

Agricultural Respirator Selection Guide



Purpose of the Guide

The Agricultural Respirator Selection Guide is designed to assist trained Agricultural Health Professionals to recommend appropriate respirators based on the clients' agricultural exposure. This guide is not intended for the professional who has not received training in respirator selection.

Agriculture and industry differ in many respects, particularly, in how the worker and the farmer obtain respiratory protection. If there is a documented respiratory hazard, industry is required by OSHA to have a respirator program that includes respirator education and medical evaluation. When recommending a respirator for the agricultural worker, it is critical that the health care provider collects basic information regarding the individual's exposures and potential health problems to assist in making the recommendation. Medical screenings may be appropriate in some instances based on the specific respiratory hazards and the health conditions of the worker.

Health care professionals need to be aware of the variety of agricultural work tasks resulting in occupational exposures and respiratory illnesses. Obtaining a detailed occupational history assists in identifying high risk areas, including respiratory hazards and activities of the work environment. Once a worker and his or her working environment has been evaluated and the individual is considered a candidate for a respirator, the health professional should utilize the Respirator Selection Guide chart to determine which respirator is best suited for a job.



Examples of Occupational History Questions

1. What are your current agricultural respiratory exposures? (example: hogs, cattle, dairy, poultry, grain, chemicals, silos, and welding)
2. Are any of these situations considered a confinement operation?
3. Do you use a power washer to disinfect buildings?
4. How much time in a day do you spend in this environment?
5. Do you apply your own chemicals? If so, what type of chemicals do you apply and how often? (example: insecticides, herbicides, fumigants)
6. Do you ever enter an environment that would be considered a confined space where there would not be enough oxygen to support life? (Example: hog confinement during or immediately after pumping out manure, poorly vented areas with exposures from fumigants, power washers, space heaters or situations such as reentry following manure pit pump out or agitation, silo entry prior to three weeks after filling)
7. Do you have hobbies other than farming that would cause a respiratory exposure? (examples: wood working or auto body painting)
8. Have you worn a mask before and if so, what type? Examples would be as follows:
 - 1 strap or 2 strap filtering face piece
 - half mask canister
 - full face piece canister
 - powered air purifier such as the Air Stream Helmet
 - or a SCBA (self contained breathing apparatus)
9. Did you have any difficulty wearing this mask?
10. Have you had a respirator fit test in the past?
11. Do you have any known medical conditions that would prohibit you from wearing a mask? (Example: heart conditions, lung conditions such as asthma or emphysema, uncontrolled hypertension, or claustrophobia)

Respirators can only provide adequate protection if they are:

- Properly selected for the task
- Fitted to the wearer
- Consistently donned and worn properly
- Regularly maintained and replaced

Education is Key

It is important to provide education to the agricultural worker on the proper use and care of their respirators as well as provide them with resources to replace or purchase a new respirator when appropriate.

Proper Storage is Important

Respirators should be readily available and properly stored in a container that provides protection from dust, moisture and contamination. Examples include a storage cabinet, tackle box or other plastic, well sealed container such as the one shown in the photo.



Respiratory Hazards - General Information

Agricultural workers are exposed to a variety of respiratory hazards that are potentially harmful to the respiratory system. Farmers are commonly exposed to low concentrations of these substances when performing numerous daily chores, with periodic high concentration exposures of certain harmful dusts or gases typical of many agricultural activities.

Farm operators are always encouraged to monitor gas concentrations in high risk settings before being exposed. This has become more economical and feasible since the prices of hand held electronic direct reading meters are decreasing. If this is not possible, or if the measured concentrations are elevated and at toxic levels, then the appropriate personal respiratory protective device should be chosen from an agricultural respiratory guide selection such as this guide, which matches hazards to the appropriate respirator.

Airborne hazards generally fall into the following basic categories:

Dusts/Aerosols

Particles that are formed or generated from solid *organic or inorganic* materials through mechanical processes such as crushing, grinding, drilling, abrading, or blasting. In agriculture, organic dusts are far more prominent than inorganic dusts.

