



"LET ME ASSURE YOU, MA'AM, THAT THESE CHEMICALS ARE PERFECTLY HARMLESS!"

Figure 8-1

(J. Kalisch)

Chapter 8

Insecticides and Your Health

Are Insecticides Dangerous?

Because insecticides are used to *kill* insects, they are toxic to the insect and closely related organisms. Some insecticides kill insects by interfering with nerve transmission; these types of insecticides are potentially toxic to other animals, including humans, because the nervous systems in all animals are similar in structure and function.

The toxicity of each insecticide is different and related to its unique chemical structure. Most insecticides labeled and used inside the home for cockroach control have low to moderate toxicity and care must be taken to avoid exposure to you, your family, and your pets. It is best to strategically place insecticides to reduce exposure to you and your family.

In the last 20 years, manufacturers have developed products which are less toxic to people and pets. When applied correctly, these products more specifically target the pest and reduce risks to people.

The idea of managing risk is expressed by the *Risk Formula*:

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

Having an understanding of the toxicity of a product and the potential for personal exposure allows risk to be lowered. No matter how toxic an insecticide is, if the amount of exposure is kept low, risk can be held at an acceptably low level. The toxicity of an insecticide can't be changed, but risk can be managed and you are the manager.

What is Toxicity?

To do their job, insecticides must control the pest. By their nature, insecticides are toxic and must be handled with care. You can tell the toxicity of a product by reading the signal word (Table 8-1) on the label. Insecticides can enter the human body three ways: 1) through the mouth (*orally*); 2) by absorption through the skin or eyes (*dermally*); and 3) by breathing into the lungs (*inhalation*).

Table 8-1. EPA toxicity categories, corresponding signal words, and relative toxicities for insecticides.

Hazard Indicators				
Signal Word	Danger	Warning	Caution	Caution
Hazard Category	Category I	Category II	Category III	Category IV
Oral LD50	0 - 50 mg/kg	>50 - 500 mg/kg	>500 - 5,000 mg/kg	>5,000 mg/kg
Dermal LD50	0 - 200 mg/kg	>200 - 2,000 mg/kg	>2,000 - 20,000 mg/kg	>20,000 mg/kg
Inhalation LC50	0 - 0.2 mg/liter	>0.2 - 2 mg/liter	>2 - 20 mg/liter	>20 mg/liter
Eye irritation	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin irritation	Corrosive	Severe irritation at 72-hrs	Moderate irritation at 72-hrs	Mild or slight irritation at 72-hrs

Danger appears on the labels of all highly toxic products (oral, dermal or by inhalation), or those which are eye or skin irritants. There are only a few products approved for cockroach control with this signal word on their label. Ingesting as little as a taste to about 3½ grams (about ¾ teaspoonful) of one of these insecticides could kill a 150 pound adult. Much less would be needed to kill a child.

Warning is the signal word required on the labels of all products moderately toxic, or cause moderate eye and/or severe skin irritation. Lethal dose to kill the same 150 pound adult is 3½ to 35 grams (about ¾ teaspoonful to 2½ tablespoons) of one of these insecticides.

Caution signal word is required on the labels of products considered slightly toxic to relatively nontoxic, or cause slight to no eye irritation and/or moderate to mild skin irritation. An average 150 pound adult could be killed by ingesting 35 to more than 350 grams (2½ tablespoons to more than a pint) of one of these insecticides.

Some *Category IV* insecticides are not required to have a signal word on their labels. All labels must bear the statement, *Keep out of reach of children*.

Relative Insecticide Toxicities

There are other ways for you to compare insecticide toxicities. In the process of getting a label

approved by the EPA, a pesticide manufacturer must determine the mammalian toxicity of the pesticide. Because companies cannot experiment on human beings, they use laboratory rodents to determine the lethal dose (LD) of the pesticide.

An oral LD₅₀ is the amount of *pure active ingredient* (in milligrams/kilogram of the animal's body weight) resulting in 50% mortality to laboratory rodents when given orally. From the results of many experiments, we can compare the LD₅₀ of insecticides and other chemicals. Understanding what an LD₅₀ means can be initially confusing. A *highly toxic* substance has a *low* LD₅₀ because it takes a small amount of the substance to kill the animal. Conversely a less toxic compound has a higher LD₅₀. The LD₅₀ of each product is one piece of information found on its Material Safety Data Sheet (MSDS). Unfortunately, there is no standardization in the chemical industry. Some MSDS sheets show the LD₅₀ of the formulated product; others may give the LD₅₀ of the pure active ingredient.

