Chapter 8
Personal Protective Equipment

This Chapter provides an overview of personal protective equipment (PPE) available to keep applicators and workers safe while working with pesticides. It describes how to select, wear, and wash protective clothing; and how to choose, wear, fit, and maintain respirators. This Chapter outlines personal protection strategies related to Universal Precautions discussed on Chapter 7, Safe Handling to reduce pesticide exposure:

- Read labels and follow directions.
- Maintain application equipment (including protective equipment).
- Use personal protective equipment and clothing.
- Prepare for emergencies—have a plan and clean-up supplies.

This pest control applicator wears PPE while working with insecticides.
Photographer: M. J. Weaver
Institution: Virginia Tech
Source: pesticides.org (Virginia Tech)
Section 1: Personal Protection

This Section describes the types of protective clothing that can reduce and prevent pesticide exposure and injuries.

**Learning Objectives:**

1. Describe at least one method to protect each of the following during pesticide application: skin, eyes, lungs, mouth.
2. Identify three factors that affect a material’s chemical resistance.
3. Outline steps to machine wash reusable PPE.

**Terms to Know:**

- Breakthrough time
- Chemical-resistant
- Personal protective equipment (PPE)
- Waterproof
- Water-resistant

Always wear chemical-resistant gloves when pouring and mixing pesticides. Photo: *National Pesticide Applicator Certification Core Manual, NASDARF*
Clothing and Personal Protective Equipment
(Protecting the Skin and Eyes)\textsuperscript{1}

Applicators who properly wear regular work clothing and label-required personal protective equipment (PPE) when applying pesticides reduce the chance of exposure—and the risk of pesticide poisoning.

Manufacturers of pesticides covered by the Worker Protection Standards (farms, forests, nurseries, and greenhouses; see Chapter 2, Pesticide Laws) must list PPE requirements in the “Agricultural Use Box” on the pesticide label. If specific items, such as goggles or a full protective suit, are not listed on the label, use signal words, precautionary statements, and product formulation as guidelines for the type of PPE that will be effective and protective. Precautionary statements, such as “Harmful or fatal if inhaled,” indicate the need for more than usual protection; a respirator should be worn if there is a chance to breathe in the pesticide.

PPE requirements on the label are affected by the product formulation. For example, emulsifiable concentrates (oil-based liquids) are generally easily absorbed through the skin, requiring increased skin protection, while products that are dusts and granules are easily inhaled and may require respirators.

Find out more about PPE for use of pesticides and many other chemicals from the Material Safety Data Sheets (MSDS) available from the retailer or manufacturer. The MSDS for a product will include sections on health hazards and specific PPE recommendations.

Protective Clothing

The clothing applicators buy and how they wear the clothing determines the level of protection from pesticide exposure, as well as comfort during the work day. Regular work clothing offers some protection. However, specialized liquid-proof, chemical-resistant clothing will provide much greater protection. (Full discussion of chemical-resistant PPE is included later in this Section.) When the greatest level of protection is needed, it can be difficult to combine safety considerations with comfort.

At minimum, when handling or applying any pesticide, wear:

\begin{itemize}
  \item Work clothing with long pants and long sleeves;
  \item Unlined, liquid-proof, chemical-resistant gloves;
  \item Shoes and socks
\end{itemize}

\textsuperscript{1} This information has been adapted from HE-FO-3877 1990—Buying and Wearing Protective Clothing for Applying Pesticides, by Wanda Olson, Sherri Gahring, and Dean Herzfeld, University of Minnesota Extension.
Additional PPE may be needed based on label directions or how a pesticide is handled or used:

- If there is a risk of pesticide coming into contact with feet, wear unlined neoprene or rubber boots.
- If there is a risk of pesticide coming into contact with the head, wear a wide-brimmed liquid-proof hat.
- If there is any chance of being sprayed, wear liquid-proof, chemical-resistant coveralls. To protect the head wear a hooded coverall or wide-brimmed liquid-proof hat.
- If mixing, loading, or handling undiluted pesticides, wear a chemical-resistant apron over cloth coveralls.
- If there is a risk of pesticide coming in contact with the eyes, wear eye protection (goggles, not safety glasses) or face shields.
- If there is risk of breathing in pesticide vapors, spray particles or dust wear a respirator designed for pesticides (See Section 2 in this Chapter).

