PURDUE PESTICIDE PROGRAMS

Purdue University Cooperative Extension Service

PESTICIDES AND PERSONAL SAFETY

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TABLE OF CONTENTS **PAGE**

PESTS AND PESTICIDES

Pests include plants and animals that vector disease, interfere with the production of food and fiber crops, or otherwise detract from our quality of life. Pesticides are natural or synthetic substances used by man to control pest organisms by disrupting some part of their life processes. Literally, the term pesticide means to "kill pests." Pesticides also include substances such as attractants, repellents, and growth regulators which may not *kill* the target pest(s). Thus, all compounds used to control and manage pests are classified as pesticides. Examples of specific types and their target pests are given in Table 1.

TABLE 1. PESTICIDE TYPES AND TARGET PESTS.

Type of Pesticide	Target Pest(s)
avicide	birds
bactericide	bacteria
defoliant	plants
desiccant	plants, insects
fungicide	fungi
growth regulator	insects and plants
herbicide	weeds
insecticide	insects
miticide/acaricides	mites
molluscicide	mollusks
nematicide	nematodes
piscicide	fish
repellents	insects, vertebrates
rodenticide	rodents (vertebrates)
sexual sterilants	insects, vertebrates
silvicide	trees and shrubs

PESTICIDE REGISTRATION

All pesticide manufacturers are legally required by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to conduct extensive scientific testing of their pesticides and pesticide products to demonstrate that strict standards for registration, as prescribed by law, have been met prior to their sale and use in the United States (Fig. 1). The EPA requires the manufacturer of a pesticide product to provide information and data on active ingredient and product chemistry, toxicology, residues, application rates, environmental impact assessment, and human safety before a product can be federally registered. Product information and data must be reviewed by EPA before a label is granted. It normally takes seven to ten years and approximately $40 million to $100 million to bring a new active ingredient from discovery to the retail market. This significant investment in scientific evaluation and regulatory scrutiny is essential to assure today's consumers that pes-

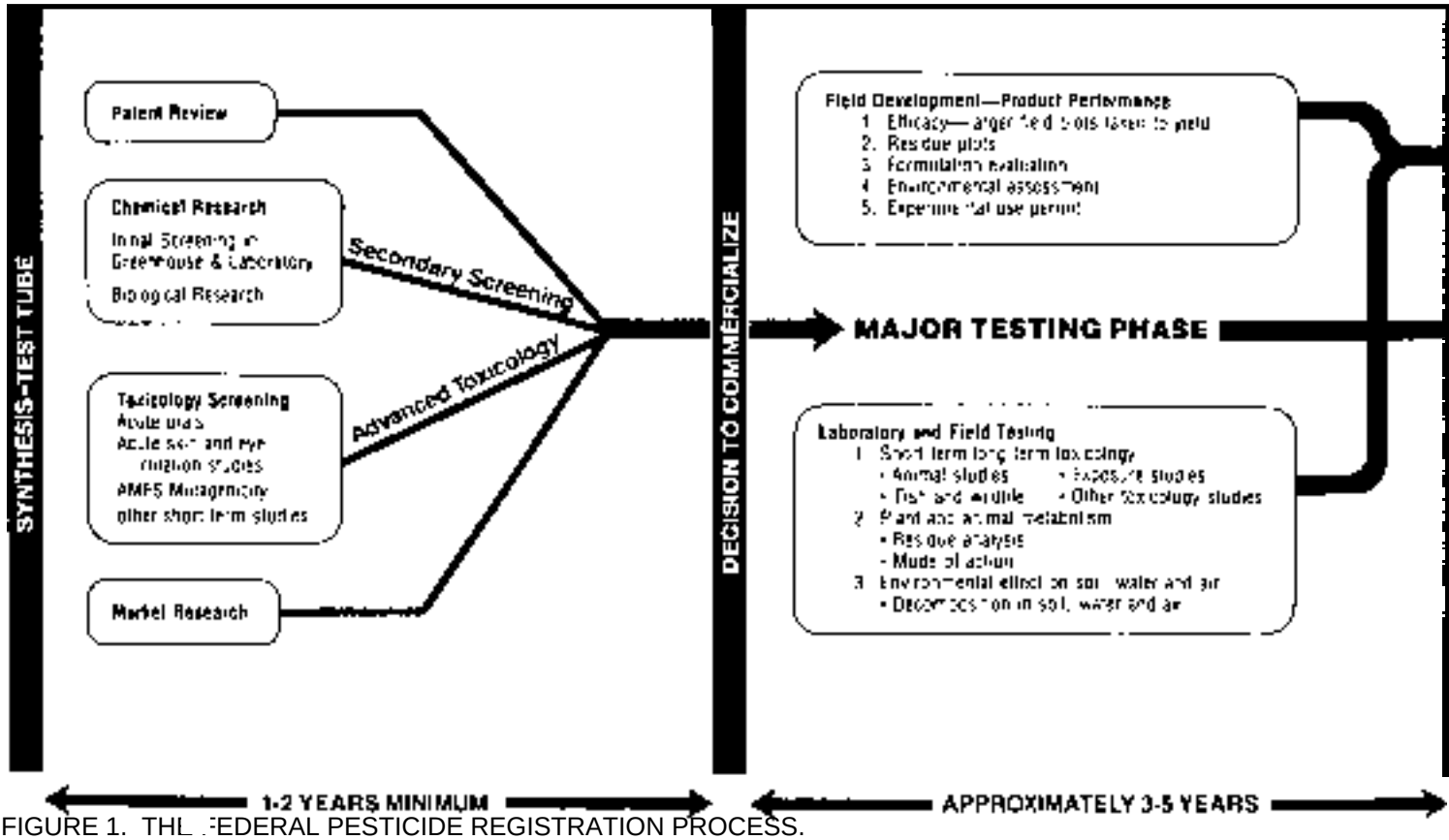


FIGURE 1. THE FEDERAL PESTICIDE REGISTRATION PROCESS.
SOURCE: The Bottom Line. Winter 1991. DowElanco.

ticides not only provide the benefits of their registered uses, but that they do so with little or no adverse impact on people or the environment.

