Chapter 6
Health and Safety

This Chapter describes potential health and safety issues involved in applying pesticides. It contains sections on pesticide toxicity, potential human health effects, how to recognize poisoning and provide first aid, and preventing poisoning.

Learning basic first aid techniques, as well as cardiopulmonary resuscitation (CPR), gives pesticide applicators the skills to cope with accidents or injuries. Photo: iStock
Section 1: Pesticide Risks and Exposure

The harm a pesticide causes a target pest is not always useful as a guide to its effects on humans. People who apply pesticides must understand the potential human health and safety risks of the products they use—and plan ahead to prevent those risks. Pesticides are tested to identify hazards to humans and regulated to warn users of the risks through information on the label.

Pesticide applicators should always check the pesticide label for the signal word and the “Hazards to Humans and Domestic Animals” and “Precautionary Statements” sections to learn more about human toxicity concerns. Products also can pose physical and chemical risks by being explosive and combustible or have other physical or chemical hazards. If the product presents either a physical or a chemical hazard, this information is included under the “Precautionary Statements.” More detailed information on hazards and precautions can be found on the pesticide’s material safety data sheet (MSDS). This Section provides general information about the hazards of pesticides on human health. In the next Section, more detailed information about health risks and symptoms specific to pesticide poisoning will be explored.

Learning Objectives:

1. Explain how Risk = Toxicity x Exposure.
2. Describe the four main pesticide routes of entry into the body.
3. Compare and contrast different types of pesticide exposure: acute, chronic, and trace.

Terms to Know:

- Acute exposure
- Allergic effects
- Chronic exposure
- Contact effects
- Dose
- Hazard
- Risk
- Routes of exposure
- Systemic effects
- Toxicity
- Trace exposure
Toxicity of the Dose

“The Dose Makes the Poison”

There are a number of useful terms for anyone to understand the level of human health risk posed by a pesticide. A poison is a substance that can cause illness if it enters the body through your mouth, nose, skin, or eyes. Whether or not a substance makes you ill and is a poison depends on the dose, which is the amount of pesticide that enters your body over a period of time. Every substance can be a poison if the dose is high enough. We use the word exposure to mean contact with any amount of pesticide, whether or not any enters the body or the dose is high enough to cause poisoning. The size of the dose needed to make you ill is called toxicity. The lower the dose needed to cause harm, the more toxic the substance.

Public health experts express this relationship between health risk from exposure to a pesticide or other substance as

$$\text{Risk} = \text{Toxicity} \times \text{Exposure}.$$  

Where:

- **Risk** is the probability or likelihood for a specific harm to occur given a product’s toxicity and at a given dose of a pesticide that enters the human body.
- **Toxicity** is the amount of pesticide need to enter the body to cause that harm, and
- **Exposure** in this case is the level and type of contact a person has to a pesticide reflected in the actual pesticide dose a person receives.

The equation is useful for remembering that exposure to pesticide alone is not enough to cause poisoning. Some pesticides are extremely toxic, even lethal, at very low doses, but if exposure is low enough no harm will result. On the other hand, people may be careless and less likely to follow safety precautions with less toxic pesticides and so increase their exposure, significantly increasing their risk of harm.

A pesticide’s toxicity may vary between different kinds of organisms and can be affected by a wide range of factors, including how the pesticide enters the body. Exposure occurs through the skin, by inhalation, by swallowing, or by eye contact. The physical and chemical differences in...
product formulations differ greatly in the exposure risk they present for the same active ingredient. Exposure is also affected by whether or not a person is working with the concentrated undiluted pesticide or with the diluted spray mixture during application.

Exposure is often associated with many routine procedures involving pesticides, such as handling opened containers; mixing and loading; working around contaminated application equipment; making spray, mist, or dust applications; cleaning up spills; and reentering a recently treated area before the spray has dried or the dusts have settled.

**Routes of Entry into the Body**

Pesticides enter the human body through the skin, the eyes, the lungs, and/or the mouth. Understanding these four routes of exposure will help pesticide applicators protect themselves from pesticide hazards.

**Skin or Dermal Exposure**

Most pesticide exposures take place through the skin. One study found that approximately 97 percent of pesticide exposure encountered during spraying operations is skin exposure. The skin is a durable barrier that protects other body organs and systems. This barrier can be injured by toxic chemicals that burn, cause rashes, or enter through scratches or cuts. Skin is also porous, and water, nutrients, and some toxic substances can pass through it, affecting organs and systems throughout the body.

