protect groundwater from contamination whenever possible. Furthermore, this plan provides agencies with direction for management policies, regulations, enforcement, and implementation of groundwater strategies.

Utah recognizes that the responsible and wise use of pesticides can have a positive economic impact, yield a higher quality of life, enhance outdoor activities, and give relief from annoying pests. The EPA has authorized the Utah Department of Agriculture and Food (UDAF) to enforce the protection of groundwater from pesticides.

The UDAF, in concert with cooperating agencies and entities, demands strict compliance with all pesticide labels, handling procedures, and usage to protect groundwater in the state.

Prevention of groundwater contamination is important, because once the water is polluted, it is very difficult and costly to correct the damage and in some instances impossible. City and urban areas contribute to pollution because water runoff can contain pesticides. Shallow aquifers or water tables are more susceptible to contamination than deeper aquifers or water tables. Sandy soils allow more pollution than clay or organic soils, because clays and organic matter adsorb many of the contaminants. For more information about what groundwater is and where it comes from, read the study manual ***Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.***

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended, establishes a policy for determining the acceptability of a pesticide use or the continuation of that use, according to a risk/benefit assessment. As long as benefits outweigh adverse effects, the EPA can continue to register the pesticide. Although the intent of a pesticide application is to apply the pesticide to the target or pest, part of the pesticide will fall on the area around the target or pest. Rain or irrigation water then can pick up the part that is not degraded or broken down and carry it to the groundwater via leaching.

There are many factors that influence the amount of pesticide contamination that can get into groundwater. The major factors are the soil type, soil moisture, persistence in soil, placement of the pesticide, frequency of application, pesticide concentration and formulation, pesticide water solubility, and precipitation. Each of these factors will influence the amount of pesticide that can penetrate the soil surface, leave the root zone, and percolate into groundwater.

Although some pesticides may have a high adsorption quality, when they are applied to sandy soil, they may still migrate to the water table because there are few clay particles or little organic matter to bind them. The management and use of pesticides is up to the individual applicator and/or landowner as to whether safe practices are used. Groundwater is a very

valuable resource and it must be protected from pesticide contamination.

PROTECTING ENDANGERED SPECIES

The Federal Endangered Species Act lists the three classifications as endangered, threatened, and experimental. Endangered has the highest level of protection. The phrase "endangered species" is used when referring to these classifications. This Act was passed by Congress to protect certain plants and wildlife that are in danger of becoming extinct. A portion of this Act requires EPA to ensure that these species are protected from pesticides.

EPA's goal is to remove or reduce the threat to endangered species that pesticides pose. Achieving this goal is a portion of the larger continuing effort to protect species at risk. Normally these restrictions apply to the habitat or range currently occupied by the species at risk. Occasionally the restrictions apply where endangered species are being reintroduced into a habitat previously occupied.

Habitats are the areas of land, water, and air space that an endangered species needs for survival. Such areas include breeding sites, sources of food, cover, and shelter, and the surrounding territory that provides space for normal population growth and behavior.

Utah's endangered species plan is a cooperative effort between federal, state, private agencies, producers, and user groups. This plan provides agency direction for regulations, enforcement, management policies, and implementation of threatened and endangered species protection strategies.

EPA launched a major project known as Endangered Species Labeling (ESL). The goal is to remove or reduce the threat to endangered species from pesticides. EPA has the responsibility to protect wildlife and the environment against hazards posed by pesticides. The ESL program is administered by the U.S. Fish and Wildlife Service (FWS) in the U.S. Department of Interior. The FWS reports to EPA concerning endangered species. EPA and FWS work cooperatively to ensure that there is consistency in the pesticide restriction information provided to agencies and pesticide users.

The UDAF acts under the direction and authority of EPA to carry out the ESL project as it relates to the use of pesticides in Utah. Many states have web sites with maps designating the habitat boundaries and listings of endangered plants and wildlife. Utah's site is www.utahcdc.usu.edu.

