

# RESPIRATORY PROTECTION MANUAL



FOR PESTICIDE HANDLERS AND APPLICATORS

Agriculture and Natural Resources  
Environmental Health and Safety Office

<http://safety.ucanr.org>

# **Respiratory Protection Manual**

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**University of California  
Agriculture and Natural Resources  
Environmental Health and Safety Office**

## **TABLE OF CONTENTS**

TABLE OF CONTENTS	Page 1
INTRODUCTION	Page 2
HAZARDS TO THE RESPIRATORY SYSTEM	Page 2
MEDICAL EVALUATION	Page 3
REQUIREMENTS FOR FIT TESTING	Page 3
HALF-MASK AIR PURIFYING RESPIRATORS	Page 4
PROCEDURES FOR THE HALF-MASK APR	Page 5
FULL-FACE AND POWERED AIR-PURIFYING RESPIRATORS	Page 5
EMPLOYER AND EMPLOYEE RESPONSIBILITIES	Page 8
RESPIRATOR CARE AND MAINTENANCE	Page 8
CARTRIDGES AND FILTERS	Page 10
APPROVAL OF RESPIRATORS	Page 11
WARNINGS AND LIMITATIONS FOR APR	Page 12
RESPIRATOR BRANDS AND CONTACTS	Page 13

# Respiratory Protection Manual

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## INTRODUCTION

The University of California, Agriculture and Natural Resources – Environmental Health and Safety (ANR-EH&S), Respiratory Protection Program establishes guidelines for the use of respirators to protect the health of employees whom, during their normal duties, are or could be exposed to hazardous substances or atmospheres. The program meets the requirements of California Code of Regulations (CCR) Title 3, Section 6739 and CCR Title 8, Section 5144.

## HAZARDS TO THE RESPIRATORY SYSTEM

Your health depends upon breathing clean air. When hazardous dusts, fumes, mists, gases, or vapors are breathed in, they become trapped in the respiratory system causing irritation and/or loss of ability to breathe. Short and/or long-term health problems may result, even death. Oxygen deficiency is a very serious situation, which can cause loss of consciousness or death in minutes, and temperature extremes can lead to damage of the respiratory system.

**Dust, Fumes, and Mists** - are tiny particles that float in the air.

**Dust** - are formed when solid materials are broken down in activities such as sanding, grinding, or crushing.

**Fumes** - occur when metal is melted, vaporized, then quickly cooled, creating very fine particles, example - welding.

**Mists** - are tiny liquid droplets created by spraying, mixing, or cleaning activities.



**Gases and Vapors** - are invisible contaminants mixed in the air.

**Gases** - are substances that become airborne at room temperature and are often produced by chemical processes or high-heat operations.

**Vapors** - are formed when liquids or solids evaporate, typically occurring with solvents, paints, or refining activities.



**Oxygen Deficiency** - is an atmosphere with less than 19.5% oxygen.

**Oxygen Deficiency** - can be caused by chemical reactions, fire, or displacement by other gases. Oxygen comprises about 21% of the air we breathe.



# Respiratory Protection Manual

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**Temperature Extremes** - extremely hot or extremely cold air can damage the respiratory system depending on the length of exposure.

**Temperature Extremes** - Activities involving high heat such as furnaces and extreme cold such as walk-in freezers are examples of these hazards.



## **MEDICAL EVALUATION**

The employer shall ensure a medical evaluation is conducted to determine the employee's ability to use a respirator before the employee is fit tested or required to use the respirator in the workplace.

## **REQUIREMENTS FOR FIT TESTING**

### ***Requirements***

Only a properly fitted respirator can protect you. Face shape, facial hair, eyeglasses, missing dentures, weight loss/gain, and skin conditions can all affect the fit of a respirator. Anyone who is required to use respiratory protection equipment must be fit tested before any equipment can be issued. Fit testing for pesticide handlers and applicators must be repeated annually as required by law. In addition, because the seal of the respirator may be affected, fit testing must be repeated if the person has:

- A weight change of 20 lbs. or more.
- Significant facial scarring in the area of the facepiece seal.
- Significant dental changes (multiple extractions without dentures).
- Reconstructive or cosmetic surgery.
- Any other condition that may interfere with facepiece sealing.

