Respirator Information Guide

It's Your Choice

The UCSC Respiratory Protection Program is designed to protect the campus community from respiratory hazards that cannot be controlled through regular engineering methods (such as exhaust hoods).

As an employee of UCSC, you are protected by occupational safety and health laws. These regulations designate how employers may distribute and require you to use respiratory protection equipment. These regulations are for your protection; however, ***as the respirator user you are ultimately responsible for your own safety.***

Listed below are some key elements of the Campus Respiratory Protection Program. Please review this information and if you have any questions or concerns about respirator use, ask your supervisor or contact EH&S for assistance.

I. Responsibilities

A. Employees, Students, Volunteers - (Assigned To Use Respirators)

Any individual issued respiratory protective equipment by UCSC is responsible for using the equipment in accordance with training and for keeping the equipment clean, in good working order, and stored in an appropriate manner.

II. Respirator Use

A. Training

After training, you should be thoroughly familiar with:

❶ Requirements for medical certification to determine you are able to wear a respirator
❷ Types and limitations of respirators and how to use a respirator properly
❸ Fit testing procedures
❹ Learning to select your respirator based on specific hazards
❺ Using only NIOSH certified respirators
❻ Inspecting, maintaining, cleaning, and storing, respirators properly

B. Fit Testing

You need to be fit tested in the type, size and style of respirator you will be wearing on the job.

Individuals cannot be fitted with a face-sealing respirator if there is any facial hair present that could come between the skin and respirator mask sealing surface. Moderate stubble or one day's growth of facial hair is considered excessive facial hair.

C. Selection

1. All respirators issued by UCSC must be NIOSH approved.
2. Selection must always be based on:

   (a) the nature of the respiratory hazard (type and/or warning properties),
   (b) extent of the hazard (concentration),
   (c) work requirements and conditions (oxygen deficient, IDLH) and
   (d) characteristics and limitations of respirators.

Section IV contains charts that can be used to help with respirator selection.

D. Use of Respirators in the Field

Once the proper respirator has been selected and issued, care must be exercised in its use, cleaning, storage and maintenance.

1. *Initial Inspection*
   a. Is it the correct type of respirator for the job? (Determine if the cartridge is intended for the hazard you are facing; particulates, gases/vapors, or a combination).
   b. Is it the correct brand and size?
   c. Is it intact, complete and functioning? Visually inspect the respirator for defective or worn parts. This inspection should include straps, hoses, valves, gaskets, rubber mask, filters and cartridges, as required.
2. *User Seal Checks* - Always perform negative and positive user seal checks on your respirator after donning. This is the only way to ensure your respirator is fitting properly each time you use it.
3. *Cleaning and Sanitizing* - Clean and sanitize your respirator after each use or each day's use:
   a. Light cleaning should be done by wiping down all rubber surfaces of the respirator with sani-wipes. Light cleaning should be done several times throughout the day when working in particularly dirty environments.
   b. Thorough cleaning is performed by removing cartridges and immersing the respirator into a cleaning/sanitizing solution. The respirator should be cleaned with brushes or scrubbers, rinsed to remove all soap/sanitizer residue, and air dried.
4. *Storage* - When not in use, store the respirator in a sealed plastic bag or other sealed container and protect it from dust, sunlight, extremes of temperature, excessive moisture, and damaging chemicals.
5. *Replacement of Cartridges/Filters*
   a. Change particulate cartridges when they become clogged with contaminants, damaged, or breathing through them becomes difficult.
   b. Change organic vapor/acid gas cartridges when the End of Service Life Indicator (ESLI) warns you the cartridge is near its end of adequate protection, or if no ESLI is present contact EH&S to develop a routine change schedule.

III. Respirator Types

This section describes the various types of respirators available for use at UCSC. Included in the discussion is an overview of the advantages, disadvantages, limitations, applications and assigned protection factors for each class of respirator.

A. N95 Filtering Facepiece (Disposable Dust/Particulate Respirators)

1. Description: Single use disposable particle masks are designed for respiratory protection against certain pneumoconiosis and fibrosis-producing dusts and mists (double strapped types) as well as non-toxic nuisance particulates (single strapped type). These types of respirators are frequently misused therefore Supervisors or EH&S authorization is required prior to use.

2. Advantages: Respirators are lightweight, disposable, relatively comfortable, and inexpensive.

3. Limitations: Disposable N95 respirators offer minimal protection due to poor sealing characteristics. They cannot be used by personnel with facial hair which comes between the respirator and the skin. N95 particulate respirators cannot be used in an oily environment (oil mist or aerosol).

4. Applications: Low concentrations of nuisance dusts, mists, pollen, and animal dust as well as some pneumoconiosis and fibrosis-producing dusts and mist.

5. Assigned Protection Factor = 3 - 5.

B. Air Purifying Half Mask Respirators

1. Description: Air purifying, half mask respirators have a rubber face seal which fits over the nose and under the chin. The respirator is fitted with cartridges which purify the air as the wearer breathes. Different types of cartridges are available for different types of air contaminants.

2. Advantages: This type of respirator is relatively lightweight and can offer good protection from many different air contaminants.