- Examples of *inorganic dust* are field/road dust from soil tillage; driving farm equipment on or working near dirt and gravel roads; harvesting operations such as combining soybeans, sorghum or other grains.
- Examples of *organic dust* in agriculture are grain dust, dust from swine and poultry operations, moldy corn or other grains, moldy silage and moldy hay. Activities that may cause exposures to this type of dust are:

- Working at grain elevators
- Transporting and storage of grain and on-site handling, transporting and storage of grain
- Grinding and mixing feed and feeding livestock
- Working in confinement or other swine housing including moving, sorting or trucking swine
- Working in livestock barns or confinement poultry including loading, sorting and unloading birds
- Cleaning out old chicken houses
- Moving spoiled grain out of storage
- Handling moldy hay

Fumes

Particles formed when a volatilized solid, such as a metal, condenses in cool air. This physical change is often accompanied by a chemical reaction such as oxidation. Examples include lead oxide fumes from smelting and iron oxide fumes from arc-welding. A fume also can be formed when a material such as magnesium metal is burned or when welding or gas cutting is done on galvanized metal. In agriculture welding, galvanized metals which contain zinc is the primary fume hazard.

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Respiratory Hazards - General Information

Mists

A mist is formed when a finely divided liquid is suspended in the air. These suspended liquid droplets can be generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing. Examples are the oil mist produced during cutting and grinding operations, acid mists from electroplating, acid or alkali mists from pickling operations, paint spray mist from spraying operations and the condensation of water vapor to form a fog or rain. In agriculture, pesticides generally fit into this category. Exposures can also be from operating high-pressure washers, pesticide sprayers, or orchard blasters.

Gases

Gases are formless fluids that occupy a space or enclosure and can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature. Examples are welding gases such as acetylene, nitrogen, helium and argon and carbon monoxide generated from the operation of internal combustion engines. Another example of a harmful gas is hydrogen sulfide, formed wherever there is decomposition of materials containing sulfur under reducing conditions. Common exposures in agriculture include hydrogen sulfate, liquid manure or nitrogen oxides from silo gas.

Vapors

Vapors are the gaseous form of substances that are normally in the solid or liquid state at room temperature and pressure. They are formed by evaporation from a liquid or solid and can be found where parts cleaning and painting takes place and where solvents are used. Common exposures in agriculture would include fumigant pesticides, gasoline and diesel fumes.

Smoke

Smoke consists of carbon or soot particles resulting from the incomplete combustion of carbonaceous materials such as coal or oil. Smoke generally contains droplets as well as dry particles. Diesel exhaust and crop residue burning are common agricultural exposures.

Oxygen deficiency

An oxygen deficient atmosphere has oxygen content below 19.5% by volume. Oxygen deficiency may occur in confined spaces, which include, but are not limited to fruit storage, storage tanks, process vessels, towers, drums, tank cars, bins, sewer, septic tanks, underground utility tunnels, manholes, and pits. The most common exposures in agriculture in this category include livestock confinement buildings with a storage pit under the building while the pit is being agitated or emptied. Entering a liquid manure storage pit anytime, entering an air tight silo which has been filed with silage, haylage or high moisture grain and working in an enclosed, poorly ventilated building having an engine exhaust, open flames or improperly ventilated indirect heaters are other examples.

Exposures to respiratory hazards should be minimized or eliminated when ever possible by utilizing the standard industrial hygiene practice of achieving primary prevention. This practice utilizes a hierarchy of controls from the most effective to the least effective which means altering the workplace instead of the worker. The best method of hazard control is positive **engineering** by using less toxic and less dangerous materials and methods. Another method of reducing respiratory hazards is **environmental controls** such as improved ventilation. In certain situations where engineering and environmental controls are not feasible, the least effective means of control is the use of appropriate personal **protective equipment** such as the respirators listed in this guidebook.

Respirator Classifications

Respirators provide protection either by removing contaminants from the air before they are inhaled or by supplying an independent source of respirable air. There are two major classifications of respirators: air purifying respirators (devices that remove contaminants from the air) and atmosphere-supplying respirators (those devices that provide clean-breathing air from an uncontaminated source).



AIR PURIFYING RESPIRATORS are grouped into three general types: *particulate removing*, *vapor and gas removing*, and *combination*. Elements that remove particulates are called filters, while vapor and gas removing elements are called either chemical cartridges or canisters. Filters and canisters/cartridges are the functional portion of air-purifying respirators and can generally be removed and replaced once their effective life has expired. The exception would be filtering face piece respirators (commonly referred to as “disposable respirators,” “dust masks” or “single-use respirators”) which cannot be cleaned, disinfected, or re-supplied with an unused filter after use.



ATMOSPHERE-SUPPLYING RESPIRATORS are respirators that provide air from a source independent of the surrounding atmosphere instead of removing contaminants from the atmosphere. These respirators are classified by the method that is used to supply air and the way in which the air supply is regulated. Basically, these methods are: self-contained breathing apparatus (air or oxygen is carried in a tank on the worker’s back, similar to SCUBA gear); supplied-air respirators (compressed air from a stationary source is supplied through a high-pressure hose connected to the respirator); and combination self-contained and supplied-air respirators.

