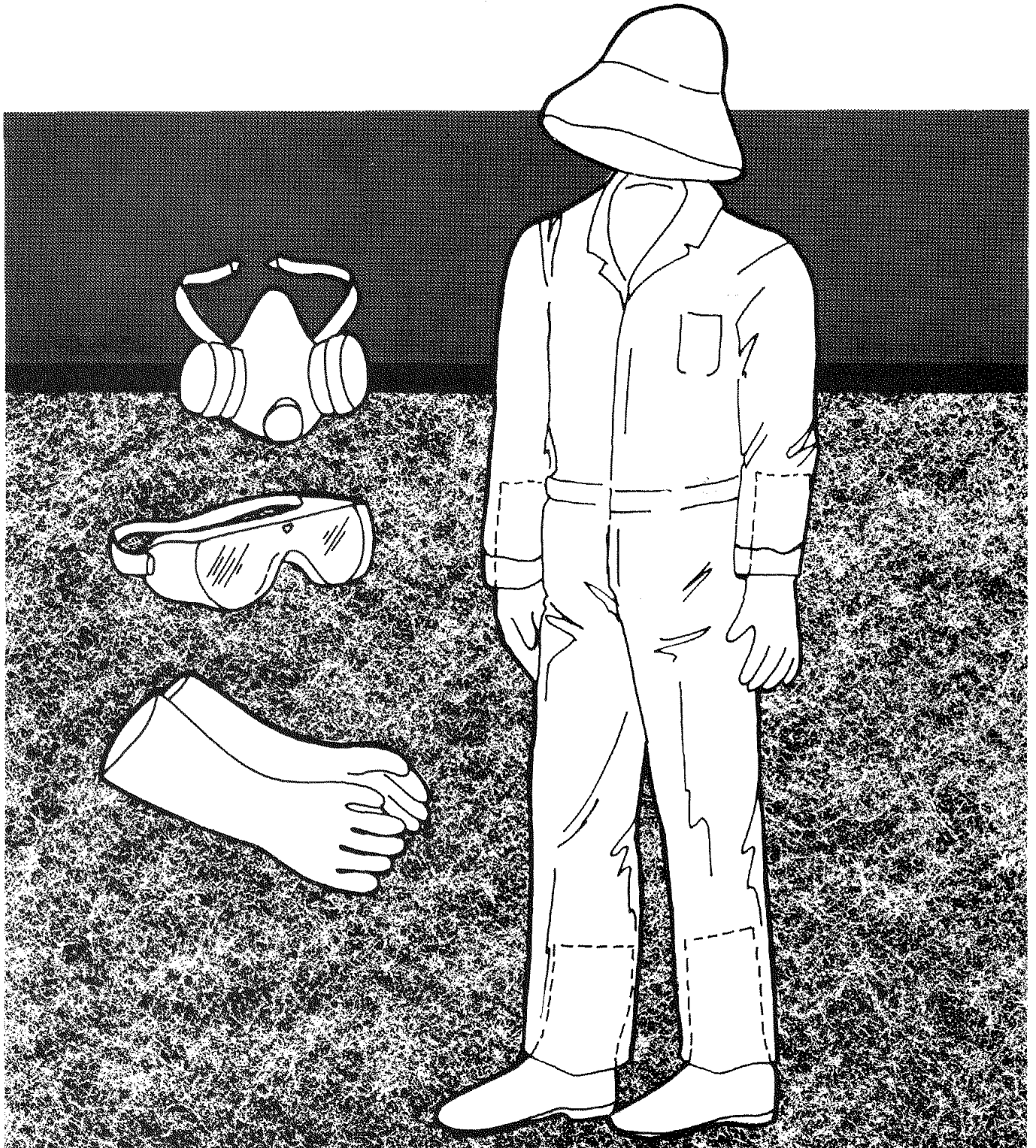
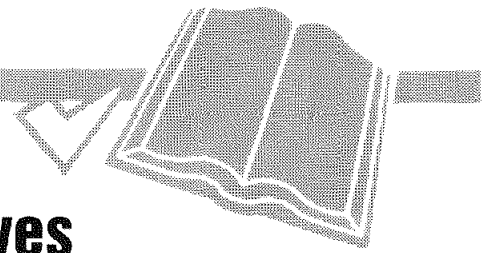
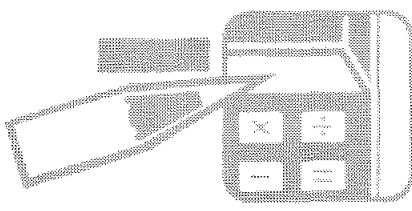

Personal Protective Equipment





Learning Objectives

After you complete your study of this unit, you should be able to:

- Describe your legal responsibility for following personal protective equipment requirements in pesticide labeling.
- Define the term “chemical resistant,” and explain how to tell when a material is not chemical resistant to a particular pesticide.
- Identify factors that determine how well a coverall will protect your body.
- Explain the importance of wearing gloves when you handle pesticides.
- Give reasons why gloves and footwear may fail to protect you.
- Explain when you should wear protective headgear, and describe appropriate headgear.
- Explain the term “protective eyewear.”
- Distinguish among dust/mist filtering respirators, vapor-removing respirators, and air-supplying respirators.
- Describe the special hazards that fumigants pose.
- Explain some basic guidelines for cleaning and maintaining personal protective equipment items.

Terms To Know

Acute effects — Illnesses or injuries that may appear immediately after exposure to a pesticide (usually within 24 hours).

Concentrates — Pesticides that have a high percentage of active ingredient.

Delayed effects — Illnesses or injuries that do not appear immediately (within 24 hours) after exposure to a pesticide or combination of pesticides.

Diluent — Anything used to dilute a pesticide.

Exposure — Coming into contact with a pesticide; getting a pesticide on a surface or in or on an organism.

Labeling — The pesticide product label and other accompanying materials that contain directions that pesticide users are legally required to follow.

MSHA — Mine Safety and Health Administration.

NIOSH — National Institute for Occupational Safety and Health.

OSHA — Occupational Safety and Health Administration in the United States Department of Labor.

Pesticide handler — Person who directly handles pesticides, such as during mixing, loading, transporting, storing, disposing, and applying or working on pesticide equipment.

Precautionary statement — Pesticide labeling statement that alerts you to possible hazards from use of the pesticide product and that may indicate specific ways to avoid the hazards.

Residue — The part of a pesticide that remains in the environment for a period of time following application or a spill.

Solvent — A liquid, such as water, kerosene, xylene, or alcohol, that will dissolve a pesticide (or other substance) to form a solution.

Water-based pesticides — Pesticides that use water as the only diluent or carrier.

Personal protective equipment (PPE) is clothing and devices that are worn to protect the human body from contact with pesticides or pesticide residues. Personal protective equipment includes such items as coveralls or protective suits, footwear, gloves, aprons, respirators, eyewear, and headgear.

Ordinary shirts, pants, shoes and other regular work clothing usually are not considered personal protective equipment, although the pesticide labeling may require you to wear specific items of work clothing during some activities.

Exposure to pesticides can cause harmful effects. To prevent or reduce exposure to pesticides, you need to wear personal protective equipment. **You are legally required to follow all personal protective equipment instructions that appear on the label or in labeling.**

Remember, the lack of any requirement for personal protective equipment or the mention of only one piece of equipment does not rule out the need for more protection. No pesticide labeling instructions can cover all situations. Your common sense, the

information on the labeling about precautions for humans, and the task you will be performing will help you to assess your potential hazard and to select the amount and kind of personal protective equipment you need for each handling job.

Pesticide labeling lists the **minimum** personal protective equipment you must wear while handling the pesticide. Sometimes the labeling lists different requirements for different activities. For example, more personal protective equipment may be required for mixing and loading than for application.

Chemical-Resistant Personal Protective Equipment

Some pesticide labeling requires you to wear chemical-resistant personal protective equipment. You must select a material that will be resistant for the period of time that you will be exposed to the pesticide. Most chemical-resistant personal protective equipment items are made of plastic or rubber, but these materials are not equally resistant to all pesticides and in all circumstances.

Factors Affecting Chemical Resistance

How chemical-resistant a material will be in your pesticide handling situation depends on the length of exposure, the exposure situation, and the chemical to which the material is exposed.