3. Limitations: Air purifying respirators cannot be used for all types of air contaminants and are limited by the type and capacity of the filters and cartridges used. Protection factors offered by these masks are not as good as that provided by a full facepiece air purifying respirator nor do they provide eye protection. Proper fit is essential and many factors may effect the face to facepiece seal. They cannot be used in oxygen-deficient atmospheres, or in atmospheres which have high concentrations of contaminants. Breathing may become difficult because of the additional effort required to draw air through the purifying media.

4. Applications: Air purifying respirators can be used for protection from a wide variety of respiratory hazards. Cartridges and filters are designed to provide protection against a specific type of hazard. The most common types of cartridges are:

    a. HEPA Cartridge – High Efficiency Particulate Air or P100 particulate cartridges for low level concentrations of certain toxic dusts including asbestos, radionuclides, and silica. Can be used safely in an oily environment.

    b. Organic Vapor Cartridge - approved for concentrations not to exceed 1000 ppm for many organic solvents, petroleum distillates, and alcohols.

    c. Acid Gas/Mist Cartridge - for atmospheres containing low levels of mineral acid gas or mist.

    e. Combination Cartridge - for environments with more than one contaminant present (organic vapors, acid gasses, and particulates). For example, a typical combination cartridge a painter may use would include an N95 particulate pre-filter and an organic vapor cartridge.

    f. Mercury Cartridge - for protection against low levels of metallic mercury vapors.

5. Assigned Protection Factor = 10

C. Air Purifying Full Facepiece Respirators

1. Description: Air-purifying full facepiece respirators work on the same principal as the half-mask respirators described above. The facepiece extends around the entire face, covering the eyes, nose, chin and mouth.

2. Advantages: Full facepiece respirators provide a better seal and therefore, more protection than half-mask air-purifying respirators. They also protect the eyes and face from irritating vapors, mists, and splashed chemicals.

3. Limitations: Full face respirators are heavier than half-masks and often less comfortable for the wearer. Full face air purifying respirators cannot be used for all types of air contaminants and are limited by the type and capacity of the filters and cartridges used. Eyeglass wearers must assure that temple bars do not interrupt the face to facepiece seal. They cannot be used in oxygen-deficient atmospheres, or in atmospheres which have high concentrations of contaminants. Breathing may become difficult because of the additional effort required to draw air through the purifying media.

4. Applications: Full face respirators are used where a greater degree of respiratory protection is needed or where eye and face protection is desirable.

5. Assigned Protection Factor = 50.

D. Powered Air Purifying Respirators (PAPR)

1. Description: This class of respirator features a battery powered, portable fan which draws air through a particulate or chemical filter and blows it to the facepiece. The fan and filter unit is usually mounted on the wearer's back or belt. Full and half-mask facepieces are available as well as a variety of helmets and hoods.

2. Advantages: Major advantages are derived from positive pressure provided by the fan forcing air into the facepiece, hood, or helmet. This eliminates difficulty in breathing provided by negative pressure respirators and reduces the importance of a good facial fit.

3. Limitations: Units are relatively expensive to purchase and maintain. Use is restricted to battery life and the fan and battery pack must be carried by the wearer at all times. They cannot be used in atmospheres deficient in oxygen or other IDLH atmospheres. Heavy exertion (breathing) may create negative pressure inside the facepiece reducing the respirator's effectiveness.

4. Assigned Protection Factor = 25 - 100.

E. Airline Respirators (Pressure Demand or Continuous Flow)

1. Description: These respirators provide clean, fresh air to the wearer from a stationary source such as a compressor or compressed air cylinders. They may be equipped with a half or full facepiece, helmet, or hood. Breathing air must be of high quality as described in Appendix VIII. Air-line respirators have limited application on the UCSC Campus. Use of respirators shall be approved on a case by case basis by EH&S.

2. Advantages: Airline respirators may be used for long periods of time and provide a high degree of protection from a variety of air contaminants. They provide minimal breathing resistance and discomfort, are light weight, low bulk, moderate initial cost and low operating costs. These respirators can be used in oxygen deficient and other IDLH atmospheres when done in conjunction with a 5 minute self-contained air supply (escape respirator).

3. Limitations: Loss of the source of air eliminates all protection to the user. Air must be delivered to the mask or hood through a hose which can be awkward to maneuver and may easily tangle or crimp.

4. Applications: These respirators can be used for protection from most all air contaminants up to, but not exceeding the IDLH level.

5. Assigned Protection Factor = up to 10,000

F. Self-Contained Breathing Apparatus (SCBA)

1. Description: SCBA's provide the user with clean air from a high pressure cylinder carried on the wearer's back. They are equipped with a full facepiece and are operated in the pressure demand mode. SCBA's provide the maximum degree of protection available from airborne contaminants.

2. Advantages: Users carry their air supply with them allowing comparatively free movement over an unlimited area.

3. Limitations: SCBA units are expensive to purchase and maintain; require the wearer to carry 20 to 30 pounds of equipment on their backs, and provide no more than 40 minutes of continuous use. Personnel with facial hair which comes between the respirator sealing surface and the wearer's face cannot utilize SCBA equipment.

