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Respiratory Protection in Agriculture

*Robert Grisso, Susan Gay, Glen Hetzel, and Bruce Stone**

Farm workers can encounter a variety of respiratory problems ranging from temporary discomfort caused by allergic reactions to fatal asphyxiation. However, the risk of contracting serious lung diseases or death can be significantly decreased by using respiratory protection (Figure 1). See the sidebar for a list of farm work that requires respiratory protection.

Choosing the Proper Equipment

The effectiveness of respiratory protection depends on your using the **proper equipment for the specific task**. Before selecting respiratory equipment, make a list of the following items:

- operations and work sites where there is any kind of contamination
- types of job where a lack of oxygen is a problem
- specific contaminants that correspond to the work site and its jobs
- potential and actual harmfulness of the contaminants
- form of the contaminant material: dust, mist, spray, gas, vapor, fume, or some combination of these
- concentrations of each contaminant

Use this list to help you or a safety equipment specialist select the right protection equipment for the job.

Categories of Respiratory Protection Equipment

Respiratory protection equipment is placed in one of two categories: 1) air purifying devices; or, 2) oxygen providing respirators.

Who Needs Respiratory Protection?

Those who:

- work in dusty fields and buildings
- handle moldy hay
- work in silos
- feed or work with feedstuffs
- work in corn silage
- uncap silos
- clean grain bins
- work in areas where bird droppings or dust from animal hair, feathers, or fur are present
- work with fish meal
- apply agricultural chemicals (e.g. fertilizers, pesticides, fumigants)
- work with toxic paints or solvents
- work in areas where dust containing old paint, rust and wood particles

Air purifying devices

Air purifying devices remove contaminants from the air and are used only where there is a sufficient oxygen supply. These devices include mechanical filter, chemical cartridge (Figures 1 – a and b), and canister gas mask respirators.

Mechanical filters

Mechanical filter respiratory protection devices are commonly known as dust masks (Figures 1 – c and d). These simple filters consist of a molded filter designed to cover the nose and mouth. The filter is held in place by one or two elastic straps that are stretched over the head. Masks with two elastic straps, in general, fit better. Some dust masks have a valve built into the filtering

*Extension Engineer, Extension Engineer, and Retired Farm Safety Specialist, Biological Systems Engineering, Virginia Tech, and Safety Manager, Virginia Farm Bureau Insurance Services, Richmond, respectively.

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substance to allow easier breathing. Dust masks should be discarded when the filter becomes clogged.

Dust masks provide protection against airborne dust particles (chemical, mineral, field, or barn), chaff, pollen, and non-toxic paint spray dusts. However, sufficient levels of oxygen must be present in the air to be filtered.

Chemical cartridge respirators

Chemical cartridge respirators provide a higher level of protection than dust masks. These respirators consist of a soft, silicone face piece, which covers the nose and mouth and contains a valve to control air movement through the respirator. Replaceable cartridges containing activated carbon are used to filter incoming air. Pre-filters are usually installed on the outside of the cartridges. Respirators are held snugly against the user's face using elastic straps or a harness. A half respirator covers only the nose and mouth of the user; a full-face respirator includes an eye shield and covers the entire face and eyes.

As a respirator user, you must anticipate the type of hazard to choose the correct cartridge to provide maximum protection. Most cartridges are designed to provide protection for a specific type of chemical hazard such as pesticides, ammonia, anhydrous ammonia, etc.

Gas masks

Gas masks use large capacity cartridges (canisters), which allow for longer working times in high levels of contaminants compared to typical respirators. These masks provide full face coverage. Cartridges may be mounted on the face piece or at the end of a flexible hose to allow mounting at the user's belt. Gas masks provide protection against pesticides and often toxic airborne materials. Like mechanical filters and chemical cartridge respirators, gas masks require sufficient levels of oxygen in the air to be filtered.

Oxygen-providing respirators

Oxygen-providing respirators are used in oxygen-deficient atmospheres. These respirators include supplied-air respirators and self-contained breathing apparatus (SCBA).

Supplied-air respiratory protection

Supplied-air respirators provide users with fresh air from a remote source such as a portable air compressor or from pressurized tanks. The fresh-air source can be located up to 300 feet from the user. Air compressors must be located in a clean-air area. Supplied-air respirators have face pieces similar to those used by chemical cartridge respirators or gas masks.

Self-contained breathing apparatus (SCBA)

A SCBA requires that you carry an oxygen supply, contained in a compressed air tank, on your back. These respirators can be used in silos, manure pits, and grain storage areas and during the fumigation of structures.

Hazardous Air Sources and Contaminants

Table 1 identifies some hazardous air condition sources common to agriculture and their potential contaminants. If you are working with or in these sources, protective equipment should be used (see Table 1).