Regular Work Clothes

The protection offered by regular work clothing depends upon the fabric and the number of layers of clothing worn. Cover as much of the body’s surface as possible with work clothing. Wear long pants and sleeves. Button or fasten shirts at the neck and wrists. Wear shoes and socks.

Heavyweight and tightly woven fabrics of cotton or polyester/cotton blends provide greater protection than 100 percent synthetic fabrics of equal weight. However, studies have shown that polypropylene knit’s wicking properties make it more effective than cotton knit as an under-layer in preventing pesticide penetration. Layering clothing also helps prevent pesticides from reaching the skin. When handling pesticides, don’t wear work clothes for more than one day without laundering.

Gloves

Hands should always be protected whenever handling any kind of undiluted or diluted pesticides; unopened or empty pesticide containers; or contaminated equipment, clothing, and other materials. Wear unlined, liquid-proof and chemically resistant clean gloves at least 12 inches long. Always check the label for glove requirements. Label requirements for gloves may vary among pesticide products as there is no one glove material that provides high protection for all pesticides. Do not wear cotton gloves because they do not provide protection against pesticides or leather gloves as they cannot be properly cleaned.
In most situations, sleeves should be worn outside the glove to prevent pesticides from running down inside the glove. When working with arms elevated, wear gloves over the sleeves that have a cuff to catch drips. Duct tape or elastic bands can be used to seal the gloves at the sleeve and are especially useful in activities when arms are both raised and lowered.

Rinse the gloves at least every four hours of use. Wash the outside of the gloves before taking them off to avoid pesticides getting on hands; then wash the inside of the gloves. Immediately after washing the gloves, wash your hands and forearms with soap and water.

**Aprons, Coveralls, and Other Specialized Protective Clothing**

Chemical-resistant clothing should be worn during mixing, loading, or other handling of undiluted pesticides, or when there is a chance of contacting sprays or dusts during application. This can be a butyl rubber, neoprene, or other chemical-resistant apron over a work coverall, a PVC rain suit, or one of the newer chemical-resistant coveralls. Aprons with sleeves—but with the back open—may be a good choice if heat stress is a concern, and shoulder and arm protection is needed. The protection offered by chemical-resistant clothing also depends upon the fabric and design features, such as flaps over zippers, elastic at the wrist and ankle, and bound or sealed seams.

As with gloves, check the label for any product-specific coverall requirements. Coveralls come in a wide range of new materials that vary in the protection they provide for different pesticides. Manufacturers and retailers are providing more information to help you match the coverall to the pesticide you use.

**Footwear**

Feet and shoes also need protection from pesticide spills. Pant legs should go over the boot. Unlined neoprene or butyl rubber boots, or Tyvek® shoe or boot covers, should be worn, unless the label has different requirements. It is also important to wear clean socks daily. Leather and canvas shoes cannot be cleaned properly and should never be worn without rubber or neoprene boots. Always clean the outside of the boot before removing it.

**Eye Protection**

Wear safety goggles (not safety glasses) or a face shield to protect the eyes from splashes and dust particles. Face shields can be purchased to fit on a hard hat or can be purchased separately. Goggles can be worn with a negative-pressure respirator or a dust mask. For best protection, goggles should have a snug fit around the nose and temple area. When both eye and lung protection are needed, a full face respirator provides greater protection than wearing both goggles and half face respirator (covering nose and mouth only).
Head and Neck Protection

A chemical-resistant hood or wide-brimmed hat will help keep pesticides off of the neck, eyes, mouth, and face. With airblast spraying, covering the head and neck is especially critical. Many disposable coveralls and raincoats/suits have hoods attached. Hard hats should not have cloth or leather sweatbands. Company or baseball hats made with fabric mesh or designed with open areas do not protect the wearer from exposure.

Chemical-resistant PPE

Regular work clothing provides protection for some types of pesticide handling, but some pesticide labels specify the use of chemical-resistant PPE—personal protective equipment that the pesticide cannot pass through during the time period it takes to complete the task. The labels of a few pesticides, such as some fumigants, prohibit the use of certain chemical-resistant PPE because of interactions. As always, the label provides the best direction on appropriate PPE.