# Respiratory Protection Manual

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## *Fit Testing*

The standard fit test method provided by ANR-EH&S is the Quantitative Fit Test utilizing an instrument called a PORTACOUNT, which measures the particle concentration both outside and inside the mask. This ratio is known as the fit factor. A fit factor of 100 is the minimum for passing the test based on OSHA guidelines. The fit test consists of eight exercises that attempt to dislodge or create a leak in the seal between the face and the facepiece.



## **HALF-MASK AIR-PURIFYING RESPIRATOR**

The standard respirator issued by ANR-EH&S for pesticide handlers and applicators is the half-mask air-purifying respirator (APR). Reusable half-mask APRs are the most commonly used type of respirator.

The half-mask APR covers the nose, mouth, and chin. The facepiece is equipped with either cartridges that capture gases and vapors, or filters, which capture particles, purifying the air as the user breathes. Each cartridge or filter is made for a specific gas, vapor or particle hazard, with some offering protection against a combination of hazards.

Since this type of respirator does not supply air, it cannot be used in oxygen deficient atmospheres, Immediately Dangerous to Life and Health (IDLH) atmospheres, or confined spaces.



The half-mask air-purifying respirator has a protection factor (PF) of 10. This only allows the wearer to be exposed to a specific contaminant at concentrations 10 times or less the allowable limits of the Threshold Limit Value (TLV) or Permissible Exposures Limit (PEL) as stated on Material Safety Data Sheets (MSDS) or pesticide container labels. The American Conference of Governmental Industrial Hygienists (ACGIH) determine the TLV and the Occupational Health and Safety Administration (OSHA) determine the PEL for hazardous substances.

# Respiratory Protection Manual

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## **PROCEDURES FOR THE HALF-MASK APR**

### ***To put on and adjust a Half-Mask APR:***

- Inspect your respirator. Make sure both inhalation and exhalation valves are inside the mask. Check for signs of wear or deterioration.
- Insure the appropriate cartridge(s) and/or filter(s) are securely attached.
- Hold the mask so the narrow nose-cup points upward.
- Grasp both of the lower mask straps and hook them behind the neck; place the top cradle straps on the top and behind the head.
- Before using your respirator, check for leaks by performing both positive and negative pressure checks:

**Positive-Pressure Check** - Block the exhaust port(s) with the heel of your hand and *exhale* gently with enough force to cause a slight positive pressure inside the facepiece. If the facepiece bulges slightly and no leaks between the face and facepiece are detected, a proper fit has been obtained.



**Negative-Pressure Check** - Block the intake port(s) with your palms and *inhale* gently for ten seconds. If the facepiece collapses slightly and no air leakage is detected between your face and the facepiece, a proper fit has been obtained.



If air leaks between the face and facepiece of the respirator, reposition it and adjust the straps for a more secure fit. If you cannot achieve a proper fit, **do not** use the respirator. Notify your supervisor immediately.

## **FULL-FACE AND POWERED AIR -PURIFYING RESPIRATORS**

Although ANR-EH&S only issues half-mask respirators, Centers may choose to accommodate employees by issuing other types of respirators including full-face and loose fitting powered air-purifying respirators.

# Respiratory Protection Manual

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## *Full-Face Air-Purifying Respirator*

The full-face respirator provides more protection than a half-mask due to its shape allowing a better seal around the face and the addition of a facepiece protecting the eyes from contact with hazardous substances. The full-face APR utilizes the same type of cartridges and filters as the half-mask APR.

Air-purifying full-face respirators have the same limitation as half-mask respirators. Since they do not supply air, they cannot be used in oxygen deficient atmospheres, IDLH atmospheres, or confined spaces.



The full-face air-purifying respirator has a protection factor of 50, allowing the wearer to be exposed to a specific contaminant at concentrations 50 times or less the allowable limits of the TLV or PEL.

**Note** - Standard eyeglasses interfere with the mask-to-face seal; therefore, the wearer should obtain an additional pair of prescription lenses attached to a spectacle mount kit for installation into the facepiece.

Accessories such as welding attachment kits, fire retardant fabric hoods, peel-off plastic lens covers, sun protective lenses and anti-fogging agents can be obtained for full-face APRs.



### *To put on and adjust a Full-Face APR:*

- Inspect your respirator. Make sure both inhalation and exhalation valves are inside the facepiece. Check for signs of wear or deterioration.
- Insure the appropriate cartridge(s) and/or filter(s) are securely attached.
- Loosen all straps; pull harness over the head and place the chin in the chin cup.
- Pull the harness down on the back of the head.
- Tighten harness gently, starting with the bottom straps and then the middle and top straps.
- Before using your respirator, check for leaks by performing the positive and negative pressure checks.

