



Personal Protective Equipment For Pesticide Applicators

Monte P. Johnson, Elizabeth P. Easter, and S.W. Horstman

Pesticides provide many benefits but can be hazardous if not used safely. We must learn to respect pesticides and the potential problems that can result from applying them in the wrong way. Personal exposure should be a major concern to anyone handling or otherwise coming into contact with pesticides. Consequently, this publication will cover some of the major subjects surrounding exposure to pesticides and how to prevent it.

Symptoms of Poisoning

One hindrance to better protection habits is that pesticide users often do not recognize that they have been poisoned. Often symptoms of pesticide poisoning are much like flu symptoms:

Symptoms of pesticide poisoning:

- nausea
- headache
- dizziness
- chest discomfort
- skin blisters
- diarrhea
- blurred vision.

Symptoms of advanced poisoning:

- vomiting
- difficulty in breathing
- drooling
- pin-point pupils of eyes
- unconsciousness.

Pesticide Labels and Signal Words

Before opening a pesticide container, carefully **read the label**. Pesticide product labels have "signal words" that clearly indicate the level of toxicity and the level of risk to the user. The following table lists the three different signal words and what they mean on a pesticide label.

| Signal Word | Toxicity Class | Toxicity | Approximate Amount Needed to Kill 50% of a Laboratory Population of Test Animals (Mice, Rats, etc. If Taken Orally) |
|-------------|----------------|------------------|---|
| DANGER | I | Highly toxic | Taste to 1/8 of an ounce. |
| WARNING | II | Moderately toxic | 1/8 of an ounce to a little over an ounce. |
| CAUTION | III | Slightly toxic | A little over an ounce to more than a pint (16 ounces). |
| CAUTION | IV | Almost nontoxic | Well over a pint (16 ounces). |

Routes of Exposure

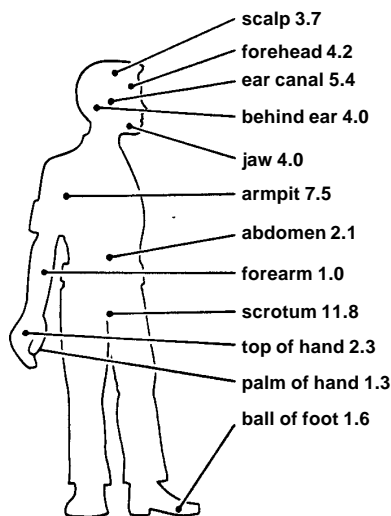
Pesticide labels describe the pesticides' routes of entry into your body. Examples are: "Poisonous if **swallowed, inhaled, or absorbed through the skin.**" Or "rapidly **absorbed through the skin and eyes.**"

Research has shown that pesticides are absorbed through the skin at different rates on various parts of the body. Special protection should be given to the scalp, ear canal and forehead areas. The groin area also is very sensitive. Since hands and forearms are the most likely places of exposure, they should always be protected when handling pesticides.

Figure 1 shows different rates of absorption through the skin on different parts of the body.

Personal Protective Equipment

Many different types of Personal Protective Equipment (PPE) are available through safety supply businesses and catalogs, pesticide dealers, and garden, nursery and forestry supply houses.



**Figure 1. —
Rates of Pesticide
Exposure Through
the Skin.**

Rates of absorption through the skin are different for different parts of the body. Compared to dermal absorption rate through the forearm (absorption rate of 1), absorption through the groin area would be more than 11 times faster.

Gloves

When the pesticide label recommends it, wear **chemically-resistant gloves**. Chemical resistance means that pesticides will not pass through the glove material.

- Always check the label for appropriate gloves to wear.
- Never wear leather, fabric, or fabric-lined gloves.
- Use gloves that extend at least to the mid-forearm.
- Consider shoulder-length gloves or gloves and chemically-resistant sleeve guards for mixing and loading.
- Replace gloves often — check for holes and leaks.
- Never place contaminated hands in gloves.

Coveralls and Aprons

Some pesticide labels may recommend a long-sleeved shirt and long-legged pants of sturdy, woven fabric. Many pesticide labels require coveralls worn over shirt and pants. Some labels will require chemically-resistant suits, with sealed seams.

Coverall materials include:

- Woven: cotton or cotton/polyester in at least 7 to 10 oz. twill (denim, chino, drill).
- Nonwoven: made by bonding fibrous webs, traditionally disposable.
- Chemical-resistant: plastic or rubber materials or fabrics coated with water resistant finishes.

Wear sleeves outside gloves and pant legs outside boots.

Chemically-resistant aprons can be worn when mixing and loading pesticides or cleaning equipment.

- Sleeveless aprons protect against spills and splashes to the body front.
- Aprons with sleeves, but open in the back, reduce exposure to the shoulders, arms, and body front and are more comfortable to wear than coveralls.

