RESPIRATORY PROTECTION MANUAL

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Introduction

Respirators are required when employees or students on campus are involved in work settings that may expose them to chemicals or dust in the air that are at harmful levels. In some shops, laboratories, medical facilities, and maintenance environments, the air may at times become contaminated with materials that are hazardous to breathe. The UC Davis Respiratory Protection Program establishes guidelines for the use of respirators to protect the health of employees and students who, during their normal duties, can potentially be exposed to hazardous substances or atmospheres. This program includes all respirators having a “NIOSH” mark on them (including N-95s). Dust masks that do not have a “NIOSH” mark are not considered respirators and may be used without a medical clearance, respirator fit test or training. Respirators should always be used as a last resort of personal protection, after first working to engineer out the hazard and exhausting all options of administrative controls.

The Respiratory Protection Program

Hazards to the Respiratory System:

The respiratory system is constantly working to cleanse and purify the inspired air. Some occupational activities and/or environments require the extra protection of equipment specifically designed to protect against hazards that may enter the body through the nose and mouth when breathing. Like clean air, many of these hazards are invisible and odorless. Breathing (or respiratory) hazards include dusts fumes and mists, gases and vapors, and oxygen deficient atmospheres. Knowing the characteristics of each hazard helps to understand why respiratory protection is so important.

**Dusts, Fumes, and Mists** - are tiny particles that float in the air. Dusts 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 that drift in the air - welding and furnace work are likely to produce fumes. Mists are tiny liquid droplets usually created by spraying, mixing, or cleaning activities. Mists may be a combination of several hazardous ingredients. When hazardous dusts, fumes, or mists are breathed in, they become trapped in the respiratory system causing irritation. Short- or long-term health problems may result, even death.

**Gases and Vapors** - are invisible contaminants mixed in the air. Gases are substances that become airborne at room temperature. Gases are often produced by chemical processes and high-heat operations. They drift quickly and undetected from their source. Vapors are formed when liquids or solids evaporate, typically occurring with solvents, paints, or refining activities. Breathing hazardous gases or vapors irritates the respiratory system, causing either short- or long-term health problems or even death.

**Oxygen Deficiency** - a lack of oxygen in the air. Oxygen deficiency can be caused by chemical reactions, fire, or displacement by other gases. In confined spaces, where ventilation is very limited or non-existent, aerobic bacterial growth and oxidation of rusting metals can also cause an oxygen deficient atmosphere. Oxygen comprises only a small percentage, about 21%, of the air we breathe. Yet, when levels of oxygen fall below 19.5% (minimal acceptable level), life-threatening health problems begin to occur very quickly.

Oxygen deficiency is a very serious situation that can cause loss of consciousness or death in minutes.
How the Program Works:

The UC Davis Campus Respiratory Protection Program is administered by the Office of Environmental Health & Safety (EH&S), and the day to day operations are administered at Occupational Health Services. The School of Veterinary Medicine (Vet Med) also conducts training and fit tests for N-95 respirators for some specific personnel and students as needed to support their program. Vet Med tracks their own personnel in a separate management system, and conducts the training and fit tests within the parameters of the Campus Respiratory Protection Manual. The program is in place to control occupational diseases caused by inhaling or breathing contaminated air.

In situations where workers may be exposed to potentially contaminated air with harmful hazards, the supervisor will carefully evaluate the job site and / or work task to determine if respiratory hazards are present. EH&S is available for consultation in evaluating potential hazards.

EH&S advises three approaches to achieving respiratory protection: The first method of protection that should always be considered is local engineering controls such as fume hoods or local exhaust systems – this is the most effective and efficient means of protecting employees from inhalation hazards. The second approach is administrative controls; these include substituting less toxic materials, if possible, reassessing the task to see if exposure can be minimized or eliminated, and the possibility of job rotation to reduce the exposure of any one person down to acceptable levels. Third: when these first two methods are not feasible, or are not yet in place, or cannot provide adequate protection, personal protective equipment is necessary.

Employees requiring respirators must be medically screened to identify any health conditions that might prohibit or limit their use of a respirator. When medical clearance is received, the employee is fit tested to find the right size and type of mask for them. With the exception of some employees and students in Vet Med, both medical clearance and fit tests take place at Occupational Health Services. Vet Med employees receive medical clearance from Occupational Health Services, and Vet Med students receive their medical clearance from Student Health and Counseling Services (SHCS) prior to fit testing at Vet Med. After a suitable respirator has been selected, they will learn how to properly use, clean and maintain their equipment. Annual re-evaluations assure that the respiratory protection selected for the employee is still effective.

Who Must Wear Respiratory Protection Equipment?

Respiratory protection equipment is required:

- For activities that cannot be safely controlled by engineering methods (e.g. pesticide applications require the portability of a respirator).

- When the working atmosphere is or may be oxygen deficient (e.g. confined spaces such as tanks, boilers, vaults, crawl spaces and storm drains).

- When airborne radioactive or toxic materials could exceed permissible exposure limits.

- For emergency use when loss of life or serious property loss or damage may be involved.
Only those persons who have been designated by their supervisor, principle investigator or EH&S as being required to utilize respiratory protection equipment, and who have been medically approved, properly fitted and trained in its use are authorized to use such equipment.