PESTICIDE LABELS

Pesticide labels are required to contain specific types of information (Fig. 2). The label is a legal document. It is the responsibility of the user to follow the label in its entirety to ensure that use, site and target pest requirements, as well as mixing, application, safety, environmental, storage, and disposal precautions, are satisfied. Following all label directions is essential to safe, effective, and environmentally sound pesticide application. It is imperative that the pesticide label be read and understood thoroughly *before* the pesticide is used. **Remember, the pesticide user is bound by law to follow all label directions!**

PESTICIDE TOXICITY

Toxicity is the capacity of a compound to cause harm to a living organism. Some pesticides are inherently more poisonous than others. In all cases, the toxicity is dose-related. For example, the more toxic the pesticide, the smaller the dose required to cause harm. A goal in pesticide application is to apply an amount that is not toxic to humans and other animals but is, never-

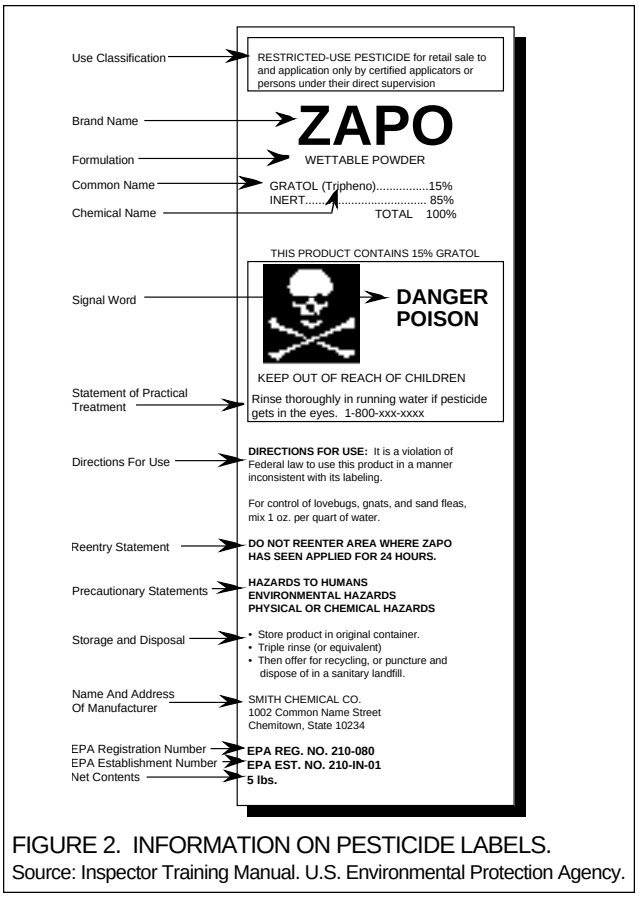
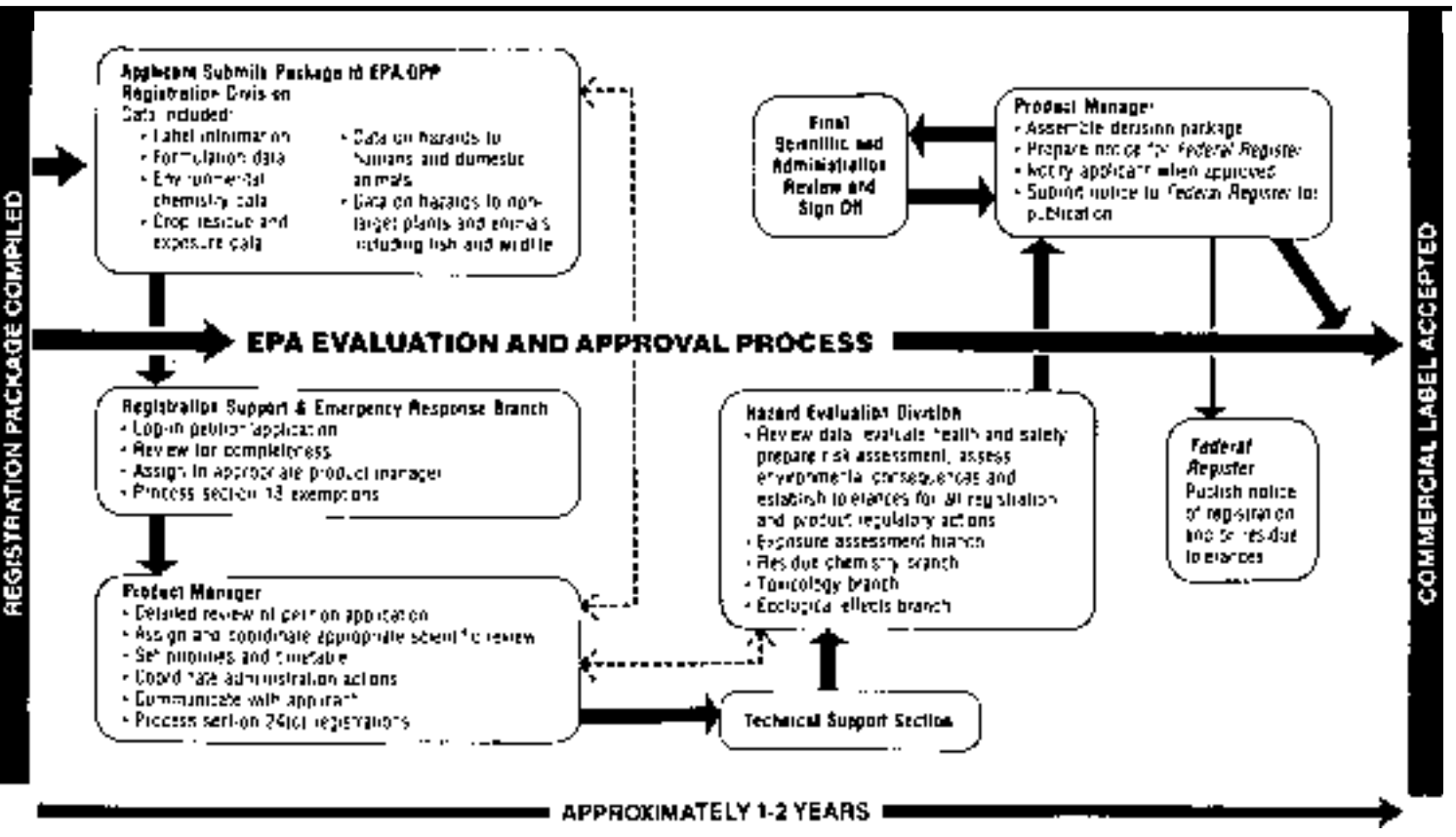


