

Pesticide Safety: Choosing the Right Gloves

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This NebGuide explains how to choose and properly use gloves when mixing, loading, or applying pesticides; how to maintain such gloves; and how these procedures can help reduce exposure to chemicals and protect human health.

Properly protecting yourself when using pesticides can decrease the risk a pesticide has on your health and safety. Handling pesticides can include mixing, loading, or applying pesticides, all of which could expose your hands to chemicals. Using the right gloves is essential, since the highest percentage of pesticide exposure occurs through the skin. Chemical-resistant gloves are one of the most important pieces of personal protective equipment (PPE). Most pesticide labels have minimum requirements for personal protective clothing and equipment. Even when the label does not require chemical-resistant gloves, we recommend that you wear them when handling any pesticide.

Types of Gloves

Choosing gloves depends on the type of pesticide and the application. In general, unlined, liquid-proof neoprene, butyl, or nitrile gloves (*Figure 1*) with tops that extend well up on the forearm are best. These materials provide good protection under most conditions, are durable, and are reasonably priced. Most of these gloves are available in reusable pairs that can be cleaned after each mixing/loading task or pesticide application. Others, such as nitrile gloves, are available as single-use disposables.

The barrier laminate glove (*Figure 2*) offers the most protection. It consists of two or more different materials that are laminated or blended together. Viton® is another good choice, but is more expensive than most other chemical-resistant gloves. When making decisions about which gloves to purchase, you must consider your risk—the length of time you will be exposed to the pesticide along with the type of pesticide you'll be using ($\text{Risk} = \text{Exposure} \times \text{Toxicity}$)—and weigh this against the cost of gloves.



Figure 1. Examples of recommended gloves: nitrile (reusable and disposable), neoprene, and butyl rubber. Photo: University of Nebraska–Lincoln.



Figure 2. Example of EPA's highest rated protective glove material, barrier laminate. Photo: University of Nebraska–Lincoln.

Table I. Types and Characteristics of Personal Protective Material.
(for use when PPE section on pesticide label lists a chemical resistance category)

<i>Selection Category Listed on Pesticide Label</i>	<i>Types of Personal Protective Material</i>							
	<i>Barrier Laminate</i>	<i>Butyl Rubber ≥ 14 mils</i>	<i>Nitrile Rubber ≥ 14 mils</i>	<i>Neoprene Rubber ≥ 14 mils</i>	<i>Natural Rubber* ≥ 14 mils</i>	<i>Polyethylene</i>	<i>Polyvinyl Chloride (PVC) ≥ 14 mils</i>	<i>Viton ≥ 14 mils</i>
A (dry and water- based formulation)	NA	NA	NA	NA	high	NA	NA	NA
B (acetate)	high	high	slight	slight	none	slight	slight	slight
C (alcohol)	high	high	high	high	moderate	moderate	high	high
D (halogenated hydrocarbons)	high	high	moderate	moderate	none	none	none	slight
E (ketones, such as acetone)	high	slight	high	high	slight	none	moderate	high
F (ketone and aromatic petroleum distillates mixture)	high	high	high	moderate	slight	none	slight	high
G (aliphatic petroleum distillates, such as kerosene, petroleum oil, or mineral oil)	high	slight	slight	slight	none	none	none	high
H (aromatic petroleum distillates, such as xylene)	high	slight	slight	slight	none	none	none	high

*includes natural rubber blends and laminates

High: Highly chemical resistant. Clean or replace PPE at end of each day's work period. Rinse off pesticides at rest breaks.

Moderate: Moderately chemical resistant. Clean or replace PPE within an hour or two of contact.

Slight: Slightly chemical resistant. Clean or replace PPE within ten minutes of contact.

None: No chemical resistance. Do not wear this type of material as PPE when contact is possible.

NA: Not Applicable. Provides high resistance but exceeds level of protection required for these formulations.

Reference: Environmental Protection Agency, "Labeling Review Manual-Chapter 10: Worker Protection Labeling, EPA Chemical Resistance Category Selection Chart," <http://www.epa.gov/oppefed1/labeling/lrm/chap-10.htm#VIA>

Waterproof gloves will not provide adequate protection from pesticides, so be sure your gloves are rated as chemical-resistant. You should avoid latex gloves, as they do not provide adequate skin protection; they disintegrate rapidly; and they are not recommended by the Environmental Protection Agency (EPA). Canvas (such as gardening) or leather gloves, gloves worn by medical personnel, or household cleaning gloves are all inadequate for working with pesticides.

You may wear lightweight, single-use cotton liners inside chemical-resistant gloves. These liners improve the comfort and ease of putting on and taking off your gloves. Never reuse these liners, however; they must be discarded after each use to avoid potential exposure to pesticides that may have been absorbed by the cotton material. In addition, you should avoid gloves with integrated linings or gloves made entirely of cotton. These materials absorb pesticides, are hard to clean, and increase your chance of pesticide exposure.