Dermal exposure can occur through airborne dust, splashes, spills, or spray mist during mixing, loading, or applying pesticides. Skin exposure also results from touching pesticide residues on treated surfaces, and contaminated clothing, pesticide containers, or equipment used during application. Methods such as overhead application, blower application of mists or dusts, and animal pour-ons or dips are more likely to expose the skin to pesticides.

**Relative absorption rate of pesticides through the skin.**
Adapted from University of Kentucky Extension.
The pesticide’s formulation affects how much the skin can absorb. Dusts, granules, powders, and water-soluble liquids and powders don’t penetrate the skin as easily as oil-based liquids or concentrated products meant to be mixed with liquids.

Not all skin absorbs pesticides in the same way. Warm, moist skin (in the groin, armpits, head, neck, or ear) tends to absorb more pesticide than the arms, legs, or hands. However, arms and hands are more likely to be cut or scratched, allowing pesticides to move quickly through the break in the skin. (See graphic on page 137.)

**Eye Exposure**

The human eye contains many blood vessels close to the surface, and can quickly absorb significant amounts of pesticide. Eye exposure arises from airborne pesticides (droplets, aerosols, or particles) and rubbing the eyes with contaminated hands or clothes. The exposure can damage on contact with the eye, especially if the pesticide is corrosive, causing serious burns. Pesticides absorbed through the eye enter the bloodstream and move to other organ systems.

**Breathing or Inhalation Exposure**

It is easy to breathe in powders, fumes, or aerosols (very small droplets suspended in the air) while handling pesticides, especially if people are mixing or loading in a confined space (inside a closed vehicle, a shed, or a garage). Breathing in pesticides may also happen outdoors, such as when applicators stand downwind when mixing or loading pesticides into equipment or during application from drift.

Exposure by inhalation can occur in three major ways: the pesticide comes into contact with the nose, throat, or lung tissue and causes damage; inhaled pesticide moves into the bloodstream from the lungs and affects other organ systems; or, when inducing vomiting to remove a petroleum-based emulsifiable concentrate or other pesticide from the stomach, the vomit is accidentally pulled into the lungs, causing lung damage and choking.

**Mouth or Oral Exposure**

Pesticide that enters the mouth (or is swallowed) is absorbed in the intestinal tract, moving it rapidly into other organ systems. Exposure by mouth is most common among children, who put their fingers, objects, or food (including contents of pellet-type bait traps) into their mouths.

Eating without washing pesticides from hands can lead to oral exposure.

Photo: University of Minnesota Extension
Adults can become exposed when pesticides splash into the mouth or on the lips; when food, beverages, or cigarettes are consumed after applying a pesticide; or when leftover pesticides are stored in containers with food or beverage labels and are consumed by accident. Other oral exposures occur when people try to suction liquid to clear clogged tubing or nozzles while transferring liquid from one container to another.

**Pesticide Risks and Exposure Summary**

Pesticide applicators can experience any one or a combination of these exposures, which may lead to either acute or chronic health effects. Key factors in determining the type and degree of harm include pesticide toxicity, dose, length or frequency of exposure, and route of entry into the body.
Section 2: Recognizing Pesticide Exposure Symptoms

The effects of pesticides on the human body vary by type of pesticides, route of entry into the body, dose and variety of other factors. Though only trained medical professionals can diagnose pesticide poisoning, pesticide applicators need to be familiar with the symptoms of the products they use. This Section provides pesticide applicators with signs and symptoms of poisoning—both acute (immediate and short-term) effects and chronic (long-term) effects.

Learning Objectives:

1. Compare and contrast the different types of acute and chronic physical reactions people can have to pesticide exposure.
2. Define each of these pesticide label signal words: Caution, Warning, Danger, and Danger/Poison.

