Respiratory Protection

Most applicators do not feel that inhalation of pesticides is a serious hazard, but it is next in importance to skin contact as a cause of pesticide accidents. Because the lungs have such a large (about 40 times larger than the skin) and highly absorptive surface area, even small amounts of pesticide are hazardous because they are almost completely absorbed. The respiratory system does have defenses, but they are not 100 percent effective against toxic gases, vapors or particulates. Toxic vapors, poisonous gases, dusts and mists that are extremely small in particle size (10 microns or smaller) are a particular hazard as they are easily inhaled. Application of insecticide sprays, dusts, mists or fogs in attics, crawl spaces, warehouses or other similar enclosed situations can expose the lungs to small particle sizes and vapors and, thus, require the use of some form of respiratory protection. Respirators should be worn as indicated on the pesticide label and whenever the application situation calls for it.

Respiratory protective devices are of two basic types: (1) air-purifying or (2) air-supplying. The pest control operator most commonly uses air-purifying respirators when protective devices are needed. However, some individuals have difficulty breathing with air-purifying respirators. These individuals should use a respirator which supplies air from its own supply or from outside.

Air-Purifying Respirators

Basically respiratory hazards can be broken down into two classes: particulates (dusts and droplets) and vapors/gases. Particulates are filtered by mechanical means while vapors and gases are removed by sorbents that react chemically with them. Respirators using a combination of mechanical and chemical sorbent will effectively remove both hazards. These respirators are limited in their capacity to purify air by the size of the cartridge or canister to remove the toxic substance.

Particulates can occur as dusts, fumes or mists. The particle size can range from macroscopic (visible to the naked eye) to microscopic (invisible to the naked eye), and their toxic effects can be severe or harmless. Mechanical filters are classified according to the protection they provide. Most particulate filters are approved only for dusts and/or mists. The filters have an efficiency of 80 to 90 percent for 0.6-millimeter (mm) particles. Respirators approved for fumes are more efficient, removing 90 to 99 percent of 0.6 mm particles. Mechanical filters load up with particulates as they are used. As they do, they become more efficient, but also become more difficult to breathe through. When a mechanical filter becomes difficult to breath through, it should be replaced. Respirators with mechanical filters are commonly referred to as **mechanical filter respirators or dust respirators**. These respirators may be desirable even though not required by the label if work is being done with mist and dust applications in attics, crawl spaces or other similar areas.

Sorbents are manufactured to remove a specific chemical or group of chemicals. In contrast, particulate-removing filters remove particulates regardless of their composition. Sorbents are available to remove specific organic vapors, acid gases and ammonia, among others. These sorbents are used in chemical cartridge respirators. These respirators, in addition to being equipped with filters to remove particulate matter, also have one or two chemical cartridges that remove toxic gasses and vapors by absorption. Each sorbent used in the cartridge has a maximum concentration use limit for that specific contaminant. Once the sorbent has been filled up with the contaminant, it will break through – that is, it will allow the full ambient concentration of the contaminant to enter the facepiece. This is in contrast to the particulate-removing filters that become more efficient as they fill up but harder to breathe through. The sorbent volume in the cartridges for these respirators is small and its lifetime is generally short. Chemical cartridge respirators are used for low concentrations and short exposure periods. Some pesticide labels may specify on the label the need to wear a respirator of this type. **Cartridge respirators are not suitable for use with fumigants.** The cartridges are too small and they tend to leak around the face piece.

Gas mask or canister respirators are equipped with canisters containing the sorbent for removal of the toxic gasses and a filter. Besides protecting the face from absorption, they contain more sorbent than cartridge respirators so they may be used for higher concentrations of toxicant and/or longer periods of exposure. These respirators are suitable for use with fumigants. The canister or, more specifically, the sorbent in the canister must be specific for the type of fumigant being used. The canisters are color coded for the various fumigants.

Cartridges and canisters have an expiration date. They can be used up to that date as long as they were not opened previously. Once opened, they begin to absorb humidity and air contaminants whether or not they are in use, and their efficiency and service life decrease.

Approval of Air-Purifying Respirators for Pesticides

All respirators intended for use with pesticides must be approved jointly by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH). The Mining Enforcement and Safety Administration (MESA) preceded MSHA, so approved respirators available today will have approval numbers issued by MESA or MSHA. The approval numbers beginning with the letters TC are assigned to all respirators approved by the agency. This number must be on the box containing the facepiece. Cartridges and filters approved for pesticides are necessary and must have the TC number affixed to them, also.

Air-Supplying Respirators

These respirators supply fresh, clean air from an outside source or cylinder rather than purifying air at the location of use and may be useful for pest control operators who have difficulty breathing with air-purifying respirators. This type of respirator is more frequently used with fumigants. There are two basic types. There are the airline masks, which supply air from the outdoors through a hose, using a pump to pump the air through the hose to the mask. The other type is the self-contained breathing apparatus. A full mask is attached to an air tank or to an oxygen-generating canister.

Fitting Your Respiratory Protection Equipment

The most important factor in respirator safety is that the unit fits correctly on the wearer's face. If a respirator does not fit properly, then toxins are entering the lungs. A respirator should have a good, even seal and inhalation and exhalation valves that are functioning correctly (see next section on care and use for problem solving).

