NebGuide

Nebraska Extension

Research-Based Information That You Can Use

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Gloves for Handling Pesticides

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This NebGuide explains types of gloves, and how to choose and properly use gloves when mixing, loading, or applying a pesticide. It covers how to maintain gloves and how these procedures can help reduce exposure to chemicals and protect human health.

Properly protecting yourself when handling pesticides can decrease the risk a pesticide poses to your health and safety. Pesticide handling includes mixing, loading, or applying pesticides, all of which could expose your hands to chemicals. Using the right gloves is essential because the majority 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 list minimum requirements for personal protective clothing and equipment, such as gloves. A pesticide label may require you to wear waterproof gloves, at a minimum. However, you may choose to wear gloves that offer more protection than those recommended. Even if a label does not require chemical-resistant gloves, we recommend that you wear them when handling any pesticide.

Waterproof gloves keep out water; they allow no measurable movement of water or aqueous solutions through the material during use. They may not offer protection against chemicals such as organic solvents (alcohol, acetone, petroleum distillates, etc.) used in some pesticide formulations.

Chemical-resistant gloves act as a physical barrier to protect your hands from chemical substances. The type of material that will offer protection varies depending on the chemicals used. No material resists all chemicals equally well, so you may need different types of gloves for different pesticides. The concentration of the pesticide and length of contact will affect how long the material will remain resistant to the chemical. According to the Worker Protection Standard (WPS), chemical-resistant PPE must be made of material that allows no measurable movement of the pesticide being used through the material during use. Typically, chemical-resistant gloves are also waterproof.

Glove Materials

Following are materials often used or considered for use when handling pesticides. Prices are given for comparison, based on gloves with similar thickness (17 mils, 1 mil = 0.001 inch).

Barrier laminate gloves (*Figure 1*) are resistant to most pesticides and offer the greatest protection. They consist of two or more different materials that are laminated or blended together. They may be uncomfortable or clumsy to wear for some tasks. (*$7—$11 per pair*)

Figure 1. Example of EPA's highest rated protective glove material, barrier laminate (Photo Credit: UNL).

Butyl rubber gloves (*Figure 2*) are made of a synthetic rubber, provide good protection under most conditions, and are durable. They also resist abrasion, and stay flexible at low temperatures. One downside to butyl is cost, as gloves are fairly expensive. (*$30—$50 per pair*)

Figure 2. Examples of recommended gloves: nitrile (reusable and disposable), neoprene, and butyl rubber (Photo Credit: UNL).

Natural rubber (latex) gloves are light and stretchable, so they fit snugly. Because of the tightness, the insides of the gloves usually are covered with a powder that makes them easier to slide on and off. Latex gloves allow for good dexterity and flexibility. They're also an inexpensive option. Unfortunately, many people are allergic to latex. The material also is not very strong; therefore, it is not recommended for extended use, or where there is a potential for punctures and cuts. (*17-mil $2 per pair*)

Neoprene rubber gloves (*Figure 2*) provide good protection under most conditions, are durable, and are reasonably priced. They are made of synthetic rubber and are flexible. They offer good finger dexterity and tear-resistance. They generally have better chemical- and wear-resistance properties than gloves made of natural rubber. (*28-mil $5- $13 per pair*)

Nitrile rubber gloves (*Figure 2*) provide good protection under most conditions, are durable, and are reasonably priced. They are available in reusable pairs that can be cleaned and reused after a mixing/loading task or pesticide application, as well as single-use disposable gloves. Some workers are allergic to nitrile, although this is far less common than latex allergies. Nitrile gloves also are puncture-resistant. Punctures are far easier to see in a nitrile glove than in most other chemical-resistant materials, making visual inspection easier. Nitrile gloves mold to the hand and offer a snug, comfortable fit for extended periods of time. (*13-mil $9 per pair*)

Polyethylene gloves are most often used for light-duty tasks that require frequent glove changes, such as in the food service industry. They can become brittle when exposed to sunlight. Use in pesticide handling is limited to dry or water-based pesticides and gloves must be thick enough to avoid tearing or puncture. (*Less than $1 per pair, usually considered disposable*).

