



# Protective Clothing and Equipment for Pesticide Applicators

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*This NebGuide explains how to choose and properly use personal protective equipment (PPE) when mixing, loading, and applying pesticides to help reduce exposure to pesticides and protect human health.*

Pesticides are valuable pest management tools and, like any tool, must be used carefully and responsibly. Dress appropriately and use personal protective equipment (PPE) to help minimize pesticide exposure and reduce the risk of pesticide poisoning. These steps also are required and necessary for appropriate and legal pesticide use.

Use all pesticides safely. Read the pesticide product label and comply with all directions. Failure to do so may subject you to state and/or federal penalties, and place you, your family, nontarget animals: your family, nontarget animals, and the environment at a greater risk of pesticide exposure.

## Manage Your Risk

Wearing protective clothing and equipment when handling or applying pesticides can reduce your risk of exposure, and thus your risk of pesticide poisoning. Understanding the toxicity of a product and the potential for personal exposure allows you to lower your risk. This idea is expressed by the Risk Formula: Risk = Toxicity X Exposure.

The toxicity of a substance can't be changed, but risk can be managed, and the applicator is the manager. No matter how toxic a substance is, if the amount of exposure is managed, risk can be held to an acceptably low level.

## What is Toxicity?

All pesticides are toxic, differing only in the degree of toxicity, and are potentially dangerous to people if exposure is high. Pesticide product labels have signal words that clearly indicate the degree of toxicity associated with a given product (Table I). The signal words—"Danger," "Warning," and "Caution"—indicate the degree of potential risk to a user, not the expected level of pest control.

Pesticides can enter the human body in three ways:

1. through the mouth (orally),
2. by breathing into the lungs (inhalation), and, most commonly,
3. by absorption through the skin or eyes (dermally).

Along with the signal words, pesticide product labels also include route-of-entry statements and specific actions a user must take to avoid exposure.

Table I. Pesticide product label signal words and relative toxicities.

Group	Signal Word	Toxicity Rating	Lethal Dose for a 150 lb. Human <sup>a</sup>
I	Danger <sup>b</sup>	Highly toxic	Few drops to 1 teaspoon
II	Warning	Moderately toxic	1 teaspoon to 1 tablespoon
III	Caution	Slightly toxic	1 tablespoon to 1 pint
IV	Caution (signal word not always required)	Relatively non-toxic	More than a pint

<sup>a</sup>The lethal dose is less than those listed for a child, or a person under 150 lbs. and more for a person over 150 lbs.

<sup>b</sup>The skull and crossbones symbol and the word "Poison" are sometimes printed with the "Danger" signal word.

## Read the Pesticide Product Label

Route-of-entry statements on the pesticide product label indicate the outcome that can be expected from different kinds of exposure. For example, a pesticide label might read, "Poisonous if swallowed, inhaled, or absorbed through the skin. Rapidly absorbed through the skin and eyes." This tells the user that this pesticide is a potential hazard through all three routes of entry, and that skin and eye contact are particularly hazardous. The specific action statements normally follow the route-of-entry statements and indicate what must be done to prevent accidental poisoning. Using the previous example, the specific action statement might read, "Do not get in eyes, on skin, or on clothing. Do not breathe spray mist."

Before handling, mixing, loading, or applying any pesticide, read the product label directions completely. If the label calls for the use of personal protective equipment (PPE), comply fully with those directions. The label will define the minimal protective equipment required for various tasks. Note that the PPE required for mixing and loading may be more extensive than the PPE required during application because of the potential for contact with a concentrated pesticide product.

## Use Personal Protective Equipment

The type of PPE needed depends both on the toxicity of the pesticide being used and the formulation (liquid, granular, wettable powder, etc.). Some labels, especially for agricultural pesticides, are affected by the Worker Protection Standard and specifically state that