References: ***Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.*** Also, Endangered Species Act of 1973, with amendments through 1996 <www.house.gov/resources/105cong/reports/105_c/esaidx.htm>.

X. CALIBRATION INFORMATION

Conversion:

Units

One acre = 43,560 square feet	**Example: ½ acre = 21,780 square feet**
One mile = 5,280 feet	Example: ¼ mile = 1320 feet
One gallon = 128 fluid ounces	Example: ½ gallon = 64 fluid ounces
One quart = 2 pints = 4 cups = 32 fluid ounces	Example: 2 quarts = 64 fluid ounces
One pint = 2 cups = 16 fluid ounces	Example: ½ pint = 1 cup = 8 fluid ounces
One tablespoon = 3 teaspoons = 0.5 fluid ounces	Example: 2 tablespoons = 1 fluid ounce
One pound = 16 ounces	Example: ¼ pound = 4 ounces
One gallon = 231 cubic inches	Example: 2 gallons = 462 cubic inches

Weights

1 ounce = 28.35 grams
16 ounces = 1 pound = 453.59 grams
1 gallon water = 8.34 pounds = 3.785 liters = 3.78 kilograms

Liquid Measures

1 fluid ounce = 2 tablespoons = 29.573 milliliters
16 fluid ounces = 1 pint = 0.473 liters
2 pints = 1 quart = 0.946 liters
8 pints = 4 quarts = 1 gallon = 3.785 liters

Lengths

1 foot = 30.48 centimeters
3 feet = 1 yard = 0.9144 meters
16 1/2 feet = 1 rod = 5.029 meters
5280 feet = 320 rods = 1 mile = 1.6 kilometers

Areas

1 square foot = 929.03 square centimeters
9 square feet = 1 square yard = 0.836 square meters
43560 square feet = 160 square rods = 1 acre = 0.405 hectares

Speeds

1.466 feet per second = 88 feet per minute = 1 mph = 1.6 kilometers per hour (kph)

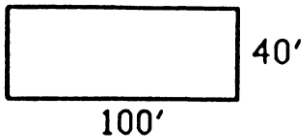
Volumes

27 cubic feet = 1 cubic yard = 0.765 cubic meters
1 cubic foot = 7.5 gallons = 28.317 cubic decimeters

Area and Volume Calculations:

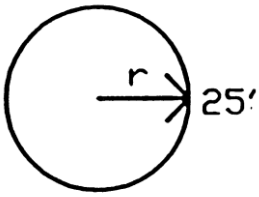
Area of Rectangular or Square Shapes

The area of a rectangle is found by multiplying the length (L) times the width (W).
(Length) x (Width) = Area
Example: (100 feet) x (40 feet) = 4000 square feet



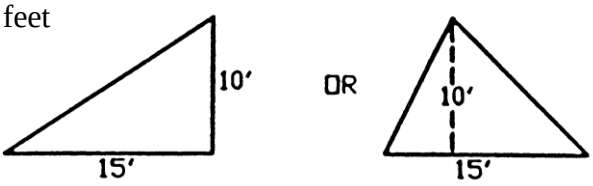
Area of Circles

The area of a circle is the radius (radius = one-half the diameter), times the radius, times 3.14.
(radius) x (radius) x (3.14) = Area
Example: (25 feet) x (25 feet) x (3.14) = 1962.5 square feet



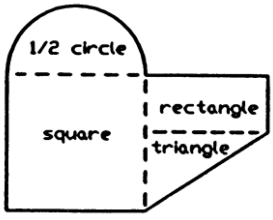
Area of Triangular Shapes

To find the area of a triangle, multiply ½ times the width of the triangle's base, times the height of the triangle.
(½) x (base width) x (height) = Area
Example: (½) x (15 feet) x (10 feet) = 75 square feet

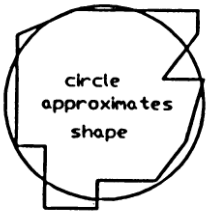


Area of Irregular Shapes

Irregularly shaped sites can often be reduced to a combination of rectangles, circles, and triangles. Calculate the area of each shape and add the values together to obtain the total area.
Example: Calculate the area of the rectangle, triangle, square, and one-half of a circle.