FIGURE 2. INFORMATION ON PESTICIDE LABELS.
Source: Inspector Training Manual. U.S. Environmental Protection Agency.



theless, poisonous to the target pest. When this is not possible, addtional precautions are necessary (see section on Pesticide Exposure, page 8).

Toxic effects from pesticides may result from a single exposure (acute toxicity) or from exposure over an extended period of time (chronic toxicity). LD_{50} values commonly are used to compare acute toxicity of pesticides. An LD_{50} represents the individual dose required to kill 50 percent of a population of test animals (e.g., rats, fish, mice, cockroaches). LD_{50} values provide measures of acute toxicity when test animals are fed pesticide-treated feed or water (oral LD_{50}) or when the pesticide is applied to the skin of the animal (dermal LD_{50}). Because LD_{50} values are standard measurements (stated in mg of pesticide per kg of body weight), it is possible to compare relative toxicities among pesticides. The lower the $LD_{50,}$ the less pesticide required to kill; i.e., a pesticide with an LD_{50} value of 10 mg/kg is 10 times more toxic than a pesticide with an LD_{50} of 100 mg/kg. The toxicity of a pesticide is related to the mode of entry of the chemical into an organism. Often the LD_{50} for inhalation is lower (more toxic) than the LD_{50} for ingestion, which is in turn lower than the LD_{50} for dermal exposure. The mammalian toxicity of a pesticide is important in helping to determine the potential hazard associated with its use; however, this does not mean that pesticides with low mammalian toxicity also are less toxic to target pests. In fact, the opposite is usually true. Pesticidal effects can vary significantly between species; for instance, pyrethroid insecticides are much more toxic to insects than to mammals.

LD_{50} values are not always given on the pesticide label; rather, the toxicity of a product is reflected by one of three signal words: DANGER, WARNING, or CAUTION. These signal words reflect the relative toxicity of the pesticide product, with DANGER being highly toxic, followed by WARNING (moderately toxic), and CAUTION (slightly toxic). Signal words can also reflect the toxicity of the formulation's sublethal effects such as skin and eye irritation. Examine Table 2 for the relationships between toxicity and signal words. A pesticide with an oral LD_{50} of less than 50 mg/kg normally will bear the signal word DANGER on its label. However, a highly toxic pesticide could be specially formulated (microencapsulation, for instance) to reduce the toxicity as compared to a similar, non-encapsulated product. Pesticides with low mammalian toxicity (oral LD_{50} greater than 500 mg/kg) generally will carry the signal word CAUTION. However, if the pesticide might cause damage to the skin or eyes, the signal word WARNING would be used in spite of the product's oral LD_{50}. The purpose of signal words is to alert the user to the toxicity of the product.

Whenever possible, choose pesticides that have high LD_{50} values. Pesticide products displaying the signal word CAUTION or WARNING are less toxic -- have higher LD_{50} values -- than those labeled DANGER. It is imperative that applicators adhere to the directions on

TABLE 2. SIGNAL WORDS USED IN LABELING. Signal words assigned to pesticide labels reflect the single most serious *TYPE* of toxic effect achieved during laboratory testing of the product; the signal word on a given label is based on oral OR dermal OR respiratory effects, but generally not all three.

	Oral Toxicity		Dermal Toxicity		
Signal Word	LD_{50}*	Amount which might kill	LD_{50}	Eye Effects	Skin Effects
DANGER	Up to and including 50 mg/kg	A taste to a teaspoonful	Up to and including 200 mg/kg	Corrosive: corneal opacity not reversible	Corrosive
WARNING	From 50 to 500 mg/kg	A teaspoonful to an ounce	200 thru 2000 mg/kg	Corneal opacity: reversible within 7 days; irritation persisting for 7 days	Severe irritation at 72 hours
CAUTION	Greater than 500 mg/kg	Greater than an ounce	Greater than 2000 mg/kg	No corneal opacity: no irritation, or reversible within 7 days	Mild to moderate

* LD_{50} values are stated in mg of pesticide per kg of body weight. One mg/kg = one part per million (ppm); and 1 ppm can be thought of as 1 inch in 16 miles, or 1 drop in 50 gallons, or 1 second in 12 days, etc. See page 14.

NOTE: ALL pesticide labels must include the statement, *KEEP OUT OF REACH OF CHILDREN*.

the pesticide label and remember that all pesticides are potentially *capable* of producing toxic effects. Treat all pesticides with respect.