Length of exposure

Not all types of materials that are resistant to a particular pesticide will protect you for the same amount of time. Some materials will keep the pesticide out for a fairly long time. Others will allow the pesticide to go through the material to your skin fairly quickly. Thin materials, such as disposable plastic gloves, shoe covers, or aprons, may be as much protection as you need for tasks that can be done in a few minutes. Longer jobs usually require items made of a heavier material.

Chemical resistance is often stated in terms of exposure time. For example, neoprene is resistant to acetone for 30 minutes or less and to diesel fuel for more than 4 hours. If you wear neoprene gloves while handling pesticides with an acetone solvent, you must change the gloves at least every 30 minutes; otherwise, the pesticide

and the acetone will get through the gloves and onto your hands.

Exposure situation

Even a chemical-resistant material will not continue to protect you if it becomes damaged during the pesticide handling task. For tasks that involve handling sharp or pointed objects or walking through rough terrain, for example, a heavy-duty or sturdy material probably would be necessary to ensure chemical resistance.

Type of chemical

Very few materials will protect you from all pesticide products. The level of chemical resistance may depend not only on what the active ingredient is, but also on whether the pesticide is liquid or dry and what diluents or solvents are used.

Choosing Chemical-Resistant Materials

Always read the pesticide labeling to see if it tells you what materials are resistant to the pesticide product. If it does not, look for another source of help in making a selection. The Environmental Protection Agency, the United States Department of Agriculture - Cooperative Extension Service, pesticide producers, or personal protective equipment manufacturers may issue guidance about which materials are resistant to particular pesticides. When no outside advice is available, you must use your own best judgment in selecting a material.

When you must select a chemical-resistant material, there are some general guidelines to follow. Cotton, leather, canvas, and other absorbent materials are not chemical resistant, even to dry formulations. Powders and dusts

sometimes move through cotton and other woven materials as quickly as wet formulations and may remain in the fibers even after three launderings. Do not use hats that have a cloth or leather sweatband, and do not use cloth or cloth-lined gloves, footwear, and aprons. These materials are difficult or impossible to clean after pesticide gets on them, and they are too expensive to be disposed of after each use.

Chemical-resistant suits and hoods

The best choice of materials for chemical-resistant suits and hoods is generally:

- rubber or plastic, such as butyl, neoprene, or polyvinyl chloride (PVC), or
- nonwoven fabric coated with plastic or another barrier material.

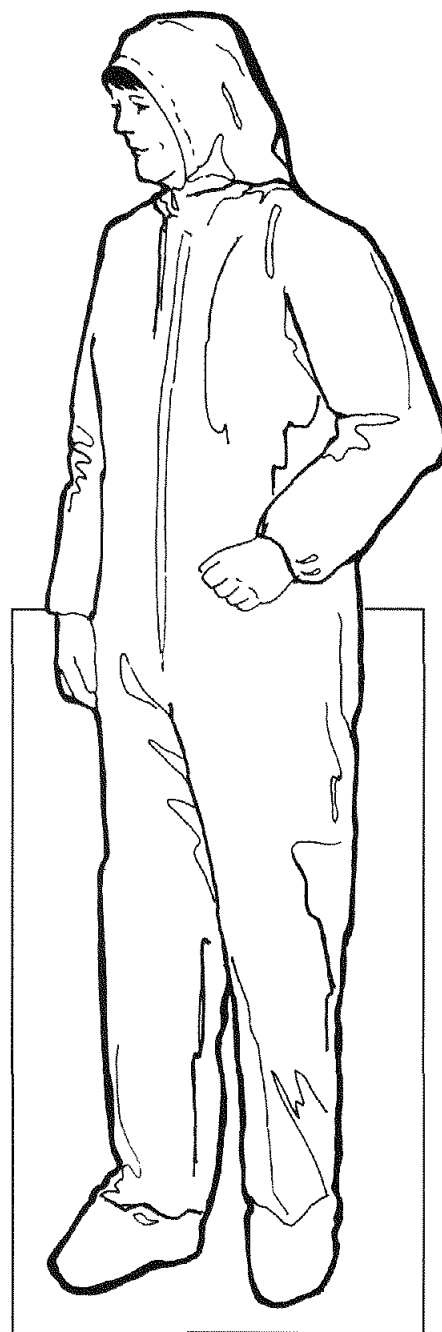
Read the packaging for the suits carefully to be sure that they are “chemical resistant,” “chemical protective,” or “liquidproof.”

Other chemical-resistant items

For other chemical-resistant items, such as gloves, footwear, aprons, and hats, you can choose from many types of materials. Foil-laminate materials are resistant to most pesticides, but many pesticide handlers consider them uncomfortable to wear and difficult to use while performing many tasks.

Any plastic or rubber material is resistant to dry pesticides and to water-based pesticides.

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 non-water-based liquid pesticides depends on the type of solvent used. Pesticides that do not dissolve in water are often mixed with other solvents to form liquid formulations. Liquid pesticides that are not water based include emulsifiable concentrates, ultra-low-volume and low-volume concentrates, low-concentrate solutions, flowables, aerosols, and invert emulsions.

Common solvents are xylene, fuel oil, other petroleum distillates, and alcohol. When xylene is in a formulation, it must be listed in the ingredient statement on the front panel of the pesticide label.

Some solvents do not have to be listed in the ingredient statement, so you may not be able to choose a chemical-resistant material on the basis of what is in the formulation. For these pesticides, select sturdy foil-laminate, butyl, or nitrile materials. Then watch for signs that the material is not chemical resistant. Sometimes it is easy to see when a plastic or rubber is not resistant to a pesticide. The material may:

- change color,
- become soft or spongy,
- swell or bubble up,
- dissolve or become like jelly,
- crack or get holes,
- become stiff or brittle.

If any of these changes occur, discard the items and choose another type of material.

Protecting Your Skin

The skin is the part of your body that usually gets the most exposure while you are handling pesticides. Pay particular attention to covering as much of your skin as possible. Remember that personal protective equipment protects you only if the pesticide remains on the outside of the material. Once the pesticide gets on the inside and next to your skin, the material works against you. It holds the pesticide tightly next to your skin for as long as it is worn. When this happens, more pesticide will get on your skin and cause irritation or will go through your skin and into your body.

Body Protection

Any time you handle pesticides, wear at least a long-sleeved shirt and long-legged pants. In many instances the pesticide labeling will require you to wear a coverall, a chemical-resistant suit, or a chemical-resistant apron.

Long-sleeved shirt and long-legged pants

Long-sleeved shirt and long-legged pants should be made of sturdy material. Fasten the shirt collar completely to protect the lower part of your neck.

Coveralls

Coveralls should be made of sturdy material such as cotton, polyester, a cotton-synthetic blend, denim, or a nonwoven fabric. One-piece coveralls look like jump suits or flight suits. Two-piece coveralls look like surgeons' suits. When wearing a coverall, close the opening securely so the entire body except the feet, hands, neck, and head are covered. If you wear a two-piece coverall, do not tuck it in at the waist; the shirt should extend well below the waist of the pants and fit loosely around the hips.

When handling pesticides that are highly or moderately toxic dermally or are skin irritants, always wear a coverall over another set of clothing that covers your body at least from shoulders to thighs. An entire set of clothing such as a long-sleeved shirt and long-legged pants worn under the coverall is ideal. Sometimes the pesticide labeling will specify a particular type of clothing to be worn under the coverall.

Several factors determine how well a coverall will protect you. Each layer of clothing and each layer of air between the pesticide and your skin provides added



protection. That is why the coverall should fit loosely. If it fits tightly, there will not be a layer of air between it and your skin, and any pesticide getting through the coverall will be in direct contact with your skin.

The design and structure of coveralls also affect how well they will protect you. Well-designed coveralls have tightly constructed seams and snug, overlapping

closures that do not gap or become unfastened readily. This construction makes it harder for pesticides to get through these areas and onto your inner clothing or your skin.

Chemical-resistant suit

Some pesticide labeling requires handlers to wear a chemical-resistant suit. This usually indicates that the pesticide is very hazardous, either for acute effects or for delayed effects, and that extra precaution is necessary to prevent the pesticide from getting on you.