Industry Standards

In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer is required by OSHA to establish and implement a written respiratory protection program with work-site-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. Examples of what the employer should include in the program are as follows:

- Procedures for selecting respirators for use in the workplace
- Medical evaluations of employees required to use respirators
- Fit testing procedures for tight-fitting respirators
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators
- Training of employees in the respiratory hazards they are potentially exposed to during routine and emergency situations
- Training of employees in the proper use of respirators, including putting on and removing them, any limitations of their use, and their maintenance
- Procedures for regularly evaluating the effectiveness of the program

Filtering Facepiece Examples



3M 8210 N95 Filtering Face Piece Respirator



3M 8511 N95 Filtering Face Piece Respirator



3M 8214 N95 Welding Fumes Respirator



3M 8271 P95 Filtering Face Piece Respirator



3M 8233 N100 Filtering Face Piece Respirator



Moldex 2300 N95 Filtering Face Piece Respirator

Agricultural Exposure Respirator Selection Logic

Activity	Exposure	Air Purifying Respirators				Supplied air respirators		Notes	
		Filtering face piece	Half mask face piece	Full face piece	Powered air-purifying	Airline	SCBA		
Livestock & Poultry CAFO (Confined Animal Feeding Operation)	Organic dust	✓ N, R, or P series	✓ N or P series	✓ N or P series	✓ HEPA filter				
	Ammonia		✓ Ammonia cartridge	✓ Ammonia cartridge				Add N or P prefilter if protection for dust is desired	
	Disinfectants	✓ <u>Solids</u> N, R, or P series	✓ <u>Solids</u> N or P series <u>Liquids</u> (add P prefilter to cartridges for spray applications) • Hypochlorite (bleach) or iodine solutions: AG cartridge • Quaternary ammonium compounds: ammonia cartridge • Oxidizing (peroxide) agents: N or P filter • Aldehyde compounds: cartridge with specific label for formaldehyde & OV • Phenol compounds: OV cartridge	✓ <u>Solids</u> N or P series <u>Liquids</u> (add P prefilter to cartridges for spray applications) • Hypochlorite (bleach) or iodine solutions: AG cartridge • Quaternary ammonium compounds: ammonia cartridge • Oxidizing (peroxide) agents: N or P filter • Aldehyde compounds: cartridge with specific label for formaldehyde & OV • Phenol compounds: OV cartridge					Read label or MSDS for proper selection based on formulation & active ingredients Spraying liquid formulations create aerosols; use N or P prefilter with chemical cartridge
	Carbon monoxide					✓	✓	May be a contaminant from poorly vented space heaters	
	Hydrogen sulfide					✓	✓	Released from manure pit during pit agitation or pumping Restrict entry, ventilate area	

Half Mask Face Piece, Full Face Piece Examples



3M Half Face Piece 6000 Series



3M Half Face Piece 6000 series
With Organic Vapor Cartridges &
5N11 N95 Prefilters