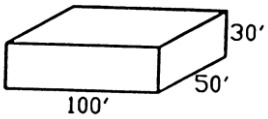
Another method is to convert the site into a circle. From a center point, measure the distance to the edge of the area in 10 or more increments. Average these measurements to find the radius, then calculate the area using the formula for a circle.
Example: Approximate the area by calculating the area of a similarly sized circle.



Volume of Cube and Box Shapes

The volume of a cube or box is found by multiplying the length, times the width, times the height.
(Length) x (Width) x (Height) = Volume

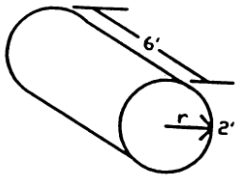
Example: (100 feet) x (50 feet) x (30 feet) = 150,000 cubic feet



Volume of Cylindrical Shapes

The volume of a cylinder is found by calculating the area of the round end (see formula for circle) and multiplying this area times the length or height.

Example: (radius) x (radius) x (3.14) = Area of Circle
(Area of Circle) x (Length) = Volume of Cylinder
(2 feet) x (2 feet) x (3.14) x (6 feet) = 75.36 cubic feet



Sprayer Calibration Formulas:

To Calculate Travel Speed in Miles Per Hour

The travel speed of a sprayer is determined by measuring the time (seconds) required to travel a know distance (such as 200 feet). Insert the values in the following formula to determine the miles per hour.

$$\frac{\text{Distance in Feet x 60}}{\text{Time in Seconds x 88}} = \text{Miles Per Hour}$$

Example: $\frac{\text{(200 feet) x (60)}}{\text{(30 seconds) x (88)}} = \frac{12{,}000}{2640} = 4.55 \text{ mph}$

To Calculate the Gallons Per Minute Applied During Broadcast Spraying

The application rate in gallons per minute (GPM) for each nozzle is calculated by multiplying the gallons per acre (GPA), times the miles per hour (MPH), times the nozzle spacing in inches (W); then dividing the answer by 5940. For small adjustments in GPM sprayed, operating pressure is changed. For large adjustments in GPM sprayed, travel speed (miles per hour) is changed or nozzle size is changed.

$$\frac{\text{GPA x MPH x W}}{5940} = \text{GPM}$$

Example: $\frac{\text{(12 GPA) x (4.5 MPH) x (24”)}}{5940} = \frac{1296}{5940} = 0.22 \text{ GPM}$

To Calculate the Gallons Per Minute Applied During Band Spraying

Broadcast spraying applies chemicals to the entire area. Band spraying reduces the amount of area and chemicals sprayed per acre. To use the above formulas for band sprayer applications, use the band width (measured in inches) rather than nozzle spacing for the “W” value.

Pesticide Mixing:

Terminology

The ***active ingredients*** of a pesticide are the chemicals in a formulation that control the target pests. The ***formulation*** is the pesticide product as sold, usually a mixture of concentrated active ingredients and an inert material. Restricted use pesticides are purchased in formulations requiring ***dilution prior to application***. Formulations are diluted with inert substances such as water. The ***percentage of active ingredients*** in a pesticide formulation directly affects dilution and application rates. Given two pesticides, A = 50% active ingredients, B = 100% active ingredients; twice as much pesticide A formulation is required to equal pesticide B formulation.

To Determine the Total Amount of Pesticide Formulation Required Per Tank

To calculate the total amount of pesticide formulation needed per spray tank, multiply the recommended dilution, ounces/pints/cups/teaspoons/tablespoons/etc. of pesticide per gallon of liquid, times the total number of gallons to be mixed in the sprayer. A full or partial tank of pesticide spray may be mixed.