Terms to Know:

- Allergic response
- Contact effects
- Heat stress
- Hypersensitivity
- Signal words
- Systemic effects

Harmful Effects of Pesticides

The effects of pesticides on the human body can be divided into immediate and short-term effects and those that result in long-term health problems. Human pesticide injuries occur because products can cause damage by contact with skin, eyes, or respiratory tract; can be absorbed by the body and cause systemic effects; and can induce allergic responses. People handling and applying pesticides can find specific toxicity and other health effects information and precautions on the pesticide’s labels. Material safety data sheets (MSDS), available from retailers or on-line for all chemicals including pesticides, are especially valuable in providing health and safety information. MSDSs have separate sections with in-depth information on hazards, first aid, exposure, and personal protection.
Acute Health Effects

Section 1 above explains how the toxicity of the pesticide itself is a big part of the equation, \( \text{Risk} = \text{Toxicity} \times \text{Exposure} \). The signal word on the pesticide label is your first indication of the product’s level of acute toxicity. The signal word chart in Chapter 3, The Pesticide Label shows different label statements for each signal word based on type of exposure and what it means for handling a pesticide.

A full discussion on pesticide toxicities is included in Appendix A, Pesticide Toxicities, including definitions of the terms LD\(_{50}\) (lethal dose) and LC\(_{50}\) (lethal concentration) and detailed information about signal words.

Understanding signal words and label statements related to toxicity and what they mean are important in helping pesticide applicators protect themselves from pesticide exposure and reduce their risk of harm. The next step is to understand the types of physical symptoms that indicate an acute pesticide poisoning or reaction.

Symptoms of Acute Pesticide Poisoning

The symptoms of acute pesticide poisoning depend upon how toxic the chemical is, the route of exposure, and the dose that enters the body. These symptoms can be contact effects (affecting skin and external tissue at the entry route), systemic effects (affecting internal body systems remote from the entry route), or allergic effects (affecting the immune system).
Contact Effects

Injury at the point of contact includes skin discoloration and irritation (dermatitis) such as itching, redness, rashes, blisters, and burns. Contact effects may also include swelling, stinging, and burning of the eyes, nose, mouth, or throat. Many herbicides and fungicides cause dermatitis. Fumigants can cause severe blisters. As herbicides are the most commonly applied pesticide group, and they predominantly cause contact injury, you can easily understand why contact skin effects are the most common form of pesticide injury or poisoning to applicators.

Herbicides, fungicides, insecticides, and fumigants may cause eye irritation or injury, sometimes resulting in irreversible damage. Swelling, stinging, and burning of the eyes, nose, mouth, or throat are relatively common contact symptoms. Permanent respiratory damage occurs less often.

Systemic Effects

Injury or harm that occurs at sites other than the entry point into the body are called systemic effects. Systemic poisoning symptoms among humans occur most often during application of pesticides that target animals. Common physical symptoms of systemic injury include:

- Nausea, vomiting, diarrhea, or stomach cramps (gastric system);
- Headache, dizziness, weakness, or confusion (nervous system);
- Excessive sweating, tearing of eyes, chills, or thirst (hormonal system);
- Chest pains (cardiovascular system);
- Breathing difficulties (respiratory system); or
- Body aches and muscle cramps (musculoskeletal system).
Allergic Effects

Allergic effects are harmful effects some people develop in reaction to substances that do not cause the same reaction in most other people. Acute allergic reactions to pesticides can be systemic, contact, or both. The difference is that these reactions happen to a limited number of people with hypersensitivity: immune systems that react strongly to the specific chemical.

Pesticide allergy symptoms may be similar to other allergy symptoms—reddening of the eyes, itchy eyes, respiratory discomfort, and asthma-like symptoms. An allergic reaction may also cause dermatitis, blisters, hives, and itching of the eyes. It could also cause illness, asthma-like symptoms, or life-threatening shock. Often the entire body is affected. Unfortunately, there is no way to know if a person is allergic to a pesticide in advance of application, so a good first aid kit should include treatment for allergic reactions.

Pesticide-specific Health Effects

There are also some pesticides that are known to have specific health effects, and it is important for pesticide applicators to be aware of these:

- Organophosphates (usually but not always insecticides) are highly toxic, accumulate over time, and have caused more poisonings than any other class of pesticide. These pesticides are harmful to a key enzyme, cholinesterase, which affects nerve function. Pesticide applicators that work with organophosphates and are concerned about chronic exposure can have a cholinesterase blood test before spraying and periodically throughout the spraying season.

- Carbamates (found in some insecticides, fungicides, and herbicides) also can be harmful to cholinesterase, but because they do not accumulate in the body, they do not normally cause long-term health effects. (Symptoms of organophosphate and carbamate insecticide poisoning are described in the table on page 144.)

- Anticoagulants (found in rodenticides) prevent blood clotting and cause severe bleeding, but are less likely to cause chronic illness or injury because they are ingested and repeated exposures are necessary for the full impact.