**How Do You Obtain Respiratory Protection Equipment?**

Contact the Office of Environmental Health & Safety at (752-1493) if you would like assistance in evaluating your workplace activities to determine the most effective means of respiratory protection for your circumstances. In some cases, a respirator may not be necessary. If a respirator is indicated, you must satisfactorily complete a respirator medical clearance, respirator fit testing, and training on the use and limitations of the equipment. When these qualifications have been met, a respirator suitable for the type of contaminants in your workplace will be issued. These same requirements must be repeated annually. Appendix A, *Procedures for Obtaining Respiratory Protection Equipment*, provides a step-by-step guide to the application procedure.

**Medical Clearance**

Each employee or student whose duties require the use of a respirator will be referred to either Occupational Health Services (752-6051) or Student Health Services (752-2300), respectively, prior to a fit test appointment. They will be asked to fill out a *Medical History Form, approved by OSHA* and possibly asked to satisfactorily complete a pulmonary function test before being fit tested with a respirator. The *Medical History Form* and the pulmonary function test results will be reviewed by a physician or other licensed healthcare practitioner for medical approval. Employees or students who are medically denied will not be issued a respirator and additional referral to a physician may be required.

**Education and Training**

Occupational Health Services will provide instruction regarding respiratory protection prior to the issuance of any type of respirator. Training includes, but is not limited to: a complete description of the equipment issued, its purpose and limitation, how the respirator functions, how to check the respirator for a good fit each time it is used (positive and negative fit check), donning/doffing of the respirator, cleaning, storage, and maintenance of the respirator, and how to inspect the respirator for damage or wear and recognize when it needs to be replaced. In addition, State and Federal regulations, as well as campus policies, will also be discussed. Vet Med trains individuals that are fit tested for N-95 respirators at their location.

The length of these instruction sessions vary with the type of equipment being described. For example, more time is needed to train personnel who may use equipment in IDLH atmospheres (atmospheres that are immediately dangerous to life and health) than would be necessary for nuisance dusts, which would be a minimal hazard.

**Procurement of Respirators**

Occupational Health Services evaluates and approves the purchase of all respiratory equipment including powered air-purifying respirators, air-line respirators and self-contained breathing apparatus (SCBA) used on campus (EH&S may assist with this process as well if specialized equipment is being considered). Selection is dependent upon the type and concentration of the contaminant. Each air-purifying respirator
issued is equipped with a filter and/or cartridges for the specific hazard being protected against. The criteria for the selection of respirators are in accordance with the Respiratory Equipment Selection Guide (Appendix A) and the American National Standards Institute-Practices for Respiratory Protection (ANSI Z88.2) 1992.

Requirements for Fitting and Testing

Only a properly fitted respirator can help protect you. Face shape, facial hair, eyeglasses, missing dentures, and certain skin conditions can all affect respirator fit. Choosing a respirator that both fits properly and provides the protection required for a specific type of contaminant is essential. Each employee or student who is required to use respiratory protection equipment must be fit tested before a respirator will be issued.

Qualitative Fit Test

A qualitative fit test is a pass/fail means of testing that relies on the subject's sensory response to detect the challenge agent.

This method is generally considered less effective than a quantitative fit test and is acceptable only when a risk assessment has been performed. Any application of this fit testing method must be made in consultation with the Occupational or Student Health Physician and EH&S. The exercises conducted during the Qualitative Fit test are the same indicated in the Quantitative Fit test (see below).

Quantitative Fit Test

A quantitative fit test measures the effectiveness of a respirator seal in the ambient atmosphere. An instrument called a PORTACOUNT™ is used to measure the particle concentration both outside the mask and inside the mask. The ratio of these two concentrations is known as the fit factor. A fit factor of 100 (for half face) and 500 (for full face) is considered the minimum in passing the test based on OSHA regulation. A fit factor of 100 (filtering face-piece), 500 (half face) and 2,500 (full face) are the UC Davis minimum requirements. The employee or student is asked to perform a specific series of exercises that attempt to dislodge or create a leak in the seal between the face and the face-piece during the fit test:

Normal Breathing (NB) - In a normal standing position, without talking, the test subject shall breathe normally for at least one minute.

Deep Breathing (DB) - In a normal standing position, without talking, the test subject shall breathe slowly and deeply, taking care so as not to hyperventilate

Turning Head Side to Side (SS) - Standing in place, the subject shall slowly turn their head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.
Moving Head Up and Down (UD) - Standing in place, the subject shall slowly move their head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

Talking (T) - The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Grimace (G) - The test subject shall grimace by smiling or frowning.

Bending Over (B) - The test subject shall bend at the waist as if they were to touch their toes.

Normal Breathing (NB) - Same as the first exercise.

Each test exercise shall be performed for a minimum of 60 seconds, except for the grimace which shall be performed for a minimum of 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

Employees who were eyeglasses will be tested while wearing them during the fit testing for half face-piece respirators. Eyeglasses are removed during the fit testing of full facepiece respirators. Eyeglass inserts are available for those personnel who wear eyeglasses and are required to wear full face-piece respirators.