Boots

- Select unlined, waterproof boots that reach at least halfway to the knee.
- **Do not** wear leather or canvas shoes or boots; if a pesticide is spilled or sprayed on these materials, they cannot be thoroughly cleaned. If contaminated shoes or boots become wet, the pesticide(s) can be reactivated.

Headwear

Select a wide-brimmed, waterproof hat that will protect the neck, eyes, mouth, and face. Plastic hard hats with plastic sweatbands are a good choice as they are waterproof. Avoid hats with a cloth or leather sweatband. Cloth or leather sweatbands are difficult or impossible to clean.

Eyewear

Wear protective eyewear when working with dusts, mists, when liquids may splash in your eyes, or when working with pressurized systems.

- **Goggles** with indirect vents provide better eye protection than safety glasses or face shields.
- **Face shields** protect the eyes and face from splashes from liquid pesticide formulations and may be worn over goggles for extra protection.
- **Safety glasses** with side shields and brow guards are recommended for some situations.
- Avoid wearing contact lenses when handling pesticides.



Respirators

The lungs and lining of the respiratory system readily absorb pesticide dusts, mists and vapors. Respiratory protection is recommended during mixing and loading pesticides, even if not required on the label. Respirator filters either chemically change the pesticide into a harmless form or a solid form that will be trapped inside the filter.



Different cartridges are available to protect against a variety of chemical gases and vapors. Replace the cartridge according to the manufacturer's recommendations, as soon as you begin to smell pesticide coming through the respirator, or if breathing becomes difficult.

Respirator Types:

- Half-mask, Particulate, Disposable — for dusts, pollen, mists, welding fumes and certain pesticides applied in solid form.
- Half-mask, Dual Cartridge, Disposable — for pesticides & ammonia
- Half-mask, Dual Cartridge, Reusable — for variety of contaminants.

- Full-face, Dual Cartridge, Reusable — for variety of contaminants.
- Air-Purifying with Helmet — for variety of contaminants.
- Canister-type Gas Mask — for variety of contaminants.
- Self-Contained Breathing Apparatus (SCBA) — used for entry and escape from all atmospheres Immediately Dangerous to Life or Health (IDLH) or oxygen deficient.

When Using a Respirator:

- Be sure you have a tight fit on your face to prevent leaks (facial hair may prevent an adequate fit).
- Dust/mist filtering respirators protect against dusts, powders, mists, and sprays. Look for NIOSH/MSHA approval number prefix TC-21C.
- Vapor-removing respirators protect against gases and vapors. Choose a cartridge approved for organic vapors/pesticides plus a pesticide prefilter, both with NIOSH/MSHA approval number prefix TC-23C, or a canister approved for pesticides/organic vapors with NIOSH/MSHA approval number prefix TC-14G.

Inspecting, Maintaining, and Replacing PPE

PPE should be either disposable or sturdy enough to be cleaned for repeated use. To remain effective, PPE must be maintained properly and replaced as necessary.

Disposables

Disposables are PPE items not designed to be cleaned and reused. However, if recommended by the manufacturer, some disposable coveralls can be laundered several times before being discarded. Discard them when they become contaminated with pesticides.

Reusables

Reusables are PPE items designed to be easily cleaned and reused. However, do not reuse items that can no longer provide adequate protection.

- Rubber and plastic suits, gloves, boots, aprons, and headgear should be washed thoroughly between uses. Inspect carefully for holes or thin places.
- Fabric clothing should be cleaned after each day's use. Clothing that is heavily contaminated should be discarded. Place items in a labeled plastic bag or hamper away from other personal clothes and away from family laundry.
- Eyewear and respirators should be cleaned after each day's use. Store where they are protected from dust, sunlight, extreme temperatures, excessive moisture, pesticides, and other chemicals. A zip-closable sturdy plastic bag works well for

storage. Check respirator valves for wear and replace them if needed. These items should last many years if they are good quality and maintained correctly.

Washing PPE

Do not allow contaminated or soiled PPE items to be washed with the regular family laundry. It could cause other items to become contaminated. Wear chemically resistant gloves when handling contaminated or soiled PPE.

Boots, helmets, goggles, respirators, and other bulky items can be washed by hand. Other items can be washed as follows:

1. Pre-rinse in a washing machine or by hand.
2. Wash in a washing machine, using a heavy-duty detergent and hot water for the wash cycle.
3. Wash only a few items at a time to allow plenty of agitation and water for dilution. Use the highest water-level setting.
4. Rinse twice using two rinse cycles and warm water.
5. Use two entire machine cycles to wash items that are moderately to heavily contaminated.
6. Run the washer through at least one additional entire cycle without clothing, using detergent and hot water, to clean the machine.