Tables 8-2 and 8-3 can be used to compare the relative toxicities of some insecticides and other substances commonly found around the home. Please note the low LD₅₀ of acetone (fingernail polish remover), one of the most dangerous products in the home. Remember, a low LD₅₀ means high toxicity.

Table 8-2. The LD₅₀ (mg/kg of body weight) of some substances found around the home. (The Merck Index, 13th edition, 2001.)

Substance	LD ₅₀	Use
absolute alcohol	10,600	beverage, preservative
acetone	10.7	fingernail polish remover
aspirin	1,000	drug, pain
caffeine	355	constituent in coffee, colas
ethylene glycol	8,540	antifreeze
propylene glycol	24,000-30,000	antifreeze
ibuprofen	626	drug, pain
nicotine	0.3	constituent in tobacco
salt	3,750	food additive
vitamin A	7,910	vitamin
warfarin	323	rodenticide, anticoagulant

Table 8-3. LD₅₀ of some insecticide active ingredients used in home cockroach control including the corresponding insecticide classes. This table can be used for comparison purposes, but it is important to remember it is the concentration and exposure creating the hazard to the individual (The Pesticide Book, 6th ed. Ware. 2004).

Active ingredient	Oral LD ₅₀	Class
eugenol (clove oil)	nontoxic	botanical
methoprene	>34,600	insect growth regulator
boric acid	>10,000	inorganic
sumithrin	>10,000	pyrethroid
piperonyl butoxide	>7,500	synergist
hydroprene	>5,100	insect growth regulator
d-limonene (citrus peels)	>5,000	botanical
diatomaceous earth	>5,000	desiccant
hydramethylnon	>5,000	aminohydrazone
tetramethrin	>5,000	pyrethroid
permethrin	>4,000	pyrethroid
sodium borate	2,550	inorganic
resmethrin	2,000	pyrethroid
pyrethrins, pyrethrum	1,500	botanical
acephate	866	organophosphate
allethrin	680	pyrethroid
cyfluthrin	500	pyrethroid
fenvalerate	451	pyrethroid
chlorfenapyr	441	pyrrole
imidicloprid	424	nicotinoid
cypermethrin	250	pyrethroid
deltamethrin	128	pyrethroid
fipronil	97	fiprole
propoxur	95	carbamate
esfenvalerate	75	pyrethroid
lambda-cyhalothrin	56	pyrethroid
abamectin, avermectin b1	10	natural toxin

Health considerations

Asthma and allergies. Recall from Chapter 1, asthma is a chronic lung disease which has become a serious problem for school-aged children in recent years. These allergies can lead to asthma and cockroach droppings are a common asthma trigger.

Certain insecticides used in homes may also cause or trigger asthma. Research studies indicate exposure to organophosphate insecticides may result in the onset of asthma, leading researchers to list insecticides as one of the preventable causes of asthma in children.

The American Lung Association says asthma attacks have a number of triggers including insecticides. Insecticides known to cause allergies, trigger asthma, and/or respiratory irritation include organophosphates, carbamates, pyrethroids, pyrethrum, and pyrethrins. The active ingredient in most currently available indoor spray, RTU, aerosol and fogger formulations belong to the pyrethroid class of chemicals.

Special sensitivity of children. The National Academy of Sciences found children are more susceptible to environmental chemicals than adults. This is because children eat more food and drink more liquids on a pound for pound basis than adults. Children also breath faster and inhale more air than adults. Therefore, considering their relative body weight, children take in more chemicals present in the environment.

At the same time, children's organs are still developing, are more susceptible and less able to detoxify chemicals. For example, a child's lungs do not develop fully until they are 6 - 8 years old. During a child's early years, exposure to environmental chemicals or irritants can have great effects on respiratory development.

Exposure to environmental chemicals during pregnancy can be significant for the child later in life. Researchers have discovered fetuses can become sensitized to chemicals or contaminates while still in the womb. The result is a child born predisposed to developing asthma, allergies, or other health problems.