(Dilution Per Gallon) x (Number of Gallons Mixed) = Required Amount of Pesticide Formulation Example: (3 ounces per gallon) x (75 gallons) = 225 ounces

Note: 1 gallon = 128 ounces; through unit conversion 225 ounces = 1.76 gallons

To Calculate the Amount of Pesticide Formulation Sprayed Per Acre

The calculate the total amount of pesticide formulation sprayed per acre is determined by multiplying the quantity of formulation (ounces/pounds/pints/cups/teaspoons/tablespoons/etc.) mixed per gallon of water, times the number of gallons sprayed per acre.

(Quantity of Formulation Per Gallon) x (Gallons Sprayed Per Acre) = Formulation Sprayed Per Acre
Example: (1/2 pound per gallon) x (12 gallons per acre) = 6 pounds per acre

To Calculate the Amount of Active Ingredients Sprayed Per Acre

To calculate the total amount of active ingredients (AI) applied per acre, multiply the amount (pounds, gallons, ounces, etc) of pesticide formulation required per acre, times the percentage of active ingredients in the formulation (100%, 75%, 50%, 25%, etc.), and divide the value by 100.

$$\frac{\text{(Amount of Formulation Required Per Acre) x (Percentage of AI)}}{100} = \text{Active Ingredients Per Acre}$$

Example: $\frac{\text{(4 pounds formulation sprayed per acre) x (75\% AI)}}{100}$ = 3 pounds of AI sprayed per acre

Note: 75 % = 0.75

To Calculate the Gallons of Pesticide Mixture Sprayed Per Acre

To calculate the total amount of pesticide mixture sprayed per acre is determined by dividing the number of gallons sprayed by the number of acres sprayed.

$$\frac{\text{Gallons Sprayed}}{\text{Acres Sprayed}} = \text{Gallons Sprayed Per Acre}$$

Example: $\frac{\text{200 Gallons Sprayed}}{\text{10 Acres Sprayed}}$ = 20 gallons of pesticide mixture sprayed per acre

GLOSSARY OF TERMS

A

ACARICIDE - A pesticide used to destroy or inhibit mites, ticks, or other arachnids.
ACTIVE INGREDIENT - The chemicals in a pesticide responsible for killing, poisoning, repelling, or other biologic activity.
ACUTE TOXICITY - Injury within 24 hours following exposure.
ADULTICIDE - A pesticide used to destroy or inhibit adult pests.
AEROSOLS - An extremely fine mist or fog consisting of solid or liquid particles suspended in air. Also, certain formulations used to produce a fine mist or smoke.
ALGICIDE - A pesticide used to destroy or inhibit algae.
ANNUAL PLANT - Plant that completes its life cycle in one growing season.
ANTICOAGULANT - A chemical that prevents normal blood clotting.
ANTIDOTE - A treatment to counteract the effects of poisoning.
APHICIDE - A pesticide used to destroy or inhibit aphids.
ARTHROPOD - Invertebrate animals such as insects, spiders, ticks, and crayfish of the phylum Arthropoda. They have segmented bodies and jointed appendages.
ATTRACTANT - A substance or device that will lure pests to a trap or poison bait.
AVICIDE - A pesticide used to destroy or inhibit birds.

B

BACTERIA - Microscopic organisms, some of which are capable of producing diseases in plants and animals.
BACTERICIDE – A pesticide used to destroy or inhibit bacteria.
BAIT - A food or other substance used to attract a pest to a pesticide or trap.
BIENNIAL PLANT – A plant that grows vegetation during the first year then produces fruit and dies during the second year.
BIOLOGICAL CONTROL - Control of pests by means of predators, parasites, disease producing organisms, or competitive microorganisms.