If you expect to be in a situation where a large amount of pesticide could be deposited on your clothing, and if you will be in that situation for a long time,

consider wearing a chemical-resistant suit even if the pesticide labeling does not require you to do so. Under those circumstances, even pesticides that are applied dry, such as dusts or granules, can get through ordinary fabric and harm you.

Chemical-resistant suits made of rubber or plastic often are referred to as "rainsuits." They may be sold as one-piece coveralls or as two-piece outfits consisting of a jacket worn over overalls. Chemical-resistant suits made of coated nonwoven fabric usually are sold as one-piece coveralls.

The biggest drawback to chemical-resistant suits is that they may make you uncomfortably warm. Unless you are handling

pesticides in cool or climate-controlled environments, heat stress becomes a major concern. Wearing a chemical-resistant suit in even moderate temperature and humidity conditions can cause you to become overheated very quickly. Take extra precautions to avoid heat stress by drinking plenty of water and taking frequent rest breaks to cool down.

Chemical-resistant apron

The pesticide labeling may require you to wear a chemical-resistant apron while you are mixing and loading the pesticide and while you are cleaning pesticide equipment. Consider wearing an apron whenever you are handling pesticide concen-

Interpreting Labeling PPE Statements

Labeling Statement

Long-sleeved shirt and long-legged pants

Acceptable PPE

Long-sleeved shirt and long-legged pants, or
Woven or nonwoven coverall, or
Plastic- or other barrier-coated coverall, or
Rubber or plastic suit

Coverall worn over short-sleeved shirt and short pants

Coverall worn over short-sleeved shirt and short pants, or
Coverall worn over long-sleeved shirt and long-legged pants, or
Coverall worn over another coverall, or
Plastic- or other barrier-coated coverall, or
Rubber or plastic suit

Coverall worn over long-sleeved shirt and long-legged pants

Coverall worn over long-sleeved shirt and long-legged pants, or
Coverall worn over another coverall, or
Plastic- or other barrier-coated coverall, or
Rubber or plastic suit

Chemical-resistant apron worn over coverall or over long-sleeved shirt and long-legged pants

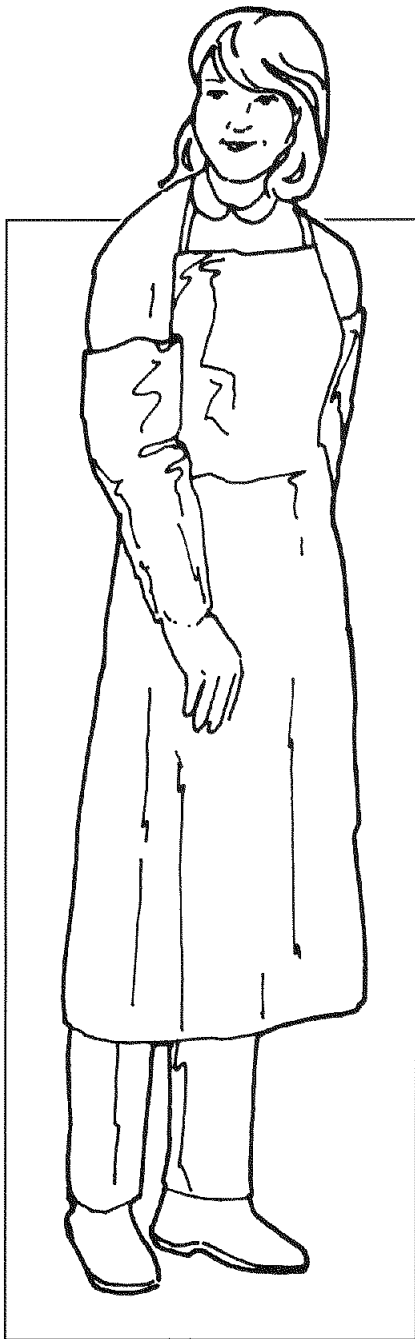
Chemical-resistant apron worn over coverall or long-sleeved shirt and long-legged pants, or
Plastic- or other barrier-coated coverall, or
Rubber or plastic suit

Chemical-resistant protective suit

Plastic- or other barrier-coated coveralls, or
Rubber or plastic suit

Waterproof suit or liquidproof suit

Plastic- or other barrier-coated coveralls, or
Rubber or plastic suit



trates. It will protect you from splashes, spills, and billowing dusts and will protect your coverall or other clothing. Wear an apron over the coverall or long-sleeved shirt and long-legged pants required for application or other handling activities.

Choose an apron that extends from your neck to at least your knees. Some aprons have attached sleeves and gloves. This style is especially protective because it

protects your arms, hands, and front and eliminates the potential gap where the sleeve and glove or sleeve and apron meet.

An apron can sometimes be a safety hazard. It can get caught in some machinery or get in your way in some situations. At those times, you may choose to wear a chemical-resistant suit instead.

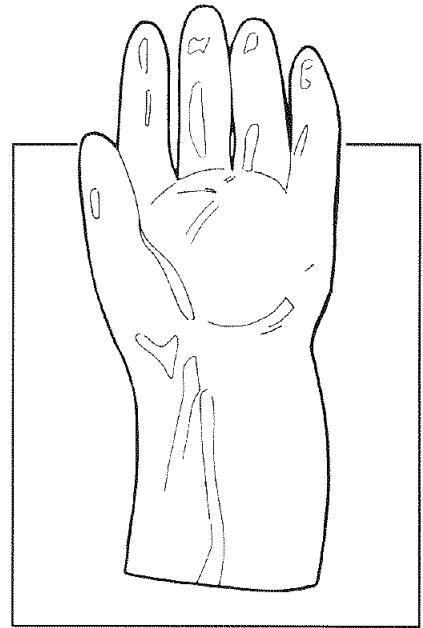
Hand and Foot Protection

Pesticide handlers get by far the most pesticide exposure on their hands and forearms. As a result, most pesticide labeling will require you to wear chemical-resistant gloves at all times while handling the pesticide. Wear chemical-resistant gloves any time you may get pesticides on your hands.

Pesticide handlers also often get pesticides on their feet. Sturdy shoes and socks are sufficient to protect your feet during a few pesticide handling activities. Canvas, cloth, and leather are difficult or impossible to clean adequately, however. Consider using chemical-resistant materials when pesticides or pesticide residues, especially concentrates, may get on your footwear.

Some pesticide labeling requires you to wear chemical-resistant footwear. Such footwear can be shoes, shoe covers, or boots. If a pesticide is likely to get on your lower legs or feet, consider wearing chemical-resistant boots. The boots should extend past your ankle and at least halfway up to your knee.

One situation where you should not wear chemical-resistant gloves and footwear is during the handling of a few fumigants, such as methyl bromide, because the gloves and footwear can trap the gas near the skin and cause burns. The labeling on these fumigants



will instruct you not to wear chemical-resistant gloves and footwear or other chemical-resistant clothing.

Wear gloves and footwear correctly

Always start out with gloves and footwear that you know are new or freshly cleaned. Don't choose a pair just because they are close by. They may already have pesticides on the inside and will not protect your hands or feet.

If pesticides get inside your gloves or footwear, you must take them off right away, wash your hands or feet, and put on a clean pair. Keep several pairs of gloves and footwear available and change to a clean set whenever you suspect the inside has become contaminated.

Avoid contaminating the inside of gloves and footwear

Even when you are wearing gloves and footwear, you can get pesticides on your hands and feet unless the gloves and footwear are:

- chemical-resistant to the pesticide being handled,

Interpreting Labeling PPE Statements

Labeling Statement

Waterproof gloves

Acceptable PPE

Any rubber or plastic gloves sturdy enough to remain intact throughout the task being performed

Chemical-resistant gloves

Barrier-laminate gloves, or
Other gloves that glove selection charts or guidance documents indicate are chemical-resistant to the pesticide for the period of time required to perform the task

Chemical-resistant gloves such as butyl or nitrile

Butyl gloves, or
Nitrile gloves, or
Other gloves that glove selection charts or guidance documents indicate are chemical-resistant to the pesticide for the period of time required to perform the task

Shoes

Leather, canvas or fabric shoes, or
Chemical-resistant shoes, or
Chemical-resistant boots, or
Chemical-resistant shoe coverings (booties)

Chemical-resistant footwear

Chemical-resistant shoes, or
Chemical-resistant boots, or
Chemical-resistant shoe coverings (booties)

Chemical-resistant boots

Chemical-resistant boots

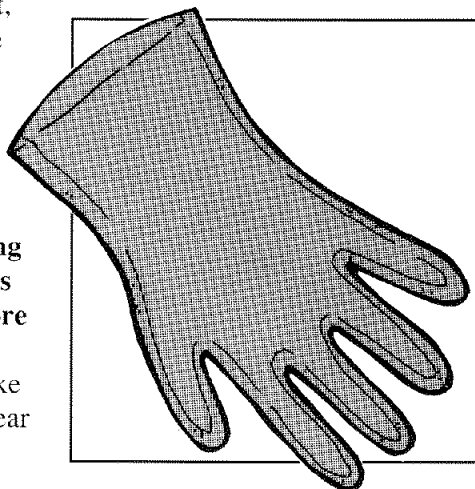
- worn correctly,
- in good condition,
- cleaned and cared for, and
- replaced often.