The EPA developed a rating chart defining chemical resistance of various materials used for gloves. These ratings range from no chemical resistance—materials that should never be used during pesticide applications—to highly chemical-resistant materials that, with proper care and cleaning, can be reused and still provide good protection. A chemical resistance category (designated with letters A-H) may be listed on the pesticide label and is based on the solvents used in pesticides rather than the pesticides themselves. These categories refer to how long you can safely wear gloves of a certain material and thickness while handling a specific pesticide. This also depends on the

formulation of a pesticide. For example, the amount of time you can wear a certain glove material when using a dry formulation may be different from the same pesticide in a liquid formulation.

Table I, a reproduction of the EPA's rating chart, gives the types of personal protective material and their characteristics to help determine the appropriate type of gloves to use when mixing and loading or applying a pesticide. The first column of *Table I* has the selection categories (A through H) that may be found on some pesticide labels, as well as the solvents (listed in parentheses) that are associated with pesticides in those categories.

The guidelines in this chart provide basic information about protective materials used in gloves. Glove longevity is determined by whether you are using a concentrated pesticide, such as when mixing and loading, or a diluted pesticide, used during application. Glove lifespan is much longer when using a diluted pesticide than when using a concentrated one. Regardless of whether you are mixing and loading or applying pesticides, the amount of contact time you have with pesticides also will be a factor. For example, someone mixing and loading a concentrated pesticide all day will need to change gloves that are labeled as having "slight" or "moderate" chemical resistance more often than someone who mixes and loads for one hour or someone who spends half a day applying diluted pesticide. Always follow label instructions about which gloves to wear for the activity you will be doing.

Disposable vs. Reusable

The majority of information in this guide addresses gloves that have 14-mil (mil = 0.001 inch) or greater thickness (often referred to as reusable). These gloves are available in a variety of sizes, cuff lengths, and thicknesses. Like any other protective equipment, however, the number of times you can reuse these gloves is determined by the hours of use. For example, gloves would have to be replaced after eight hours of continuous use, but if used for shorter intervals they could be reused several times. Other factors include the age and condition of the material. After enough use or lengthy storage, glove material can become brittle and less impervious to chemicals. Also, any glove, no matter its thickness, should be discarded if it becomes torn or damaged. Do not reuse gloves from one season to the next.

Gloves with less than 14-mil thickness (often referred to as disposable) have a shorter usable life than those gloves indicated in the EPA chart. These disposable gloves are available in a variety of thicknesses (e.g., 4, 8, or 12 mil), sizes, and cuff lengths.

Cost often varies with thickness; thicker gloves usually are more expensive. Keep in mind, however, that thicker gloves offer better protection than thinner ones.

In general, disposable gloves may be preferable over reusable because they can be discarded after one use and thus do not require as much maintenance as reusable gloves. However, because reusable gloves are thicker, always consider the type of pesticide being used and the length of time needed to make the application. Thicknesses of 14 mil or greater may be a better choice in some circumstances.

Reusable gloves must be washed and carefully removed after use to prevent contaminating your skin or other areas, such as the interior of tractor cabs. In addition, reusable gloves must be stored properly and checked for leaks before using again; you can throw away disposable gloves according to directions on the label upon completion of your pesticide application.

Glove Size

Depending upon the manufacturer and material, disposable and reusable gloves are available in standard or long-cuff lengths. Determine the best glove size for you by measuring the circumference around the palm of your hand. For example, if it measures 8 inches, a medium would probably be the best choice.

Table II lists available glove sizes:

Proper glove fit is essential. Poorly fitting gloves can complicate your ability to apply pesticides correctly. A glove

Table II. Glove size in relation to circumference of the hand at the palm.

Glove size	Circumference of palm (in inches)
Extra small	6-7
Small	7-8
Medium	8-9
Large	9-10
Extra large	10-11
2XL	11-12
Jumbo	12-13

that is too tight will be uncomfortable and may split, allowing the pesticide to penetrate your skin. Gloves that are too large can slide on your hands and allow the pesticide to run down into the gloves and onto your skin. Handling equipment also becomes more difficult when you can't grip it sufficiently, increasing the chance for mistakes. Always try on your gloves and ensure they fit properly before handling pesticides.

Glove Thickness

The thickness of the material used in chemical-resistant gloves can affect their lifespan and their susceptibility to tears, abrasions, and general wear. Both disposables and reusables are available in various thicknesses. Manufacturers sell gloves with thickness ranges falling between 4-22 mils (Figure 3). Other thicknesses also may be available. Note that breakthrough time (the length of time for the pesticide to permeate the glove) is generally greater the thicker the material.

As mentioned earlier, the lifespan of a pair of gloves also depends on whether you are using concentrated or diluted pesticides. Concentrated pesticide will wear out gloves much faster and decrease lifespan much more quickly than diluted pesticides. Keep this in mind when choosing a glove thickness.

