

Agricultural Respiratory Protective Equipment

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Farm and Ranch Series | Safety

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Many harmful air-borne contaminants exist on farms and ranches, e.g., pesticides, dusts, anhydrous ammonia, etc. Protection from air-borne contaminants can be achieved in several ways.

- **Substitute nontoxic substances:** replace toxic pesticides with reduced-risk biological control agents or mechanical/cultural controls.
- **Engineering controls:** install ventilation systems on tractor cabs and confined spaces.
- **Administrative controls:** rotate workers and restrict re-entry into sprayed fields.
- **Personal protective equipment:** provide respirators, dust masks and protective clothing.

In some work situations, less toxic materials, or engineering and administrative controls are not feasible. In these instances, personal protection is the best line of defense.

Several types of personal protective equipment (PPE) are available. These include respirators, goggles, headgear, boots or shoes, aprons, gloves and clothing. To be effective and protect you against the specific contaminant, the PPE must be clean, fit properly and be in good working order.

Air-purifying respirators function by filtering contaminants from the air. They **do not** supply oxygen to the wearer. Air-purifying respirators can only protect at or below specific concentrations of contaminants. Labeling on each air-purifying respirator carton or package contains specific information about maximum concentrations and types of contaminants protected by the respirator. If the labeling does not give information about maximum concentration protection levels, contact the manufacturer **or** do not exceed five times the threshold

limit value (TLV)¹ for that contaminant. Because this is only a rule of thumb, you need to know the actual safe exposure limit for specific hazards.

Types of Respirators

There are two types of air-purifying respirators: disposable and reusable.

The disposable respirator comes in two types. The most common disposable respirator is the dust filter mask. Use a dust filter mask whenever suspended dust particles are in the air: during haying, combining, cultivating dusty fields, cleaning dusty barns, applying lime and fertilizers. The only recommended dust filter mask has two straps and a tested and certified number (TC#). Two straps give a better fit. Masks with only one strap typically do not provide a seal. Fibrous material used in the dust filter mask physically traps particles. This type of respirator **does not** protect against chemical vapors, gases, toxic pesticide sprays or lack of oxygen. The other type of disposable respirator looks similar to half-mask (covers the nose and the mouth), cartridge type, reusable respirators, but the cartridge cannot be replaced.

Reusable air-purifying respirators have replaceable filter cartridges. The most common facial types are the half and full face masks. A full face mask covers the nose, mouth and the eyes. If the hazard irritates the skin or eyes, use a full face respirator. Respirator cartridges can be changed with other hazard cartridge types to fit the hazard (e.g., a particulate cartridge to a gases and vapors cartridge). Some cartridges come with pre-filters to use with the respirator cartridge. **Do not forget to use them.** If you do not use them, you reduce the amount of protection available to you. Cartridges or respirators from one manufacturer cannot be used with cartridges and respirators from another manufacturer. Reusable air-purifying respirators protect from chemical vapors,



Quick Facts

- **Read the label or material safety data sheet (MSDS)** for the type of respiratory protection required.
- Ensure proper fit.
- Store respirators in a sealable, nonporous bag and in an area not exposed to chemicals or other agents that may be absorbed by the respirator cartridges.

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dusts and mists. They **do not** protect from lack of oxygen. Be sure to follow all label requirements.

Selection and Use

Air-purifying respirators offer adequate protection against many common agricultural respiratory hazards. Specific limitations that govern the use of these respirators are prior knowledge of the contaminant, the general air quality and the physical surroundings.

There are many considerations for evaluation, selection and use of air-purifying respirators: correct respirator selection, proper fit, regular maintenance, and an assessment of the situation where the respirators will be used. Disregarding any of these items may result in danger for the wearer due to a false confidence in the respirator's ability to protect. The user must understand its limitations and recognize situations that require more extensive protection.

Respirators work by using either a chemical or mechanical filtration system. Chemical cartridges use specially treated activated charcoal or other substances that have a high absorption capacity. Mechanical filter elements provide protection against particulate matter such as dust, mists or metal fumes. Mechanical filters work by physically trapping particulate matter. Unlike chemical filters, mechanical filters become more efficient with use, but make it harder to breathe. Therefore, change them when breathing becomes difficult. Change chemical filters periodically or when the odor of the contaminant is detected or as directed by the manufacturer. The time to change filters depends on contaminant concentration and breathing rate of the user.