Polyvinyl chloride (PVC) is another common material used in chemical-resistant gloves. Most PVC gloves stay flexible even in cold environments. PVC has fairly high puncture resistance and provides excellent grip. (*$4 per pair.*)

Viton® is a good choice for glove material because it is very flexible and comfortable to wear. It is more expensive than most other chemical-resistant gloves. (*$150-$175 per pair*).

Cotton gloves are neither chemical-resistant nor waterproof. Avoid using cotton gloves, unless directed to do so by the label. Certain fumigants, such as pelletized aluminum phosphide, require cotton gloves because they can penetrate rubber, neoprene, and leather. If trapped inside a glove, these fumigants can cause severe skin irritation and burns, or be absorbed through the skin. Cotton gloves allow airflow so that fumigant gases won't be trapped against and burn the skin.

Canvas and leather gloves are neither chemical-resistant nor waterproof. They are not recommended because they can absorb pesticides and cannot be cleaned. Household cleaning gloves or gloves worn by medical personnel are inadequate for handling pesticides.

Glove Thickness

The thickness of the material can affect a glove's lifespan and its susceptibility to tears, abrasions, and general wear. Manufacturers sell gloves with thickness ranges of 4–22 mils, and other thicknesses also may be available. Breakthrough time, the length of time it takes for the pesticide to permeate the glove, is generally longer the thicker the material. A material's breakthrough time will be shorter when exposed to concentrated pesticides as opposed to diluted pesticides, but even so, the thicker material will offer protection longer. Cost often varies with thickness; thicker gloves usually are more expensive. Keep in mind, however, that thicker gloves offer better protection than thinner ones.

Disposable vs. Reusable

Gloves with less than 14-mil thickness often are referred to as disposable (*Figure 3*) and are used only once.

Thicker gloves, 14-mil or greater, are often referred to as reusable. They can be cleaned after each mixing/loading task or pesticide application and used again. Reusable gloves still have limited lifespans, however. The number of times you can reuse these gloves is determined by the hours of use or contact time, and the type and concentration of pesticide being handled. Gloves exposed to concentrated pesticides will wear out much faster than those exposed to diluted pesticides.

Figure 3. Disposable nitrile gloves in 4-, 8-, and 12-mil weights (Photo Credit: UNL).

In general, disposable gloves may be preferable over reusable gloves 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 handle the pesticide (mix, load, or apply). Thicknesses of 14 mils or greater may be a better choice in some circumstances.

Glove Size

Proper glove fit is essential. Poorly fitting gloves can leave you vulnerable to pesticide exposure. A glove that is too tight will be uncomfortable and may split open, allowing the pesticide to come in contact with your skin. Gloves that are too large can slide around on your hands and allow the pesticide to run down into the gloves and onto your skin. Operating equipment and other tasks also become more difficult when you can't get a good grip, increasing the chance for mistakes. Always try on gloves and ensure they fit properly before handling pesticides.

Depending on 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 widest part of the palm of your hand. For example, if it measures 8 inches, medium would probably be the best choice. *Table I* lists available glove sizes:

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

Glove size	Circumference of palms
Extra small	6–7 inches
Small	7–8 inches
Medium	8–9 inches
Large	9–10 inches
Extra large	10–11 inches
2XL	11–12 inches
Jumbo	12–13 inches

Glove Selection

The type of glove material that will provide protection depends upon the pesticide used, whether it is concentrated or diluted, and the length of contact time with the pesticide. The glove material and thickness are two factors to consider.

Any plastic or rubber material is resistant to dry pesticides and to water-based pesticides (those with water as the only diluent or solvent). Dry pesticides include dusts, granules, pellets, and some baits. Water-based pesticides include wettable powders, soluble powders, some solutions, dry flowables (water-dispersible granules), and microencapsulated pesticides.

