



Protective Clothing and Equipment for Pesticide Applicators

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This NebGuide describes 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 your exposure to pesticides and reduce your risk of being poisoned.

When working with any pesticide, read the product label and comply with all its directions and requirements. Failure to do so may subject you to state and/or federal penalties, and place you, your family, nontarget animals, and the environment at greater risk of experiencing harmful effects related to pesticide exposure.

Manage Your Risk

There are two ways to manage the health risks posed by pesticides: selecting the least toxic pesticide product suitable for the job, and minimizing your exposure to the pesticide. We can express this idea with the Risk Formula:

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

If either the pesticide toxicity or your exposure level decreases, your risk also decreases. No matter how toxic a pesticide is, you can keep risk at an acceptably low level by minimizing your exposure to it. Wearing the appropriate clothing and protective equipment is key to minimizing your exposure.

What is Toxicity?

All pesticides are toxic, differing only in their degree of toxicity. Therefore, all pesticides are potentially dangerous to people if they are exposed to a high enough dosage. Pesticide product labels have signal words—‘Caution,’ ‘Warning,’ and ‘Danger’—that clearly indicate a product’s level of acute human toxicity (*Table I*). Since all pesticide products are proprietary combinations of active and inert ingredients, each product’s toxicity profile is unique.

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).

A product may be more toxic by one of these routes of exposure than by another due to the way it interacts with the body and how it is formulated. For example, a product may cause severe lung irritation when inhaled but have little effect if absorbed through the skin, or vice versa. Likewise, dry formulations such as dusts are more likely to be inhaled than liquid products, while the skin absorbs oil-based liquid products more readily than other formulations. The EPA assesses a product’s toxicity through each route of exposure, and the label’s signal word indicates the level of toxicity for the route(s) of exposure determined to be a product’s most hazardous. 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. Acute toxicity signal words used on pesticide product labels.

Toxicity Category	Signal Word	Toxicity Rating	Lethal Oral Dose (for a 150-lb. Human ^a)
I	Danger ^b	Highly toxic	Few drops to 1 tsp
II	Warning	Moderately toxic	1 tsp to 1 Tbsp
III	Caution	Slightly toxic	1 Tbsp to 1 pint
IV	Caution (signal word optional)	Relatively nontoxic	More than 1 pint

^aFor a child or person under 150 lbs., the lethal dose is smaller than what is listed.

^bThe skull-and-crossbones symbol and the word 'Poison' are sometimes printed with the signal word 'Danger.'

Read the Pesticide Product Label

Route-of-entry statements on the pesticide product label indicate which routes of exposure are likely to result in negative health effects. 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 the product is a potential hazard through all three routes of entry, and that skin and eye contact are particularly hazardous. Specific action statements normally follow the route-of-entry statements and indicate what the user must do to prevent accidental poisoning. Continuing 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, or entering a pesticide-treated area, read the entire product label. If the label calls for the use of PPE, comply fully with those directions. The label will define the minimum 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 concentrated pesticides when engaged in these activities. Products labeled for agricultural uses have specific PPE requirements for early-entry workers (who enter treated areas before it is safe to do so without protection).

A product's PPE requirements may also vary depending on how you are using the product. For example, a product approved for both indoor and outdoor uses may require you to wear respiratory protection when applying the product in an enclosed space but not when applying it outdoors.

Choose the Right PPE

In general, the more toxic the pesticide, the greater the need for PPE. If a pesticide label does not have specific PPE requirements, always take reasonable precautions. 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 are often more hazardous to use than dry formulations, and extra protection is warranted while mixing and/or loading them. 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 should use extra protection.