Cancer. The World Health Organization estimates 75-85% of all cancers are related to environmental exposure to pollutants, smoking, and diet. It is understandable many people are concerned about cancer risks of chemicals used inside the home. Tables 3 and 4 do not address cancer risks, but the results of carcinogenicity tests can sometimes be found on MSDS sheets. MSDS sheets are readily available for professional-use pesticides. To obtain MSDS sheets for *over-the-counter* insecticides, you may need to contact the manufacturer's consumer information number, listed on the label. Pesticide information profiles (PIPs) offer similar information as MSDS and are available for many active ingredients: <http://extoxnet.orst.edu/pips/ghindex.htm>.

What if an Insecticide Poisoning Occurs

Get medical advice quickly if unusual or unexplained symptoms appear during the application or later the same day. Insecticide poisoning symptoms are often similar to flu symptoms (headache, fatigue, dizziness, nausea, stomach cramps, and diarrhea). A person who may have been poisoned should not be left alone. Do not let anyone get dangerously sick before calling a physician or going to a hospital. It is better to be too cautious than too late. Take the insecticide container (or the label) to the physician. The key is *rapid* treatment, as time continues to elapse after exposure, the chances for survival decrease. Refer to *Signs and Symptoms of Pesticide Poisoning* (available from University of Nebraska-Lincoln Extension, EC-2505) and *Recognition and Management of Pesticide Poisonings* (available online: <http://npic.orst.edu/rmpp.htm>) for more details about pesticide poisonings.

If the common emergency telephone number is available in your area, immediately call 911 whenever an insecticide poisoning is suspected. Concurrently, the call may be connected to the nearest poison control center. They will be able to provide specific directions on procedures to follow until emergency personnel arrive. If the common

emergency telephone number is *not* available in your area, contact:

1. The Poison Center, 1-800-222-1222
2. The nearest hospital
3. A physician

Always wash exposed skin of the victim with a detergent and plenty of water. Skin irritation can result from continuous exposure if not treated. If clothing has been contaminated, particularly by an insecticide readily absorbed dermally, remove it immediately.

Even though you carefully apply insecticides, accidents can happen. Be prepared. Get a *Hotlines Card* (available from University of Nebraska-Lincoln Extension, EC-2501) and keep it with you at all times. Do not hesitate to contact medical authorities if any symptoms of insecticide poisoning occur. It is better to be safe than sorry.

Most of the insecticides used to control cockroaches are much less toxic than the insecticides used for other applications. When applied properly, they are unlikely to cause any problem for the user. However, use all insecticides safely. Read the insecticide product label completely and comply with all directions given.

Pets are sometimes at risk for insecticide poisonings. If you suspect your pet may have been exposed to an insecticide, contact your veterinarian immediately. For additional information, The American Society for the Prevention of Cruelty to Animals (ASPCA) has an Animal Poison Control Center online: http://www.asPCA.org/site/PageServer?pagename=pro_apcc

Always Wear the Right Stuff!

Minimizing exposure is the first step toward reducing your risk of insecticide poisoning. The type of personal protective equipment (PPE) needed depends on the toxicity of the insecticide being used and the formulation (i.e., liquid, wettable powder, etc.). Some labels specifically state certain items of clothing, equipment, eye wear, footwear, and gloves must be used. Others carry no statement at all. In general, the more toxic the insecticide, the greater your need to use PPE.

Although most cockroach control insecticides

do not have specific PPE requirements, reasonable precautions should always be taken. Liquid insecticides are often more hazardous to use than dry formulations. Extra protection is warranted while mixing or loading insecticides. In cases where there will be prolonged exposure to the spray or where the application is being made indoors, you should use extra protection.

Protective Clothing. When an applicator sprays an insecticide inside the home for cockroaches, where does the spray go? Most will go where the applicator wants it to go, but some insecticide bounces back and gets on the applicator. Studies have shown 80-90 percent of the insecticide which lands on the applicator gets on their hands and forearms. Simply wearing gloves and a long sleeved shirt will drastically reduce dermal exposure during applications.

But, any time you are using insecticides, you should wear at least a long-sleeved shirt and long-legged pants, or coveralls (woven fabric)



Figure 8-2. The basic uniform. When applying pesticides: long sleeved shirt, long pants to protect arms & legs, shoes and socks, and gloves.

(B. Ogg)

which fully cover your arms and legs. (Figure 8-2) Select garments made of cotton instead of cotton/polyester blends. Shoes and socks should also be worn. Avoid sandals, thongs, and cloth or canvas shoes to minimize exposure of the feet to liquid insecticides. Leather shoes are suitable while using most insecticides.

Protect Your Head, Eyes and Hands.