- Fumigants (used in some insecticides, herbicides, and antimicrobials) are highly toxic and very dangerous if inhaled. Fumigants (particularly methyl bromide, which has no odor) affect the nervous system, and symptoms of poisoning include poor coordination, confusion, drowsiness, and slurred speech. These symptoms resemble drunkenness, and can easily be mistaken for excessive alcohol use. Alcohol also may increase the applicator’s sensitivity to fumigants. Do not drink alcohol 24 hours before or after using a fumigant, to ensure that a possible poisoning reaction is easier to diagnose.
Botanicals (used in rodenticides and other pesticides) are derived from plants, and can be very toxic; strychnine, for example, is a botanical.

Symptoms of Organophosphate and Carbamate Insecticide Poisoning

<table>
<thead>
<tr>
<th>Mild Poisoning</th>
<th>Moderate Poisoning</th>
<th>Severe Poisoning</th>
</tr>
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<tbody>
<tr>
<td>Fatigue</td>
<td>Inability to walk</td>
<td>Unconsciousness</td>
</tr>
<tr>
<td>Headache</td>
<td>Weakness</td>
<td>Severe constriction of pupils</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Chest discomfort</td>
<td>Muscle twitching</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>Contracted pupils in the eyes</td>
<td>Runny nose and drooling</td>
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<tr>
<td>Excessive sweating or salivating</td>
<td>More severe versions of mild poisoning symptoms</td>
<td>Difficulty breathing</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td></td>
<td>Coma</td>
</tr>
<tr>
<td>Stomach cramps and diarrhea</td>
<td></td>
<td>Death</td>
</tr>
</tbody>
</table>

The biggest problem in responding to acute poisoning is that every person is different—and some are more affected or can be more severely injured by pesticides than others. Many health experts refer to “sensitive populations” as those with whom toxic chemicals should be used with an extra margin of safety. Some of these “sensitive populations” include:

- Infants and children, whose rapid growth and development may be seriously or permanently damaged by an acute exposure;
- Pregnant women, who are encountering rapid physical changes themselves and are carrying a rapidly growing and developing fetus who may be seriously or permanently affected by an acute exposure; and
Elders, the disabled, and people with existing medical conditions (such as asthma, respiratory disease, and known allergies), all of whom have body systems already weakened or susceptible to acute exposure.

A pesticide applicator familiar with the chemical’s toxicity and the most common symptoms of acute exposure will be able to respond rapidly and effectively if poisoning occurs (see Section 3 for information on first aid).

Chronic Health Effects

Research has shown that certain pesticides have both acute and chronic health effects while other pesticides have been shown to have little potential to harm human health. Chronic health effects of pesticides may not become evident until months or years after exposure, making it difficult to connect the cause (pesticide exposure) to an effect (illness years later). Types of chronic health effects from pesticide exposure of concern include:

- Cancer or other tumors that are not cancerous;
- Infertility;
- Birth defects;
- Miscarriage or stillbirths;
- Nervous system conditions; hormonal imbalances; and blocking of natural responses of the immune system.

Since these health effects can be caused by many other things—from family genetic history, development, lifestyle, other types of exposures (infection, radiation), or a combination of factors, it is unclear about when pesticide exposure is the main or a contributing factor to these illnesses or injuries.

One research effort that is providing answers for pesticide applicators is the Agricultural Health Study, a collaborative effort involving the National Cancer Institute (NCI), the National Institute of Environmental Health Sciences (NIEHS), and the U.S. Environmental Protection Agency (EPA). The multi-year, phased study includes almost 90,000 private pesticide applicators, spouses and children of private applicators, and commercial ag pesticide applicators recruited within Iowa and North Carolina.
The study has several components, but one major effort is to study cancer and non-cancer health outcomes over time for pesticide applicators and their families. Data from study participants were compared with health statistics of people who farm, but do not apply the pesticide. Results so far have associated specific pesticides to prostate cancer, retinal degeneration, Parkinsonism, and other long-term health effects. The study results also found those pesticide handlers and applicators who follow label directions, wear the right personal protective equipment, and follow other required and recommended safety practices greatly reduce their risk for these health problems. For more information about the Agricultural Health Study see the study web site at http://aghealth.nci.nih.gov.