Contamination often happens when handlers remove their gloves briefly to adjust their equipment, open a pesticide container, wipe their face, etc., and then put the gloves on again over their contaminated hands. If you must remove your gloves during a handling activity, **wash your gloves thoroughly before taking them off, and wash your hands thoroughly and dry them before you put the gloves on again.**

Handlers also sometimes make the mistake of putting on footwear with contaminated hands. This

may transfer the pesticide from your hands to your socks and feet.

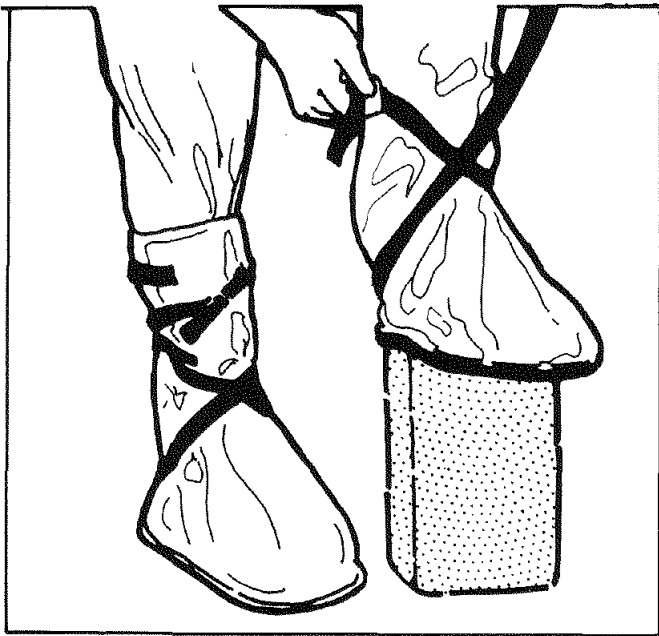
You must keep pesticides from running down your sleeves or pants legs and into your gloves and footwear. For many jobs, you



will be working some of the time with your arms raised and some of the time with them lowered. Close the glove cuff tightly outside the sleeve and put heavy-duty tape or an elastic band around the end of the glove where it meets the sleeve. Some gloves have a method of tightening the cuff to your sleeve so the pesticide cannot run down into the glove.

Place sleeves outside the gloves to keep pesticides from running down the sleeves and into the gloves. Use gloves that go up over your wrist and at least half way to your elbow.

For jobs when you will be exposed to pesticides on your legs, put your pants legs outside the

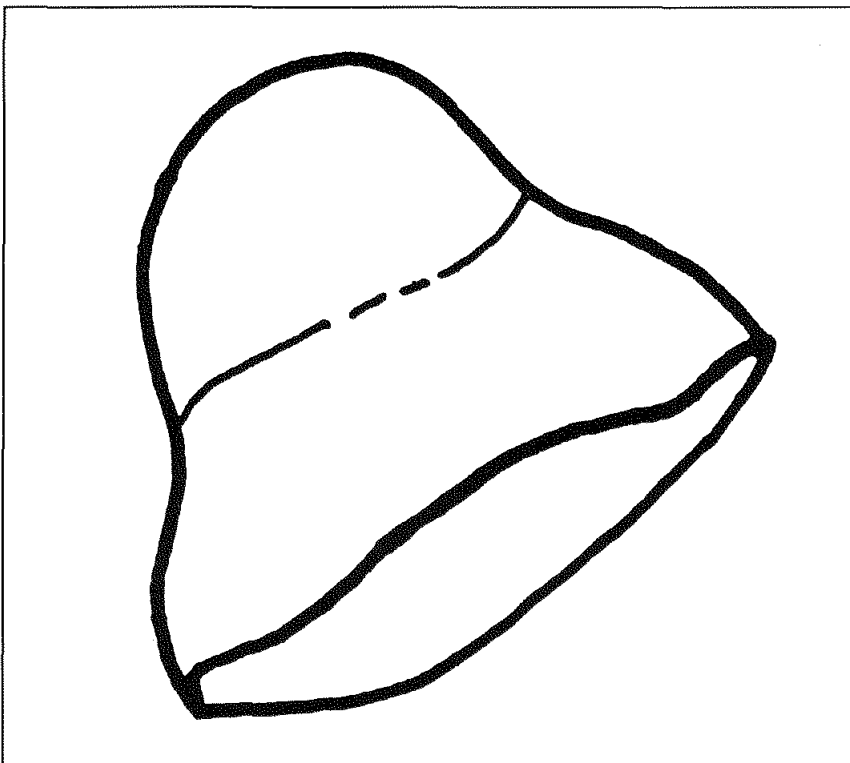


boots so the pesticide will not travel down your leg and collect in the boots or shoe covers.

Head and Neck Protection

If you will be exposed to pesticides from above, wear something to protect your head and neck. A chemical-resistant

hood or wide-brimmed hat will help keep pesticides off your head, neck, eyes, mouth, and face. Plastic "safari" hats with plastic sweatbands are a good choice. They are relatively cool in hot weather. Other more flexible hats and hoods are also available in chemical-resistant materials. Many chemical-resistant jackets or



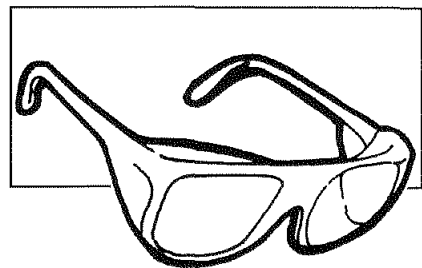
coveralls can be purchased with attached protective hoods.

Protecting Your Eyes

When the pesticide labeling requires you to wear protective eyewear, wear goggles, a face shield, or safety glasses with shields at both the brow and sides. Eyes are very sensitive to the chemicals in some pesticide formulations, especially concentrates, and temporary blindness caused by an accident may delay or prevent self-treatment. Eyes also readily absorb some pesticides.

Shielded safety glasses or full-face shields are a good choice in many handling situations, because they are comfortable, do not cause fogging or sweating, and give good eye protection for many exposure situations. Face shields that are cupped inward towards your throat give better protection from splashes than straight face shields. However, if you will be in an open cab during an airblast application, flagging directly under an aerial application, applying mists, fogs, or aerosols indoors, or in any other situation where you will be enveloped in a spray, mist, or dust, wear goggles that fit tightly against your face.

Either goggles or shielded safety glasses can be worn with a half-face respirator. Full-face respirators are supplied with their own face shield, so additional eye protection is not required.



