



Farm Respiratory Protection¹

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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, a five- to twenty-five-dollar respirator could have prevented farmers from acquiring nagging, permanent lung damage caused by longterm exposure to dusts, mists, gases, and vapors. But choosing a respirator can be very confusing -- there are so many different kinds on the market today.

PINPOINT THE HAZARD

The first step to choosing a respirator is determining what kind of hazard you'll be facing (see Table 1). 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're 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're microscopic as well and are formed during activities such as welding.

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

The third category of hazards is oxygen-deficient atmospheres. Examples of oxygen-deficient atmospheres include manure storage's, oxygen-limiting (sealed) silos and controlled atmospheres (CA) storages 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 storages, or is displaced by other gases as in manure storage's 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, maybe you could use different management practices when harvesting and storing crops to reduce dust and mold. Perhaps you need better ventilation in your barn. Can you work outdoors instead of in an enclosed building? Or maybe you could be using a non-toxic, less toxic, or less volatile pesticide. After you've tried to reduce or eliminate the hazard, if you're still at risk, use a respirator.

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TWO CATEGORIES OF RESPIRATORS

There is no such thing as an all-purpose respirator. There are specific respirators for specific contaminants, so choose your respirator carefully. But no matter what kind or brand of respirator you choose, it should be approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA). If the respirator or filter has a number preceded by the prefix "TC," you can be assured that it is approved.

Air-Purifying Respirators

There are two categories of respirators, airpurifying and supplied air. The first, AIRPURIFYING RESPIRATORS, are equipped with filters through which the wearer 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, like those sometimes found in manure storage pits. Air-purifying respirators are good in areas such as barn lofts with moldy hay, fields during tilling or pesticide application, or construction sites where fiberglass or wood dusts are likely to be found.

Because the wearer must pull air through the filter, all air-purifying respirators put added stress on you. For this reason, 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're able to wear one. There are several types of air-purifying respirators.

Mechanical Filter Respirators

Mechanical filter respirators protect you from particulate contaminants: dusts, mists, or metal 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. Usually a single respirator offers protection only against dusts and mists but a few will protect against dusts, mists and fumes.

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. In general, the common dust mask found in hardware stores, often labeled as a "nuisance dust mask," is not considered a respirator and will not provide suitable protection from particulates. Nuisance dust masks are most easily distinguished by their single elastic strap. NIOSH has approved a few dust masks for use with some toxic dusts and mists, such as dry fertilizer and molds. They will not, however, provide adequate protection from pesticide dusts and mists. Approved models have two elastic straps in back for a better seal. Look for a "TC" number to be sure yours is approved. **Mechanical filter respirators should not be worn in areas considered IDLH.**

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. 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.

The filtering cartridges for these respirators screw onto the front of the mask. There are specific cartridges for specific contaminants, so make sure you have the right cartridge for the hazard you're facing. For example, there are cartridges specifically made for use with pesticides; others contain different absorbents to filter out ammonia. 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 prevents mismatched

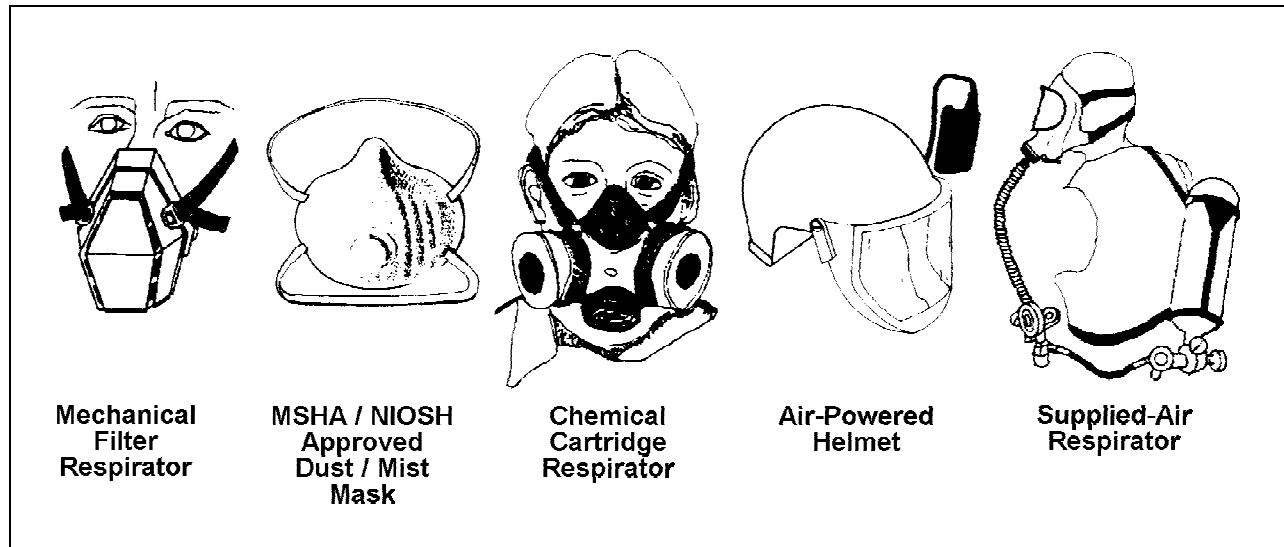


Figure 1. 5 types of respirators

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 connected 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 IDLK.