Never use air-purifying respirators when:

1. **There is a lack of oxygen.** These respirators only purify air; they **do not** supply oxygen. Determine lack of oxygen, or oxygen deficiency, in one of two ways: **direct measurement equipment** (these devices are available from fire departments and many utility companies) and **evaluation** (tanks, pits, storage bins and tunnels are likely to be oxygen deficient).
2. **Present contaminants do not have warning properties**, e.g., odor, irritant

properties or taste. Many contaminants have warning properties at high concentrations. By then it is too late. **Be careful.** Odor, taste and irritation are easily determined. Many compounds have no warning properties. However, manufacturers can inform you of specific warning properties. Detecting contaminants that do not have warning properties can be difficult, and the contaminant can leak through or around a respirator and you will not know it.

3. **The contaminant is extremely toxic (TLV less than 1 ppm).** Consult the product label, material safety data sheet (MSDS) or the manufacturer. Manufacturers of specific chemicals can suggest respirators for specific compounds. Many toxic contaminants are generated in place: hydrogen sulfide in manure pits, nitrogen dioxide in silos. For additional information, contact your local Colorado State University Extension county office. For more information on air-borne hazards and pesticide protective equipment, refer to fact sheet 5.019, *Agricultural Air-Borne Hazards*, and 5.021, *Agricultural Pesticide Protective Equipment*.
4. **There is an unknown contaminant.** This is the most frequently encountered danger in the work place. Detection of unknown contaminants may require extensive and expensive analytical work. However, it could be a simple and quick procedure.
5. **The contaminant level exceeds the ability of the respirator to protect the wearer.** The label on each respirator carton or package contains specific information about maximum concentrations and types of contaminants protected by the respirator. **Study this label carefully.** As a rule, if the label does not specify maximum concentrations, do not wear the respirator in atmospheres containing more than five times (5X) the allowable concentration of a contaminant. For example, if a safe TLV is 5 (in any unit), never use air-purifying respirators when the concentration goes above 25 units. Knowledge of the air-borne concentration of a contaminant is needed to select proper protection.
6. **The respirator is not approved for the contaminant of concern.** Approval agencies are the National Institute

Checklist of rules to protect you and your employees:

- Always inspect and test fit with new cartridges. Do not use a respirator that's been sitting around since last season.
- Follow the test fit instructions.
- Clean the respirator daily according to manufacturer's instructions. To extend cartridge life, store the respirator and cartridges in an air-tight bag.
- Store the respirator in a sealable plastic bag away from contaminants, not in a machine shop or livestock confinement building. The cartridges in the respirator continue to absorb the gases (e.g., exhaust fumes or pit gases) in a storage area until the charcoal has reached its absorption capacity.
- Do not use respirators with beards or other facial hair that passes between the sealing flange of the respirator and the face.
- Purchase air flow respirators from agricultural chemical and other dealers, safety supply catalogs and hardware stores.

for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA). Approved respirators will have a "TC" (tested and certified) number on the label showing proper approval.

7. **The contaminant has a "skin" designation.** Unless other PPE is also used, contamination still results through dermal absorption, even with an approved respirator. Examples are organophosphate pesticides, such as malathion. Follow the pesticide label for the required PPE.

With those limitations in mind, evaluate each work situation before choosing a respirator. Select a specific respirator

designed to function safely within the boundaries you determine. If there is no respirator that fits the limits you select, re-evaluate your selection. **Never use an unapproved respirator; your life may depend on it.**

Testing for Fit

Improper facial fit negates respirator effectiveness. More than one brand and size of a particular type of face piece are available. Therefore, the first task is to understand what a properly fitting face piece is. A properly fitting face piece can be determined with a fitting test. The fitting test uses banana oil, a pungent but non-hazardous oil or irritant smoke, etc. **Use the correct cartridge for the contaminant.** If you can smell the test substance with the respirator on, then the face piece does not fit properly. Select the brand that fits properly.

Test different brands of respirators to ensure the best possible fit before purchasing. This is the only way to protect yourself and your employees. Make sure the respirator is not deformed. Avoid excessive facial hair that may prevent a proper seal. Any odor, skin or eye irritation can be an

indication of possible leakage. Weight gain or loss will require refitting.

Features, Advantages and Limitations

The following can be used to compare the features, advantages and limitations of air-purifying respirators.

All chemical cartridges and filters are color-coded to reference cartridges to specific applications. Although all manufacturers use color coding, cartridges from one manufacturer are not interchangeable with cartridges from another manufacturer. The following are the color codes:

Acid gases ²	White
Organic vapors ³	Black
Ammonia gas	Green
Acid gases and organic vapors...	Yellow
Highly toxic particulate filter cartridge (HEPA) ⁴	Purple

¹TLV is the time-weighted average concentration for a normal eight-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

²Acid gases include sulfur dioxide (SO₂), chlorine gas (Cl₂) and hydrochloric acid (HCl).

³Pesticides are classified as organic vapors.

⁴HEPA= high efficiency particulate attenuation.