Interpreting Labeling PPE Statements

Labeling Statement	Acceptable PPE
Chemical-resistant hood or wide-brimmed hat	Rubber- or plastic-coated safari-style hat, or Rubber- or plastic-coated firefighter-style hat, or Plastic- or other barrier-coated hood, or Rubber or plastic hood, or Full hood or helmet that is part of some respirators
Protective Eyewear	Shielded safety glasses, or Face shield, or Goggles, or Full-face style respirator
Goggles	Goggles, or Full-face style respirator
Dust/mist filtering respirator	Dust/mist respirator, or Respirator with dust/mist filtering cartridge, or Respirator with organic vapor-removing cartridge and pesticide prefilter, or Respirator with canister approved for pesticides, or Air-supplying respirator
Cartridge respirator	Respirator with organic vapor-removing cartridge and pesticide prefilter, or Respirator with canister approved for pesticides, or Air-supplying respirator
Canister respirator (gas mask)	Respirator with canister approved for pesticides, or Air-supplying respirator
Air-supplying respirator or Self-contained breathing apparatus (SCBA)	Air-supplying respirator, or Self-contained breathing apparatus (SCBA)

Protecting Your Respiratory Tract

The respiratory tract — the lungs and other parts of the breathing system — is much more absorbent than the skin. You must wear a respirator when the pesticide labeling directs you to do so. Even if the labeling does not require it, you should consider wearing a respiratory protective device:

- if you are in an enclosed area and the pesticide you are handling

has a labeling precautionary statement such as “do not breathe vapors or spray mist,” or “harmful or fatal if inhaled,” or

- if you will be exposed for a long time to pesticides that are in or near your breathing zone.

Some fumigants and a few other pesticide formulations contain an additive that will warn you if you begin to inhale the pesticide. Such warning agents often are used when the active ingredients in the pesticide are highly toxic ones that you would

otherwise not be able to detect. The additive may have a characteristic odor or be a mild irritant to alert you that you should put on a respirator or that your respirator is no longer protecting you. The warning agent can help you determine when you should use a respirator for products whose labeling does not require respiratory protection in all situations.

Some pesticide labeling lists the type of respirator you should wear when handling the product. Other labeling requires the use of

a respirator, but does not specify the type or model to be used. NIOSH and MSHA approve respirators as adequate for certain types of uses. When the pesticide labeling requires you to use a respirator, you must wear one that is approved by NIOSH and MSHA. If the respirator has more than one part, all the parts must be approved.

Studies have shown that many pesticide handlers do not use respirators correctly and so are not being well protected. Before you use a respirator, you should be trained in the correct procedures for selecting, fitting, cleaning and sanitizing, inspecting, and maintaining respiratory protective equipment.

There are two basic types of respirators:

- **air-supplying respirators**, which supply you with clean, uncontaminated air from an independent source, and
- **air-purifying respirators**, which remove contaminants from the air around you.

Air-Supplying Respirators

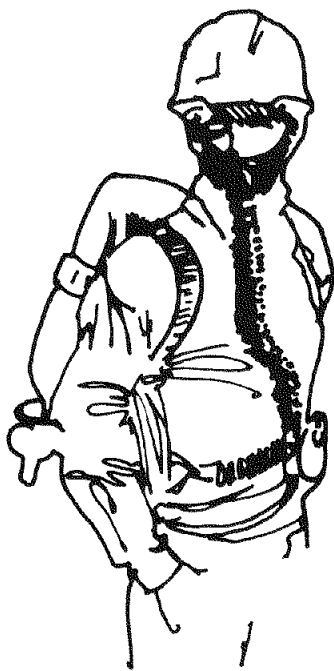
Air-supplying respirators are used in a few specialized situations where other types of respirators are not protective enough. Use an air-supplying respirator when the pesticide labeling tells you to.

In addition, you should use one when handling pesticides:

- when the oxygen supply is low, or
- during fumigation in enclosed areas, such as greenhouses or other buildings, railcars, ship holds, or grain bins.

Supplied-air respirators

These respirators pump clean air through a hose to the face mask. You are limited to working within the distance the hose can reach from the supply of clean air.



Self-contained breathing apparatus

This type of respirator supplies clean air from cylinders that you carry with you, usually on your back. This lets you move more freely and over a wider area than you can with a supplied-air respirator. Get training from competent instructors before using self-contained breathing equipment. These devices contain a limited air supply (usually about 30 to 45 minutes), which may be used up even more quickly in high temperatures or with excessive exertion.

Air-Purifying Respirators

In most situations where pesticide handlers need to use a respirator, some type of air-purifying respirator provides enough protection. Air-purifying respirators will not protect you from fumigants, from extremely

high concentrations of vapor, or when the oxygen supply is low.

Functions of air-purifying respirators

Air-purifying respirators remove contaminants from the air in two ways:

- by filtering dusts, mists, and particles, and
- by removing gases and vapors.

Sometimes you will need only a respirator that filters dusts and mists from the air; at other times, you will need one that removes gases and vapors as well.

Wear a dust/mist-filtering respirator if the pesticide labeling tells you to or if you will be exposed to pesticide dusts, powders, mists, or sprays in your breathing zone. Wear a respirator that also removes vapors if the pesticide labeling tells you to or if you will be exposed to gases or vapors in your breathing zone.

Styles of air-purifying respirators

Air-purifying respirators are of three basic styles:

- dust/mist masks, which usually are shaped filters that cover the nose and mouth to filter out dusts, mists, and particles,
- devices consisting of a body and one or more cartridges that contain air-purifying materials, and
- devices consisting of a body and a canister that contains air-purifying materials.

Cartridges may contain either dust/mist-filtering material or vapor-removing material. For pesticide handling tasks where vapor removal is needed, a prefilter must be used with the vapor-removing cartridge. The prefilter removes dusts, mists, and other particles before the air passes through the vapor-remov-

ing cartridge. A few vapor-removing cartridges have an attached prefilter, but most are sold separately. Separate prefilters are preferred for use with pesticides, because they often need to be replaced before the vapor-removing cartridge is used up.

Some cartridge-type respirators are one-piece units with cartridges permanently attached to the facepiece. After use, the entire unit is discarded. Other cartridge respirators are two-piece units with removable cartridges and a body that can be cleaned and reused. The dust/mist filtering or vapor-removing cartridges and the prefilters can be replaced when they lose their effectiveness.

A **canister** contains both dust/mist-filtering and vapor-removing material. Canisters contain more air-purifying material than cartridges. They last much longer and may protect you better in situations where the concentration of gas or vapor in the air is high. They are also much heavier and more uncomfortable to wear.

Canister-type respirators are often called gas masks. They usually have the canister connected directly to the facepiece or worn on a belt and connected to the facepiece by a flexible hose. The body is designed to be cleaned and reused. The canisters can be replaced when necessary.

Selecting and using dust/mist-filtering devices

Dust/mist filtering masks and cartridges are approved by NIOSH and MSHA. You must wear one that has their stamp of approval. Nonapproved filters are not as protective and are not acceptable.

Pesticide handlers must wear dust/mist-filtering masks or



cartridges with NIOSH/MSHA approval number prefix TC-21C.

Look for a dust/mist mask that is held in place by two straps. One-strap styles are not approved by NIOSH and MSHA, because they do not keep the respirator adequately sealed against the face.

When you wear a dust/mist filter — either a mask, cartridge, or prefilter — you will have more trouble breathing as more dusts, mists, and other particles become trapped in the filter material. When breathing becomes too difficult, replace the filter. Eight hours of use is usually the limit for these filters. During continual use, you may need to change filters twice a day, or even more often in dusty or dirty conditions. Do not use a dust/mist mask when the pesticide will completely soak the mask and be held close to the skin and breathing passages. Replace

the mask if it gets soaked or loses its shape.

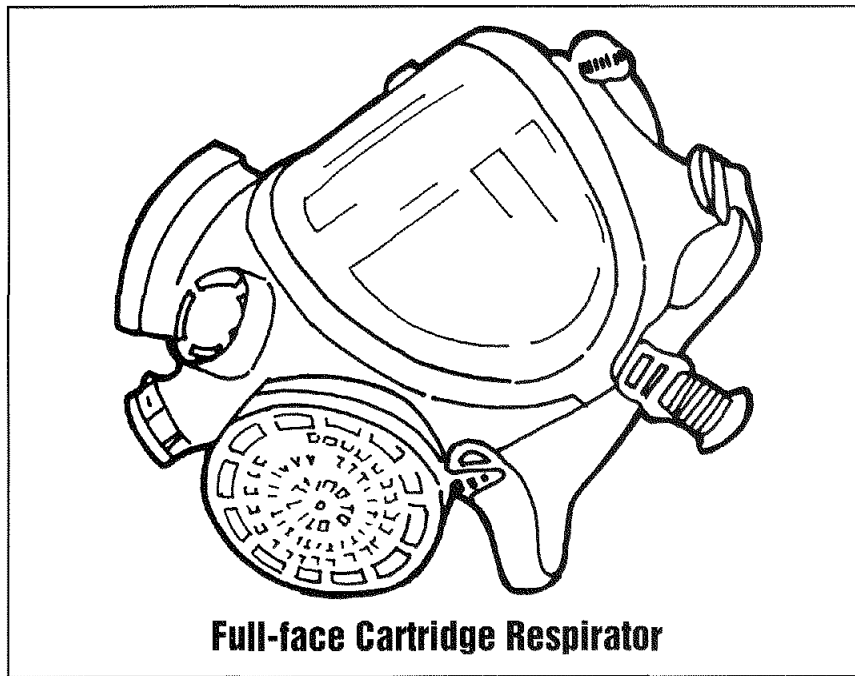
Selecting and using vapor-removing devices

Vapor-removing devices are rated by NIOSH for the types of gases and vapors they will remove. For pesticide handling tasks where vapor protection is needed, NIOSH requires that an organic-vapor-removing material and a pesticide prefilter be used.