Other Types of Health Risk

Pesticides aren’t responsible for all of the injuries or illness applicators experience. Working outdoors, long hours, in humid conditions, and hot sun, possibly while wearing protective equipment, can lead to two very serious health problems: heat stress (see box on the following page) and skin cancer, which is related to overexposure to the sun.

According to the American Cancer Society, more than two million cases of sun-related skin cancer are diagnosed yearly in the United States. Most of these skin cancers develop on the sun-exposed areas of the body, such as the face, ears, neck, lips, and hands. The common skin cancers rarely spread to other parts of the body, but increase the risk of more serious types of skin cancer, melanoma.

Melanoma, the most serious type of skin cancer, accounted for about 68,720 cases of skin cancer in 2009 and most (about 8,650) of the 11,590 skin cancer deaths that occur each year. It is a form of skin cancer that can be very invasive and aggressive. The risk factors include overexposure to sun in childhood and continued overexposure as an adult. Melanomas may occur on sun-exposed areas, but can also appear on other parts of the body.

Sun exposure is greatest between the hours of 10:00 a.m. and 4:00 p.m., often a time when pesticide applicators are working outdoors. Prevent skin cancer by wearing loose, light clothing to block out the sun’s ultraviolet (UV) rays; a hat to protect the face, scalp, and neck; sunglasses to protect skin around the eyes; and, most important, sunscreen marked SPF 15 or greater on all exposed skin.
Heat Stress

An Occupational Hazard for Pesticide Applicators

Heat Stress is another common risk to applicators. Acute and chronic exposures to pesticides are the most serious risks for pesticide applicators, but by no means the only ones. The required personal protective equipment (PPE) may compound heat stress. Add insufficient sweating to intense sun, high temperature, and humid conditions, and heat stress is a risk. **Heat stress** occurs when the body’s core temperature exceeds 100.4 degrees and can take many physical forms. Certain medications increase sensitivity to heat, including those used for allergies, nasal congestion, heart disease, hypertension, and depression.

Symptoms of heat stress include:

- Fatigue, exhaustion, or muscle weakness;
- Dizziness and fainting;
- Clammy skin or hot, dry skin;
- Behavior changes, confusion, slurred speech, irritability, or irrational actions;
- Headache, nausea, and chills;
- Severe thirst and dry mouth; and
- Heavy sweating or a complete lack of sweating.

Heat stroke occurs when the body temperature is elevated dramatically. Heat stroke is a medical emergency and can be fatal if not promptly and properly treated. Cooling the victim is a critical step in the treatment of heat stroke.

Preventing heat stress or heat stroke is mostly common sense: apply pesticides in early morning or late in the day to avoid wearing PPE during the heat of the day; use PPE that allows evaporation; take frequent work breaks in the shade; and drink plenty of water. Check with your physician, if you routinely take any prescription medication or over-the-counter allergy or cold medicine to make certain you know about any drug-related heat sensitivity.

For more information on heat stress see: [http://www.cdc.gov/niosh/](http://www.cdc.gov/niosh/)

Summary

Avoiding the health risks associated with pesticide application begins with knowing the chemical’s toxicity and avoiding exposure. Recognizing the symptoms of acute and chronic exposure and knowing what to do in case of a pesticide exposure emergency—and doing it quickly—can help prevent health problems due to pesticides.
Section 3: Applying First Aid for Pesticide Exposure

After recognizing symptoms of pesticide poisoning, the pesticide applicator needs to act rapidly to prevent further exposure, summon help, and apply first aid measures. The speed and effectiveness of these actions will determine how many people are injured and how much the exposure will affect their immediate survival, severity of injury, or long-term health. This Section describes how pesticide applicators can be ready to respond when an acute pesticide exposure causes a serious or life-threatening physical reaction.

Learning Objectives:

- Identify the parts of the product label & MSDS that provide information about first aid and medical help.
- List the basic first aid steps for all four routes of pesticide exposure.
- Describe the basic first aid for heat stress.
- Provide an overview of why contacting a Poison Center is important.

Terms to Know:

- Cardiopulmonary resuscitation (CPR)
- First aid
- Materials Safety Data Sheet (MSDS)
- Poison Control Center
- Shock
Planning for Emergencies

Applicators have used pesticides to eliminate harmful pests, plants, insects, and microorganisms for many years, and most do it without incident. On those rare occasions when a serious pesticide exposure occurs, the applicator’s thoughtful advance planning can prevent illness, injury, or even death. Personal protective equipment (PPE), covered in the Chapter 7, Safe Handling, is the best defense against pesticide poisoning, but is no guarantee. The applicator who “expects the best and prepares for the worst” will be ready to provide first aid—emergency help or treatment given to an injured or ill person before regular medical services arrive or can be reached.