Hazard

Hazard as related to pesticide use must be considered separately from the toxicity of a given pesticide or pesticide product. Hazard varies according to exposure. The more the exposure, the greater the danger involved in using the pesticide. Therefore, the hazard (risk) associated with a given pesticide or pesticide product is dependent upon the toxicity of the compound and the probability of exposure. The hazards associated with pesticide use and application can be reduced by selecting products that are of low toxicity and by taking proper measures to prevent exposure. The degree of hazard associated with a pesticide product depends on the following:

- Toxicity of the active ingredient
- Concentration of the active ingredient
- Type of formulation
- Type of protective clothing worn
- Rate of application
- Frequency of application
- Method of application
- Persistence in the environment

One of the ways that hazard can be reduced is by the type of formulation. Granular formulations, as compared with dusts containing the same percentage active ingredient, result in less exposure for the applicator. The label, therefore, may carry the signal word CAUTION instead of WARNING. Careful reading of the label is required to determine the exact nature of potential hazards and the precautions required for safe handling.

Additional sources of information regarding the toxicity and hazard of pesticide products can be found on pesticide labels and material safety data sheets (MSDS), or by contacting universities, regulatory agencies, pesticide manufacturers, pesticide dealers, libraries, etc.

Modes of Action and Symptoms of Pesticide Poisonings

Pesticides are classified according to their biological activities and chemical structures. Biological effects differ greatly among pesticide classes. Because of the great diversity of pesticides, it will not be possible to cover all the symptoms and treatments in this publication. Instead, only those pesticides that present the greatest potential toxicity and hazard to humans will be addressed. Information on other pesticides can be obtained the from the EPA publication, *Recognition and Management of Pesticide Poisonings* (EPA-735-R-98-003), March 1999.

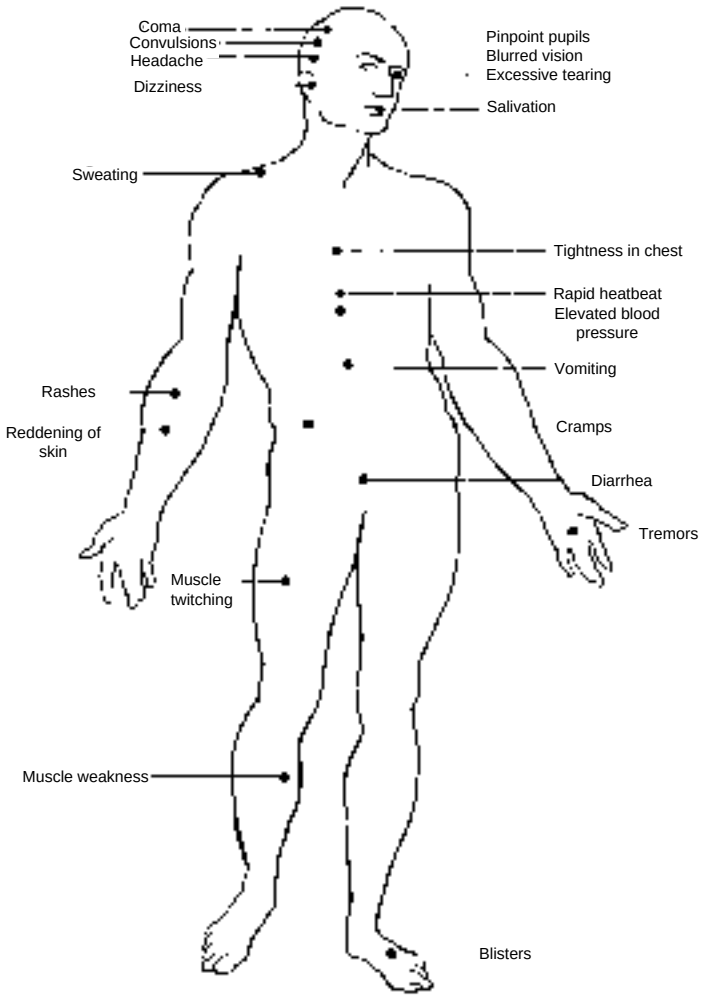


FIGURE 3. SYMPTOMS OF PESTICIDE POISONING.
Source: Pesticide Education Manual: A Guide to Safe Use and Handling. Pennsylvania State University.

Acute Toxicity

All pesticides are designed to disrupt essential metabolic processes of the target pest. These processes may be neural, hormonal, cellular, or structural. In order to relate the specificity of a pesticide to possible effects on humans, the similarity or lack of similarity of mode of action in the pest to that in humans must be considered. Pesticides that affect a pest in a unique manner (e.g., growth regulators) have little effect on humans; conversely, pesticides that are toxic to systems similar to those in man--such as the nervous system--may pose a

greater potential hazard to humans. The symptoms of pesticide poisoning (Fig. 3) are specific to the pesticide or pesticide *class* . The applicator should be aware that the poisoning symptoms described on the pesticide label are associated with that *class* of pesticide. General symptoms of acute chemical poisoning are headache, nausea, dizziness, irritation of the skin or eyes, or the appearance of a rash. If any of these symptoms--or any of the symptoms listed on the pesticide label--should occur during use of a pesticide, discontinue use, eliminate possible sources of further contamination, and seek help.

Chronic Toxicity

Chronic exposure to pesticides and other hazardous chemicals can result in delayed or long-term health effects. Chronic effects may include deterioration of organs (especially the liver) and the nervous system, cancer, and changes or alterations in the reproductive system. Pesticides that are found to pose unacceptable risks from chronic exposure are removed from use. As in acute toxicity, chronic toxicity is dose-related. Health effects will appear first in those populations with the most pesticide exposure (e.g., production workers and pesticide applicators). Pesticide applicators should take appropriate protective measures to reduce their long-term exposure to pesticides.