Protecting your head is advisable, especially if you will be applying insecticides over your head. In general, a wide-brimmed, easily cleaned hat which protects the neck, eyes, mouth, and face is adequate. Avoid hats with cloth or leather sweat bands as these will absorb insecticides. Baseball-style caps have headbands which absorb and retain insecticides.

Insecticides are readily absorbed through the eyes and can cause eye damage. Use goggles or a face shield (Figure 8-3) whenever such a statement is found on the label. Gloves are often needed



Figure 8-3. Insecticides injected into cracks and crevices will sometimes bounce back to the applicator. To prevent this, wear eye protection.

for mixing, loading, and applying insecticides. Unlined, liquid-proof neoprene, butyl, PVC or nitrile gloves which extend well up on the forearm are the best. Avoid lined gloves because the lining can absorb the chemicals and is hard to clean. Latex gloves, commonly used by medical personnel, do not provide adequate protection. Avoid cotton and leather gloves because they can absorb insecticides.

In most cases, wear gloves under the sleeves to keep the insecticide from running down the sleeves and into the glove. When working with hands over your head, roll glove tops into a cuff to keep insecticide from running down the gloves to your forearms.

Protect Your Lungs. The lungs and lining of the respiratory system readily absorb insecticide dusts and vapors from the air (Figure 8-4). Respiratory



Figure 8-4. Avoid inhaling boric acid by wearing a dust mask.

protection, therefore, is essential whenever the label calls for it. Respiratory protection is recommended during mixing and loading, even if not required by the label. A cartridge respirator is suitable when exposure will be intermittent, such as for cockroach control applications.

Respirators used while applying insecticides should be approved by the National Institute of Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Be sure to read and follow the manufacturer's instructions for use and care of the respirator. Filters, cartridges, and canisters must be approved for insecticide use (those designated as removing and trapping organic vapors) and must be replaced

at proper intervals. Inspect and test respirators before use to insure a snug fit against the face. Exposed parts of the mask must be cleaned after each use, and the cartridges should be stored in an airtight container.

Protective Clothing Care. When working with insecticides, you should wear clean clothing daily. It is best to reserve one set of clothing for insecticide work if possible. Launder and store insecticide contaminated clothing separately. Clothing becoming wet from insecticides should be removed immediately! Fast action will reduce your exposure to the insecticide. Destroy clothing (including shoes and boots) saturated with concentrated insecticides. Waterproof and chemical-resistant hats, gloves, boots and goggles should also be washed daily and hung to dry. Test gloves for leaks by filling them with water and gently squeezing.

Wash Up!

Good personal hygiene is essential. Soap and water is cheap insurance against insecticide contamination. Wash your hands and face often when working with insecticides. Never smoke, eat, drink, or use the toilet after handling insecticides without first washing your hands! Shower immediately after using insecticides and before changing into clean clothes.

Insecticide Handling, Storage and Disposal

Insecticides are valuable pest management tools, and like any tool, they must be used carefully and responsibly. Read the label to determine the best way to handle insecticides.

Even when proper procedures are followed, insecticide spills can occur. Knowing what steps to take in the event of an insecticide spill will allow you to respond quickly and properly. Once the spill has been cleaned up, you should read the label for specific decontamination directions. Remember, always wear proper protective clothing when dealing with insecticide spills and to clean up your

equipment and clothing when you are finished.

Store insecticides in a locked and posted cabinet where children cannot get to them. Insecticides should never be stored in a garage, basement, or other unlocked locations in your home. Read the label for correct storage procedures.

Proper rinsing of insecticide containers reduces a potential source of contamination of soil, surface, and ground water. When contamination occurs, plants and animals may be harmed and water supplies affected. Prevention of environmental contamination is always better and less expensive than cleanup.

When an empty liquid insecticide container is disposed of according to label directions, it must be properly rinsed. Triple rinse plastic, non-pressurized metal, and glass containers which have contained liquid or wettable powder formulations. For empty aerosol, bait or dust containers, follow label directions for proper disposal. Refer to *Safe Transport, Storage and Disposal of Pesticides* (available from University of Nebraska-Lincoln Extension, EC-2507) for more details.

Things to Remember

- ✓ Read and follow all label directions.
- ✓ Store insecticides only in the original, labeled containers.
- ✓ Wear appropriate protective gear as directed by the label.
- ✓ Never reuse an insecticide container for any purpose.