Read the pesticide label. The label includes information critical to poisoning prevention (what PPE to use, what actions to avoid, how to handle the product). It also provides warnings about the health risks posed by the pesticide, the possible physical risks (fire or explosion, for example), and first aid measures, and these warnings are the foundation of good emergency planning. Keep the pesticide label readily available at the application site for reference if a poisoning occurs.

Review the Materials Safety Data Sheet (MSDS), a reference that the U.S. Occupational Health and Safety Administration (OSHA) require employers to give workers handling hazardous chemicals. The MSDS contains information about first aid for people exposed to the chemical.

Ready emergency phone numbers for immediate use. These phone numbers should be posted near all telephones within the application area, programmed into cell phones, and carried by the applicator or workers in a pocket. Emergency planners recommend that all citizens “ICE” (In Case of Emergency) their cell phones, programming emergency phone numbers for one-touch dialing. Numbers on a pesticide applicator’s list should include:

- The emergency number, 9-1-1, a signal used nationwide to alert police, fire, and ambulances in the applicator’s local area to respond. In most of the U.S., the dispatch center receiving the 9-1-1 call can find the caller’s exact location from the number.
- The National Poison Control Center, a service that provides every day, round-the-clock telephone assistance for all types of poisoning. The phone number is 1 (800) 222-1222.
- The phone number of the nearest hospital emergency room to the pesticide application site. A map of the fastest route to the hospital is also a good idea.
- The phone number of a health care provider or clinic for each person who will be working at the application site, so that first responders and emergency room physicians can find out specific background health information on an injured or ill person.

Note:
All Danger/Poisoning labels must have a note to physicians describing the medical treatment for poison emergencies. Pesticides labeled with other signal words may also contain this information.

Note:
Remember that the pesticide applicator or person assisting the victim is also at risk of getting the chemical on skin or clothing, or of breathing the same fumes inhaled by the victim. Make sure that responders are sufficiently protected during attempts to apply first aid.
Prepare a first aid kit. One version of the contents of a pesticide applicator’s first aid kit is provided on page 155. The size and contents can vary, depending upon the pesticide toxicity, number of people working at a site, usual route of exposure, and other specific circumstances.

Learn CPR (cardiopulmonary resuscitation). CPR is a life-saving technique used on people who have no heartbeat and/or are not breathing. The American Red Cross provides CPR training in businesses, schools, and many other community locations.

Basic First Aid for Pesticide Poisoning

Eliminate the Exposure

If a pesticide applicator recognizes exposure symptoms or suspects poisoning, his or her first step is to eliminate or reduce the exposure to both the exposed person and the responder.

For all four routes of exposure, these first steps are critical:

- For skin exposure, get the pesticide off of the victim by removing contaminated clothing and rinsing the skin continuously for 15 minutes with lots of water.
- For eye exposure, get the pesticide off of the victim by rinsing the eye continuously for 15 minutes with a low-pressure stream of water.
- For breathing exposure, move the victim away from the pesticide mist, aerosol, or fumes to a well-ventilated area or clean air.
- For oral exposure, stop the victim from eating or drinking and immediately call the National Poison Center emergency number for instructions or check the pesticide label’s first aid section.
- For shock, get medical help and keep the victim warm and on his or her back with feet elevated above the head.
- For heat stress or shock, move the victim into the shade immediately; keep cool with water or ice on skin. In case of heat stroke get immediate medical help.

Water may be the difference between death or permanent injury and complete recovery from poisoning. Keep clean drinkable water in farm vehicles. If no running water is available and the first aid kit doesn’t contain enough, an irrigation ditch, pond, lake, or watering trough will work.

Call for Help

As soon as the pesticide is removed from the victim, the next step is to call 9-1-1 if the victim is having any reaction that may be life-threatening. Some pesticide labels include an 800 number to call for product specific pesticide exposure and first aid information. If the victim is unconscious, having
trouble breathing, having seizures or convulsions, seriously burned, or in severe pain, getting professional help fast may save a life.