# Respiratory Protection Manual

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## *Powered Air-purifying Respirator*

The powered air-purifying respirator (PAPR) is a motorized system utilizing cartridges and filters to clean ambient air before it is delivered by a constant flow to the breathing zone of the user. A PAPR system typically includes a blower, battery, headpiece, and a breathing tube. PAPRs come with either loose or tight fitting facepieces. Since the blower has rechargeable batteries, it can be reused with the addition of a freshly charged battery or after the batteries have been recharged.



Powered air-purifying respirators have the same limitation as half-mask and full-face APRs. Since they do not supply air, PAPRs cannot be used in oxygen deficient atmospheres, IDLH atmospheres, or confined spaces. The PAPR has a protection factor of 25 to 50 depending on the facepiece.

**Note** - If battery runs out during use on the loose fitting facepiece, wearer has no protection due to elimination of positive pressure.



## *To use a powered air-purifying respirator*

- Inspect your equipment. Check for signs of wear or deterioration.
- Insure the appropriate cartridge(s) and/or filter(s) are securely attached.
- Check battery life is full.
- Mount belt units on your waist and adjust until it is comfortable.
- Put on facepiece or helmet.
- Turn blower on prior to entering work area.



# Respiratory Protection Manual

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## **EMPLOYER AND EMPLOYEE RESPONSIBILITIES**

### *Employer Responsibilities*

- Provide a written Respiratory Protection Program (see Guidelines at [http://safety.ucanr.org/Policies\\_-\\_Procedures/](http://safety.ucanr.org/Policies_-_Procedures/))
- Provide a medical evaluation when required.
- Conduct initial and annual required respirator fit testing.
- Provide respirators, replacement parts, cartridges and filters.
- Conduct initial and annual required respiratory protection training.
- Provide a means to clean and store respirators.
- Maintain employee training, medical and exposure records.
- Provide labels, Material Safety Data Sheets (MSDS) and any other related information to assist with respirator, cartridge and filter selection.
- Provide medical service if required.

### *Employee Responsibilities*

- Be familiar and understand the written Respiratory Protection Program.
- To be clean shaven before using a respirator.
- Inspect the respirator before and after each use.
- Perform a positive and negative fit check prior to using the respirator.
- Replace the cartridges and filters when necessary or required.
- Care, maintenance and storage of the respirator, cartridges and filters.
- To know which cartridge(s) and filter(s) to use for the hazard.
- To wear the respirator where it is required.
- To notify the employer if suspected of being exposed to a hazardous substance.

## **RESPIRATOR CARE AND MAINTENANCE**

Primary responsibility for maintaining the respirator in proper and clean condition rests with the employee. Wearing a dirty or damaged respirator can cause skin and respiratory irritation, including exposure to hazardous substances. Also, wearing a respirator that hasn't be cleaned and disinfected properly can lead to illness including colds, pneumonia, and bronchitis.

Your respirator should be cleaned and disinfected after each use and inspected for proper function prior to each use. Proper storage of your respirator and cartridges is also an important factor.

