



Farm Respiratory Protection

E 36

Dennis J. Murphy, Professor, Agricultural Safety and Health

William C. Harshman, Research Assistant

Cathleen M. LaCross, Technical Writer

Farming is filled with respiratory hazards: pesticide vapors, dusty fields, dangerous hydrogen sulfide accumulations in manure pits and pump sumps, nitrogen dioxide in conventional silos, and many others. Farmer's Lung and Organic Dust Toxicity Syndrome (ODTS) are allergic reactions to dust from moldy hay or grain and may result in costly medical treatment, permanent lung damage or death.

In many cases an inexpensive respirator could prevent farmers from acquiring nagging, permanent lung damage caused by long-term exposure to dusts, mists, gases, and vapors. This fact sheet examines categories and types of farm respiratory protection and the proper use of these devices.

Pinpoint the Hazard

The first step to choosing a respirator is determining the type of respiratory hazard. There are three basic categories of respiratory hazards on the farm. The first category, particulate contaminants, includes dusts, mists, and fumes. Dusts are usually the largest particles, but not all dusts can be seen with the naked eye. Mold spores, for example, are microscopic. They are released when moldy hay, silage, or grain is disturbed. Mists are suspended liquid droplets and are usually found near mixing, spraying, and cleaning operations. Fumes are solid particles of evaporated metal. They are microscopic as well and are formed during activities such as welding.

The second category of respiratory hazard is gases and vapors. Gases are chemicals that are gaseous at ambient (room) temperature. Examples include hydrogen sulfide, the deadly manure pit gas; nitrogen dioxide, which can be found in conventional silos; and carbon monoxide from operating internal combustion engines. Vapors are released from liquids, such as pesticides, paints, adhesives, and lacquer thinner.

The third category of respiratory hazard is an oxygen-deficient atmosphere. Examples of oxygen-deficient atmospheres include manure storage, oxygen-

limiting (sealed) silos and controlled atmosphere (CA) storage for fruits and vegetables. In such structures, the oxygen content of breathable air, normally about 21%, is reduced to levels as low as 5%. The reduction in oxygen may occur deliberately, such as with CA storage, or oxygen may be displaced by other gases as in manure storage and conventional silos.

Once you've pinpointed the hazard (or hazards), and before resorting to a respirator, try to reduce or eliminate the source of the problem. For example, use a different management practice when harvesting and storing crops to reduce dust and mold. Provide improved ventilation in your barn or work outdoors instead of in an enclosed building. Another possibility may be to use a non-toxic, less toxic, or less volatile pesticide. *After* you have tried to reduce or eliminate the hazard, if you are still at risk, use a respirator.

Nuisance Dust Mask

A nuisance dust mask is not an approved respirator. This type of mask offers some protection against large particles of dust but not against smaller particles that may enter deeply into the lungs and cause respiratory distress or disease. Nuisance dust masks most often are constructed of a very light paper filter and have only a single, thin strap. These masks are normally of the one-size-fits-all variety and the thin strap is not adjustable, making a good fit difficult at best (Figure 1). They are easily stretched and distorted by putting on and taking off the mask. Nuisance dust masks are best worn by persons with no existing respiratory distress or breathing limitations for short-term exposure to light levels of non-toxic dusts, such as sweeping out a garage or shop floor.



Figure 1. Single strap dust mask.

Approved Respirators Identified

There is no such thing as an all-purpose respirator. Specific respirators are used for specific contaminants or atmospheres. Choose your respirator carefully. *Use a respirator approved by the National Institute for Occupational Safety and Health (NIOSH).* Older style NIOSH approved respirators or filters have a number preceded by the prefix “TC”. Newer models of approved respiratory protection have the NIOSH TC approval number followed by a description of the respirator. An example is: “NIOSH TC 23C dual cartridge half mask with disposable filter used for pesticides and ammonia.”

The newer respirators are also rated according to the filter’s efficiency in reducing dust, mists, and fumes and their time use limits against oil based chemicals or pesticides in the atmosphere. Filtering efficiencies can be 95%, 99%, or 99.97%. Respirators rated 99.97% effective are given a rating of 100% as a practical matter. A respirator with a designation of N, R, or P indicates: not resistant to airborne oils, plugs quickly (N); resistant to airborne oils for up to 8 hours (R); or oil proof, possibly resistant to airborne oils for up to 8 hours, change filter every 40 hours of use or 30 days, whichever comes first (P). The filtering efficiency rating and resistance to oils rating can appear independently on the respiratory unit, pre-filters, cartridges, the packaging, and in advertisements. In addition to the TC number, approved respirators always have at least two elastic straps or a head band (Figure 2).