For any other pesticide exposure, no matter how minor it seems, call the Poison Center. Be prepared to tell the Poison Center staff the name of the pesticide; how much of the pesticide was inhaled, swallowed, or spilled on the victim; how long ago the exposure occurred; and what symptoms the victim has right now. The health professional, often a specially trained pharmacist, will provide instructions on what to do next.

**Apply First Aid: Pesticide on the Skin**

The faster a poison is washed off the victim, the less injury. In every situation where skin is exposed, washing it off is the right thing to do. The person applying first aid should be careful not to get pesticide on him- or herself while helping the victim.

- Rinse the skin and clothing with water from a shower, hose, faucet, water tank, or pond. If there is no running water available, a ditch, lake, or watering trough will at least dilute the poison and wash most of it off.
- Remove the clothing, even after it is soaked with water. Fabric absorbs chemicals, so it has to come off. Cut it off, if necessary.
- Wash skin and hair thoroughly with soap and water. If detergents or commercial cleaners are available and not harmful to skin, use them instead.
- Dry and wrap the victim in a blanket.

Corrosive pesticides can burn the skin. Burn symptoms include redness, irritation, or burning; pain or numbness; and blisters or black dead skin at the contact site. If skin is burned:

- Wash the skin with lots of running water.
- Remove contaminated clothing carefully, as it may be stuck to the skin and could cause more skin damage if removed with force.
- Cover the burn loosely with a clean soft cloth.
- Get the victim to a hospital immediately.
- Do not apply any ointments, grease, butter, or skin medications.

**Apply First Aid: Pesticide in the Eye**

Injuries on the surface of the eye can be extremely painful. It is important to wash pesticide out of the eye quickly, but as gently as possible to avoid further damaging the surface and for a sufficient amount of time.

- Hold the eyelid open and wash the eye with a gentle stream of clean, running lukewarm water for 15 minutes or longer.
- Do not use eye drops, drugs, detergents, or medications in the wash water. They can make the injury worse and cause even greater pain.
Apply First Aid: Pesticide in the Lungs

Pesticides applied as dusts, mists, vapors, or gases can damage the lung surface, but also move quickly into other body systems or cause immediate allergic reactions. The victim has to be removed from the poison, but this can pose a risk to a rescuer. If the victim is inside an enclosed space (a room, trailer, or building) do not go into the area without an air-supplied respirator. For inhalation poisoning:

- Move the victim to fresh air immediately; do not let the victim walk.
- Open all doors and windows, if the exposure happens indoors.
- Loosen all tight clothing (belts, collars).
- Keep the victim’s chin up so that the airway remains open for breathing.
- Keep the victim calm and quiet. Wrap the victim in a blanket if he or she is having chills.
- Protect a victim who is convulsing from falling or hitting his/her head and monitor breathing closely while waiting for help to arrive.
- Begin artificial respiration if the victim has stopped breathing or has irregular breathing. Always remember to clear the victim’s mouth and keep the chin up to keep the airway open.
- Do not give alcohol in any form.

Apply First Aid: Pesticides by Mouth

Follow the direction of the Poison Center and the pesticide label. Both may include instructions to make the victim vomit or dilute the pesticide by drinking water or milk.

Vomiting

Vomiting is the quickest way to get the pesticide out of the victim’s body, but is now not commonly recommended, as it may cause more harm than good. Only induce vomiting if directed by either the label first aid directions or emergency health professionals. Vomiting can also be fatal under certain circumstances, such as:

- The victim is unconscious or convulsing, and might choke on the vomit.
- The victim swallowed a corrosive (strong acid or alkaline chemical), which damages tissue and causes severe pain in the mouth and throat as it goes down—and when it comes up.
- The victim swallowed a pesticide with petroleum products (gasoline, kerosene, oil, lighter fluid, or concentrate that hasn’t been diluted yet)

If any of these situations happens, do not try to get the person to vomit.
Helping the Victim to Vomit
Get the victim to vomit in a position that will not allow any vomit to be inhaled into the lungs. Lying face down or kneeling forward works best; never allow the victim to lie on his or her back. Then:

- Make the victim drink lots of water or milk. Give one to two cups for children up to five years old, as much as a quart for victims five years or older. This will cause some people to vomit.
- Give the victim syrup of ipecac or a glass of soapy water to drink. This will make almost everyone vomit immediately. If neither is available, put your finger or the blunt end of a spoon at the back of victim’s throat to make him or her gag. Never use a sharp or pointed object to trigger the gag reflex this way.
- Save some of the vomit. The doctor may need it for tests.