The term chemical-resistant means that no measurable movement of the pesticide through the material occurs during the period of use. Some PPE is water-resistant only. Water resistant refers to PPE that keeps a small amount of fine spray particles or small liquid splashes from penetrating the clothing and reaching the skin. Waterproof (liquid-proof) material keeps water-soluble materials out, but it may not necessarily keep out oil- or solvent-based products. Waterproof materials include items made of plastic or rubber.

Three factors affect a material’s chemical resistance: the chemical breakthrough time, condition of the chemical-resistant material, and the type of chemical resistance:

- **Chemical breakthrough time.** The length of time it takes a pesticide to pass through a material to reach the skin is called the breakthrough time. Some materials will keep the pesticide out for a long time. Others will allow the same pesticide to reach the skin quickly. Disposable gloves, shoe covers, aprons, and other disposable PPE may provide enough protection for tasks done in a few minutes. Longer jobs usually require items made of a more resistant material.

- **Damaged chemical-resistant material.** A chemical-resistant material will not continue to be protective if it is damaged. For tasks that involve handling sharp objects or walking through rough terrain, a sturdy material would be necessary to resist punctures or tears.

- **Type of chemical resistance.** Different materials provide different types of protection to different pesticides. No single material can protect against all pesticide products. The chemical resistance of a material also depends on whether the pesticide is liquid or dry, and what diluents or solvents are mixed with it.
Look for PPE items with labels stating that the materials have been tested using ASTM (American Society for Testing Materials) test methods for chemical resistance, such as test method F739-91. Gloves and footwear made of PVC or rubber (butyl, nitrile, neoprene, or natural rubber) must be at least 14 mils thick. Pesticides can leak through stitching holes and gaps in seams. For chemical resistance, PPE items should have sealed seams.

Wear gloves and other PPE rated “highly-chemically resistant” for the product you are using to provide the longest breakthrough time and greatest safety. This is especially important when handling, mixing, and loading the undulated pesticide. Help prevent pesticides from getting through chemically-resistant items by regularly washing off pesticides that are splashed or spilled and at least every four hours.

Commonly used materials for PPE items include:

- **Tyvek**, a non-woven olefin fabric is used in aprons and coveralls that should be worn over regular work clothing. Although fairly strong, Tyvek can be punctured. It is flammable and should not be used near heat, flame, or sparks. Tyvek is intended to be disposable; its protection after washing has not been tested. Tyvek comes uncoated or as a laminate. The effectiveness of uncoated Tyvek is similar to soil-repellent-finished cotton or cotton/polyester blends. Uncoated Tyvek is suitable for handling undiluted or more toxic pesticides. The different types of laminates of Tyvek vary in their protective value for handling undiluted or more toxic pesticides.

- **Barrier-laminate materials** are resistant to most pesticides and a good choice for many situations. Barrier-laminate (Silver shield /4-H) gloves may be uncomfortable and clumsy to wear for some kinds of tasks. Try wearing fitted rubber gloves over barrier-laminate gloves for comfort, protection, and dexterity.

- **Plastic or rubber material** is resistant to dry pesticides and to water-based pesticides (those that use 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.

- **Nitrile** is a synthetic rubber material and contains no latex. It provides high chemical resistant to many—but not all—pesticide products. It is puncture and abrasion resistant and easier to put on and take off than some other glove materials. Nitrile gloves are
Choosing the Right Chemical-resistant PPE for the Job

If the pesticide label requires the use of chemical-resistant PPE, but does not state which materials are resistant to the product, select sturdy barrier-laminate, butyl, or nitrile materials. Then watch for signs that the material is not resistant to the chemical you are using. For example, the material may change color; become soft or spongy; swell or bubble; dissolve or become jellylike; crack or get holes; or become stiff or brittle. If these changes occur, discard the item and choose another material.

When choosing an appropriate chemical-resistant PPE material, also consider whether it allows you enough movement and flexibility and will withstand the physical demands of the task. The PPE will protect you for the approximate time listed on the chart if:

- No punctures, tears, or abrasions allow pesticide to penetrate the material; and
- Pesticide does not get inside the PPE through careless practices, such as allowing pesticide to run into gloves or footwear, or putting the PPE on already contaminated hands or feet.