Pesticide handlers must use either:

- a cartridge approved for organic vapor removal plus a prefilter approved for pesticides (NIOSH/MSHA approval number prefix for both is TC 23C), or
- a canister approved for pesticides (NIOSH/MSHA approval number prefix is 14G).

When you wear a vapor-removing respirator, remember



Full-face Cartridge Respirator

that vapor-removing materials gradually lose their ability to hold more gases and vapors. Their useful life can vary greatly depending on:

- the amount of particles in the air,
- the concentration of vapor being filtered,
- the amount of absorbent material they contain,
- the breathing rate of the wearer,
- the temperature and humidity, and
- the length of time they have been stored before use and between uses.

If you notice an odor, taste, irritation, or dizziness, that is a signal that you are no longer being protected. Some vapor-removing materials have a “service life indicator” to tell you when the material is nearly used up. The instructions on some other materials will tell you to replace them after a specific number of hours of use. If there are no instructions about replacement, change the cartridge or canister after about 8 hours of use.

Air-delivery systems

Air-purifying respirators draw air through the filters and vapor-removing materials in one of two ways. Ordinary air-purifying respirators depend on the wearer’s lung power to draw air through the purifying material with each breath. Powered air-purifying respirators (PAPR’s) assist the wearer by pulling the air through mechanically. Dust/mist masks and most cartridge and canister respirators are nonpowered air-purifying respirators.

If you have a respiratory problem, even a temporary problem such as a cold or allergy, you cannot wear nonpowered cartridge and canister respirators. You need strong lung pressure to draw the air through the purifiers into your lungs. Even persons with normal lung capacity cannot wear these respirators for long periods of time, because they tend to be hot, uncomfortable, and exhausting.

Before you use these respirators, have a medical examination to make sure that you do not have

a medical condition that would prevent you from using such devices. If you have trouble breathing while you are wearing your respirator even though you have used and cared for it correctly, see your physician to find out whether you have a health problem.

Powered air-purifying respirators use a blower to draw air to the user. PAPR’s should not be confused with air-supplying respirators, because they do not supply clean air. The air is cleaned by cartridges or canisters, as it is with other air-purifying respirators. These respirators are available as lightweight backpacks, or they may be mounted on or in application equipment where the power is supplied by the vehicle’s electrical systems.

Fitting air-purifying respirators

Respirators fit wearers in one of two ways. Most must seal tightly to the face; others are loose-fitting.

Face-sealing respirators must form a tight seal against your face to be effective. Otherwise, pesticides can leak in around the edges. People with beards cannot wear this style of respirator because a tight seal cannot be formed through the hair. These respirators must be fitted to each wearer and are not interchangeable among handlers.

Dust/mist masks are face-sealing respirators. They fit over your nose and mouth and have a clip that you press around the bridge of your nose to help form a seal. Most cartridge and canister respirators are also face-sealing respirators. **Full-face styles form and keep a tight seal better than half-face styles.**

Many pesticide handlers are not being adequately protected while

wearing face-sealing cartridge and canister respirators, because they often break the seal by pulling the respirator away from their face to get temporary relief from the heat, sweat, itching, or difficult breathing. Once the seal is broken in the exposure area, the respirator's ability to protect you is greatly reduced. Face-sealing cartridge and canister respirators are most useful for short-term tasks.

Your face-sealing respirator should be tested before you wear it in a situation where you may inhale pesticides. There are two types of tests: **fit tests** and **fit checks**. They ensure that the respirator is operating correctly and that you are being protected.

Have a **fit test** before you use your cartridge or canister respirator the first time, and then be retested periodically. Get the fit test through a program approved by NIOSH and OSHA, the agencies that regulate respirator fit testing. Public health departments, fire departments, and the Cooperative Extension Service may be able to tell you where to find an approved fit testing program.

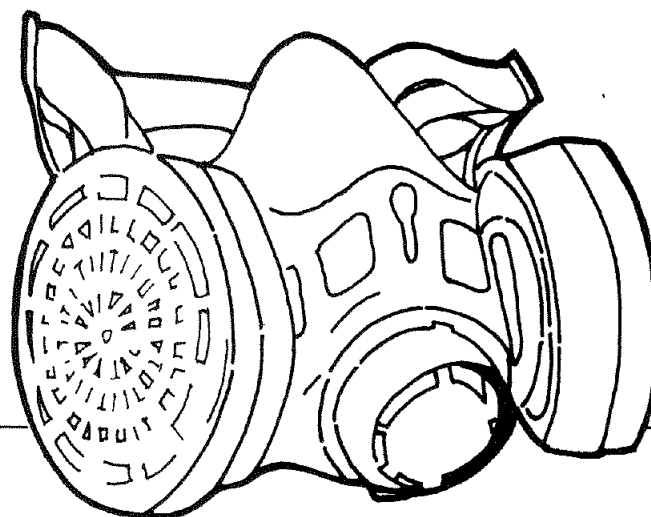
The two main types of fit tests are:

- testing whether the wearer can detect a test substance by irritation, odor, or taste, and
- measuring the actual amount of a test substance that gets inside the facepiece.

A **fit check** is an on-the-spot check that you should do to make sure the respirator is still working correctly. Do a fit check each time you wear a face-sealing respirator.

There are two methods for checking the seal of the facepiece against your face. To check by the first method:

- close off the inlet of the canister or cartridge (cover it with your palm, replace the caps, or squeeze



Half-face Cartridge Respirator

the breathing tube so that it does not allow air through),

- inhale gently so that the facepiece collapses slightly, and
- hold your breath for about 10 seconds.

If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator probably fits tightly enough and will work correctly. This method does not work for dust/mist masks.

The second method for testing the facepiece seal is to close the exhalation valve with your palm and exhale gently into the facepiece. If slight pressure builds up inside the facepiece without any evidence of outward leakage, the respirator probably fits tightly enough and will work correctly. This method is not appropriate for respirators with an exhalation





valve cover that would have to be removed first.

Another on-the-spot fit check is the use of a test substance to determine whether you can detect an odor, taste, or irritant. This fit check tests both the facepiece seal and whether a vapor-removing cartridge or canister is still working. Most test agents are gases or vapors and will not test a dust/mist-filtering mask or cartridge. Test agents are available from catalogs and dealers that sell a variety of respirators. If you cannot detect the test agent while you are wearing the respirator, it probably is working correctly.

Loose-fitting respirators are powered air-purifying respirators that constantly pump air through a cartridge or canister into a loose-fitting helmetlike or hoodlike head covering. The positive outward pressure caused by the steady outflow of air prevents contaminants from entering the headpiece. The purified air circulates over the user's head, face, and neck and provides some cooling.

Not all loose-fitting respirators move the air at the same rate. Most pesticide handling tasks require a minimum airflow rate of 4 cubic feet per minute. If you are doing physically strenuous work, use a respirator with an airflow rate of at least 6 cubic feet per minute.

Loose-fitting respirators do not have to form a seal on your face, so people with facial hair can use them safely. They do not require extra lung power and are not nearly as tiring or as hot as face-sealing respirators.

Loose-fitting respirators are much more expensive than face-sealing respirators. In some situations, however, they are the only safe option. For example, you might have to use one if you have facial hair that prevents an ad-

equate seal with the respirator facepiece.