Dress with Safety in Mind

Whenever you are using pesticides, at the very least you should wear a long-sleeved shirt, long pants, shoes, socks, and, except in select cases, chemical-resistant gloves (Figure 1). Many labels will require you to wear more than this, depending on the product's toxicity and approved uses. To reduce pesticide penetration, select garments

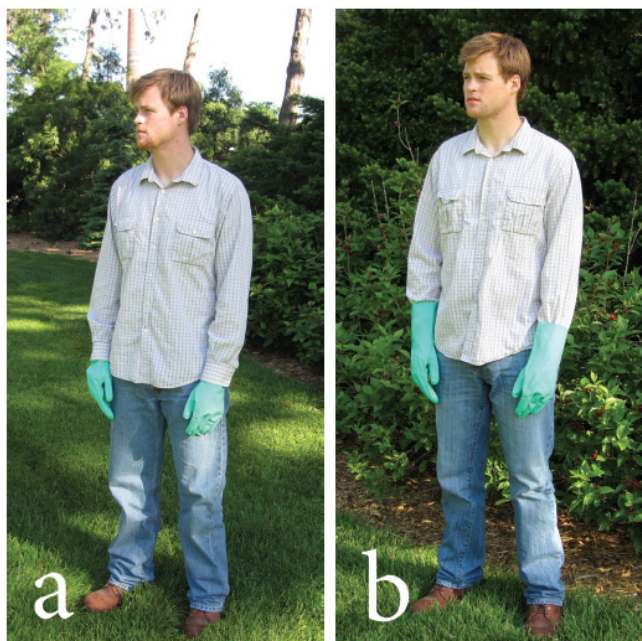


Figure 1. Wear a long-sleeved shirt, long pants, shoes plus socks, and chemical-resistant gloves when applying pesticides. We recommend wearing gloves inside sleeves (1a), but wearing gloves outside sleeves may be preferable when working with your hands above your head (1b).

made of tightly woven fabrics. Disposable coveralls, such as those made of Tyvek®, provide adequate protection to a pesticide applicator under most conditions. Some products or situations may require the use of protective suits made of, or coated with, butyl rubber, neoprene, PVC, or one of the newer coated and laminated polyethylene fabrics. Chemical-resistant aprons are a common requirement for handling concentrated liquid pesticides.

Always wear shoes and socks. Avoid sandals, flip-flops, and cloth or canvas shoes to minimize exposing your feet to liquid pesticides. Leather shoes are adequate while using most pesticides, but they are not preferred: Leather will absorb and hold liquids, meaning that you risk exposure to any pesticide trapped in the leather each time you wear the shoes in the future. Therefore, wear chemical-resistant boots while working with highly toxic liquid pesticides (signal word: Danger) or when you may have prolonged exposure to any pesticide spray.

Protect Your Head, Eyes, and Hands

Protection for your head is generally advisable, and in some cases, it is specifically required by pesticide labels. 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, including baseball caps, as these will absorb and trap pesticides. Labels that require 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.



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

Pesticides are readily absorbed through the eyes and can cause eye injury. Wear goggles or safety glasses when the label requires them. (See Figure 3 for examples.) Additionally, consider wearing eye protection any time you use a liquid pesticide with a 'Warning' or 'Danger' signal word on its label. Some goggles have a wider bridge over the

nose that allow them to be worn with respirators. If using goggles, select a pair with the correct type 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 the use of a full-face shield.



Figure 3. Different types of safety goggles and glasses.

Chemical-resistant gloves (Figure 4) are typically required for mixing, loading, and applying pesticides. Unlined neoprene, butyl, PVC, Viton®, barrier laminate, or nitrile gloves with cuffs that extend well up on the forearm are best. Most of these gloves are available in reusable pairs that you can clean after each mixing/loading task or pesticide application. Others, such as nitrile gloves, are available in single-use disposable versions in a variety of thicknesses, or 'mil weights' (Figure 5).

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 be absorbed through the



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.

skin or cause severe irritation. Avoid gloves with cotton lining on the insides; the lining can absorb pesticides and is difficult to clean. Latex gloves, commonly used by medical personnel, do not provide adequate protection from pesticides because they are not chemical resistant.

In most cases, we recommend tucking gloves under your sleeves to keep the pesticide from running down the sleeves and into your gloves. When working with your hands above your head, tuck your sleeves under your gloves and roll the glove cuffs up to prevent pesticides from running down to your forearms. As an extra safety measure, you can duct tape around where the glove and sleeve meet. For more information about selecting gloves, see G1961, *Gloves for Handling Pesticides*.