Handling Contaminated Clothing and PPE

When you finish an activity in which you are handling pesticides or are exposed to them, remove your PPE right away. Start by washing the outside of your gloves with detergent and water before removing the rest of your PPE. Wash the outside of other chemical-resistant items before you remove your gloves. This practice helps you avoid contacting the contaminated part of the items while you are removing them, thus keeping the inside surface from becoming contaminated. Applicators should empty granular pesticides from clothing cuffs and pockets before rinsing and removing gloves at the end of application. If any other clothes have pesticides on them, change them also. Determine whether contaminated items should be disposed of or cleaned for reuse.

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Chapter 8. Personal Protective Equipment
Hand Washing Reusable PPE

Wear protective gloves whenever handling or cleaning contaminated clothing or personal protective equipment. If you cannot wash reusable PPE right away, place into clear, sealed plastic bags until they are washed, whether they must be hand washed or can be placed in a washing machine. Some chemical-resistant items that are not flat, such as gloves, footwear, hats, and coveralls, must be washed twice—one to 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.

Wash goggles, face shields, shielded safety glasses, and washable parts of respirators after each day of use. Use a detergent and hot water to wash them thoroughly. Remove any contaminants (such as residual pesticides) under running water with a soft brush or cloth and then sanitize. Rinse thoroughly and dry the items or hang them in a clean area to dry.

Pay particular attention to elastic bands on goggles, hats, respirators, and other PPE. Replace elastic bands made of absorbent materials with chemical-resistant headbands. After each day of use, inspect headbands for signs of wear or deterioration, and replace them as needed.

Machine Washing Reusable PPE

Always wash pesticide-contaminated items separately from the family laundry. Otherwise, pesticide residues may be transferred to the other laundry and may harm you or your family. Keep the clothing separate from other laundry until it has been washed. Be sure that the people who clean and maintain your PPE and other work clothes know they can be contaminated by touching these items. Instruct them to wear gloves and an apron and work in a well-ventilated area, if possible, and avoid inhaling steam from the washer or dryer.

Pesticides can cling to and be absorbed by protective clothing. To handle and wash clothing as safely as possible, know when the clothing was contaminated and which pesticides and formulations have been used. Wear waterproof chemical-resistant gloves when handling clothing or reusable PPE contaminated with pesticides.

In general, the more water-soluble the pesticide, the easier it is to remove from clothing. Clothing soiled with highly toxic and concentrated pesticides must be handled carefully. Undiluted emulsifiable concentrates and other oil-based pesticides are very difficult to remove from fabrics; such clothing should be discarded.

Clothing worn while handling or applying pesticides should be washed every day. Use the following procedure for washing non-chemical-resistant items such as cotton, cotton/polyester, denim, canvas, and other absorbent
materials, and for most chemical-resistant items. Most pesticides can be removed from clothing, if you follow these guidelines:

- Wash items separately from family laundry.
- Pre-rinse or pre-soak the clothing in detergent. A pre-wash laundry product can be effective in removing oil-based pesticides.
- Wash small loads, using the highest water level. If you have a washer that uses less water, such as a front-loading model, run the clothing through a second cycle.
- Use the longest wash time available on your machine.
- Use hot water for washing (146°F). If you have turned down the thermostat on your hot water heater to conserve energy, increase it temporarily to wash pesticide-contaminated clothing.
- Use a heavy-duty liquid detergent. Use 1½ times the recommended amount of detergent for heavily soiled clothes or clothing with an applied soil-repellent finish.
- Wash items soiled with hard-to-remove pesticides, such as diluted oil-based pesticides, two or three times.
- Clean the washing machine after laundering pesticide-contaminated clothing by running the machine empty for a complete cycle with detergent.

Hang the washed items to dry outside, if possible as sunlight helps breakdown many pesticides. 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 residues. When the items are exposed to clean air and sunlight, most residues move to the surface of the fabric, evaporate, or break down. You may wish to buy two or more sets of PPE, so you can leave one set airing while wearing the other set.

Do not hang items in enclosed living areas—pesticide residues that remain in the items may evaporate and expose people or animals in the area. If it is not possible to hang fabric items to dry, a clothes dryer may be used.