In many situations, loose-fitting respirators are a good choice. For example, you might choose to use one:

- to avoid the need for fit tests and fit checks,
- if you will be exposed to pesticides for several hours at a time, or
- if you are working in situations where heat stress is a concern.

Personal Protective Equipment for Handling Fumigants

Fumigants are pesticides that are applied as a gas or that readily form a gas when they are applied. Their pesticidal action is in the gaseous form. Fumigants are very highly toxic to plants and animals, including humans. Use extreme caution and wear appropriate personal protective equipment whenever you handle fumigants. Personal protective equipment requirements for protection from fumigants are often very different from the requirements for other types of pesticides. Follow labeling directions for each fumigant exactly.

Inhaling even small amounts of some fumigant gases can be fatal or cause severe injury. You must wear the respirator listed on the fumigant labeling. Wear it during any handling activity, including removing tarps or other coverings, when exposure to the gas is likely.

Never work alone with fumigants, especially in enclosed areas. Arrange to be monitored at all times by another handler who has immediate access to an appropriate respirator, in case rescue is needed.

While handling a fumigant indoors or in any enclosed area,

use an air-supplying respirator. In enclosed areas such as greenhouses, ship holds, railcars, bins, vaults, and chambers there may not be enough oxygen for you to breathe. Cartridge and canister respirators will not protect you in these situations.

Some fumigants readily penetrate plastic, rubber, and leather. These fumigants may be trapped **inside** gloves, boots, or tight-fitting coveralls and cause severe skin irritation or lead to poisoning through skin absorption. The labeling on these fumigants will tell you the appropriate personal protective equipment to wear while handling them. Such labeling often will tell you to wear loose-fitting clothes and “breathable” footwear such as canvas or other fabric. The labeling may tell you not to wear any gloves or to wear cotton or other absorbent gloves.

Disposables and Reusables

Personal protective equipment items either should be disposable or should be easy to clean and sturdy enough for repeated use.

Disposables

Disposable personal protective equipment items are not designed to be cleaned and reused. Discard them when they become contaminated with pesticides.

Chemical-resistant gloves, footwear, and aprons that are labeled as disposable are designed to be worn only once and then thrown away. These items often are made of thin vinyl, latex, or polyethylene. These inexpensive disposables may be a good choice for brief pesticide handling activities that require flexibility and will not tear the thin plastic.

For example, you might use disposable gloves, shoe covers, and apron while pouring pesticides into a hopper or tank, cleaning or adjusting a nozzle, or making minor equipment adjustments.

Nonwoven (including coated nonwoven) coveralls and hoods usually are designed to be disposed of after use. Most are intended to be worn for only one workday’s exposure period. The instructions with some coated nonwoven suits and hoods may permit you to wear them more than once if each period of use is short and they do not get much pesticide on them. Be especially alert when reusing these items, and be ready to change them whenever there are signs that pesticides could be getting through the material or that the inside surface is contaminated.

Dust/mist masks, prefilters, canisters, filtering and vapor-removing cartridges, and a few cartridge respirators are disposables. They cannot be cleaned, and they should be replaced often.

Reusables

Some personal protective equipment that you buy may be designed to be cleaned and reused several times. However, do not make the mistake of reusing these items when they are no longer protecting you.

Rubber and plastic suits, gloves, boots, aprons, capes, and headgear often are designed to be cleaned and reused, but even these reusables should be replaced often. Wash them thoroughly between uses. Before you put them on, inspect reused items carefully for signs of wear or abrasion. If they show **any** sign of wear, throw them out. Even tiny holes or thin places can allow large quantities of pesticides to

move to the inside surface and transfer onto your skin. Check for rips and leaks during cleaning by using the rinse water to form a “balloon” or by holding the items up to the light.

Even if you can see no signs of wear, replace reusable chemical-resistant items regularly. The ability of a chemical-resistant material to resist the pesticide decreases each time the items are worn, and after repeated exposure to pesticides. Even though you do not see any changes in the material, the pesticide may be moving through the material and getting on your skin. The pesticide moves through the material in the same way air leaks through the surface of a balloon — slowly, but steadily.

A good rule of thumb is to throw out gloves that have been worn for about 5 to 7 days of work. Extra-heavy-duty gloves, such as those made of butyl or nitrile rubber, may last as long as 10 to 14 days. Because hand protection is the most important concern for pesticide handlers, make glove replacement a high priority. The cost of frequently replacing your gloves is a prudent investment. Footwear, aprons, headgear, and protective suits may last longer than gloves, because they generally receive less exposure to the pesticides and less abrasion from rough surfaces. However, they should be replaced regularly and at any sign of wear.

Fabric coveralls are designed to be cleaned after each day’s use and reused. However, absorbent materials such as cotton, polyester, cotton blends, denim, and canvas cannot be cleaned adequately after they are drenched or thoroughly contaminated with concentrated pesticides labeled with the signal word “DANGER” or “WARNING”. **Always** discard any such

clothing or footwear. They cannot be safely reused.

Most protective eyewear and respirator bodies, facepieces and helmets are designed to be cleaned and reused. These items may last many years if they are good quality and are maintained correctly.

Maintaining Personal Protective Equipment

When you finish an activity where you are handling pesticides or are exposed to them, remove your personal protective equipment right away. Wash the outside of your gloves with detergent and water **before** you remove them. Consider washing the outside of other chemical-resistant items before you remove them also. This helps you avoid contacting the contaminated part of the items while you are removing them and helps keep the inside surface uncontaminated. If any other clothes have pesticides on them, change them also. Determine whether the items should be disposed of or cleaned for reuse.

Place reusable items in a plastic bag or hamper away from your other personal clothes and away from the family laundry. Place disposables in a separate plastic bag or container. The pesticides remaining on your personal protective equipment, work clothing, and other work items could injure persons who touch them. Do not allow children or pets near them. Do not allow contaminated gloves, boots, respirators, or other equipment to be washed in streams, ponds, or other bodies of water.

Clean all reusable personal protective equipment items

between uses. Even if they were worn for only a brief period of exposure to pesticides during that day, wash them before you wear them again. Pesticide residues that remain on the personal protective equipment are likely to continue to move slowly through the personal protective equipment material, even chemical-resistant material. If you wear that personal protective equipment again, pesticide may already be on the inside next to your skin. Also, personal protective equipment that is worn several times between laundering may build up pesticide residues. The residues can reach a level that can harm you, even if you are handling pesticides that are not highly toxic.

Washing Personal Protective Equipment

Wash pesticide-contaminated items separately from uncontaminated clothing and laundry. Otherwise, the pesticide residues can be transferred onto the other clothing or laundry and can harm you or your family.

Alert the persons who do the washing

Be sure that the people who clean and maintain your personal protective equipment and other work clothes know that they can be harmed by touching the pesticide that remains on the contaminated items. Tell them that they should:

- wear gloves and an apron, especially if handling contaminated items regularly or handling items contaminated with highly toxic pesticides.
- work in a well-ventilated area, if possible, and avoid inhaling steam from the washer or dryer.

Washing procedure

Follow the manufacturer's instructions for cleaning chemical-resistant items. If the manufacturer instructs you to wash the item but gives no detailed instructions, or offers no cleaning instructions at all, follow the procedure below. Some chemical-resistant items that are not flat, such as gloves, footwear, and coveralls, must be washed twice — once to thoroughly clean the outside of the item and a second time after turning the item inside out. Some chemical-resistant items, such as heavy-duty boots and rigid hats or helmets, can be washed by hand using hot water and a heavy-duty liquid detergent. They should be dried and aired as directed below.

The best procedure for washing non-chemical-resistant items, such as cotton, cotton/polyester, denim, canvas, and other absorbent materials, and most chemical-resistant items is:

1. **Rinse** in a washing machine or by hand.

2. **Wash only a few items at a time** so there will be plenty of agitation and water for dilution.

3. **Wash in a washing machine**, using a heavy-duty liquid detergent and hot water for the wash cycle.

4. **Rinse twice** using two entire 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 after each batch of pesticide-contaminated items, and before any other laundry is washed.

Drying procedure

Hang the items to dry, if possible. It is best to let them hang

for at least 24 hours in an area with plenty of fresh air. Even after thorough washing, some items still may contain pesticides. When the items are exposed to clean air, remaining pesticide residues move to the surface and evaporate. You may wish to buy two or more sets of equipment at a time so you can leave one set airing in a clean place while you are using the other set. Do not hang items in enclosed living areas, because pesticides that remain in the items may evaporate and expose people or animals in the area.