Diluting the Poison
Corrosive chemicals (acidic or alkaline) should be diluted as quickly as possible. Follow the label first aid directions or that of an emergency health professional when diluting the poison. Give the victim water or milk: one cup for victims under two years of age, one to one-and-a-half cups for children aged two to five, and two cups for adults. Activated charcoal administered to the victim can absorb some of the poison until help arrives. When trying to dilute the poison, you do not want vomiting, so give it fast enough to dilute the poison but not gag the victim. Do not give alcohol in any form.

Apply First Aid: Shock
Poisoning can lead to shock, a collapse of circulatory function, caused by severe injury, blood loss, or disease. Blood flows through the entire body, and shock occurs when blood circulation isn’t working normally. The blood may not have enough oxygen to keep body cells going. An allergic reaction may be inflaming and constricting the blood vessels. Internal bleeding may be depleting the blood volume. Shock is life-threatening and may not be obvious. The symptoms of shock include:

- Pale, moist, cold, and clammy skin;
- Eyes with dilated pupils or a vacant, unfocused appearance;
- Shallow and irregular breathing;
- Weak, rapid, and irregular pulse; and
- Fainting or unconsciousness.

While waiting for medical help to arrive, keep the victim on his or her back with feet elevated above the head. (The exception is a victim who is vomiting, who should not be on his or her back.) Keep the victim warm to prevent shivering, but don’t allow him or her to overheat. Help the victim remain quiet and calm until help arrives. Never give anything by mouth to an unconscious person. Never give alcohol in any form.
Apply First Aid: Heat Stress or Stroke

The normal body temperature is 98.6 degrees F. A person suffering from heat stroke may have a body temperature of 105 degrees or more, which can cause brain damage or death if the victim isn’t cooled quickly. For heat stroke:

- Get the victim into the shade immediately;
- Remove clothing, apply cool water to the skin or place the victim in cool water, and fan to promote sweating and evaporation;
- Place ice packs under the armpits to cool the trunk;
- Monitor the temperature until it goes down to 102 degrees or less; and
- When sweating resumes, encourage the conscious victim to slowly drink water. Never give alcohol in any form.

Summary

A pesticide applicator who knows the chemical, reads the label, notes signal words, plans for potential poisoning situations, and has trained in basic first aid and CPR could save lives. The key to poisoning first aid is asking for help right away and having the means to do so. Cell phones pre-programmed with emergency numbers are an essential part of a pesticide applicator’s first aid kit. Always call 9-1-1 if there is any possibility of poisoning. Always call the Poison Center for advice if there is even the mildest suspicion of poisoning.

However, in pesticide poisoning, another old adage applies: An ounce of prevention is worth a pound of cure. Chapter 7, Safe Handling covers preventive methods and equipment that will help applicators and workers avoid contact with pesticides—and pesticide poisoning—in the first place.
Prepare a First Aid Kit

A first aid kit for pesticide applicators can be elaborate or simple. Use a sturdy wooden box, tool box, or lunch pail with a tight-fitting cover and latch, and have large plastic containers for clean water. Label both the kit and the clean water with a waterproof marker. Experts agree that the following items belong in every pesticide poisoning kit:

- Clean water (at least 1-5 gallons if none is near the site)
- Activated charcoal (to absorb swallowed poisons)
- Saline eyewash
- Syrup of ipecac (to get the victim to vomit, if label first aid directions recommend it or if directed by an emergency health professional)
- Bandaids, bandages, and tape
- Blanket
- Shaped plastic airway (for mouth-to-mouth resuscitation)
- Written list of emergency numbers for each worker
- Pesticide label and MSDS
- Empty jars with non-leaking lids (for a drinking glass or to hold samples of vomit for doctors)
- Pencil and paper (for recording information about the pesticide exposure, taking first aid directions from the Poison Center, or getting directions to the nearest hospital)

Other helpful items for a first aid kit:

- Eyewash bottle
- Teaspoon (for ipecac or inducing vomiting)
- Cooler with ice
- Thermometer
- Scissors or a sharp knife
- Disposable towels
- Liquid soap
- Clean clothing
- Can of evaporated milk (pop top)

Remember to “ICE” your cell phone: preprogram 9-1-1, hospital numbers, poison center, and other phone numbers In Case of Emergency.