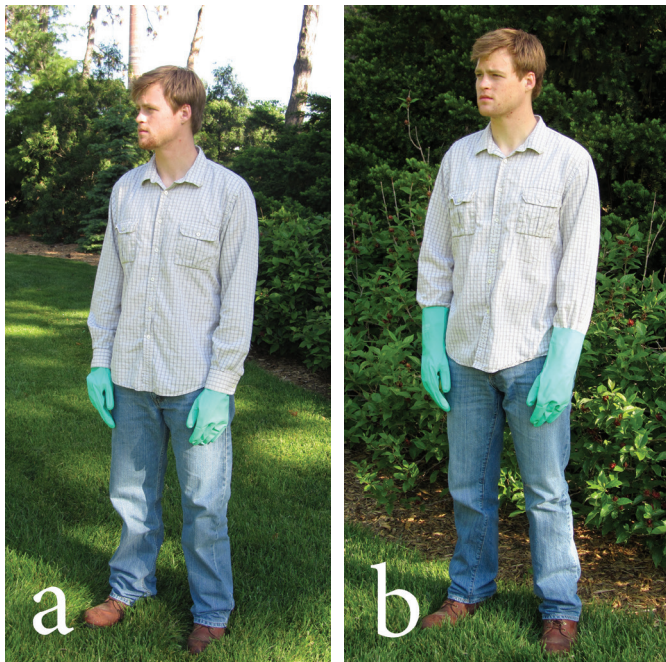


Figure 1. Wear a long-sleeved shirt, long pants, shoes plus socks, and chemical resistant gloves when applying pesticides. We recommend wearing gloves inside sleeves (1a), but wearing gloves outside sleeves may work equally well (1b).

certain items of clothing, equipment, eyewear, footgear, and gloves must be used. Others do not include such a statement. Some of the PPE required are specific to early entry while others are specific to handling and applying. In general, the more toxic the pesticide, the greater the need for PPE.

### Choose the Right PPE

If a pesticide label does not have specific PPE requirements, always take reasonable precautions and use common sense. Use the route-of-entry and specific action statements from the product label to determine the type and degree of protection needed to handle the pesticide safely. For example, if you'll be handling pesticides or pesticide equipment, consider wearing chemical-resistant gloves even if the label doesn't specifically call for them.

Liquid pesticides often are more hazardous to use than dry formulations, and extra protection is warranted while mixing and/or loading pesticides. Recognize that in cases where there will be prolonged exposure to the spray or where the application is being made in an enclosed area, you must use extra protection.

### Use Protective Clothing

Whenever you are using pesticides, at the very least you should wear a long-sleeved shirt, long pants, shoes, socks, and chemical-resistant gloves (Figure 1). Many labels will require you to wear more than this, depending on the product's toxicity and use. To reduce pesticide penetration, select garments made of tightly woven fabrics. Disposable coveralls, such as those made of Tyvek®, provide adequate protection to a pesticide applicator under most conditions. Protective suits made of or coated with butyl rubber, neoprene, PVC, or one of the newer coated and laminated polyethylene fabrics may be needed for certain applications.

Shoes and socks also should be worn. Avoid sandals, flip-flops, and cloth or canvas shoes to minimize exposing your feet to liquid pesticides. Leather shoes are suitable while using most pesticides;



Figure 2. Example of a protective hat that can be worn when applying pesticides.



Figure 3. Different types of safety goggles and glasses.

however, leather will absorb liquids. Therefore, wear chemical-resistant boots while working with highly toxic liquid pesticides (signal word: "Danger") and when there may be prolonged exposure to any pesticide spray. Applicators who mix and load liquid concentrates, especially highly toxic ones, also should wear chemical-resistant aprons.

### Protect Your Head, Eyes, and Hands

Protection for your head also is advisable and in some cases is specifically required. In general, a wide-brimmed, easily cleaned hat that will keep pesticides away from the neck, eyes, mouth, and face is adequate (Figure 2). Avoid hats with cloth or leather sweatbands as these will absorb pesticides. Baseball-style caps have headbands that readily absorb and retain pesticides. Labels that specify the use of headgear are generally found on highly toxic liquid concentrates. When working with these pesticides, wear a chemical-resistant hood or a plastic hard hat with a plastic sweatband and a rain-trough edge to keep drips off your neck and back.

Pesticides are readily absorbed through the eyes and can cause eye injury. When the labels for liquid pesticides include precautionary statements with the signal words "Warning" or "Danger," it generally indicates the need for eye protection. Use goggles or safety glasses when the label requires it. (See Figure 3 for examples.) Some goggles have a wider bridge over the nose to be compatible with respirators. Goggles will provide adequate protection if they have the right type of venting. Safety goggles have three types of venting:

- open vents for impact protection only; not recommended for use with pesticides;
- indirect vents for protection from pesticide and other chemical splashes; and
- non-vented for protection from gases, mists, and fumes.

Other labels may require a full face shield.