3MR 6001 OV Cartridge



3MR 6003 OV / AG



3MR 6004 Ammonia
& Methylamine



3M 2091 P100
Particulate Filter



3M 2071 P95
Particulate Filter



North 7700 Half Face
Silicone Respirator



North 5500 Half Mask
Economic Respirator
w/Organic Vapor Cartridges



North Organic Vapor
Cartridge & P100
Particulate Filter



North Organic Vapor
Cartridge



North Ammonia
& Methylamine
Cartridge



North Organic
Vapor & Acid
Gas Cartridge



North Pancake Filter
Adapter



North R95 Particulate Oil
Degrading Filter



North P100 Pancake filters



3M Full Face Piece 6000 series



3M 7800 Series Ultimate Reuseable
Full Face Piece Respirator



North Safety 7600 Series Silicone
Full Face Piece



North Safety Small 5400 Economic
Full Face Piece

Activity	Exposure	Air Purifying Respirators				Supplied air respirators		Notes
		Filtering face piece	Half mask face piece	Full face piece	Powered air-purifying	Airline	SCBA	
Livestock & Poultry CAFO	Methane					✓	✓	Explosion hazard Prevent sparks, ventilate area
Pesticide use (herbicides, insecticides)	Aerosols (solids and sprayed liquids) Organic vapors (sprayed liquids)	✓ <u>Solids</u> N, R, or P series	✓ <u>Solids</u> N or P series <u>Liquids</u> Organic vapor cartridge & P prefilter	✓ <u>Solids</u> N or P series <u>Liquids</u> Organic vapor cartridge & P prefilter	✓ <u>Solids</u> HEPA filter <u>Liquids</u> Organic vapor cartridge & P prefilter			Read label or MSDS EPA requires statement including respirator selection http://www.pestmanagement.rutgers.edu/PAT/RespiratoryProtectionforPesticides.PDF EPA toxicity categories: http://www.epa.gov/pesticides/health/tox_categories.htm
Grain handling; Silo or bin unloading	Organic dust (feed or grain dust, molds, spores)	✓ N series	✓ N or P series	✓ N or P series	✓ HEPA filter			
Anhydrous ammonia field application	Ammonia		✓ Ammonia cartridge	✓ Ammonia cartridge				Protect skin and eyes if using half face piece
Welding	Metal fumes (particulates)	✓ N100, R100, or P100	✓ N100, R100, or P100 filter	✓ HEPA filter			✓	Ventilate area to control carbon monoxide exposure Use UV and face protection
Using gas or diesel engine indoors (power-washing, skid loader, etc.)	Carbon monoxide		No air purifying respirator effective; ventilate area or use supplied air or SCBA				✓	Ventilate area to control carbon monoxide exposure Using gas or diesel engines indoors can create an environment that is considered an oxygen deficient atmosphere

Powered Air Purifying and SCBA (Self Contained Breathing Apparatus) Examples



3M 700 Series Helmet Headtops



Air-Mate 30 Minute 2000 SCBA



3M 400 Series Visor Headtops



**3M Dual Airline, Supplied Air, Tight-Fitting
Face Piece Systems**



**3M Speedglas™ AdFlo PAPR System
Clean Air Welding System**

Activity	Exposure	Air Purifying Respirators				Supplied air respirators		Notes
		Filtering face piece	Half mask face piece	Full face piece	Powered air-purifying	Airline	SCBA	
Fumigation	Toxic gases Potential oxygen deficiency in enclosed area		✓ (only for outdoor use) OV cartridge & P prefilter	✓ (only for outdoor use) OV cartridge & P prefilter		✓ For enclosed areas	✓ For enclosed areas	Read label or MSDS Supplied air respirators required for soil or space fumigants in enclosed areas http://www.pestmanagement.rutgers.edu/PAT/RespiratoryProtectionforPesticides.PDF
Silo entry non-air-tight silo oxygen limiting	Oxides of nitrogen Potential oxygen deficiency						✓	Do not enter for at least 10-14 days after filling without running blowers for at least 30 minutes, monitoring nitrogen oxide levels to assure nontoxic levels and wearing SCBA if elevated levels.
Paint (spraying)	Aerosol Organic vapors	✓ N, R, or P series	✓ OV cartridge & P prefilter	✓ OV cartridge & P prefilter		**	**	** Isocyanate paints require supplied air respirators
Woodworking, remodeling	Aerosols (wood, sheetrock dusts)	✓ N, R, or P series	✓ N or P filter	✓ N or P filter	✓ HEPA filter			
	Organic vapors (lacquers, thin- ners, varnish, adhesives)		✓ OV cartridge					

Particulate filters & prefilters

Designation according to oil degradation resistance

N = not for use in presence of oil mist

R = some resistance to oil mist

P = for use where oil mist present ("oil proof")

Chemical cartridges

OV = organic vapors

AG = acid gas

Designation according to filter efficiency

95 = moderate filtering efficiency (95%)

99 = high filtering efficiency (99%)

100 = highest filtering efficiency (99.97%), comparable to HEPA (high efficiency particulate air) filter

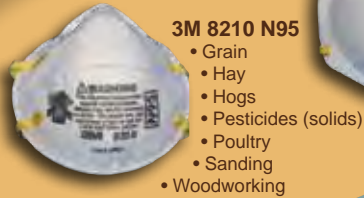
Ex: N95: can not be used in presence of oil mist, has 95% filter efficiency.

P100: can be used if oil mist present, 99.97% filter efficiency

Agricultural Respirator Selection Guide

Use Only NIOSH Approved Respirators

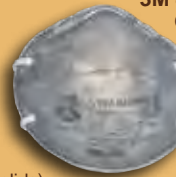
Disposable Particulate Respirators



- 3M 8210 N95**
- Grain
 - Hay
 - Hogs
 - Pesticides (solids)
 - Poultry
 - Sanding
 - Woodworking



- 3M 8511 N95**
- Exhalation Valve
- Grain
 - Grinding
 - Hay
 - Hogs
 - Pesticides (solids)
 - Poultry
 - Sanding
 - Woodworking



- 3M 8247 R95**
- Charcoal Filter
- Hog Odors
 - Poultry Odors
 - Nuisance Odors
 - Oil and non-oil based particles