Protect Your Lungs

Your lungs and the lining of your respiratory system readily absorb pesticide dusts and vapors in the air. Therefore, respiratory protection is essential whenever a product label requires or recommends it. No respirator is suitable for all situations. The type of respirator (*Figures 6–9*) an applicator should or must use depends on the type and toxicity of the pesticide, where the application will take place, and other factors. In all cases, the respirator should bear a mark indicating it is approved by the National Institute of Occupational Safety and Health (i.e., ‘NIOSH approved’). One-strap dust masks, such as those commonly available at hardware stores, are generally not NIOSH approved and will not provide adequate protection from pesticides.

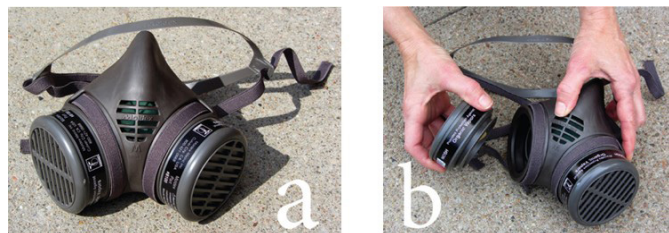


Figure 6. Half-face cartridge respirator with cartridges attached (6a) and cartridge detached (6b).



Figure 7a. Full-face canister respirator, without canister. (Photo courtesy of 3M); 7b. Closeup 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)

Federal regulations govern the occupational use of respirators. In addition to establishing performance criteria for the approval and classification of respirators, these regulations require that, before a person uses a respirator on the job, they:

- receive a medical evaluation to ensure they are medically fit to work while wearing a respirator;
- be fit tested for the specific brand, make, model, and size of respirator they intend to use, to ensure it will provide the desired protection; and
- receive training on how to properly use and maintain their respirator.

For more information about using respirators while handling pesticides, see EC3021, *Respirators for Handling Pesticides* and EC3027, *Fit Testing a Respirator for Pesticide Application*.

Caring for Protective Equipment

Wash reusable equipment such as hats, gloves, goggles, respirator bodies, and chemical-resistant footwear daily with soap and water. Hang equipment up to dry in a clean, pesticide-free location. If these items become heavily contaminated during the course of your work, remove them immediately, wash yourself off with soap and water, dispose of the soiled items according to label directions, and put on clean replacements before resuming your work.

To minimize your pesticide exposure, it is crucial to be equipped with intact chemical-resistant gloves. Test reusable gloves for leaks each day by filling them with water and gently squeezing the top. If water comes out, replace the gloves. Disposable gloves have a very limited lifespan. The thinner the gloves, the more often you will need to replace them throughout the day to maintain your protection.

Laundering Pesticide-Contaminated Clothing

- If possible, reserve one or more sets of clothing specifically for handling pesticides; do not wear this clothing for any other purpose. Begin each day wearing clean clothes. Remove these clothes upon finishing your pesticide work and change into clean clothes before going home for the day. Or, wear chemically resistant, disposable (non-reusable) coveralls over your clothing.
- Remove clothing heavily soiled with pesticides immediately and dispose of it according to label directions. This includes shoes and boots saturated with pesticides.
- At the conclusion of pesticide handling activities, wash your clothing immediately. If this is not possible, wash it as soon as you can, but always separately from family laundry.
- Wear chemical-resistant gloves when handling contaminated clothing, even to launder.
- Wash only a few items at a time. Do not mix with regular laundry.
- Use liquid detergent, hot water, and the machine's highest water level.
- 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 or machine dry using the regular dryer setting. After running a cycle, consider wiping the dryer drum with a damp paper towel to remove any pesticide residue.

Washing Up

Good personal hygiene is essential to keeping yourself pesticide free. Soap and water are inexpensive 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 your home.

Be Prepared for an Emergency

Keep emergency telephone numbers handy (see Emergency Phone Numbers box) and post them where pesticides are stored, mixed, or applied. If you experience any signs or symptoms of pesticide poisoning (nausea, skin rashes, headaches, coughing, diarrhea, chest pain, twitching, or seizures), see a physician immediately. Take the pesticide label with you when seeking medical care. For more information, see EC2505, *Pesticide Poisoning: Managing Risk and Recognizing 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 Environment and Energy
To report chemical spills 8 a.m. to 5 p.m. M-F
402-471-2186; 877-253-2603

Nebraska State Patrol
To report chemical spills after hours or
on holidays
800-525-5555; 402-471-4545



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