Using a clothes dryer is acceptable for fabric items, if it is not possible to hang them to dry. However, over a period of time, the dryer may become contaminated with pesticide residues.

Maintaining Eyewear and Respirators

Wash goggles, face shields, shielded safety glasses, and respirator bodies and facepieces after each day of use. Use a detergent and hot water to wash them thoroughly. Sanitize them by soaking for at least 2 minutes in a mixture of 2 tablespoons of chlorine bleach in a gallon of hot water. Rinse thoroughly to remove the detergent and bleach. Dry thoroughly or hang them in a clean area to dry.

Pay particular attention to the headbands. Headbands made of absorbent materials should be replaced with chemical-resistant headbands. After each day of use, inspect all headbands for signs of wear or deterioration and replace as needed.

Store respirators and eyewear in an area where they are protected from dust, sunlight, extreme temperatures, excessive moisture, and pesticides or other chemicals.

A zip-closable sturdy plastic bag works well for storage.

Respirator maintenance is especially important. Inspect your respirator before each use. Repair or replace it whenever any part shows sign of wear or deterioration. Maintain an inventory of replacement parts for the respirators you own, and do not try to use makeshift substitutes or incompatible brands. If you keep a respirator for standby or emergency use, inspect it at least monthly and before use.

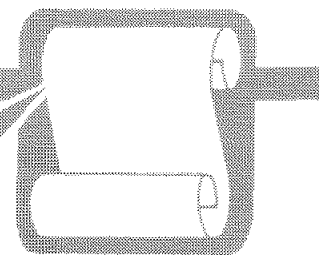
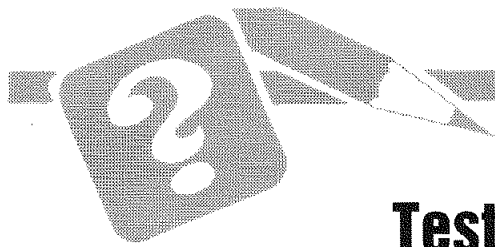
If you remove your respirator between handling activities:

- Wipe the respirator body and facepiece with a clean cloth.
- Replace caps, if available, over cartridges, canisters, and prefilters.
- Seal the entire respirator in a sturdy, airtight container, such as a zip-closable plastic bag. If you do not seal the respirator immediately after each use, the disposable parts will have to be replaced more often. Cartridges, canisters, prefilters, and filters will continue to collect impurities as long as they are exposed to the air.

At the end of any work day when you wore a reusable respirator:

- Remove the filter or prefilter. Most filters should be discarded. A few are designed to be washed and reused.
- Take off the cartridges or canisters. Discard them or, if still usable, replace their caps and seal them in an airtight container, such as a zip-closable plastic bag.
- Clean and store respirator as directed above.

Discard disposable respirators according to manufacturer's instructions. Do not try to clean them.



Test Your Knowledge

Q. What legal responsibility do you have for wearing the personal protective equipment that the pesticide labeling lists for your handling situation?

A. By law, you must wear at least the personal protective equipment listed on the labeling for the handling task you will be performing. You are allowed to wear additional or more protective personal protective equipment.

Q. Define the term “chemical resistant”.

A. Chemical resistant: Able to prevent movement of the pesticide through the material during the period of use.

Q. How can you tell when a material is not chemical-resistant to the pesticide you are handling?

A. The material may change color; become soft or spongy; swell or bubble up; dissolve or become like jelly; crack or get holes; become stiff or brittle.

Q. What factors determine how well your coverall will protect your body?

A. 1. A coverall is most protective if it fits loosely so there is a layer of air between it and the skin or inner clothing.
2. A coverall is most protective if it is worn over another layer of clothing, because each layer of clothing adds a protective layer of air as well as a layer of fabric.
3. Coveralls are most protective if they have tightly constructed

seams and snug, overlapping closures that do not gap or become unfastened readily.

Q. When should you wear chemical-resistant gloves? Why are gloves so important to a pesticide handler?

A. Wear chemical-resistant gloves any time you may get pesticides on your hands, except for some fumigants whose labeling may direct you not wear gloves. The hands are by far the most likely route of exposure for a pesticide handler.

Q. If you need to remove your gloves during the handling activity, what steps should you take to remove them and put them back on?

A. 1. Wash gloves thoroughly before taking them off.
2. Wash hands thoroughly and dry them before putting the gloves on again.

Q. Why do pesticides sometimes get on your skin even when you are wearing gloves and protective footwear?

A. The items may not be chemical-resistant to the pesticide being handled; they may not be worn correctly; they may not be in good condition; or they may not have been cleaned correctly or replaced soon enough.

Q. When should you wear protective headgear? What type of headgear should you use?

A. Whenever you may be exposed to pesticides from above, wear protective headgear to help keep pesticides off your head, neck, eyes, mouth, and face. Wear a chemical-resistant hood or wide-brimmed hat. Plastic “safari” hats with plastic sweatbands are a good choice.

Q. When the pesticide labeling calls for “protective eyewear,” what should you wear?

A. Wear goggles, a face shield, or safety glasses with brow and side shields.

Q. What are the differences among dust/mist-filtering respirators, vapor-removing respirators, and air-supplying respirators?

A. Dust/mist-filtering respirators are masks or cartridges that filter dust, mists, and particles out of the air around you. Vapor-removing respirators use a cartridge or canister to remove pesticide gases and vapors from the air around you. Air-supplying respirators provide you with clean air either from an air tank or from a location where the air is not contaminated with pesticides.

Q. What special hazards do fumigants pose for pesticide handlers?

A. Fumigants pose a serious inhalation hazard to pesticide handlers. Some fumigants also can cause severe skin burns if they are trapped next to the skin by tight clothing or chemical-resistant personal protective equipment.

Q. If the chemical-resistant gloves you have selected are reusable, how often should you routinely replace them? Under what conditions should you replace chemical-resistant items immediately?

A. Throw out most reusable gloves that have been worn for about 5 to 7 days of work. Extra-heavy-duty gloves, such as those made of butyl or nitrile rubber, may last as long as 10 to 14 days. Replace chemical-resistant items immediately if they show any sign of wear or have holes, tears, or leaks.

Q. What should you do with a coverall that has highly toxic pesticide concentrate spilled on it?

A. Dispose of the coverall. It cannot be adequately cleaned.

Q. What should you tell the people who will be laundering your clothing about how to protect themselves from pesticides?

A. Tell them to:

1. Wear chemical-resistant gloves and apron, especially if handling contaminated items regularly or handling items contaminated with highly toxic pesticides.
2. Work in a well-ventilated area and do not inhale steam from the washer and dryer.

Q. What should you do with your respirator between handling tasks?

A. Seal the respirator in a clean, airtight container, such as a sturdy zip-closable plastic bag. If possible, put caps over the opening on the cartridges or canisters.

Q. What should you do when you are finished using your respirator for the day?

- A.**
1. Discard any masks, filters, or respirators that cannot be reused.
 2. Take off the prefilters and cartridges or canisters. Discard them or, if still usable, replace their caps and seal them in an airtight container, such as a zip-closable plastic bag.
 3. Wash the respirator body, facepiece, and any reusable filters. Soak them for at least 2 minutes in

a mixture of 2 tablespoons of chlorine bleach in a gallon of hot water. Rinse thoroughly. Dry thoroughly or hang them in a clean area to dry.

4. Store the respirator and any reusable cartridges, canisters, filters, and prefilters in an airtight container in an area where they are protected from dust, sunlight, extreme temperatures, excessive moisture, and pesticides or other chemicals.

Q. How will you know when to replace dust/mist masks, prefilters, and dust/mist-filtering and vapor-removing canisters and cartridges?

- A.**
1. Change dust/mist masks, cartridges, and prefilters immediately if you have trouble breathing. They usually need to be changed at least every 8 hours.
 2. Change vapor-removing canisters or cartridges immediately if you smell, taste, or feel irritation from pesticide vapors. Change them whenever any "service life indicator" tells you that you should, or after the time limit set by the manufacturer. Otherwise, replace them after about 8 hours of use.