Figure 2. Double strap dust mask.

Categories and Types of Respirators

There are two categories of respirators: air purifying and supplied air. AIR-PURIFYING RESPIRATORS are equipped with filters through which the user breathes. **IMPORTANT:** These respirators *do not supply oxygen*. Therefore, they should not be worn in areas considered immediately dangerous to life or health (IDLH), such as oxygen-deficient areas (oxygen-limiting silos, for example) or highly toxic atmospheres (manure storage pits). Air-purifying respirators are good in areas such as barn lofts with moldy hay, fields during tilling or pesticide applica-

tion, or construction sites where fiberglass or wood dusts are likely to be found.

For most air-purifying respirators, the user must pull air through the filter with their own breathing. This type of respirator is often referred to as a “negative pressure” respirator because the user must draw in oxygen (inhalation) through the respiratory unit. Negative pressure air-purifying respirators often put added stress on you. If you suffer or suspect that you suffer from respiratory problems such as asthma, lung or cardiovascular disease, check with a doctor to make sure you are able to wear one.

There are several types of air-purifying respirators.

Disposable Particulate Respirators. Disposable particulate respirators are an approved type of respirator but are also commonly referred to as dust masks, making it easy to confuse them with a nuisance dust mask. Disposable particulate respirators protect you from particulate contaminants such as dusts, mists, and sometimes fumes. The filters are made of a fibrous material that traps particles as you inhale. These respirators are useful during operations such as haying, harvesting, tilling dusty fields, applying fertilizer and lime, grinding feed, and sweeping. Both disposable and reusable masks are available. Disposable masks are more convenient—you simply throw them away when they’re saturated. Reusable masks, on the other hand, may save you money in the long run and create less waste.

Filters and disposable masks should be replaced when breathing becomes too labored, when the mask loses its shape and no longer seals well to your face, or if you taste or smell the substance. Remember: *a “nuisance dust mask” is not considered a respirator.*

Chemical Cartridge Respirators. Chemical cartridge respirators filter out low concentrations of toxic gases and vapors. An absorbent material such as activated charcoal absorbs contaminants from inhaled air. These masks can also be equipped with particulate filters, so if you’ll be exposed to gases or vapors *and* dusts or mists, this is the kind of respirator you should wear.



Figure 3. Full-face cartridge type respirator.

There are half-mask models and full-face models; the latter provides eye and face protection as well. The half-masks are also available in disposable or reusable models. Full-face models (Figure 3) provide considerably more protection against contaminants than half-mask models because they seal to the face better.

The filtering cartridges for these respirators usually screw onto the front of the mask. The cartridges are changeable, so if you have a reusable mask you can use it for any gas or vapor contaminant, provided you have the right cartridge.

Cartridges should be replaced after eight hours' use or when "breakthrough" occurs—that is, when you begin to smell or taste the contaminant or when dizziness or irritation occurs. Make sure the cartridge brand matches the respirator brand. Manufacturers use different threads which may prevent mismatched brands (respirators and cartridges) from sealing properly. *Chemical cartridge respirators should not be worn in areas considered immediately dangerous to life or health (IDLH).*

Gas Masks. Gas masks, or chemical canister respirators, are very similar to chemical cartridge respirators except they can be used in areas where gases are extremely toxic or highly concentrated. The canisters hold more chemical sorbent than cartridges, so they have a greater filtering capacity and last longer. Canisters can be mounted on a belt, worn on the back or chest, or they can be screwed onto the mask beneath the chin. They're reconnected to the facepiece by an air hose.

Gas masks are only available with a full-facepiece. The canister should be replaced after eight hours' use or when "breakthrough" occurs. *Gas masks should not be worn in areas considered IDLH.*

Powered Air-Purifying Respirators (PAPRs) A PAPR (Figure 4) is an air-purifying respirator with a motorized blower that forces air through the filtering device. A PAPR is a "positive pressure" respirator because clean air is being delivered to the breather. It makes breathing easier for the wearer, so this type of respirator may be recommended by a doctor for someone with a respiratory or cardiovascular ailment. They tend to be cooler, too, because there is a constant stream of air over the wearer's face and head. Many PAPRs have a hard helmet and rigid visor under which the air is blown. There are also half-mask and full-face models and models with non-rigid helmets available. A PAPR with a full-face mask or closable hood will offer as much or more protection against contaminants than a full-face chemical cartridge respirator.