The test will not be conducted if there is any hair growth between the skin and the face-mask sealing surface.

Fit Testing Requirements

Fit testing must be repeated at least annually. In addition, because the seal of the respirator may be affected, fit testing must be repeated at the first available opportunity if the employee or student has:

- Significant weight change
- Significant facial scarring in the area of the face-piece seal
- Significant dental changes (i.e., multiple extractions without prosthesis, or dentures)
- Reconstructive or cosmetic surgery
- Any other condition that may interfere with the face-piece sealing

Records and Documentation

After fit testing has been satisfactorily completed, the employee is issued a Respirator Fit Test report.
The report will indicate the make, model and size of the respirator to be used by the employee, the overall fit factor (for quantitative fit test), indication of pass or fail (for qualitative fit tests) and the date of fit testing. Medical clearance, fit test and training records are all maintained by Occupational Health Services, with exception of Vet Med employees and students that have been fit tested at Vet Med.

Operating Procedures and Limitations for Respiratory Equipment

Disposable Filtering Face-pieces (N-95 Units)

Use of N-95s – The usefulness of N-95 units is primarily found in a couple of main areas. 1) Nuisance type particulates (i.e. dust, cobwebs, mixing chemical powders, etc.) 2) For use in work conditions where one may be working around viruses, bacteria, etc. (i.e. BSL3, Student Health Services, etc.). Occasionally these units (specific types) can be used while working with particulate hazards in addition to nuisance level organic vapors below OSHAs Permissible Exposure Limit.

Limitations - Disposable filtering face-pieces offer limited protection due to poor sealing characteristics inherent in their design. Since they provide no protection against gases and vapors and supply no oxygen, they cannot be used in atmospheres with gases or vapors or in oxygen deficient areas. Neither can they be worn for protection against toxic contaminants, nor when facial hair extends under the face-piece sealing area.

Policy - N-95 filtering face-pieces (single-use respirators) fall under the category of "respirators" by definition and should be treated as such for worker protection.

It is important to note that any filtering face-piece containing the “NIOSH” label is considered a respirator, and falls under the same requirements as half face and full face respirators for medical clearance and fit tests, when the N-95 is required for the job. On occasion, if the N-95 is being worn as an extra precaution, on a voluntary basis for protection against nuisance, it can be worn as a ‘voluntary’ status. The individual would still need medical clearance and fit test, however it would be under ‘voluntary’ status. The process for this is handled at Occupational Health Services. There are some “dust masks” that do not contain a “NIOSH” label and have no requirements at all, however these have not been tested or certified, and users should be mindful of this.

Note: Effective July 29, 2019 until January 18, 2020 CalOSHA emergency standard CCR 8 §5141.1 Protection from Wildfire Smoke is in effect (this emergency regulation has been extended to April 24, 2020). During a wildfire smoke event N-95s must be offered to employees working outside for more than one hour when the Air Quality Index (AQI) exceeds 151. In accordance with this standard, employees must be provided training on the regulation, the health effects of wildfire smoke and the safe use and maintenance of N-95 respirators. Voluntary use of N95 respirators under this emergency standard does not require medical clearance or fit testing. Employee exposures to wildfire smoke above the AQI of 500 are covered under CCR 8 §5144, Respiratory Protection.

Procedure - To put on and adjust an N-95 respirator:

1. Position the respirator in your hands with the nosepiece at your fingertips.
2. Cup the respirator in your hand, with the nosepiece at your fingertips, allowing the
headbands to hang freely below your hand. Position the respirator under your chin with
the nosepiece up. The top strap goes over your head, resting high at the top back of your
head. The bottom strap is positioned around the neck and below the ears. The straps do
not cross over one another. If there is only 1 headband, it should rest high at the back of
your head.

3. Most disposable respirator models have a metal nose clip. Place your fingertips from both
hands at the top of the metal nose clip. Slide your fingertips down both sides of metal
nose strip to mold the nose area to the shape of your nose.

4. Checking the fit – First place both hands completely over the respirator, then take a
quick breath in to check whether the respirator seals tightly to the face. Be careful not to
disturb the position of the respirator. Next, place both hands completely over the respirator
and exhale. If during either step, air leaks around the nose, readjust the nosepiece as
described above and if this does not solve the leak issue, try a different N-95 respirator.

Air-purifying Half-Face Respirators

Availability and Types for Use - Reusable half-face respirators are the most commonly used type of respirator. Half-face respirators are air-purifying devices that cover the nose, mouth, and chin. The face-piece is equipped with either cartridges that capture gases and vapors, and/or filters which capture particles, filtering 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.

Limitations - Since this type of respirator does not supply air, it cannot be used in oxygen deficient atmospheres, in IDLH atmospheres, or in confined spaces. It can only be used for protection against the contaminants listed on the cartridge or the manufacturer’s cartridge selection chart at known concentrations. The half-face has a protection factor of 10, allowing the wearer to only be exposed to a specific contaminant at concentrations less that 10 times the allowable limits (PEL). It cannot be used against natural gas or vapors with poor warning properties. The wearer should leave an area immediately if the smell of gas or vapor is detected inside the mask or if the breathing resistance increases.