Powered Air-Purifying Respirators (PAPRS)

A PAPR is simply an air-purifying respirator with a motorized blower that forces air through the filtering device. It makes breathing easier for the wearer, so this type of respirator may be recommended by a doctor for someone with a minor 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 nonrigid helmets available.

PAPRs can be used for dusts, mists, gases, and vapors, provided you have the right filters. The blower is powered by a battery pack strapped onto the wearer's waist or back. Rechargeable or disposable D-cell batteries can be used -- most batteries last 6-8 hours. Or you can use a 12V or 24V DC adapter, which will run the blower from a vehicle battery. Powered air-purifying respirators should not be worn in areas considered immediately dangerous to life or health (IDLH).

Supplied-Air Respirators

The other category of respirators, SUPPLIED-AIR RESPIRATORS, are the only kind 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, has a portable air tank that is carried on the back like those worn by scuba divers and firefighters.

Supplied-air respirators are undeniably 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're risking their lives. Many farmers underestimate the danger associated with such areas. Dangerous gases can build up in IDLH areas, creating a lethal, oxygen-deficient atmosphere that can kill you, 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. Don't become a statistic. Just because you successfully entered the pit the last time doesn't mean you will this time. 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 an IDLH area. The hazards of manure pits and silo gases are more fully described in the Agricultural Engineering Fact Sheets Safety-16, "*Silo Gases-The Hidden Danger*," and Safety-28, "*Manure Storage Hazards*."

TESTING AND CARING FOR 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.

Also, if possible before you buy, contact an industrial hygienist to find out where you can get a fit test. If not possible before buying, be sure to do this after the purchase but realize you may not get a good fit with the one you now have. A fit test is administered by a trained person to make sure your respirator has a good seal. It should be done before wearing any new respirator and once a year in subsequent years. During the test, you will be asked to put on your respirator, adjust it, and move your head around and talk while an irritating smoke or strong odor is waved around your head. If you can't detect any irritation or odor, your mask has a good seal.

Every time you put on an air-purifying respirator, conduct a fit check. This is something you can do yourself. Place your palms over the exhale port on approved respirators, and exhale. The respirator should slightly push out from your face. Next cover the inhale ports, or filters, and inhale 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.

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 filter's 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.

Glasses, gum or tobacco chewing, facial hair, or even stubble can prevent your respirator from sealing properly also. A human hair is an average of 10 microns in diameter-, contaminants can be anywhere from 0.2 to 16 microns in diameter. You should be clean-shaven if you want the utmost 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 respirators; in any contaminated environment contaminants can stick to contacts and cause damage to your eyes.

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 (see Table 1). 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.

Table 1. Required Protection for Respiratory Hazards

Respiratory Hazard	Required Protection
Pesticide dusts, mists, vapors, and gasses	A NIOSH-approved chemical cartridge respirator or gas mask with added pro-filter. For extremely high gases concentrations, where the oxygen level may be low, wear a supplied-air respirator. Refer to pesticide container label for additional requirements.
Mold dust, grain dust, manure dust, dust from poultry operations, road or field dust, and untreated sawdust	A NIOSH-approved mechanical filter respirator or dust/mist mask approved for use with toxic dusts.
Ammonia	A NIOSH-approved chemical cartridge respirator or gas mask approved for use with ammonia.
Hydrogen sulfide (manure gas)	Supplied-air respirator approved by NIOSH.
Nitrogen dioxide (silo gas)	Supplied-air respirator approved by NIOSH.
Welding fumes	A NIOSH-approved mechanical filter respirator approved for use with fumes.
Spray paint mists	A NIOSH-approved mechanical filter respirator approved for use with spray paints or organic vapor cartridge with paint prefilter on chemical cartridge respirator.
Carbon monoxide (gas-powered vehicle or machinery exhaust)	A NIOSH-approved gas mask or supplied-air respirator.
Fumigants	CAUTION: Fumigants are highly penetrating and some can penetrate the rubber and plastic parts on respirators. In addition, some are colorless and odorless and give no warning of exposure. Many respirators approved for pesticides are NOT approved for protection against fumigants. For the best protection, completely avoid fumigants and treated areas yourself and leave entry into treated areas to trained professionals.