Drying PPE

Hang the items to dry outdoors, if possible, as the sunlight and fresh air will help remove remaining pesticide residues. If it is not possible to air dry, then using a clothes dryer is acceptable for fabric items. However, the dryer can become contaminated with pesticide residues over time.

Avoiding Heat Stress

Heat stress is the illness that occurs when the body builds up more heat than it can cope with. Severe heat stress (heat stroke) can result in death. Signs and symptoms of heat stress may include:

- Fatigue (exhaustion, muscle weakness)
- Headache, nausea, and chills
- Dizziness and fainting
- Loss of coordination
- Severe thirst and dry mouth
- Altered behavior (confusion, slurred speech, quarrelsome or irrational attitude).

Anyone showing signs and symptoms of heat stress should be treated immediately.

Heat stress is not caused by exposure to pesticides, but may affect pesticide handlers who are working in hot conditions. Wearing PPE can increase the risk of heat stress by limiting the body's ability to cool down. The following suggestions can help reduce the chance of heat stress:

- Use the least amount of PPE to provide adequate protection — don't wear extra PPE if you don't need it!
- Select the coolest PPE required for the job — woven fabrics (cotton, cotton/polyester) allow air to pass through fairly easily. Some recently developed disposable garments also provide some ventilation.
- During heat stress conditions drink plenty of water before, during, and after work — don't rely on thirst as an indicator of how much fluid your body needs.
- Work during the coolest times of day (if possible).
- Use work/rest cycles — take frequent breaks.

Additional Information

Kentucky Cooperative Extension Service Publications

(contact your local county Extension office)

Core Manual: Applying Pesticides Correctly: A Guide for Private and Commercial Applicators

PAT 2 — Kentucky's Pesticide Applicator Training and Certification Program

PAT 3 — Sprayer Nozzles: Selection and Calibration

PAT 4 — Greenhouse Pesticides and Pesticide Safety

PAT 5 — NAPIAP in Kentucky

ENT 53 — Vendors of Beneficial Organisms in North America

ENT 54 — Vendors of Microbial and Botanical Insecticides and Insect Monitoring Devices

ID 98 — Guidelines for Pesticide Use

ID 100 — Understanding Pesticide Labels and Labeling

ID 103 — Kentucky's Endangered and Threatened Species

IP 9 — Pesticide Residues in Grains, Vegetables, Fruits and Nuts

IP 11 — Residues in Animal-derived Foods

IP 13 — Protecting Kentucky's Groundwater: A Grower's Guide

HE 2-319A — Tips for Laundering Pesticide-Contaminated Clothing

Special Report 91-1 — Kentucky Pesticide User Practices and Alternatives, 1990

Special Report 92-2 — Kentucky Pesticide User Practices and Alternatives, 1991

Special Report 93-2 — Kentucky Pesticide User Practices and Alternatives, 1992. Includes comprehensive summaries for 1990-1992.

Kentucky Cooperative Extension Service Videotapes

(contact your local county Extension office)

V7-ENT-0316 — Applying Pesticides Correctly...The Label Is Your Guide

V8-ENT-0350 — Pesticide Safety Equipment

V8-AEN-0348 — Groundwater and Well Testing Series

PESTICIDE EMERGENCY TELEPHONE NUMBERS

Pesticide Spills

If you have a pesticide spill and need information on how to handle this type of emergency, call: **911**

Kentucky Environmental Response — **(800) 928-2380**

CHEMTREC Pesticide Emergency Hotline (24 hour) — **(800) 424-9300**

Disaster Emergency Service (24 hour);

State Coordinating Agency for Disasters and Emergencies — **(502) 564-7815**

Division of Pesticides, Kentucky Department of Agriculture — **(502) 564-7274**

Kentucky Department of Human Resources — **(502) 564-4537**

Pesticide Exposures

If you have a person who has been exposed to a particular pesticide, provide your physician or emergency room with these emergency numbers, designed to provide pharmacological information on pesticides to health professionals:

The Kentucky Regional Poison

Center of Kosair Children's Hospital — **(800) 722-5725**

In Metro Louisville call — **589-8222**

National Pesticide Clearinghouse — **(800) 858-PEST (7378)**

Texas Tech University Health Sciences Center

School of Medicine

Department of Preventive Medicine and Community Health

Lubbock, TX 79430

Authors:

Dr. Monte P. Johnson
Extension Specialist
Department of Entomology
University of Kentucky

Dr. Elizabeth P. Easter
Interior Design Department
University of Kentucky

Dr. Sanford W. Horstman
Preventive Medicine &
Environmental Health
Albert B. Chandler Medical
Center
University of Kentucky

Special thanks to Dr. Larry R. Piercy, Agricultural Engineering Department, University of Kentucky, for reviewing this manuscript.

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, disability, or national origin.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, C. Oran Little, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort.

Issued 1-95; Last Printed 2-97, 2000 copies; 4000 copies to date.