The half-face respirator cannot be worn when facial hair extends under the face-mask sealing area.

Procedure - To put on and adjust a half-face respirator:

1. Inspect your respirator: Make sure both inhalation and exhalation valves are in place on
the mask. Check for any signs of wear or deterioration.

2. Hold the mask so the narrow nose-cup points upward.

3. Grasp both of the lower mask straps and hook them behind the neck; place the top
cradle straps on the top of and behind the head.
4. Before using your respirator, check for leaks by performing both positive- and negative pressure checks.

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

![Image of respirator check](image)

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

![Image of respirator check](image)
Air Purifying Full Face Respirators

*Availability and Types for Use* - Full face respirators provide more protection than half-face because their shape allows a better mask-to-face seal. The addition of a face-piece protects the eyes from irritating chemicals, splashes, or particulate atmospheres. Full face respirators are equipped with selective types of air-purifying cartridges or filters - dependent upon the protection required - to capture dust, mists, fumes, or gas and vapor hazards.

*Limitations* - Air-purifying full face respirators have the same limitations for use as half face respirators. Since they do not supply air, they cannot be used in oxygen deficient atmospheres or temperature extremes, in IDLH atmospheres, or in confined spaces. The full face respirator has a protection factor of 50, only allowing the wearer to be exposed to a specific contaminant at concentrations less than 50 times the allowable limits (PEL).

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 mask. The spectacle kits are available through EH&S and the prescription lenses are available from an outside eye Dr. (ask Occupational Health Services for details).

*Procedure* - To put on a full face respirator:

1. Inspect your respirator. Check for any signs of wear or deterioration. Make sure the appropriate cartridges or filters are securely attached and that the expiration date of the filters has not passed.

2. Loosen all straps; pull the harness over the head and place the chin in the chin cup.

3. Pull the head harness well down on the back of the head.

4. Tighten the harness gently, starting with the bottom straps and then the middle and top straps.

5. Before using your respirator, check for leaks by performing the positive- and negative pressure checks as described in the half-face section of this manual.

6. Return the respirator to Occupational Health Services for maintenance or for replacement if it becomes damaged or shows signs of wear.
Powered Air Purifying Respirators (PAPR): Loose & Tight Fitting Face-pieces

**Availability and Types for Use** - Powered Air Purifying Respirators (PAPR) are belt-mounted, battery-operated blower respirators. Contaminated air is filtered through a cartridge, filter, or cartridge/filter combination, while a constant supply of purified/filtered air is delivered to the face-piece. Since the blower has rechargeable batteries, it can be reused with the addition of a freshly charged battery. Tight and loose fitting face-pieces are approved by NIOSH, and available at UC Davis.

**Limitations** - A PAPR with a belt-mounted blower and selected cartridges cannot be used in oxygen-deficient atmospheres, in IDLH atmospheres, or for protection against gases or vapors. The batteries should be fully charged before using the blower. The protection factor varies depending upon the face piece. It cannot be used in emergency situations.

**Procedure** - To use a powered air purifying respirator, each time:

1. Inspect your equipment. Check for any signs of wear or deterioration. Make sure the appropriate cartridge(s)/filter(s) are securely attached.
2. Ensure that appropriate airflow is achieved by using a manometer and following manufacturer’s guidelines.
3. Mount the unit on your waist and adjust the belt until it is comfortable.
4. Put on the face mask.
5. Turn the blower on. Air will flow into the mask.

Note: There are certain brands that have the fan motor/blower and filter at the center nosepiece of the mask instead of on the belt.

**Air Supplied Airline Respirators**

Air supplied airline respirators are used when fresh supplied air from a tank is necessary during work operations. Typical applications for these units would be working in an environment that would require clean air with enough oxygen that an Air Purifying Respirator could not provide. When using these devices it is important to ensure that the location of the air tank is not near a source of carbon monoxide or any other air contaminant, and that the tank has appropriate Grade D air as described by the compressed gas association.
Self-Contained Breathing Apparatus (SCBA)

**Availability and Types for Use** - Self-Contained Breathing Apparatus (SCBA) units provide the user with a supply of Grade D breathing air regardless of ambient air contamination. They may be used in atmospheres unsuitable for air-purifying respirators. This includes use in IDLH atmospheres and for emergencies where breathing hazards may exist and mobility is essential. SCBA units may be used in IDLH atmospheres only in conjunction with a positive-pressure full face-mask, and a five-minute escape breathing air apparatus. All employees using SCBA require specialized training.

Departments utilizing SCBA units must purchase their own EH&S-approved equipment. Though purchased by the department, the use of such equipment by university personnel comes under the control of the UCD Respiratory Protection Program administered by EH&S.

**Limitations** - The air supply in a standard SCBA cylinder is normally rated for between a 30 and 60 minute duration; however, heavy exertion and stress will increase breathing rates and deplete the air in less than the original available time; usually in half the time. *When the alarm bell on the unit sounds and the light flashes, the wearer has a quarter of the air supply remaining.* No one should work alone in hazardous atmospheres-a standby with SCBA and proper communications equipment should always be nearby.

The positive-pressure full face-mask used with the SCBA unit cannot be worn when facial hair extends under the face-piece sealing area of the mask.