The type of material that is resistant to nonwater-based liquid pesticides depends on the formulation of the product being handled. Liquid pesticides that are ***not*** water-based include emulsifiable concentrates, ultra-low-volume and low volume concentrates, low-concentrate solutions, flowables, aerosols, dormant oils, and invert emulsions. Common organic solvents found in these pesticide formulations are xylene, fuel oil, petroleum distillates, and alcohol.

The EPA developed a chart that rates the chemical resistance of various materials used for gloves when exposed to different pesticide formulations, ranging from dry and water-based formulations to those with different types of organic solvents. EPA and product registrants use the chart to determine gloves to be used when handling a particular pesticide. This information is then given on the pesticide label.

Table II, a reproduction of EPA's chart, gives the types of glove materials and their ratings to help determine the appropriate gloves to use when mixing and loading or applying a pesticide. The first column of *Table II* has the solvent categories (A through H). A pesticide formulation's solvent category is based on the solvent(s) used in the formulation rather than the active ingredient(s). Examples of solvents in those categories are given in parenthesis.

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

Solvent Category	Types of Glove Material							
	Barrier Laminate	Butyl Rubber ≥ 14 mils	Nitrile Rubber ≥ 14 mils	Neoprene Rubber ≥ 14 mils	Natural Rubber* ≥ 14 mils	Polyethylene	Polyvinyl Chloride (PVC) ≥ 14 mils	Viton ≥ 14 mils
A (dry and water-based formulations)	high	high	high	high	high	high	high	high
B (ketones)	high	high	slight	slight	none	slight	slight	slight
C (alcohol)	high	high	high	high	moderate	moderate	high	high
D (acetates)	high	high	moderate	moderate	none	none	none	slight
E (aliphatic petroleum distillates)	high	slight	high	high	slight	none	moderate	high
F (aromatic petroleum distillates, <40%)	high	high	high	moderate	slight	none	slight	high
G (aromatic petroleum distillates, ≥40%)	high	slight	slight	slight	none	none	none	high
H (halogenated hydrocarbons)	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.

Reference: Environmental Protection Agency, "Label Review Manual-Chapter 10: Worker Protection Label, EPA Chemical Resistance Category Selection Chart for Gloves," at *https://www.epa.gov/sites/production/files/2016-02/documents/chap-10-feb-2016.pdf*

The high, moderate, slight, and none ratings tell the amount of chemical resistance each material has to a particular solvent category. A *high* chemical-resistance rating for a solvent category means that, with proper care and cleaning, the glove can be reused and still provide good protection. A rating of *none* means the material offers no chemical resistance and should not be used for a specific solvent category. The notes at the bottom of the chart tell how long you can safely wear gloves of a certain material and thickness while handling a pesticide in a specific solvent category. All ratings are based on gloves that are at least 14 mils thick, except for barrier laminate and polyethylene. EPA says that only gloves with a *high* level of chemical resistance should be listed on product labeling. This means that when selecting gloves, if you have options, select the type with the *high* protection rating for the product you will use.

A label may specifically list the glove material to use when handling the product (*Figure 4*), or may refer to the solvent category and allow the handler to choose (*Figure 5*).

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants.
- Chemical-resistant gloves, made of barrier laminate or Viton ≥ 14 mils.
- Shoes plus socks.
- Protective eyewear.

Figure 4. Some pesticide labels list the type of gloves that must be used.

Personal Protective Equipment

Some materials that are chemical resistant to this product are made of barrier laminate, nitrile rubber, neoprene rubber, or viton. If you want more options, follow the instructions for category E on an EPA chemical-resistance category selection chart.

Figure 5. Some pesticide labels may refer to an EPA chart that lists suitable chemical-resistant materials.

Liners

You may wear lightweight, single-use cotton liners inside chemical-resistant gloves, provided the liners do not extend outside the chemical-resistant gloves. These liners can improve the comfort and ease of putting on and taking off your gloves. Never reuse these liners, in order to avoid potential exposure to pesticides that may have been absorbed by the cotton material. If directly contacted

by a pesticide, remove and discard the liners immediately. In addition, you should avoid gloves with integrated linings, linings that cannot be separated from the glove. The Worker Protection Standard (WPS) prohibits the use of chemical-resistant gloves with non-separable absorbent lining materials. These materials absorb pesticides, are difficult to clean, and increase your chance of pesticide exposure.