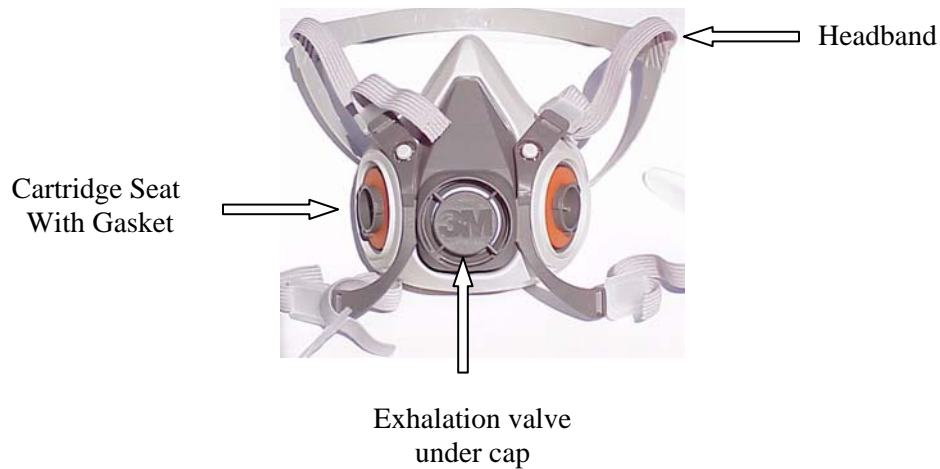
# Respiratory Protection Manual

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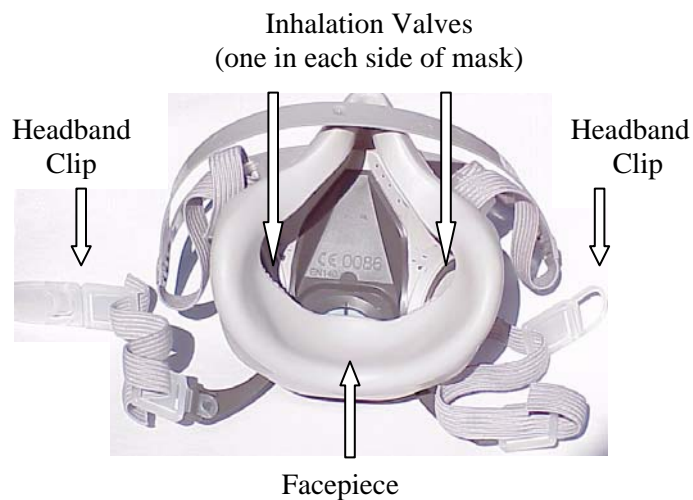
## *Respirator Inspection (what to look for)*

- **Facepiece** - cuts, tears, holes, cracks, distortion, and unusual stiffness.
- **Headband** - breaks, frays, tears, unusual stiffness, loss of elasticity, and missing clips.
- **Exhalation Valve** - distortion, tearing, foreign matter.
- **Inhalation Valves** - distortion, tearing, foreign matter.
- **Cartridge Seats** - presence of gasket (if required), foreign matter, stripped threads.
- **Cartridges and filters** - foreign matter, stripped threads, same brand as respirator.

### **FRONT**



### **BACK**



# Respiratory Protection Manual

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## *Procedures for Cleaning Respirators*

- **Disassemble** - Remove filters, cartridges, or canisters (do not immerse in cleaning solution), inhalation and exhalation valves and any components recommended by the manufacturer. Discard or repair any defective parts.
- **Washing** - Use warm (not hot) water and a mild detergent (liquid soap) or a cleaner recommended by the manufacturer, scrub all parts with a stiff bristle (not wire) brush to remove foreign matter.
- **Rinse** - Use warm clean water, rinse all parts thoroughly, shake off excess water.
- **Disinfecting** - Use a household bleach (one capful per gallon of warm water), place all washed pieces in solution for 10 to 15 seconds, and shake off excess solution.
- **Drying** - Parts should be hand-dried with a clean lint-free cloth or air-dried.
- **Reassemble** - After drying, reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
- **Test** - Check the respirator to ensure that all parts work properly.

## *Storage of respirators, cartridges and filters*

Store your respirator in such a way that no part of it will be stretched bent, compressed, or exposed to temperature extremes. If its shape becomes distorted, it may develop leaks. Remove cartridges and/or filters from respirator and place in separate plastic bags.

Respirators and cartridges cannot be stored unprotected out in the open. They should be placed in a bag and stored in a locker, desk or shelf for protection.

## **CARTRIDGES AND FILTERS**

Only same brand cartridges and filters can be used with the respirator. **Do not cross brand any parts of the respirator.** Respirators will not provide respiratory protection if parts are of a different brand. Interchanging different brand parts is against OSHA regulations and illegal.

Proper cartridge/filter combination



Improper cartridge filter combination.  
(Duct tape holding two different brands together)



# Respiratory Protection Manual

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## *Cartridge and Filter Change Outs*

The life of a cartridge depends on three factors: the contaminant concentration, length of exposure time, and the user's exertion or breathing rate.

The rule-of-thumb for replacing cartridges and filters is:

- If you detect any odor or taste of contaminant inside your respirator.
- If you experience difficulty in breathing due to blockage of particulate on the filters.
- Cartridges and filters become wet.
- After 8 hours of total use.
- Loose track of hours cartridges and filter have been used.