Chemical-resistant gloves (Figure 4) often are needed for mixing, loading, and applying pesticides. Unlined, liquid-proof neoprene, butyl, PVC, Viton®, barrier laminate, or nitrile gloves with tops that extend well up on the forearm are best. Most of these gloves are available in reusable pairs that can be cleaned after each mixing/





Figure 4. Chemical-resistant gloves (top row, left to right): natural rubber, disposable nitrile, reusable nitrile and (bottom row, left to right) neoprene, butyl rubber, Viton, and barrier laminate.



Figure 5. Disposable nitrile gloves in 4, 8, and 12 mil weights.



Figure 6. Half-face cartridge respirator with cartridges attached (6a) and cartridge detached (6b).

loading task or pesticide application. Others, such as nitrile gloves, are available in single-use disposable versions in a variety of mil weights (Figure 5).

Avoid lined gloves because the lining can absorb the pesticides and is hard to clean. Latex gloves, commonly used by medical personnel, do not provide adequate dermal protection because they are not chemical-resistant. Never wear cotton, leather, or canvas gloves unless the label specifically requires them, as with certain fumigants. Some fumigants penetrate rubber, neoprene, and leather, and if trapped inside a glove, can cause severe skin irritation or be absorbed through the skin.

In most cases, we recommend wearing gloves under your sleeves to keep the pesticide from running down the sleeves and into the gloves. When working with your hands above your head, roll glove tops into cuffs to prevent the pesticide from running down the gloves to your forearms. As an extra safety measure, you can duct tape around where the glove and sleeve meet. Remember, the most important thing is to wear gloves! For more information about types of gloves, see G1961, *Pesticide Safety: Choosing the Right Gloves*.

### Protect Your Lungs

Your lungs and the lining of your respiratory system readily absorb pesticide dusts and vapors from the air. Respiratory protection, therefore, is essential whenever the label calls for it and is recommended during mixing and loading, even if not required by the label. Respiratory protection also is recommended whenever an applicator will be exposed to intensive concentrations of pesticide dusts, fumes, or vapors. The type of respirator an applicator uses will be determined by the type and toxicity of the pesticide, application site, and other factors.

Particulate respirators (dust masks) are acceptable when applying pesticide dusts and granules, and for protection against large droplets suspended in air. They are not recommended for protection against



Figure 7a. Full-face canister respirator, without canister. (Photo courtesy of 3M); 7b. Close-up of canister. (Photo courtesy of North by Honeywell)



Figure 8. Self-contained breathing apparatus. (Photo courtesy of MSA.)



Figure 9. Supplied-air respirator. (Photo courtesy of MSA.)

vapors. Always read the pesticide label for product-specific recommendations. In all cases, the selected respirator should bear a mark indicating it is approved by the National Institute of Occupational Safety and Health (NIOSH-approved). One-strap dust masks typically available at hardware stores generally are **not** NIOSH-approved and will not provide adequate respiratory protection. Discard particulate respirators after each use and do not attempt to reuse a disposable respirator.

Most air-purifying respirators consist of a tight-fitting mask with disposable cartridges or canisters (Figures 6 and 7). The respirator design may be a half-mask (covers the nose, mouth, and chin) or full-face (covers the entire face). An air-purifying respirator equipped with suitable cartridges/canisters is needed for protection against vapors. An air-purifying respirator also can provide protection against dusts/mists if the appropriate filter/cartridge/canister is selected. Canisters typically have a longer use life than cartridges because they have more absorption capacity. A full-face respirator provides greater protection than a half-mask and also protects the eyes.

If the oxygen supply is likely to be low or the application will result in heavy concentrations of highly toxic pesticides, such as fumigants, an atmosphere-supplying respirator such as a self-contained breathing apparatus (SCBA, Figure 8) or supplied-air respirator (Figure 9) will be needed. The air pack is an SCBA commonly used for fumigation. Air packs typically supply 25–30 minutes of air and consist of a full-face mask attached to a tank of air carried on the applicator's back. The supply time may be considerably shorter if the respiration rate increases due to overexertion. A warning bell can be set to signal depletion of the air supply.

Air-supplied respirators provide air from an outside source that is pumped to the applicator through an airline. A major advantage of an airline is that the air supply does not expire in a short time. However, the airline must be towed throughout the facility being treated; air pump failure or a constriction of the airline can shut off the air supply. Also, the air pump must be located in a fumigant-free area. In combination with an SCBA, an air-supplied respirator offers an unlimited work period with backup respiratory protection provided by the SCBA if the outside air supply is cut off for any reason.