C

CHEMICAL CONTROL - The control or management of pests with treatments of products produced by chemistry.
CHRONIC TOXICITY - Injury or illness beyond 24 hours following exposure due to prolonged or repeated exposure.
CONCENTRATION - The amount of active ingredient in a given volume of diluent.
CONTAMINATION - The presence of an unwanted substance in or on plants, animals, soil, water, air, or structures.
CULTURAL CONTROL - A pest control method that includes changing sanitation and/or work practices.

D

DECONTAMINATE - To remove or break down a chemical from a surface or substance.
DEFOLIANT - A substance or material used to remove foliage.
DERMAL TOXICITY - Injury when absorbed through the skin.
DESICCANT – A substance that removes water from plant foliage.
DIAGNOSIS - The identification of the nature or cause of problem or fault.
DISINFECTANT – A pesticide used to destroy or inhibit microorganisms.

DOSE OR DOSAGE - Amount or rate of chemical applied to a given area or target.
DUSTS - Pesticides that are nonliquid and comprised of fine particles.

E

ENDANGERED SPECIES - Legally classified as a species in danger of extinction.
ERADICATION - Pest management strategy that attempts to eliminate all members of a pest species.
EVALUATION - To examine or investigate for the purpose of judging the value, extent, or success.
EXPOSE - To be subjected to or come in contact with a material.
EXPOSURE ROUTE - The dermal, oral, or inhalation (respiratory) route by which a substance may enter an organism.
EXTERNAL PARASITE - An animal smaller than its host that lives upon the outside of its host for at least part of its life cycle.

F

FOGS - Pesticide sprays composed of very fine droplets from 0.1 to 50 microns in diameter. Fogs remain suspended for a long period of time.
FORMULATION - Pesticide as prepared by the manufacturer.
FUMIGANT - Pesticide that controls by giving off fumes.
FUNGICIDE - A pesticide used to destroy or inhibit fungi and other plant pathogens.
FUNGUS A group of saprophytic and parasitic spore producing organisms usually classified as plants that lack chlorophyll and include molds, rusts, mildews, smuts, mushrooms, and yeasts.

G

GERMICIDE - A pesticide used to destroy or inhibit germs.
GROUNDWATER - Water sources located beneath the soil surface from which water is obtained.

H

HARBORAGE - A site that shelters and provides the food and water required for a particular organism to survive.
HERBICIDE – A pesticide used to destroy or inhibit weeds.
HOST - Plant or animal that is invaded by a parasite and from which the parasite gets its nutrients.

I

INERT INGREDIENT - In a pesticide formulation it is an inactive material without pesticidal activity.
INHALATION TOXICITY- Injury when inhaled.
INSECT - Any of the class Insecta of arthropods with well defined head, thorax, abdomen, 6 legs, and typically 1 or 2 pairs of wings.
INSECTICIDE - A pesticide used to destroy or inhibit insects.
INSPECTION - A critical examination an evaluation aimed at forming a judgment or determination.
INTEGRATED PEST MANAGEMENT (IPM) - A planned pest control program in which various techniques are used to keep pests from causing economic, health related, or aesthetic injury.
INTERNAL PARASITE - An animal that lives within the body of its host for at lease a portion of its life cycle.

L

LARVICIDE - A pesticide used to destroy or inhibit larval pests.
LEACHING - Process by which some pesticides move through the soil.
LEGAL STATUS - Classified such that it is permitted or allowed by law.

M

MECHANICAL CONTROL - Physical control of pests using devices or machines that kill the pests and/or alter their environment.

MIST - Pesticide sprays composed of droplets 50 to 100 microns in diameter. Particle size is sufficient to settle fairly rapidly, but still remain suspended long enough to be effective.
MITE - Any of numerous small arachnid that often infest animals, plants, and stored foods.
MITICIDE - A pesticide used to destroy or inhibit mites.
MOLLUSCICIDE – A pesticide used to destroy or inhibit snails or slugs.

N

NEMATICIDE – A pesticide used to destroy or inhibit nematodes.
NONLETHAL - Not capable of causing death.
NONTARGET ORGANISM - Any plant or animal other than the intended target of a pesticide application.
NOXIOUS PLANT - Plant that is recognized as being offensive and/or injurious to animals or other plants.