Preparation and Use

Glove manufacturers put the name of the glove material on the packaging, but sometimes not on the gloves themselves. To avoid confusion, write the glove material on the inside of the glove cuff with a permanent marker. Before handling the pesticide, read the pesticide label to make sure you will be using the correct type of glove.

Check gloves before each use for brittleness, wear, or leaks. A good practice is to fill the gloves with water and look for any holes or tears, or put on the gloves 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.

In most cases, we recommend wearing sleeves over the tops of your gloves to keep pesticide from running down the sleeves and into the gloves (*Figure 6, left*). When working with your hands above your head, roll glove tops into cuffs over your sleeves or wear gloves over your sleeves (*Figure 6, right*) to prevent the pesticide from running down the gloves onto your forearms. As an extra safety measure, you can apply duct tape where the glove and sleeve meet. The most important thing is to wear gloves! If you are mixing and loading a concentrated pesticide and it gets on your gloves, you should rinse them immediately before continuing the activity.

Figure 6. Wear sleeves over the tops of your gloves when working with pesticides, in most cases (left). When working with pesticides above your head, wear gloves over your sleeves (right) (Photo Credit: UNL).

Figure 7. Adapted from publication by The Ohio State University, PSEP & OSU Ag Safety and Health.

Figure 8. Adapted from publication by The Ohio State University, PSEP & OSU Ag Safety and Health.

Cleaning and Removal

All gloves must be carefully removed after use to prevent contaminating your skin or other areas, such as the interior of tractor cabs. Never place contaminated gloves directly onto the seat of your vehicle or other surfaces with which you may come in contact. After finishing the job, thoroughly wash and remove gloves (*Figures 7 and 8*). By following these guidelines, you can prolong the life of your gloves as well as protect yourself from exposure.

After removing 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.

Storage and Disposal

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

1. After using disposable gloves, discard them according to label directions.

2. Store unused disposables in their original bag or a container with a lid. Store cleaned reusable gloves in a bucket or plastic bag once they are dry (*Figure 9*).

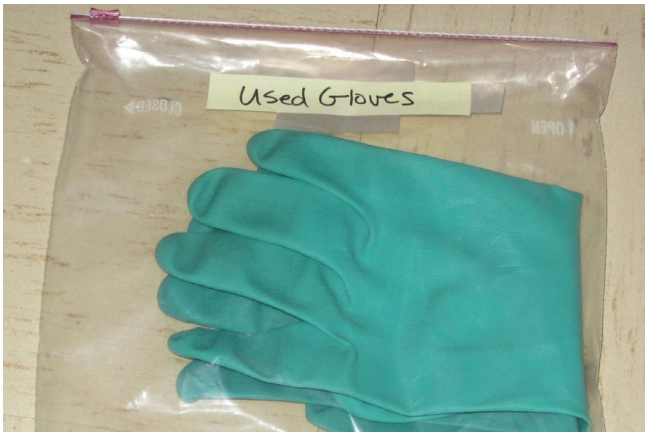

Figure 9. When dry, store cleaned gloves in a sealed, labeled plastic bag or bucket (Photo Credit: UNL).

3. Mark the container with its contents (e.g., 'new disposable gloves' or 'used gloves').

4. Store gloves in a different location from pesticides to protect 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.

Summary

Using the type of gloves required by the pesticide label, and properly maintaining and storing gloves when not in use will reduce your risk of pesticide exposure. If waterproof gloves or no gloves are required by the label, consider upgrading to chemical-resistant gloves to improve protection. Although disposable gloves (thickness of less than 14 mils) cost less and reduce cleaning and storage considerations over reusables (greater than or equal to 14 mils), thicker gloves increase protection from exposure.

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