## Use and Care of a Respirator

Always read and follow the label guidelines to see what type of respiratory protection is required for the pesticide you'll be using. OSHA (Occupational Safety and Health Administration) requires that when using a respirator, you must have a medical evaluation prior to fit testing. In addition, you will need to be properly trained in respirator use.

- Use respirators approved by the National Institute of Occupational Safety and Health (NIOSH).
- Read and follow the manufacturer's instructions for use and care of the respirator. Filters, cartridges, and canisters must be designed for the type of contaminant expected. For example, a particulate filter is appropriate for dusts and mists. An organic vapor cartridge is necessary for protection against

organic vapors, such as pesticides. Other examples include mercury vapor cartridges or acid gas cartridges. Manufacturers also offer combination cartridges when protection against multiple types of contaminants is needed.

- Cartridges and canisters have a limited useful life and must be replaced at proper intervals.
- Inspect and perform a seal check before using a respirator to ensure snug seal against the face. Users with facial hair may not be able to obtain an adequate seal; a clean shave along the seal line is usually necessary.
- Exposed respirator parts must be cleaned after each use, and cartridges should be stored in an airtight container in a clean location. For more information about fit testing and respirator care, see EC3021, *Respirators for Handling Pesticides* and EC3027, *Fit Testing a Respirator for Pesticide Application*.

## Caring for Protective Clothing

Applicators who routinely work with pesticides should wear clean clothing daily, and reserve at least one set of clothing for pesticide work if possible. Launder pesticide-contaminated clothing and store work clothing separately.

Clothing that has become wet from pesticides should be removed immediately. Fast action will reduce your exposure to the pesticide. Discard clothing (including shoes and boots) saturated with any concentrate or any diluted spray of highly toxic pesticides (signal word: "Danger"). Waterproof and chemical-resistant hats, gloves, boots, and goggles should be washed daily and hung to dry. Test reusable gloves for leaks by filling them with water and gently squeezing the top. If water comes out, replace the gloves.

## Laundering Clothing Soiled With Pesticide

- Wear uncontaminated clothes during pesticide applications. Remove these clothes upon finishing the job and change into clean clothes before going home for the day. Or wear chemically resistant, disposable (non-reusable) coveralls over your clothing.
- At the end of the job or application, remove your contaminated clothing and wash immediately. If this is not possible, wash later but always separately from family laundry.
- Dispose of clothing heavily soiled with pesticide according to label instructions. This includes shoes and boots saturated with pesticides.
- Wear chemical-resistant gloves when handling contaminated clothing, even to launder.
- Wash pesticide-contaminated clothing daily.
- Wash only a few items at a time. Do not mix with regular laundry.
- Use liquid detergent, highest water level, and hot water.
- Use wash cycle for heavily soiled clothes.
- After washing, remove clothing from the machine and run the

washer through another cycle with hot water and detergent before laundering other clothing.

- Line dry if possible, or use the regular dryer setting.

## Washing Up

Good personal hygiene is essential to keeping yourself pesticide-free. Soap and water are cheap insurance against pesticide contamination.

- Wash your hands and face often and keep soap and water nearby when working.
- If you've handled pesticides, always wash your hands with soap before smoking, eating, drinking, or using the toilet.
- Shower immediately after using pesticides and before changing into clean clothes.
- Remove and leave shoes at the door so you don't track pesticides into the house.

## Be Prepared for an Emergency

Take the pesticide label with you when seeking medical care. Have emergency telephone numbers handy (see Emergency Phone Numbers box) and keep them posted where pesticides are stored, mixed, or applied. If you experience any pesticide poisoning signs or symptoms (nausea, skin rashes, headaches, coughing, diarrhea, chest pain, twitching, or seizures), see a physician immediately. For more information, see EC2505, *Managing the Risk of Pesticide Poisoning and Understanding the Signs and Symptoms*.

## Disclaimer

Reference to commercial products or trade names is made with the understanding that no discrimination is intended of those not mentioned and no endorsement by University of Nebraska–Lincoln Extension is implied for those mentioned.

## Emergency Phone Numbers

The Poison Control Center  
For aid in human poisoning cases  
800-222-1222

Nebraska Department of Environmental Quality  
To report chemical spills 8 a.m. to 5 p.m. M-F  
402-471-2186; 877-253-2603

Nebraska State Patrol (after hours)  
To report chemicals spills after hours  
800-525-5555; 402-471-4545

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