4. Assigned Protection Factor = up to 10,000

IV. Respirator Selection Charts

Locate the respirator number of a specific job or hazard in Chart A and determine the type of respirator the number represents from Chart B.

CHART A

JOB OR HAZARD	RESPIRATOR NUMBER
Acids (inorganic, low concentration)	7
Acids (inorganic, moderate concentration)	12
Animal Hair	1
Ammonia	5, 13
Asbestos (Patching or wet removal)	6, 11, 15
Atmosphere deficient in oxygen	15
Fiberglass	6, 11
Formaldehyde	3, 10
Glue Vapors	2, 8
Lead Dust or Fume	6, 11, 15
Mercury	14
Metal Dust (except lead)	6, 11
Nuisance dust	1
Organic solvents	2, 8
Painting	4, 9
Soldering	4, 9
Welding	6, 11
Wood dust	1, 6, 11

CHART B

RESPIRATOR TYPES

1. N95 Filtering Facepiece (Disposable Dust/Mist/Fume Mask)
2. Half Mask, Organic Vapor Cartridge
3. Half Mask, Formaldehyde Cartridge
4. Half Mask, Combination N95 Pre-filter/Organic Vapor Cartridge
5. Half Mask, Ammonia Cartridge
6. Half Mask, P100 HEPA Filter
7. Half Mask, Acid Gas/Mist Cartridge
8. Full Facepiece Mask, Organic Vapor Cartridge
9. Full Facepiece Mask, Combination N95 Pre-filter/Organic Vapor Cartridge
10. Full Facepiece Mask, Formaldehyde Cartridge
11. Full Facepiece Mask, P100 HEPA Filter
12. Full Facepiece Mask, Acid Gas/Mist Cartridge
13. Full Facepiece Mask, Ammonia Cartridge
14. Half or Full Facepiece Mask, Mercury Cartridge
15. Contact EH&S

V. Respiratory Protection Terms and Definitions

Air-Purifying Respirator: A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned Protection Factor (APF): The minimum anticipated protection provided by a properly functioning respirator or class of respirators to a given percentage of properly fitted and trained users.

Atmosphere-Supplying Respirator: A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Breakthrough: The penetration of challenge material(s) through a gas or a vapor air-purifying element. The quantity or extent of breakthrough during service life testing is often referred to as the percentage of the input concentration.

Canister or Cartridge: A container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand Respirator: An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Disposable Respirators: A respirator that is discarded after the end of its recommended period of use, after excessive resistance or physical damage, or when odor breakthough or other warning indicators render the respirator unsuitable for further use.

Dust: A solid, mechanically produced particle with a size ranging from submicroscopic to macroscopic.

Employee Exposure: Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-Of-Service-Life Indicator (ESLI): A system that warns the respirator user of the approach of the end of adequate respiratory protection; for example, that the sorbent is approaching saturation or is no longer effective.

Escape-Only Respirator: A respirator intended to be used only for emergency exit.

Filter or Air-Purifying Element: A component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering Facepiece (Dust Mask): A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit Factor: A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit Test: Means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Fume: A solid condensation particulate, usually of a vaporized metal.

Gas: An aeriform fluid that is in a gaseous state at standard temperature and pressure.

Helmet: A rigid respiratory inlet covering that also provides head protection against impact and penetration.

High-Efficiency Particulate Air (Hepa) Filter: A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood: Means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately Dangerous to Life or Health (IDLH): An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Mist: A liquid condensation particulate.

Negative Pressure Respirator (Tight Fitting): A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen Deficient Atmosphere: An atmosphere with an oxygen content below 19.5% by volume.

Particulate Filter Series N-R-P: New criteria eliminates classification of particulate filters according to hazard such as “dust, mist, fume” and provides for three levels of filter efficiency (95%, 99%, 99.97%). Each efficiency is available in a series of filter types known as N, R, P. The N, R, P designation corresponds to how resistant a filter is to oil. A single use, double strapped “dust mask” is now called an N95 single use filtering facepiece. Any HEPA cartridge is referred to as a P100 filter.

Efficiency	NaCl aerosol test (N=Not oil resistant)	DOP aerosol test (R=Resistant to oil)	DOP aerosol test (P=oil Proof)
95%	N95	R95	P95
99%	N99	R99	P99
100 (99.97%)	N100	R100	P100

Positive Pressure Respirator: A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered Air-Purifying Respirator (PAPR): An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure Demand Respirator: A positive pressure atmosphere- supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative Fit Test (QLFT): A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative Fit Test (QNFT): Means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Self-Contained Breathing Apparatus (SCBA): An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service Life: The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Single-Use Dust or Dust and Mist Respirators: Respirators approved for use against dusts or mists that may cause pneumoconiosis and fibrosis.

Supplied-Air Respirator (SAR) or Airline Respirator: An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Tight-Fitting Facepiece: A respiratory inlet covering that forms a complete seal with the face.

User Seal Check: An action conducted by the respirator user to determine if the respirator is properly seated to the face.

Vapor: The gaseous state of a substance that is solid or liquid at temperatures and pressures normally encountered.