O

ORAL TOXICITY – Injury when taken by mouth.
OVICIDE – A pesticide used to destroy or inhibit eggs.

P

PARASITE - An organism that lives on or in a living host and that gets all or part of its nutrients from the host.
PATHOGEN - Any organism capable of causing disease.
PEDICULICIDE – A pesticide used to destroy or inhibit lice.
PERCOLATE - To pass slowly through a material or spread throughout an area.
PERENNIAL PLANT - Plant that persists for several years usually with new herbaceous growth present each year.
PERSISTENCE - To have a continued or prolonged effect after treatment.
PESTICIDE - Any substance or mixture of substances intended for defoliating or desiccating plants, preventing fruitdrop, inhibiting sprouting, or for preventing, destroying, repelling, or mitigating any insects, rodents, fungi, bacteria, weeds, or other forms of plant or animal life or viruses, except viruses on or in living man or other animals.
PHEROMONE - A chemical substance that is produced by an animal and serves especially as a stimulus to other individuals of the same species for one or more behavioral responses.
PHOTOLYTIC DECOMPOSITION - Chemical decomposition or breakdown by sunlight.
PHYTOTOXICITY - Injury to plants by a chemical.
PISCICIDE - A pesticide used to destroy or inhibit fish.
POLLUTION - The act of polluting or contaminating the environment with harmful chemicals or waste products.
PRECIPITATE - The formation of a suspension of an insoluble compound by mixing two solutions.
PREDACIDE - A pesticide used to destroy or inhibit predators.
PREDATOR - An animal that attacks, kills, and feeds on other animals.
PREHARVEST INTERVAL – The length of time following the application of a pesticide when harvesting is restricted.
PRESCRIPTION - A proven formula for the control of pests.
PREVENTION - An action that makes it impossible or very difficult for an unwanted activity to happen.
PROTECTED STATUS - Animal or plant species that is designated as endangered, threatened, or experimental, and is protected by federal or state law.

R

RATE OF APPLICATION - The amount of pesticide applied, usually measured as per acre, per 1,000 square feet, per linear foot, or per cubic foot.
RE-ENTRY INTERVAL - The length of time following an application of a pesticide when entry into the areas is restricted.
REPELLENT - A compound that keeps pests away.
RESIDUAL - Leaving a residue that remains effective for some time.

RESIDUAL SPRAY - A pesticide spray that leaves a residue that remains effective for some time.
RISK - A probability of an adverse effect in a given situation.
RODENTICIDE - A pesticide used to destroy or inhibit rodents.

S

SANITIZER – A pesticide used to destroy or inhibit microorganisms.

SIGNAL WORDS - Required words that appear on pesticide labels to denote the relative acute toxicity of the product.
SILVICIDE - A pesticide used to destroy or inhibit trees and woody vegetation.
SLIMICIDE - A pesticide used to destroy or inhibit slime molds.
SOLUBILITY - The extent to which one substance is able to dissolve in another.
STERILANT - A pesticide used to destroy or inhibit microorganisms
SURFACE WATER - Water on the earth's surface in rivers, lakes, ponds, streams, etc.

T

TARGET - The plants, animals, structures, areas, or pests at which the pesticide or other control method is directed.
TOXIC - Poisonous to living organisms.
TOXICITY - The degree or extent to which a chemical or substance is poisonous.

U

UNPROTECTED STATUS - Animal or plant species that is not protected by federal or state law.

V

VECTOR - An animal that can carry and transmit a pathogen.
VERTEBRATE ANIMAL- Animal with a segmented backbone and spinal column.
VIRUS - Ultramicroscopic parasites that can multiply only in living tissues and cause many animal and plant diseases.

W

WATER TABLE - The upper level of the water saturated zone in the ground.
WEED - A plant that is not valued where it is growing.