Laundry Aids

Using chlorine bleach in a regular wash cycle is not effective in removing pesticide residue from fabric. Starch finishes increase protection of regular work clothing. A stiff fabric starch finish traps the pesticide, which is washed away with the starch. Apply starch each time the garment is washed, using either spray or liquid products. If you are applying pesticides at ground level, make sure to starch pant legs from the knees down.

Chapter 8. Personal Protective Equipment
Section 2: Respiratory Devices

The respiratory system is one of the most vital and easily injured parts of the human body. This Section describes how pesticide applicators can protect themselves from breathing in vapor, droplets, or particles that arise from handling and applying pesticides. It provides an overview of the types of respiratory devices, how to choose the right respiratory protection, how to ensure that devices fit well and prevent exposure, and how to maintain and store respiratory equipment. As an American Lung Association ad claimed during a recent respiratory health campaign, “If you can’t breathe, nothing else matters.” Applicators knowledgeable about respiratory devices are certain to breathe easier.

Learning Objectives:

1. List the eight elements of the Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard for all employees who use respirators.
2. Describe why a TC number is important when selecting a respirator for a specific task.
3. Identify situations in which an air-supplying respirator is the only choice to protect a pesticide applicator.
4. Describe how to perform a fit test and a fit check.

Terms to Know:

- Air-purifying respirators
- Air-supplying respirators
- Fit check
- Fit test
- Powered Air-Purifying Respirator
- Self-contained Breathing Apparatus (SCBA)
- TC number

Respirators can help applicators breathe easier. Photo: iStock
Respiratory Devices (Protecting the Lungs)

Your respiratory system—the body system that lets you breathe—is one of the most vital and easily injured parts of your body. Inhaling a pesticide can cause many different health problems. What happens to your respiratory system and the rest of your body when you are applying pesticides depends on several factors. These factors include the type and toxicity of the pesticide, the type and size of the particles inhaled, and the amount inhaled.

Harmful effects from inhaling a pesticide can include:

- Damage, irritation, or obstruction within the mouth, throat, and lungs;
- Acute poisoning, if enough of a pesticide is transported into the bloodstream through the lungs; and
- Long-term health effects resulting from pesticides being brought into the body through the lungs.

Wear a good-quality respirator to protect yourself when there is a risk of inhaling pesticides. A properly fitted and maintained respirator will help protect you from the damaging effects of airborne pesticides. Minnesota has adopted the federal Occupational Health and Safety Administration (OSHA) Respiratory Protection Standard (CFR 1910.134) into state law. Part of the standard is an employee respiratory protection program. The following eight elements are required for all employees who use respirators, including pesticide handlers:

1. Procedures to select the proper respirator for your worksite or job.
2. Medical evaluation to determine ability to use a respirator.
3. Fit testing for tight-fitting respirators.
4. Proper use of respirators.
5. Cleaning procedures and schedules.
6. Care and maintenance of respirators.
7. Procedures to ensure adequate air quality (including supplied-air respirators).
8. Training on hazard recognition, dangers, and proper use and care of respirators.
9. Program evaluation on respirator fit, selection, use, and maintenance.

For more information about the Standard, see MN OSHA, MN Dept. of Labor and Industry (web: www.dli.mn.gov/MnOsha.asp).

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3 Graphics in this Section are adapted from National Safety Council's Pocket Guide For Respiratory Protection and U.S. Department of Agriculture/EPA Bulletin #825—Applying Pesticides Correctly — Respiratory Protection
How a Respirator Works
A respirator is a protective device used to keep pesticides out of the lungs. Respirators work in one of two ways: they either purify the air or supply clean air.

**Air-purifying respirators** filter the air you breathe. Some air purifying respirators are simply have filtering masks, while others have filter cartridges that can be changed or replaced. **Air-supplying respirators** provide you with clean fresh air from outside, either through a pressurized air tank (often carried on the user’s back) or through an air hose connected to the respirator.

There are many variations of respirator design within these two categories (air-supplying and air-purifying). To be fully effective, the respirator should be used only in the way the manufacturer recommends.