There are two types of fit tests: qualitative and quantitative. A qualitative fit test requires a personal response from the individual being tested. A test agent, such as isoamyl acetate (banana oil), saccharin aerosol or an irritant smoke is used. Proper fit is evident when the wearer cannot smell the test agent. This test should take place during the training program and not at the work location.

A qualitative test is easy to perform, requires little equipment, can be administered by an inexperienced person and is relatively low in cost. However, the test requires some subjective response from the wearer. In addition, employers must maintain their own documentation on each employee's test results because no other record of the test, such as a strip chart, is available.

The second type of fit test, the quantitative, uses a test aerosol and an analytical instrument to measure the amount of aerosol that seeps into the mask. The facemask's respirator is fitted with a probe that allows a small air sample to be continually taken from the interior of the mask. The air sample is then fed to an instrument that detects the amount of test aerosol present. Particulate aerosol, which is found in the facemask, is called leakage or penetration. Any leakage is indicated on a strip chart.

A quantitative test is more precise than a qualitative test and provides documentation of a good respirator fit; however, this test can be expensive and uneconomical. The test also requires an experienced operator and about 15 minutes.

There are also two tests that should be performed daily to check for a proper respirator fit. These are tests of negative pressure and positive pressure. These should be performed several times daily after finding a properly fitting respirator by the quantitative or qualitative methods. According to Occupational Safety and Health Administration (OSHA) regulations, the respirator should be worn for 10 minutes prior to performing any fit test.

The negative pressure fit check requires the wearer to inhale and hold his breath for 10 seconds, while the palms of the hands are placed over the inhalation valve openings. If there are no leaks, the facemask should collapse. If there is a leak, the mask's position can be shifted and the headband straps readjusted. If no air is leaking and the mask still does not collapse, the exhalation valve should be inspected.

The positive pressure fit check requires the wearer to place the palm of the hand against the opening of the exhalation valve. When gently exhaling, the mask should bulge slightly indicating no leaks. If there are noticeable leaks, and the mask still does not bulge, then the inhalation valves should be inspected for distortion and the facemask readjusted.

Care and Use of Respiratory Protection Equipment Filter and Chemical Cartridge Respirators

There are only three moving parts in many respirators. These include a pair of soft rubber intake valves and a clear plastic or rubber exhaust valve.

A dust filter respirator is nothing more than a mechanical filter. As air enters the unit laden with dust, the dust is deposited on the outer surface of the filter. The clean air passes through the filter and into your lungs.

Chemical cartridge respirators contain one or two cartridges with a filter on the outside to remove dust and droplets. The cartridge contains an absorbent to remove low concentrations of toxicants in the air. Cartridges should be used that are designed for the chemicals you are using.

The intake valve is hinged on one side. It swings in as you inhale and flaps shut upon exhalation.

When you inhale, you create a partial vacuum inside your respirator. This pulls air through your filter. It also pulls the exhaust valve closed, preventing dirty air from entering there.

This exhaust valve(s) is mounted over an opening(s) in the lower respirator body. As you exhale, a pressure is created inside your respirator. This pushes the intake valve(s) shut and forces the exhaust valve(s) open, letting the air escape.

Several conditions can create problems in using your respirator. If material builds up on the filter surface, the plugging will create a resistance as you try to breathe in. To correct this problem, take a new filter from the supply package. Fold the filter carefully over the filter fork, and insert the fork into the filter holder. Be sure that the edges of the filter are not creased. The filter is held in place with a spring retaining clip.

The second problem is caused by a missing intake valve. This will cause you to breathe in and out through the filter, and the exhaled moisture will cause the filter to plug quickly. Spare valves are available from the respirator manufacturer. Clip a new valve onto the raised retaining posts to solve this problem. This area of your respirator is usually wet from exhaled moisture and sweat. Dust will collect here and block a valve open, especially during below freezing weather. An exhaust valve could also be blocked open by having an edge tucked into the valve opening. Correct this problem by lifting the valve out of the opening.

Occasionally, a valve will become stiff and allow dust to enter your mask. Obtain a spare exhaust valve. It is installed by pushing out on a spring-loaded pin that raises the valve retaining post. The rubber valve is then stretched over the post. Inspect this part of your respirator carefully, several times each day.

The facepiece cushion, made of soft, spongy rubber, is stretched over the respirator body. You can bend the body to adjust the fit for a good seal against your face. Should you be unable to get a good, comfortable fit with the one type of respirator, then other types of respirators are available. Most have soft rubber bodies that tend to mold easily against your face. Beards and long sideburns can interfere with getting a tight facial seal.

In order for all these parts to function properly, it is necessary for you to regularly wash them in plain, warm water. Do not be afraid to take your respirator apart for cleaning, and be sure to remove any dust build-up you find around the exhaust valves. After each use, taking five minutes for this washing will assure you that your respirator will do its job. When you have finished washing your respirator, it belongs in your locker, if you have one, or it should be stored in its own box near your working area. Respirators must not be left hanging on a hook somewhere to be contaminated. All respirators used with pesticides must be approved jointly by MSHA and NIOSH. Make sure that your respirator has been approved by these government agencies.

All respirators have limitations. They do not supply oxygen. All they do is filter particles or vapors out of the available air.

Leave the area at once if you get dizzy, become ill, or smell any contaminant. Follow this rule anytime you wear respirator protection.