Acute Toxicity of Carbamate and Organophosphorous Insecticides

Carbamate and organophosphorous insecticides, which act as neurotoxins, are among the most toxic classes of pesticides. The mammalian toxicity of pesticides in these classes ranges from 1mg/kg (highly toxic) to 4000 mg/kg (slightly toxic). A large percentage of carbamate and organophosphorous insecticides are in the high to moderate toxicity categories. This is because the target site of these pesticides, the insect nervous system, is similar to that of mammals. Carbamate and organophosphorous insecticides interfere with the proper signaling between nerve cells and between nerves and the muscles they activate (Fig 4). Because muscles are responsible for the movement of the diaphragm during breathing, severe poisoning by organophosphates and/or carbamates can cause the victim to stop breathing and die from lack of oxygen. Normal movement of muscles requires a nerve signal to initiate a muscle contraction. At the site of contact between a nerve and muscle (neuromuscular junction), the nerve (upon receiving a signal from the central nervous system) releases a chemical, acetylcholine, which signals the muscle to contract. In normal situations, the acetylcholine is then removed by an enzyme, acetylcholinesterase, and the muscle can relax. If the acetylcholine is not removed, the muscle will remain in a state of

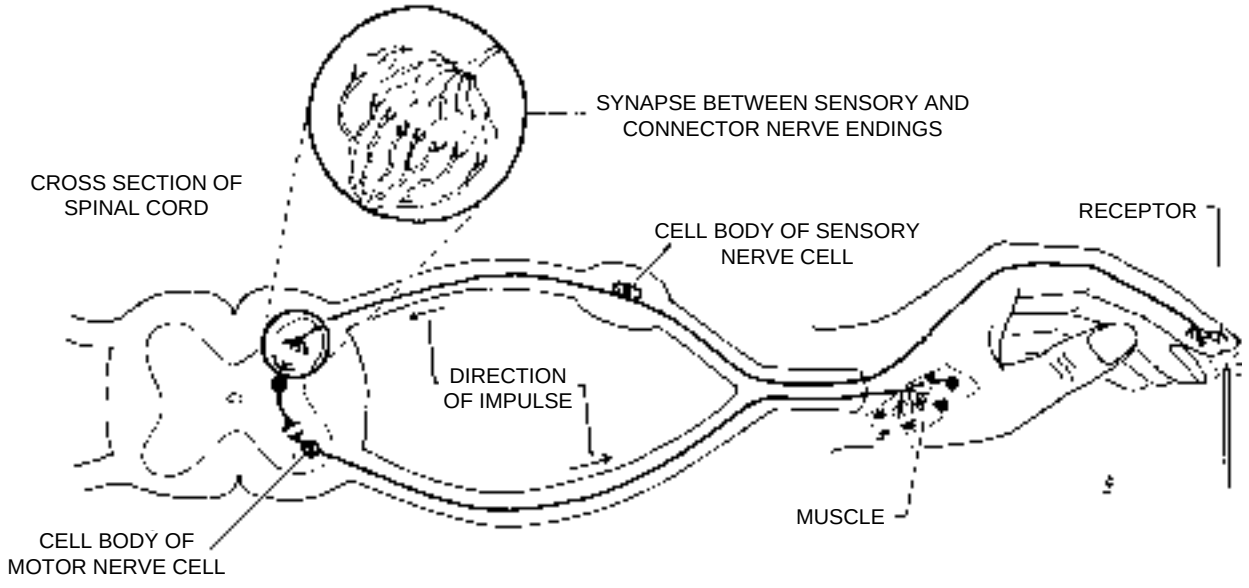


FIGURE 4. DIAGRAM OF NERVE COMMUNICATION IN MAN. A SIMPLE REFLEX ACTION.

contraction. Carbamate and organophosphorous insecticides are acetylcholinesterase inhibitors -- that is, they prevent the acetylcholinesterase from removing the acetylcholine from the neuro-muscular junction. At a high enough concentration of the neurotoxic insecticide, the muscle will attain a state of permanent contraction. If the muscles that move the diaphragm are permanently contracted, breathing will cease.

Poisoning Symptoms of Carbamate and Organophosphorous Insecticides

Acetylcholine also is used as a signal from one nerve to another. Acetylcholinesterase inhibitors can disrupt acetylcholine signaling in the central nervous system. This disruption can cause headaches, dizziness, nausea, restlessness, anxiety and, in severe poisonings, convulsions. Mild poisonings are often accompanied by "flu-like" symptoms: headache, nausea, vomiting, and dizziness. These symptoms may be mis-diagnosed as the flu. More severe poisonings will be accompanied by restlessness and anxiety and progress to muscle twitching, weakness, tremor, loss of coordination, vomiting, and diarrhea. Hypersecretion (sweating, tearing, and salivating) also may occur. If the insecticide is inhaled, effects on the lungs (tightness in the chest, wheezing, and coughing) often occur. If the poisoning is life-threatening, the victim may become unconscious, incontinent, or convulsive, or may suffer a depression in respiration.

Treatment of Carbamate and Organophosphorous Insecticide Poisonings

While carbamate and organophosphorous insecticides both are acetylcholinesterase inhibitors, there are some important differences in their mode of action. Poisonings from exposure to carbamate insecticides may result after only a short exposure but generally can be reversed faster than poisonings from organophosphorous insecticides. If treated in time, inhibition by carbamates is completely reversible. If the vital signs can be maintained, the victim eventually will recover. It is especially critical to maintain an oxygen supply to the body. Atropine as an antidote for carbamate poisoning because it will partially block the action of acetylcholine. This allows the muscles to relax until the body removes enough of the carbamate to return acetylcholinesterase activity to normal. Atropine relieves the poisoning symptoms while the body's detoxication system works to remove the carbamate.

Atropine also is an antidote for poisoning by organophosphorous insecticides. Unlike carbamates, which are completely reversible inhibitors, organophosphorous insecticides can inhibit acetylcholinesterase irreversibly, leading to loss of acetylcholinesterase. Inhibition by organophosphorous insecticides can be reversed by administration of pralidoxime, which will prevent loss of acetylcholinesterase. However, pralidoxime is also an acetylcholinesterase inhibitor. While it is useful in treatment of organophosphorous insecticide poisoning, it can exacerbate carbamate poisoning. In order to assure proper treatment, the poisoning agent must be positively identified. It is virtually impossible to distinguish carbamate poisoning from organophosphorous insecticide poisoning based on symptoms alone. The label on the pesticide container may be the only source for determining the poisoning agent.