It is University of California's policy to change out cartridges and filters after 8 hours of total use. Write the date on new cartridges/filters and keep track of hours so you'll know when to change them out.

Use only new cartridges and filters for changing out replacements. All new cartridges and filters come in factory sealed bags. Do not change out with unsealed cartridges and filters.

Factory Sealed Cartridges



## **APPROVAL OF RESPIRATORS**

The National Institute of Occupational Safety and Health (NIOSH) is the acting agency, which approves all safety equipment, **not** OSHA. OSHA's authority is to create safety standards and regulate them. All respirators including parts, cartridges and filters must have the NIOSH approval for use at University of California facilities. All brands of respirators issued by ANR-EH&S have NIOSH approval. The approval can be found with the manufacturer information, which comes with respirators and their parts.

# Respiratory Protection Manual

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## WARNINGS AND LIMITATIONS FOR APRs

Air-purifying respirators **cannot** be worn for protection against gas or vapor contaminants with poor or no warning properties (irritation, odor or taste) or are sensory desensitizers. The following is a partial list of materials for which these cartridge respirators may **NOT** be used for respiratory protection, regardless of concentration or time exposure.

THIS LIST IS NOT COMPLETE AND DOES NOT REPLACE A COMPLETE EVALUATION OF THE WORK PLACE AND ITS CONTAMINANTS BY AN INDUSTRIAL HYGIENIST.

- |                            |                            |
|----------------------------|----------------------------|
| 1. Acrolein                | 11. Methyl Bromide         |
| 2. Arsine                  | 12. Methyl Chloride        |
| 3. Bromine                 | 13. Methylene Chloride     |
| 4. Carbon Monoxide         | 14. Nickel Carbonyl        |
| 5. Dimethylaniline         | 15. Nitro Compounds:       |
| 6. Dimethyl Sulfate        | Nitrogen Oxides            |
| 7. Hydrogen Selenide       | Nitroglycerin              |
| 8. Hydrogen Cyanide        | Nitromethane               |
| 9. Hydrogen Sulfide        | 16. Ozone                  |
| 10. Isocyanate Compounds:  | 17. Phosgene               |
| Methylene Bisphenyl        | 18. Phosphine              |
| Isocyanate (MDI)           | 19. Phosphorus Trichloride |
| Toluene Diisocyanate (TDI) | 20. Stibine                |
| Methyl Isocyanate          | 21. Sulfur Chloride        |

***Do not use any air-purifying respirator under any of the following conditions:***

- Sandblasting (abrasive blasting).
- Fire fighting.
- For protection against fumigants.
- In oxygen deficient atmospheres (any atmosphere having less than 19.5% oxygen).
- In atmospheres where the concentrations of toxic contaminants are unknown, or are IDLH.
- For protection against gases or vapors which generate high heats or a reaction with the sorbent material in the cartridge.
- For protection while performing or observing:
  1. Flame cutting or flame welding.
  2. Welding using fluxes containing fluorides.
  3. Welding of painted, coated, or plated surfaces.

These operations generate harmful vapors and/or gases which air-purifying respirators cannot filter out sufficiently to protect the welder.

# Respiratory Protection Manual

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*Immediately leave the area and replace the respirator if:*

- Breathing becomes difficult.
- Dizziness or other distress occurs.
- You can sense irritation, smell or taste the contaminants.
- The respirator becomes damaged.

## **RESPIRATOR BRANDS AND CONTACTS**

ANR-EH&S provides fit testing for three different brands of respirators as required by OSHA regulations. The primary brand fit tested and issued is North Safety Products with MSA and 3M as secondary choices. These companies can be contacted for technical information, catalogs, charts and local distributors.

- **North Safety Products**

2000 Plainfield Pike  
Cranston, RI 02921

Telephone: 800-581-0444

Internet: <http://www.northsafety.com>

- **MSA ( Mine Safety Appliances)**

(Corporate Headquarters)  
121 Gamma Drive  
RIDC Industrial Park  
O'Hara Township  
Pittsburgh, PA 15238

Telephone: 1-800- 672-222

Internet: <http://www.msanet.com>

**Mailing Address:**

P.O. Box 426  
Pittsburgh, PA 15230-0426

- **3M**

3M Center, Bldg. 275-6W-01  
P.O. Box 33275  
St. Paul, MN 55133-3275

Telephone: 1800-896-4223

Internet: <http://www.3M.com/occsafety>