**Procedure** - To use a Self-Contained Breathing Apparatus (SCBA):

1. Remove the unit from its case or cabinet and inspect it carefully to ensure that it is operating properly before putting it on. Follow the instructions specified by the SCBA manufacturer for air-cylinder operation.
   - Check the cylinder gauge for a “full” indication.
   - Check the connection between the cylinder and the regulator.

2. Put on the SCBA unit and adjust the harness.
3. Check hoses and overall condition of the mask (straps, lens, etc.).
4. Put the mask on and adjust it. Start with the bottom straps, and then the top straps (pull the top strap snug, not tight).


5. Place your palm over the inhalation opening of respirator and inhale slowly until the mask is drawn toward your face; hold your breath for 10 seconds to see whether there is any leakage in the mask-to-face seal.

6. With your palm still over the opening of the exhalation valve, exhale, noting whether there is any leakage around the face-piece. This step also clears the exhalation valve.

7. Make the air connection to the regulator.

8. *Always switch the regulator to positive-pressure mode (up) before entry into an IDLH atmosphere.*

9. Inspect the SCBA unit at least monthly to ensure proper operation for emergency use. Document your inspections (see Appendix F, *Monthly Maintenance Checklist for SCBA units*).

**Pressure-Demand Regulator** - The pressure-demand regulator minimizes any chance of contaminants leaking into the mask during inhalation because the entire face-mask is kept at positive pressure in relation to the surrounding atmosphere. A special full face-mask equipped with a positive-pressure exhalation valve is held closed by air pressure to prevent contaminants from leaking into the face-piece during inhalation. Because proper performance of the pressure demand regulator is essential to the wearer’s protection, any problems with the regulator must be immediately reported to EH&S.

**Respiratory Protection against M. tuberculosis**

**Availability and Types for Use** - The use of NIOSH-certified respirators equipped with HEPA filters by all workers potentially exposed, in conjunction with an effective respiratory protection program should be used in health-care settings for protection against M. tuberculosis.

**Assignment of Responsibility** - Supervisory responsibility for the respiratory protection program should be assigned to designated persons with expertise in issues relevant to the program, including Occupational Health Services. Respirator wearers and supervisors should receive training in the reasons for needing to wear their respirator and the potential risks of not doing so. Health care workers should undergo fit testing to identify a respirator with an adequate fit. In addition, the employee should receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. The program should be completely evaluated at least annually.

**Specialized Respiratory Protection Equipment** Umbilical respirators supply clean air through a hose attached to a compressor, or a tank of compressed air. As the user inhales, air flows into the respirator. Use of an umbilical air-line system may be permitted in an IDLH atmosphere under certain conditions.

All supplied air systems used for respiratory purposes must meet a minimum quality and purity of air as stated in the California Code of Regulations: Title 8, Section 5144. Should the above type of protective equipment, or other specialized equipment be required, contact EH&S for an evaluation.
Emergency Use of Respirators

Emergency Situations

An emergency can be defined as “an unforeseen combination of circumstances that calls for immediate action”. Respiratory hazards often occur during emergencies when fire fighters or other emergency service personnel need immediate entry into a fire or accident scene. Other types of breathing hazards may occur when people are exposed to hazardous substances while trapped by an accident, escaping from the scene of a fire or accident, or when they are exposed to hazardous spills. An unforeseen chemical reaction may also result in an overexposure to hazardous substances.

Acceptable Equipment during Emergencies

Each respiratory device has a limited ability to protect health. During emergency entry—when there is neither time nor opportunity to evaluate the degree of exposure—only SCBA should be used. SCBA is approved for use in IDLH atmospheres. After the type and degree of breathing hazards are evaluated, other respiratory equipment may be recommended.

Reporting Emergency Use

Notify EH&S at 752-1493 following any incident where emergency respiratory protection equipment has been used.

Maintenance and Care of Respirators

Respirator Maintenance and Care - The User

Primary responsibility for maintaining the respirator in proper and clean condition rests with the employee.

- Before each use, inspect your equipment for defects, signs of wear, or damage. Make sure it is clean before you put it on.

- Visually inspect the area between the cartridge and the face-piece to make sure the cartridge is seated correctly.

- Clean and disinfect your respirator as often as necessary to be maintained in a sanitary condition, using safety equipment wipes, or a solution of water and a mild detergent (with the exception of use in Emergency situations in which case cleaning should take place following every use). Clean the inside first and then the outside, so exterior contaminants don’t get inside the mask. Protect your respirator and cartridges/filters from dirt and damage by storing them separately in securely closed sturdy plastic bags. Write your name on the bag. Cleaning procedures need to be followed within the instructions of Cal/OSHA respiratory
cleaning guidelines found in Appendix 2B (http://www.dir.ca.gov/title8/5144b_2.html)

- 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.