Medical Tests for the Effects of Carbamate and Organophosphorous Insecticide Exposure

Because of irreversible inhibition, chronic exposure to organophosphorous insecticides can depress an individual's level of acetylcholinesterase. In the course of a spray season, significant depletion of acetylcholinesterase can occur, making the applicator more vulnerable to damaging effects from both organophosphorous and carbamate insecticides. Medical tests are available to determine acetylcholinesterase levels; but because these levels vary among individuals, a baseline acetylcholinesterase level must be established prior to exposure. Once a person's base level of acetylcholinesterase has been determined, the effects of exposure to organophosphorous insecticides can be detected by a reduction in the level of acetylcholinesterase. Individuals who show reduced acetylcholinesterase levels should not apply organophosphorous insecticides until their acetylcholinesterase levels return to normal. The body normally makes new acetylcholinesterase on a continuous basis, and levels return to normal after several weeks. Thus, persons handling organophosphate insecticides for an extended period should consider (in consultation with their physician) a program for monitoring acetylcholinesterase.

Toxicity of Pyrethrin and Pyrethroid Insecticides

Naturally occurring pyrethrins and synthetic compounds (pyrethroids) which act similarly are neurotoxins, but they are *not* acetylcholinesterase inhibitors; they affect the electrical signal that travels within a nerve. Insects and fish are much more susceptible to pyrethroids than are mammals, in which severe pyrethroid poisoning rarely is seen. Pyrethroids can irritate skin and eyes and produce allergic reactions, so proper clothing and eye protection is important when handling liquid formulations. Some individuals report tingling,

stinging, burning, itching, or numbness after dermal contact with pyrethroids. These effects may occur immediately or two to four hours after exposure. They do not cause sensitization and generally disappear after 24 hours.

Treatment of Poisoning by Fumigants

Fumigants pose a high inhalation hazard. Victims of poisoning by fumigants should be removed to fresh air immediately. Some fumigants are corrosive to lung tissue and cause pulmonary edema (fluid in the lungs). Victims should be placed in a reclining position, with care being given to minimize movement and maintain breathing.

PESTICIDE EXPOSURE

Toxicity is the first part of the hazard equation; the second part is pesticide exposure.

HAZARD (RISK)	=	TOXICITY x EXPOSURE

Before injuries can occur, pesticides must enter the body through one of three routes of exposure: ***dermal*** (absorption through the *skin or eyes*); ***respiratory*** (inhalation through the *lungs*); or ***oral*** (ingestion by *mouth*).

Dermal absorption is the most common route of pesticide exposure for the applicator. Contact with the concentrated product during mixing and loading presents the greatest risk of exposure. The degree of absorption depends on the properties of the pesticide, its formulation, and the parts of the body exposed. The forearms and hands are the most likely sites of pesticide accumulation during normal pesticide applications. Hands left unwashed after pesticide use can contaminate other parts of the body. Figure 5 gives examples of specific body regions and their relative susceptibility to pesticide absorption. Eyes also are extremely sensitive to pesticides. They are highly absorptive, and direct eye injury can occur when pesticides are accidentally splashed in the face.

Respiratory exposure by inhalation occurs during the handling of powders, dusts, fine sprays, and gases (fumigants). The lungs provide a point of rapid entry into the bloodstream.

Oral exposure generally results from improper storage or handling. Keep pesticides in their original containers; **never** transfer pesticides into bottles or food containers of any kind. This is extremely important in case of poisoning, because unmarked containers provide no instructions to medical personnel regarding pesticide class and treatment of the poisoning. Always keep pesticide containers tightly closed and out of the reach of children and animals.

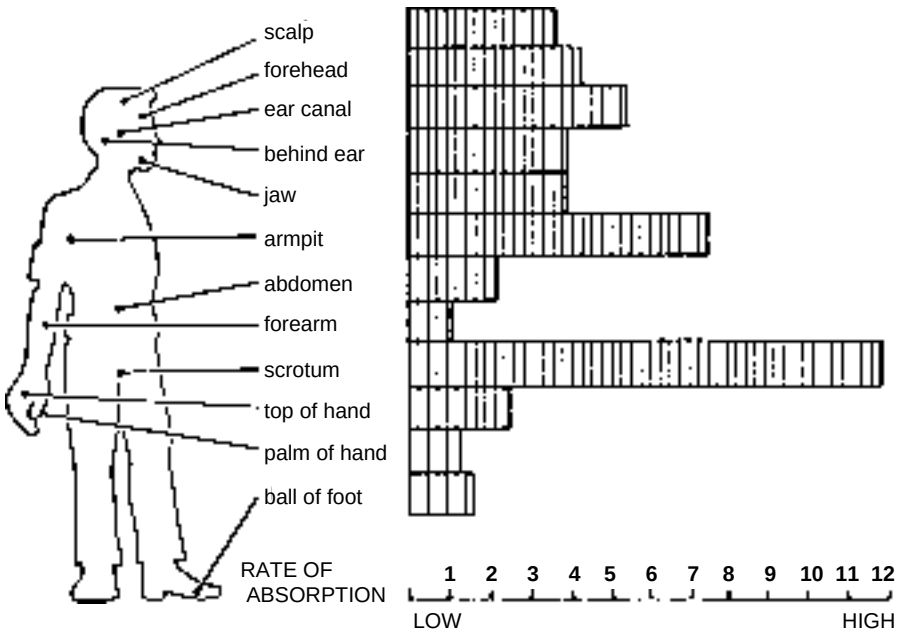


FIGURE 5. Rates of absorption in the human body depend on the pesticide formulation and the exposed areas of the body.
Source: The Safe and Effective Use of Pesticides. 1988. University of California, Publication 3324.