If you are unsure which type of protective equipment is best for your work, ask the professionals who sell safety equipment or check the Materials Safety Data Sheets (MSDS) for recommendations.

a) b) c) d)

Figure 1. Various respiratory protection devices that can protect you. Respirators in both a) and b) are air purifying devices and can protect you from hazardous vapors. Dust masks shown in c) and d) will protect the lungs from small particles but are not effective for hazardous vapors. All protection devices need proper fit.

Places where You Can Purchase Respiratory Equipment

Most types of protective respiratory equipment can be found at safety supply stores. Farm supply stores and agricultural chemical suppliers are also good sources. If these suppliers do not have the equipment you need, they can order the equipment for you. Make sure to test-fit respiratory devices to ensure a proper seal between your face and the face piece.

Respiratory Equipment Safety

Respiratory equipment can safeguard your health and save your life in any hazardous air condition. However, when using such equipment without proper care and precautions, the device may be ineffective. A list of guidelines and precautions that every worker should comply to when using protective respiratory equipment follows:

- *You should be completely familiar with equipment use, replacement, care, cleaning, and storage through proper training (SCBA requires special training for use).*
- *You should test equipment before every use* – follow the manufacturer's instructions for properly testing equipment. While using a respirator that has cartridges, check the fit using one of two methods of testing:

1. Positive fit check – exhale while covering the exhalation valve with the palm of your hand – if you feel air against the skin of your face, there is a leak in the seal.
2. Negative fit check – cover the cartridge(s) with your hands and inhale – if the mask is drawn tightly to your face, there is no leakage.

- *Make sure the equipment properly fits you* – leakage defeats the effectiveness of even the best respirator for the situation. Testing the equipment will assure a proper fit.
- *You should regularly clean and repair equipment.*

In Case of Emergency

If you suddenly feel **Sick, Dizzy** or **Cannot Breathe** properly, *leave the hazardous area immediately.*

If someone else is overcome by toxic gases:

1. Protect yourself with a proper respirator before entering the hazardous area.
2. Remove the victim to fresh air.

Act Quickly, but **Thoughtfully!**

A few minutes without oxygen can cause brain damage or death for the victim, but if you act without thinking about your own safety, you could also become a victim.

Call for Help

Make sure everyone in the work area and at least one person outside the work area is aware of the hazards that may be present. Each of these people needs to know how to contact emergency rescue personnel and be able to convey any information rescue teams may need (i.e. physical address, directions to the location, hazardous materials present etc.):

Rescue Squad: _____

Fire Department: _____

Emergency: 911

Your additional local number: _____

Table 1. Hazardous air sources and contaminants

Silage	Manure Pits	Confined Poultry Housing	Confined Hog Housing	Pesticides
• CO_2 • nitrogen oxides • mold spores	• ammonia • methane • CO_2 • hydrogen sulfide	DUSTS: • feathers and feather particles • dried skin material • dried fecal material • dried feed products GASES: • ammonia • CO_2	DUSTS: • hair and skin particles • dried feed products • dried fecal particles GASES: • ammonia • CO_2 • hydrogen sulfide • methane	TOXIC: • fumes • gases • mists • dusts

- *You should regularly change filter cartridges and pre-filter*s – store the filter cartridges properly. Store cartridges in an airtight plastic bag so they will not absorb vapors from the surrounding environment. Place the mask and the cartridges in separate airtight bags.

A change in smell or taste or the initiation of coughing while using filter cartridges may indicate that hazardous materials are coming through the filter and it should be changed. Consider setting a regular schedule to change the filter if the contaminant cannot be noticed by the five senses.

If you use a pre-filter for more than five or six hours a day, change the filter daily. Changing filter cartridges **before** breathing becomes difficult is extremely important.

Proper maintenance is a key for proper protection – follow these tips:

- *You should store protective equipment in a clean, dry place AWAY from work and chemical storage areas. Self-sealing plastic bags are ideal for storing clean respirators.*

- *You must be fully capable of wearing protective equipment.* Some health conditions which could cause problems are: asthma, allergies, emphysema, high blood pressure, heart disorder, claustrophobia, or minor facial abnormalities. If you are unsure of how your health issues could affect the proper use of protective equipment, check with your physician. All areas of the face in contact with the respiratory protection device must be clean shaven to insure a good seal.

- *Buy only certified respirators.* Examine the labels for approval by NIOSH or MSA. The labels should show an approval number.

- If it is practical, *assign respirators to individuals.*

Caution: Often, it is necessary to use other protective equipment and clothing when using respiratory protective equipment, such as special gloves, eye protection, and long sleeve shirts.

Additional Reading Material

Grisso, R.D., S. Gay, G. Hetzel, and B. Stone. 2004. *Farmer's Lung: Causes and Symptoms of Mold and Dust Induced Respiratory Illness*. Virginia Cooperative Extension publication 442-602, Virginia Tech, Blacksburg, Va.

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