- Cartridge change out schedules need to be in place: the general rule of thumb for particulate filters is when resistance in breathing occurs or when the filter is noticeably dirty, it is time to change it out. For all other cartridges that contain an adsorbent (for example, organic vapor or multi-gas cartridges) the change out schedule will be as follows:

  1. If using the cartridges for greater than 4 hours in one day, they need to be changed daily or

  2. If they are used sporadically throughout the week, they need to be changed 1 time per week.

Cartridges should never be used for a total of more than 8 hours. There are certain types of cartridges which have “end of service life indicators” (ESLI), that change color when the adsorbent has been used, however most cartridges do not offer this feature, so it is the responsibility of the employee to change the cartridge out as described above.

- Inspect and examine all SCBA units at least monthly to ensure proper operation. Document the inspections (see Appendix D for a sample Monthly Maintenance Checklist for SCBA Units).

- Return damaged respirators to Occupational Health Services in exchange for a new or reconditioned one. A respirator must be returned to Occupational Health Services if any of the following conditions are met:

  1. It is no longer needed

  2. It malfunctions or is damaged

  3. It becomes too difficult to breathe through the respirator

  4. The employee's employment at UC Davis is terminated
Occupational Health Services Maintenance Responsibilities:

Occupational Health Services will:

- Disinfect and recondition respirators (according to California Code of Regulations, Title 8 Section 5144)
- Inspect valves, head straps and other parts, replacing them with new parts, if defective
- Reissue reconditioned respirators
- Conduct an annual survey of all SCBA units (or ensure UC Fire Department has done this for their own SCBA equipment)
- Upon request, conduct annual training classes on SCBA inspection and training requirements for departmental personnel who may utilize SCBA units

If you have questions about respiratory hazards in your workplace, or about the respiratory protection equipment you have been issued, contact Occupational Health Services at 752-6051 or EH&S at 752-1493.

Program Responsibilities

University Policy

It is the policy of the University of California, Davis to maintain, insofar as it is reasonably within the control of the University to do so, an environment that will not adversely affect the health, safety, and well-being of students, employees, visitors, and neighboring human populations.

Because of the potential risks involved from exposure to hazardous substances in the workplace, UC Davis provides necessary respiratory protection equipment, and develops operational procedures for those employees who are required to use the equipment. All activities involving the use of respiratory protection equipment in facilities controlled by UC Davis are conducted in compliance with Title 8, section 5144 of the California Code of Regulations (CCR). The UC Davis Respiratory Protection Program establishes procedures and requirements to meet various enforcing agencies' regulations for use of respiratory protection equipment, and provides the necessary health and safety protection to those persons falling within the jurisdiction of the program.
**Principal Investigator, Supervisor, or Division Head**

Each person in charge of a research project or other activity where respiratory protection equipment is used is responsible for:

- Identifying, with the assistance of EH&S, those employees who may need respiratory protection equipment; scheduling them at Occupational Health Services for medical evaluation, fit testing, and training in the proper use and maintenance of the equipment.
- Requesting assistance from EH&S in evaluating operations that may present health and safety hazards requiring the use of a respirator.
- Contacting Occupational Health Services or Student Health Services for medical approval before assigning employees or students to jobs requiring the use of respirators.
- Enforcing the use of respiratory protection equipment and other requirements when applicable.

**Employee or Student Responsibilities**

Any UC Davis employee or student participating in the Respiratory Protection Program for use of respiratory equipment is responsible for:

- Using only the make, model and size of respirators for which they have been trained and fitted by Occupational Health Services or Vet Med.
- Informing their supervisor or occupational physician performing the clearance of any personal health problems that could be aggravated by the use of respiratory equipment (such as asthma, allergies, or high blood pressure).
- Guarding against damage and ensuring respirators are not disassembled, modified, or otherwise altered in any way other than by the changing of respirator cartridges or filters.
- Reporting any observed or suspected malfunctioning respirator to Occupational Health Services and Supervisor.
- Bringing used respirators to Occupational Health Services to be exchanged for a new or cleaned and reconditioned unit.
- Updating their respirator use certification annually by completing the medical questionnaire, pulmonary function test (when required), fit testing and training.
**Occupational Health Services Responsibilities**

Occupational Health Services is responsible for the following functions:

- Providing a centralized facility for purchasing, maintaining, and evaluating all respiratory equipment needed and used by UC Davis employees and students.
- Providing instruction on the need for respiratory protection; criteria for selecting respirators; and respirator fitting, use and maintenance.
- Maintaining inventory and issuing respiratory protection equipment.
- Conducting initial, annual and other required fit tests for employees who utilize respiratory equipment.
- Coordinating Medical Clearance and training for respirator users prior to a fit test.
- Conducting inspections for respiratory equipment usage, maintenance and storage.
- Maintaining records of fit test results, training, and medical approvals.
- Serving as consultants for respiratory protection questions (along with assistance of EH&S).

**Definitions**

**Aerosol** – A gaseous suspension of fine solid or liquid particles.


**Approved** - Tested and listed as satisfactory jointly by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH).

**Canister (Air-Purifying)** - A container filled with sorbents and catalysts that remove gases and vapors from air drawn through the unit. The canister may also contain an aerosol (particulate) filter to remove solid and liquid particles.

**Cal/OSHA** – California Occupational Safety and Health Administration: The State Regulatory Agency which sets the minimum requirements for respiratory use.
Cartridge - A small container filled with air-purifying media. (often activated charcoal / carbon)

Confined Space - An enclosure such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit that has limited means of getting out and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.