Preventing Pesticide Exposures

Here are some suggestions for reducing levels of pesticide exposure and minimizing potential hazards:

- Select the safest formulation—usually granular or microencapsulated materials.
- Use a pesticide with a reduced concentration of active ingredient.
- Reduce the rate of application to the lowest effective level.
- Mix only enough pesticide to complete the assigned task.
- Select a method of application that minimizes personal contact.
- Purchase only enough pesticide to do the job.
- Wear all protective clothing stipulated on the label.
- Avoid direct contact with the pesticide when mixing and filling equipment.
- Use pesticides only in well-ventilated areas.
- Be cognizant of others around you during application. Consider their safety.
- Dispose of pesticide containers properly.
- Be attentive to re-entry intervals specified on the label.
- Always keep pesticides in their original, labeled pesticide containers.
- Avoid pesticide drift.
- Avoid conditons which might lead to ground water contamination.

Protective Clothing and Personal Safety

Preventing exposure to pesticides requires personal protective equipment (PPE) as shown in Table 3. The types of PPE required vary according to the toxicity of the pesticide. Read the pesticide label for complete instructions and specific requirements related to PPE. Notice that mixing pesticides normally requires more personal safety equipment than applying them (except fumigation). This is because the mixing process necessitates handling pesticides in their most concentrated form. Pesticide exposures can be minimized by following all safety precautions found on the pesticide label. Remember, the primary line of defense against exposure to pesticides is personal protective equipment.

After obtaining the proper equipment, give your employees and family members the necessary training for using it. If you are serious about reducing health risks from pesticide exposure, you must inspect the job site to ensure compliance with personal safety requirements.

Handling Pesticide-Contaminated Clothing

Always assume that clothing worn while working with pesticides has been contaminated. It should be laundered after each use. The longer pesticide-contaminated clothing remains unwashed, the more difficult the process of pesticide removal. It is best to presoak contaminated clothing in hot water containing a heavy-duty liquid detergent. Start the wash cycle after the presoaking water has been drained. Prerinsing and regular washing are the most effective methods of removing low level pesticide contamination from clothing. Clean the washing machine immediately after the wash cycle by running a complete cycle of new water and detergent through it. Line drying is preferable to machine drying, as it eliminates the potential for dryer contamination. (for more details on line drying, PPP-38)

Care must be exercised when handling pesticide contaminated clothing. If there is any doubt that contaminated clothing can be laundered effectively, discard it. For example, absorbent clothing contaminated with liquid concentrates should be discarded. Nonabsorbent items may be reused: certain types of chemical resistant gloves, boots, and aprons.

Pesticide Safety Tips

- Always read the label before buying and/or using pesticides. Use pesticides only for the purpose(s) listed and in the manner directed.
- Pesticides that require special protective clothing or equipment should be used only by trained, experienced applicators.
- Do not apply more than the specified amount of pesticide: It is illegal to apply more than labeled rates. Over-application is wasteful and can harm people and the environment.
- Keep pesticides away from food, dishes, and utensils.
- Keep children and pets away from pesticides and areas where pesticides have been applied.
- Do not smoke or eat while applying pesticides; avoid inhaling pesticides.
- Never spray pesticides outdoors on a windy day.
- When mixing pesticides, be careful to avoid splashing.
- Avoid damage to or spills from pesticide containers.
- If you spill a pesticide on your skin, wash immediately with soap and water. If you contaminate your clothing with a pesticide, change immediately and launder it according to instructions given above.

- Wash with soap and water after using pesticides, and launder clothes before wearing again.
- If someone swallows a pesticide, call a physician, hospital, or local poison control center immediately. Keep the pesticide label or labeled container with you as a reference for the physician.
- Store pesticides under lock in original containers with proper labels. Never transfer a pesticide to another container (e.g., soft drink bottle).
- Dispose of empty containers properly, as described on the label.
- Keep adequate pesticide use and application records.

TABLE 3. INTERPRETATION OF PESTICIDE LABEL STATEMENTS.

Label Statement	Acceptable PPE	Label Statement	Acceptable PPE
Long-sleeved shirt and long pants	Long-sleeved shirt and long pants, or Woven or non-woven coverall, or Plastic, or other barrier-coated coverall, or Rubber or plastic suit	Chemical-resistant gloves	Barrier-laminate gloves, or Other gloves that glove selection charts or guidance documents indicate are chemical-resistant to the pesticide for the period of time required to perform the task
Coverall worn over short-sleeved shirt and short pants	Coverall worn over short-sleeved shirt and short pants, or Coverall worn over long-sleeved shirt and long pants, or Coverall worn over another coverall, or Plastic, or other barrier-coated coverall, or Rubber or plastic suit	Chemical-resistant gloves such as butyl or nitrile	Butyl gloves, or Nitrile gloves, or Other gloves that glove selection charts or guidance documents indicate are chemical-resistant to the pesticide for the period of time required to perform the task
Coverall worn over long-sleeved shirt and long pants	Coverall worn over long-sleeved shirt and long pants, or Coverall worn over another coverall, or Plastic, or other barrier-coated coverall, or Rubber or plastic suit	Shoes	Leather, canvas, or fabric shoes, or Chemical-resistant shoes, or Chemical-resistant boots, or Chemical-resistant shoe coverings (booties)
Chemical-resistant apron worn over coverall or over long-sleeved shirt and long pants	Chemical-resistant apron worn over coverall or long-sleeved shirt and long pants, or Plastic, or other barrier-coated coverall, or Rubber or plastic suit	Chemical-resistant footwear	Chemical-resistant shoes, or Chemical-resistant boots, or Chemical-resistant shoe coverings (booties)
		Chemical-resistant boots	Chemical-resistant boots
Chemical-resistant protective suit	Plastic-or other barrier-coated coveralls, or Rubber or plastic suit	Chemical-resistant hood or wide-brimmed hat	Rubber or plastic coated safari-style hat, or Rubber or plastic coated firefighter-style hat, or Plastic, or other barrier coated hood, or Rubber or plastic hood, or Full hood or helmet that is part of some respirators
Waterproof gloves	Any rubber or plastic gloves sturdy enough to remain intact throughout the task being performed		

Source: Personal Protective Equipment Guide. Coveralls,Gloves, and other Skin Protectants. U.S. Environmental Protection Agency and U.S. Department of Agriculture Cooperative Extension Service.