- 3M 8271 P95**
- Grain
 - Grinding
 - Hay
 - Hogs
 - Poultry
 - Sanding
 - Woodworking



- 3M 8577 P95**
- Oil and non-oil based aerosol particles
 - Carbon Filter
 - Hog Odors
 - Poultry Odors
 - Nuisance Odors



- 3M 8233 N100**
- Grain Dust
 - Grain Handling
 - Grinding
 - Hay
 - Mold
 - Pesticides (solids)
 - Spores
 - Welding

Reusable Particulate and Gas/Vapor Respirators

- Organic Vapor/Acid Gas**
- Disinfectants
 - Bleach



- Ammonia**
- Anhydrous Ammonia
 - Hogs
 - Poultry



- Organic Vapor**
- Paint
 - Pesticides
 - Add particle filter if spraying



- Multi Gas**
- Paint
 - Pesticides
 - Disinfectants
 - Bleach
 - Formaldehyde



Cartridge Face Piece
Use with Cartridges and Particulate Filters



- Particulate Filter P100**
- Feed or Grain Dust
 - Hogs
 - Mold
 - Organic Dust
 - Poultry
 - Spores
 - Welding
 - Woodworking



Filter Retainer
• Use on top of cartridges



Filter Cover

Other Types of Respiratory Protection

- Powered Air Purifying**
- Use Appropriate Filter/Cartridge
- Grain Handling
 - Livestock & Poultry Confinement
 - Pesticides
 - Woodworking



**Not for use in an oxygen deficient environment*



- Supplied Air/SCBA**
- Carbon Monoxide
 - Fumigation (enclosed areas)
 - Hydrogen Sulfide
 - Methane
 - Manure Pits
 - Paint



- Self Contained Breathing**
- Carbon Monoxide
 - Hydrogen Sulfide
- (manure pits)
- Methane
 - Silo entry

Particulate Filter N95
Use as Pre Filter with Cartridges

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Airborne (or Respiratory) Hazards may result from either an oxygen deficient atmosphere or breathing air contaminated with toxic particles, vapors, gases, fumes or mists. The proper selection and use of a respirator depend upon an initial determination of the concentration of the hazard or hazards present in the workplace, or the presence of an oxygen deficient atmosphere.

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Which Respirator is Right for the Farm Work You Do?

Do you have any respiratory exposures?
Examples: Working with hogs, cattle, dairy, poultry, grain, tobacco, cotton, pesticides, chemicals, silos and welding

Consider Your Exposures

Most farm activities put you at risk for some type of respiratory exposure causing a need for respiratory protection.

Are you exposed to dust/aerosols?

Grain, Hay, Hogs, Pesticides (solids) Poultry, Mold, Grain Dust

Consider the Following Options:

- Filtering Facepiece Respirator
- Half Facepiece Respirator with P100 Filters
- Full facepiece respirator with P100 Filters
- Powered Air Purifying Respirator (PAPR) with HEPA filter



Are you exposed to chemicals?

Pesticides (Organic Vapors), Ammonia, Disinfectants, Bleach (Acid Gas)

Consider the Following Options with appropriate cartridges or filters:

- Half Mask Cartridge Respirator
- Powered Air Purifying Respirator (PAPR)



Do you work in an oxygen deficient environment*?

Livestock and Poultry Confinement
Grain Handling, Fumigation,
Manure Pits, Hydrogen Sulfide, Silo

Use one of the following:

- Self Contained Breathing Apparatus (SCBA)
- Combination Supplied Air Respirators / SCBA



*An example of an oxygen deficient environment is a confined space where there would not be enough oxygen.

Recommendations and Resources

Fit Testing - choosing the right respirator with the right fit is essential to having adequate protection. Tight fitting respirators should be fit tested at least annually, and fit checked with each use. To find out more information about proper fit contact AgriSafe Network. www.agrisafe.org

Occupational Safety and Health Administration (OSHA) requires medical evaluation before any employee can be fit-tested for wearing a respirator. If you have a medical condition that would prohibit you from wearing a respirator consult a health care provider.

Example: heart conditions, lung conditions such as asthma or emphysema, uncontrolled hypertension or claustrophobia

Additional Information

Related Respiratory Health Training:

- **AgriSafe Learning Lab-** To access OnDemand trainings regarding respiratory health head to learning.agrisafe.org



Useful Federal Agencies:

- National Institute for Occupational Safety and Health (NIOSH)- Institute within the Center for Disease Control and Prevention
- Occupational Safety & Health Administration (OSHA)
- Environmental Protection Agency (EPA)

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Protecting the People Who Feed the World

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