Contaminant - A harmful, irritating, or nuisance material that is foreign to the normal atmosphere.

Dust – Fine, dry particles of matter.

Exhalation Valve - A device that allows exhaled air to leave a respiratory device and prevents outside air from entering through the valve.

Face-piece - That portion of a respirator that covers the wearer’s nose, mouth, and/or eyes. Designed to make a gas-tight or dust-tight fit with the face, it includes the headbands, exhalation valve(s), and connections for an air-purifying device.

Filter - A fibrous medium used in respirators to remove solid or liquid particles from the airstream entering the respiratory enclosure.

Fit-Check (Negative and Positive) - A procedure used to determine if the respirator is properly adjusted by blocking the intake port(s), the exhaust port(s) and inhaling and exhaling, respectively. This procedure should be done each time a respirator is used.

Fume - Airborne particulate formed by the evaporation of solid material e.g. metal fume emitted during welding.

HEPA - High-Efficiency Particulate Air Filter - A filter designed to remove 99.97% of airborne particulate 0.3 um in diameter.

IDLH Atmosphere - An atmosphere immediately dangerous to life or health (IDLH). An IDLH atmosphere poses an immediate hazard to life, such as being oxygen deficient (containing less than 19.5% oxygen), or produces an irreversible debilitating effect on health.

Inhalation Valve - A device that allows respirable air to enter the face-piece and prevents exhaled air from leaving the face-piece through the intake opening.

MSHA - Mine Safety and Health Administration - A Federal agency that tests, approves and certifies respiratory protection equipment used in mining operations
NIOSH - National Institute for Occupational Safety and Health - A Federal agency that tests, approves, and certifies respiratory protection equipment.

OSHA - Occupational Safety and Health Administration - The Federal Agency which sets the minimum requirements for respirator use.

Particulate Matter - A suspension of fine solid or liquid particles in air, such as dust, fog, fume, mist, smoke or sprays. Particulate matter suspended in air is commonly known as an aerosol.

PEL - Permissible Exposure Limit as established by the Occupational Safety & Health Administration (Fed OSHA and Cal/OSHA).

Pesticide - For the purpose of this manual, the terms pesticide and pesticide chemical are synonymous with economic poison, as defined under the United States Department of Agriculture's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

PF - Protection Factor - The overall protection afforded by a certain type of respirator as defined by the ratio of the concentration of contaminant outside a face-mask to that inside the equipment under conditions of use. For example: if a half-mask respirator has a protection factor of 10, it may be used for protection in atmospheres with a contaminant concentration up to 10 times the permissible exposure limit.

Pulmonary Function Test - Tests requiring use of an approved spirometer including forced vital capacity (FVC), the maximum amount of air that can be expired from the lung after full inhalation, and forced expiratory volume after one second (FEV₁), the amount of air forcibly expired in one second.

Qualitative Fit Test - A test procedure to determine the effectiveness of the seal between the face-mask and the wearer’s face using a challenge agent such as Bitrex, Isoamyl Acetate, Irritant Smoke or Saccharin. This is a pass/fail test, where if the individual detects the agent during the fit test, they fail; if they don’t detect the challenge agent during the fit test, they pass.

Quantitative Fit Test - The measurement of the effectiveness of a respirator seal in the surrounding atmosphere. This test, using a PORTACOUNT, is performed by dividing the measured concentration of the dust particles in the surrounding atmosphere by the measured concentration of the particles inside the respirator face-piece.

Resistance - Opposition of the flow or air, as through a canister, cartridge or particulate filter.
**Respirator** - A device designed to protect the wearer from inhalation of harmful atmospheres.

**SCBA - Self-Contained Breathing Apparatus** - For the purpose of this manual, a unit designed to provide the wearer with clean independent of the contaminated surrounding air. A supply of approved compressed air contained in a gas cylinder is carried by the wearer. SCBA units are generally restricted to types equipped with pressure-demand regulators that maintain positive pressure in a full face-mask.

**Supplied-Air Respirator** - For the purpose of this manual, a hose-mask respirator equipped with a face-piece, breathing tube, safety harness and safety line. Air is supplied through a hose connected to a compressed-air cylinder or air compressor.

**Test Subject** - A person wearing a respirator for quantitative fit testing.

**TLV - Threshold Limit Value** - A list published yearly by the American Conference of Governmental Industrial Hygienists as a guide for exposure concentrations that a healthy individual normally can tolerate for eight hours a day, five days a week, without harmful effects. Airborne particulate concentrations are generally listed as milligrams per cubic meter of air (mg/M3). Gaseous concentrations are listed as parts per million (ppm) by volume.

**Umbilical System** – A respirator system, which includes a hose connecting the face piece to an air supply.

**Vapor** - The gaseous state of a substance that is solid or liquid at ordinary temperature and pressure.
Appendix A

Procedures for Obtaining Respiratory Protection Equipment

1. **Respirator Fitting and Training** - Contact Occupational Health Services Respiratory Protection Program directly (752-6051) to schedule an appointment. (or if part of the Vet Med group being fit tested and trained by Vet Med, then use the Vet Med contact).