PLAN OF ACTION FOR ACUTE PESTICIDE POISONINGS

A pesticide user should establish a plan of action to follow in case of a pesticide-related accident. Advanced planning and preparation should be routine. Make sure all employees are familiar with appropriate emergency procedures.

Contact Medical Personnel

Step one in any poisoning emergency is to prevent further exposure and make sure the victim is breathing; then call emergency medical personnel.

Maintain Vital Signs

Administer first aid while help is on the way. Maintenance of vital signs is imperative, and cardiopulmonary resuscitation techniques may be required. The cause of death of most pesticide poisoning victims is respiratory failure. Many victims will recover if the supply of oxygen to the body can be maintained. Only a doctor will have the medication and equipment necessary to treat a poisoning victim properly. Always provide attending medical personnel with a copy of the pesticide label.

Eliminate Further Contamination

Ingested Pesticides. If an individual swallows a pesticide, act immediately: Do not wait for symptoms to appear.

The pesticide label will indicate whether or not vomiting should be induced; care should be taken to *verify* that vomiting is permissible. Never induce vomiting if the victim is unconscious or convulsive. In cases where vomiting *can* be induced safely, fast action can mean the difference between life and death for the poisoning victim. Syrup of ipecac is useful for inducing vomiting; make sure the victim assumes a forward kneeling position or remains on his right side, if lying down, to prevent vomitus from aspirating into the lungs. Gastric lavage--performed by a physician--is another method for removing stomach contents. The latter must be performed as soon as possible after ingestion of the pesticide--and no longer than two hours afterward. After two hours, the pesticide will have passed into the intestine, thus requiring a different approach to effect removal of the poison; physicians can administer absorptive charcoals to prevent the absorption of the pesticide from the intestine and promote its elimination in the feces.

It is important to remember to consult the pesticide label before proceeding with first aid. There are certain situations where inducing vomiting might only cause *additional* damage. Vomiting should **not** be induced if the pesticide formulation contains organic solvents or corrosives such as strong acids and bases since these materials can cause serious, permanent damage to sensitive tissues of the esophagus--or the lungs, if aspiration occurs.

Pesticides on the Skin. Wash the pesticide off the victim as soon as possible to prevent continued exposure and injury.

- Remove clothing and drench the skin with water (shower, hose, faucet, pond, etc.).
- Cleanse skin and hair thoroughly with soap and water. (Don't abrade or injure the skin while washing.)
- Dry the person and wrap in a blanket.

Chemical Burns of the Skin. Taking immediate action is extremely important.

- Remove contaminated clothing.
- Wash skin with large quantities of cold running water.
- Immediately cover the affected area loosely with a clean, soft cloth.
- Do <u>not</u> use ointments, greases, powders, or other drugs recommended as first aid treatments for chemical burns.

Pesticides in the Eye. It is very important to wash out the affected eye as quickly but as gently as possible.

- Hold eyelids open; wash eyes with a gentle stream of clean running water at body temperature, if possible.
- Continue washing for <u>15 minutes or more</u>.
- Do not use chemicals or drugs in wash water; they may increase the potential for injury.

Inhaled Pesticides. If the victim is in an enclosed area, wear an appropriate respirator when removing the person from the contaminated area.

- Immediately carry the victim to fresh air.
- Loosen all tight clothing.
- Apply artificial respiration if breathing has stopped or is irregular.
- Keep the victim as quiet as possible.
- If the victim is convulsing, watch breathing and protect the person from falling and striking his head. Pull the chin forward so that the tongue does not block the air passage.
- Prevent chilling. Wrap patient in blankets but do not overheat.

SOURCES FOR PESTICIDE INFORMATION

Purdue Pesticide Programs
(765) 494-4566

Purdue Cooperative Extension Service
(888) 398-4636

Office of Indiana State Chemist (Purdue Univ.)
(765) 494-1594

CHEMTREC Transportation Emergency
(800) 424-9300

National Pesticide Telecommunications Network (NPTN)
(800) 858-7378

Indiana Department of Labor
Bureau of Safety Education and Training
(317) 232-2688

Environmental Protection Agency Region V
Pesticides and Toxic Substance Branch
(312) 353-2000

EPA Safe Drinking Water Hot Line
(800) 426-4791

EPA Community Right-To-Know Hot Line
(800) 535-0202

PESTICIDE POISONING

Indiana Poison Center
(800) 222-1222

PESTICIDE SPILL REPORTING

Indiana Department of Environmental Management
(888) 233-7745

EMERGENCY PHONE NUMBERS

Local Police: _____

State Police: _____

Hospital: _____

Physician: _____

Fire: _____

Ambulance: _____

Indiana Poison Center: (800) 382-9097

CHEMTREC: (800) 424-9300

Think of one part per million (ppm) as:
1 inch in 16 miles
1 drop in 50 gallons
1 second in 12 days
1 penny in $10,000
1 mg/kg = 1 ppm

Think of one part per billion (ppb) as:
1 inch in 16,000 miles
1 drop in 50,000 gallons
1 second in 32 years
1 penny in $10,000,000
1µg/kg = 1 ppb

Think of one part per trillion (ppt) as:
1 inch in 16,000,000 miles
1 drop in 50,000,000 gallons
1 second in 32,000 years
1 ng/kg = 1 ppt

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