When Should a Respirator Be Worn?
Wear a respiratory protective device if there is any risk of inhaling pesticide vapors or fumes, especially if the label states “Do not breathe vapors or spray mist” or “Harmful or fatal if inhaled.” The risk of inhaling pesticides is greatest:

- If you are exposed to pesticides for long periods.
- If you dilute or mix concentrates.
- If you use sprays or dusts.
- If you work in an enclosed area, such as a greenhouse, building, or other structure.
- If you work with airblast or similar types of fine mist sprayers.

The label will specify when a respirator must be used and what type should be used. The label also will specify a respirator that is Mine Safety and Health Administration (MSHA)/National Institute of Occupational Safety and Health (NIOSH) approved. Some labels provide more specific information such as:

> “Full-face respirator approved for pesticides (MSHA/NIOSH approval number prefix TC-23C) or canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G).”

Even if the label does not require a respirator, if there is a potential for inhaling pesticides, wearing a good, properly fitted respirator can help minimize your overall exposure.

Respirators can be obtained from farm supply stores and safety equipment companies stores and online. Make sure the respirator has a NIOSH/OSHA seal of approval. This indicates that the item has been tested and certified to provide protection against the listed contaminants.
Choosing the Right Type of Respiratory Device

There are several types of respiratory devices. Each type is useful for certain activities. There is no all-purpose device. Make sure you use the correct one for the chemical, formulation, or task at hand. Always read and follow instructions on the product label.

The label will specify the type of respirator that provides protection for a given pesticide and task. In the previous example, the respirator type has a “TC” (Tested and Certified) number. This TC number shows that a respirator has been tested and certified by MSHA/NIOSH. The number following the TC designation specifies the type of respirator (examples are described below). Only approved respirators carrying the MSHA/NIOSH certification should be used. Non-certified respirators available in hardware or department stores will not provide adequate protection for pesticide application.

Dust/Mist Respirators

A dust/mist respirator (TC-84A) is designed to screen out solid dust and liquid mist particles. An approved dust/mist respirator will have two straps to ensure a tight fit and adequate seal. Some models also have an exhale valve and a “nose clip” to help prevent leakage and improve wearer comfort.

Cartridge Respirators

A TC-23C respirator is equipped with cartridges. These cartridges contain activated charcoal or other material that selectively “grabs onto” the organic vapors found in many pesticides, while allowing a supply of clean, fresh air to pass through unimpeded. A NIOSH-approved cartridge respirator will have a black label or band on the cartridge that signifies that it is protective against most pesticides.

Most cartridge-style respirators can be fitted with dust/mist pre-filters that snap onto the top of the cartridge for added protection against dusts and mists. You can also buy the TC-23C as a “full-face” respirator that combines the respiratory protection provided by the cartridges with eye and face protection.

Full-face Chemical Cartridge or Canister Respirator

This is a respirator that also protects eyes and face and may have cartridges attached directly to the face mask or a canister connected by a hose.

Adapted from University of Illinois Private Applicator manual
It may be used when you are exposed to pesticides for a short time, such as when diluting or mixing pesticide concentrates or spraying or dusting animals. Use it with an ammonia cartridge or canister when transferring anhydrous ammonia to a nurse tank or from nurse tank to applicator.

**Devices for Fumigants or Other Toxic Gases**

If you are using fumigants, are exposed to toxic gases, or are working in an area where there is a lack of oxygen you must use an air-supplying respirator. Three of the most common types of air-supplying respirators are described below.

**Powered Air Purifying Respirator (PAPR)**

Other types of respirators are sometimes used when mixing, handling, or applying pesticides. For example, people who are not comfortable with a standard dust/mist respirator mask may choose to wear a powered air-purifying respirator (PAPR). This is the only type of respirator that provides adequate protection for people with facial hair.

PAPR units use a motorized blower to bring cool air in through a filter that removes dust or mist particles. Generally, certified PAPR respirators carry the TC-21C designation. PAPR respirators are not a replacement for an air-supplying respirator (such as a SCBA or other positive pressure breathing system).