Figure 4. Powered air-purifying respirator (PAPR).

Powered air-purifying respirators should not be worn in areas considered immediately dangerous to life or health (IDLH).

SUPPLIED-AIR RESPIRATORS are the only respirators to be used in areas considered IDLH. These respirators can be used in manure pits, sealed silos, or fumigated bins containing high-moisture grain. They supply the wearer with fresh, clean air from an outside source. There are two types of supplied-air respirators. The first, *air line respirators*, provide clean air through a hose that is connected to a stationary air pump or tank. The second, a *self-contained breathing apparatus*, or SCBA, (Figure 5) has a portable air tank that is carried on the back like those worn by scuba divers and firefighters.

Supplied-air respirators are very expensive to buy and maintain, and instruction and practice are necessary to use one correctly. Farmers should understand, however, that every time they enter a sealed silo or manure pit without one, they are risking their lives. Dangerous gases can build up in IDLH areas, creating a lethal, oxygen-deficient atmosphere that can kill, literally, in seconds—faster than anyone can attempt a rescue. Unless you are wearing a supplied-air respirator or have the atmosphere inside the area monitored for dangerous gases, you can never be sure. Contact an industrial hygienist or your local fire department—perhaps they have a supplied-air respirator you can borrow if you feel you must enter



Figure 5. Supplied-air respirator (SCBA).

an IDLH area. The hazards of manure pits and silo gases are more fully described in the Agricultural Engineering Fact Sheets E-16, "Silo Gases—The Hidden Danger," and E-28, "Manure Storage Hazards."

Testing, Caring and Wearing Your Respirator

Once you have decided what kind of respirator you need, visit your local farm supply store, ag chemical supplier, hardware store, or industrial safety equipment company. Try on several brands and styles of respirators to see which is the most comfortable for you. They come in all shapes and sizes, so it's smart to try before you buy.

Before using a new respirator it is best to have a "fit test" performed by a trained person to ensure the respirator makes a good seal with your face. Such expertise is often not readily available for farmers but any user can learn to perform a "fit check" for himself or herself. Each time you put on an air-purifying respirator, place your palm over the exhale port and exhale. The respirator should slightly push out from your face. Next cover the inhale ports, or filters, inhale and hold for 10 seconds. The respirator should suck back onto your face and maintain good suction for the entire 10 seconds. If you do not get a good seal, readjust straps or reposition the respirator and redo the check. When wearing a respirator, if at any time the seal breaks and you begin to smell or taste a contaminant or if you experience dizziness, nausea, or irritation, get out of the contaminated area and into fresh air immediately.

Glasses, gum or tobacco chewing, facial hair, or even stubble can prevent your respirator from sealing properly. A human hair can average 75-100 microns in diameter; contaminants can be anywhere from 0.2 to 16 microns in diameter. You should be clean-shaven if you want good protection. If you wear prescription glasses, adapters are available for securing prescription lenses inside the facepiece of a full-face respirator. Don't wear contacts with res-

pirators: in any contaminated environment, contaminants can stick to contacts and cause damage to your eyes.

Periodically inspect your respirator for damage and dirt. Look for excessive dirt around the facepiece, detergent residue, missing valve covers, a cracked facepiece, breaks or tears in the headstraps, or loss of elasticity in the headstraps. NEVER attempt to repair a damaged respirator beyond replacing replaceable parts, such as filters and headstraps. Call the manufacturer to see if they supply parts for your particular respirator. Don't try to substitute parts from other respirators that might prevent a total seal.

Clean your respirator often in warm, soapy water (remember to remove all cartridges and filters first!). After it is thoroughly dry, store it in a sealed plastic bag. If you leave the respirator out in the open with the cartridges and filter attached, cartridges can adsorb vapors and filters can collect dust from the air and become saturated. Duct tape may be placed over the face of the cartridge or filter to prevent further exposure to dusts or vapors in the environment.

Conclusion

Respirators can prevent many respiratory ailments associated with farming—but only if you wear one! Make sure you choose the right type of respirator for the hazard or hazards you'll be facing. Before long, wearing it will become habit. If you maintain it and clean it regularly, the small investment a respirator costs you now might save you and your family the expense of large medical bills later in life. For more information on respiratory hazards and protection, contact county extension offices, industrial hygienists, safety and health professionals, or respiratory protection manufacturers.

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