Proper Use

In most cases, we recommend wearing gloves under your sleeves to keep pesticide from running down the sleeves and into the gloves (Figure 4). When working with your hands above your head, roll glove tops into cuffs over your sleeves to prevent the pesticide from running down the gloves to your forearms. As an extra safety measure, you can apply duct tape where the glove and sleeve meet. Remember, the most important thing is to wear gloves!



Figure 3. Disposable nitrile gloves in 4-, 8- and 12-mil weights. Photo: University of Nebraska–Lincoln.



Figure 4. Wear gloves under long sleeves to protect yourself from pesticide exposure. Photo: University of Nebraska–Lincoln.

If applying fumigants, be especially careful to follow label directions regarding gloves. Some fumigants can penetrate materials such as rubber and neoprene, and may cause severe skin irritation if trapped and absorbed by the skin. Many labels for pelletized fumigants, such as aluminum phosphide, may require dry cotton gloves. These gloves allow airflow so that fumigant gasses won't be trapped against and burn skin.

Proper Cleaning and Removal

After finishing a pesticide application, remove and discard disposable gloves and then wash your hands with soap and warm water. It is especially important to do so before eating, smoking, or using the toilet. Wash reusable gloves with soap and warm water while still wearing them, and then remove them.

If you are using a concentrated pesticide for mixing and loading and it gets on your gloves, you should rinse them immediately before continuing the activity. Then, after finishing the job, thoroughly wash and remove the gloves, as outlined below. By following these guidelines, you can prolong the life of your gloves as well as protect yourself from exposure.

To remove disposable gloves properly:

1. Grasp the outside cuff of one glove with the other gloved hand and pull it inside out and off the hand. Be careful not to touch your skin. Then, ball up the removed glove in your gloved hand as you take off the remaining glove by grasping the inside of the cuff and pulling it off. You can pull it so the first glove ends up inside the glove you just removed.
2. Finally, dispose of gloves according to label directions, being careful at all times not to contaminate clothes and skin.

To remove reusable gloves properly:

1. Wash the outsides of your gloves with soap and warm water. Use a sink if one is available nearby, otherwise bring a bucket and water onsite with you.
2. Next, with one gloved hand, grasp the fingers of the other glove and slowly work back and forth alternately between the gloves until you have pulled off both gloves.
3. Finally, hang the reusable gloves out to dry. Do not put gloves in the washing machine!

After removal of either disposable or reusable gloves, always wash your hands with warm water and soap before going about daily activities. This will ensure that you do not transfer pesticide residue from your hands into your home, vehicle, or other areas where it could expose you, your family, or other nontargets to pesticides.

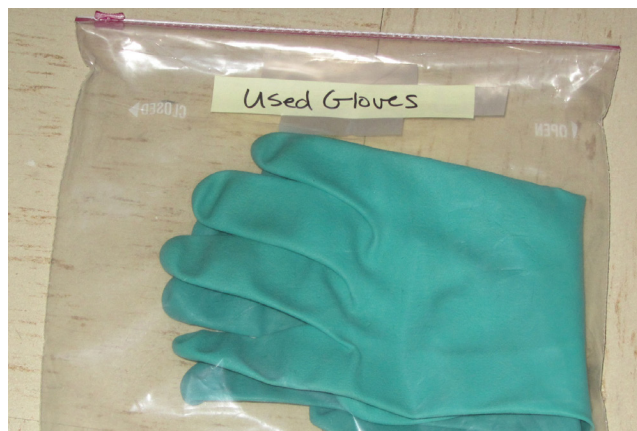


Figure 5. Properly store used gloves in a plastic bag or bucket labeled as such. Photo: University of Nebraska–Lincoln.

Storage and Disposal

Proper maintenance of chemical-resistant gloves includes not only cleaning and removal, but also safe storage and disposal practices.

1. Store unused disposable or reusable gloves in their original bag or other container with a lid, such as a plastic bucket. Mark the container with the name of its contents.
2. After using disposable gloves, discard them according to label directions.
3. Store reusable gloves in a bucket or plastic bag marked as such once they are dry (*Figure 5*). Never place contaminated gloves directly onto the seat of your vehicle or other surfaces you may come in contact with.
4. Check reusable gloves before each pesticide application for leaks or wear. A good practice is to fill the gloves with water and look for any holes or tears, or put the gloves on and put your hands in a bucket or sink of clean water. Dispose of any glove according to the pesticide label if it is defective or has significant wear and replace with a new one.
5. Store gloves in a different location from pesticides to prevent them from accidental contamination during storage. Gloves should be stored in a clean environment, away from direct sunlight or temperature extremes. Do not store used gloves in your home where they might be accessible to children or pets.

By following the label, using recommended chemical-resistant gloves when applying pesticides, and properly maintaining gloves when not in use, you will reduce your risk of pesticide exposure.

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**Index: Pesticides
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