**Self-contained Breathing Apparatus (SCBA)**

Self-contained breathing apparatus (SCBA) respirators (TC-13F) supply the user with clean, fresh oxygen. This differs significantly from the respiratory devices previously described (dust masks, cartridge respirators, and gas masks). Air is supplied through a tube and face piece, which is fed by an air tank on the user’s back. A SCBA is the only type of respirator that can be used in conditions where oxygen is low (below 19.5 percent) or where contaminant levels are “Immediately dangerous to life and health.” Examples include silos, manure pits, or areas where grain has been fumigated and levels of phosphine gas exceed 15 parts per million (ppm).

**Positive-pressure Air System with Emergency Escape Cylinder**

Another type of respirator, sometimes used in greenhouse operations, is the continuous flow, supplied air respirator (TC-19C). It uses a full face piece, similar to a SCBA, but has a remotely located pump to supply clean air through a hose to the user. With a positive-pressure system, it is very important to locate the air pump in an uncontaminated area, since the pump does not filter the air coming through the hose to users.
How to Ensure a Proper Respirator Fit

Select a respirator that fits properly. Most pesticide respirators come in different sizes to fit different face sizes and shapes. Other than PAPR respirators, beards, sideburns, and mustaches make it impossible to wear a respirator properly or get an adequate seal. Glasses can cause problems, too (especially with full face respirators). There are two ways to determine whether your respirator fits properly: a fit check and a fit test.

Fit Check

A simple “fit check” should be done whenever you put on the respirator. It only takes a few seconds to perform a two-part fit check.

- **Positive pressure check** – Cover the exhalation valve with your hand and exhale gently into the facepiece. If a slight positive pressure is built up inside the facepiece without any evidence of leakage, the fit is satisfactory. This test method is the most widely used to check proper fit in the field.

- **Negative pressure check** – Close off the air inlet valves (cover the cartridges with your hands), inhale gently to collapse the facepiece slightly, and hold your breath for 10 seconds. If the facepiece remains slightly collapsed and no leakage is detected, the respirator fits properly. It may be difficult to get a good seal when trying to cover the inlet valves (cartridges).

To check for fit, cover the exhalation valve of the respirator tightly with the palm of your hand. Blow out gently for several seconds. The respirator face piece should bulge out slightly, and you should not feel air leakage around the seal. If you do feel air leaking, readjust the straps, and make sure that the seal touches your face all the way around. If you simply cannot get a good fit, try a different size or style respirator.

Fit Test

OSHA Respiratory Protection Standard CFR 1910.134 requires most industries to have a formal respiratory protection program under OSHA regulation. In most fit tests, the user wears the respirator and is exposed to a harmless substance that has a distinctive odor or flavor in an enclosed area. If the wearer can smell or taste the substance, the respirator does not fit properly. The references at the end of this chapter can provide additional information on fit-testing procedures.

Note: Since a respirator protects only your breathing passages and lungs, you still need to wear protective clothing on other parts of your body.

Positive pressure fit check (left).
Photographer: Dwight Seal
Source: pesticidepics.org (Virginia Tech)

Negative pressure fit check (right).
Photographer: Tom Bowman
Source: pesticides.org (Virginia Tech)
How to Care for and Maintain a Respirator

Proper care and maintenance of respirators will help them work effectively. Cleaning respirators and replacing cartridges and canisters as needed reduces the possibility of exposure to pesticides and other substances that can accumulate on respirator parts. The respirator should be disassembled and cleaned either when the face piece appears dirty or on a routine daily basis. Instructions for cleaning usually come with your respirator. Generally, you should remove the cartridge and wash the face piece with warm soapy water, then rinse and dry it. Always store your respirator in a clean, dry location out of sunlight.

Replace cartridges or canisters as directed by the respirator’s instructions. Applicator can write the date first used on the cartridges. This can help them know when to replace the cartridge.

Respirators should be stored in a clean, dry location, preferably in a plastic bag. Sunlight is also detrimental to respirator performance and can cause rubber or silicone facepieces to crack and weather prematurely.

Certain illnesses and diseases can be spread through contact with respirator parts, especially if they have not been properly cleaned. If you must share a respirator, properly clean and sanitize the respirator after every use.

References on Respiratory Protection

Pesticide Applicator Update: How to Interpret the New NIOSH Approval Codes for Respirators, 1999, T. W. Dean, Publication SM-64, University of Florida Cooperative Extension Service, Pesticide Information Office