2. **EH&S Evaluation** - EH&S personnel will determine if the use of a respirator is necessary by evaluating the work process. This may be evaluated by one or a combination of the following methods:
   - Consulting with the supervisor.
   - Interviewing the employee.
   - Observing the work operation.
   - Collecting air samples during the work process to assess airborne exposure to any toxic material. Respirators will be required for all operations where the concentration is in excess of the limits specified by the State or Federal OSHA, American Conference of Governmental Industrial Hygienists, or as deemed necessary by EH&S.  
   - Evaluating existing or alternative engineering controls.

3. **Medical History Questionnaire and possibly a Pulmonary Function Test** - Upon referral from EH&S, you should make an appointment with Occupational Health Services at 752-6051 (Students should contact Student Health Services at 752-2300) for a Respiratory Medical Clearance with the possibility of a pulmonary function test. At that time you will be asked to fill out a *Medical History Questionnaire Form*. Once you have received medical clearance, Occupational Health Services can then proceed with the fit testing and training.

4. **Respiratory Protection Training** - The purpose of this training is to inform the user of the limitations, use, and care of the respirator. Anyone requiring a respirator, including all disposable respirators must be informed of the limitations of the masks.

5. **Respirator Fit Testing** – Occupational Health Services (or Vet Med personnel if part of the Vet Med group) can provide a fit test when all of the above elements are met. A respirator that provides the
best comfort and protection will be issued. Upon completion of the successful fit test, all supplies will be provided to the user in order to begin using the respirator.

6. **Respirator User’s Responsibilities**

   a. Update your respirator qualification status annually.

   b. Reschedule for a future date if you cannot attend your scheduled appointments.  
      (A **No-Show** fee may be submitted by Occupational Health Services if a written/verbal cancellation is not received 24 hours prior to the scheduled appointment)

   c. Return your respirator to Occupational Health Services when you end your employment at UCD or when you no longer need it.
### Appendix B

**Cartridge and Filter Color Coding Chart**

<table>
<thead>
<tr>
<th>Color</th>
<th>Type of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Organic Vapor Cartridge</td>
</tr>
<tr>
<td>White</td>
<td>Acid Gas Cartridge</td>
</tr>
<tr>
<td>Yellow</td>
<td>Organic Vapor and Acid Gas Cartridge</td>
</tr>
<tr>
<td>Green</td>
<td>Ammonia and Methylamine Cartridge</td>
</tr>
<tr>
<td>Olive Green</td>
<td>Organic Vapor and Formaldehyde Cartridge</td>
</tr>
<tr>
<td>Purple (Magenta)</td>
<td>Dust, Fumes, Mists, Asbestos, Radionuclides and Highly Toxic Particulates (HEPA) Filter</td>
</tr>
<tr>
<td>Black/Purple</td>
<td>Organic Vapor and HEPA Combination</td>
</tr>
<tr>
<td>White/Purple</td>
<td>Acid Gas and HEPA Combination</td>
</tr>
<tr>
<td>Yellow/Purple</td>
<td>Organic Vapor/Acid Gas and HEPA Combination</td>
</tr>
<tr>
<td>Green/Purple</td>
<td>Ammonia/Methylamine and HEPA Combination</td>
</tr>
<tr>
<td>Olive Green/Purple</td>
<td>Organic Vapor/Formaldehyde and HEPA Combination</td>
</tr>
<tr>
<td>Pre-Filters</td>
<td>Dusts, Fumes &amp; Mists or Pesticides or Paints</td>
</tr>
</tbody>
</table>

Always read the NIOSH cartridge and/or filter labels prior to use to make certain that you are using the correct one for your application, and for use with the respirator you have been trained and fitted for. Respirators labeled for protection against particulates only shall not be used for gases or vapors. Respirators labeled for protection against gases and vapors only shall not be used for particulates. If you have questions about filter and/or cartridge replacements, please contact Occupational Health Services at 752-6051.
Appendix C

SCBA INSPECTION

Each Self-Contained Breathing Apparatus unit stored for emergency use shall be inspected monthly to ensure proper operation. The following items noted below are suggested inspection procedures. Since there are numerous types of SCBAs available from different manufacturers, refer to the instructions specified in the owner’s manual for proper cleaning, maintenance and operating procedures.

The department shall assign a responsible person(s) to conduct a monthly (or more frequent) inspection of each SCBA unit and record the results on the proper form (See Appendix D).

* Open the bag and retrieve the respirator; check the date of last service. If the mask has not been serviced within one year, consult with EH&S 752-1493.

* Inspect all hoses by stretching them and looking for cracks or holes; check hose connections for deterioration. Place the mask in a new bag and seal it.

* Examine the air cylinder pressure gauge for proper air pressure; check the tightness of all hose connections. Examine the regulator.

* Open the air cylinder valve to pressurize the regulator; check that the regulator pressure gauge has approximately the same pressure as the cylinder gauge. Then close the air cylinder valve to see whether the pressure goes down. A noticeable decrease in pressure (within one to two minutes) indicates a defective regulator or hose.

* Check the regulator for proper use.

* Open the purge valve slightly—air should flow. Then, close the purge valve and bleed the air out slowly using the “on-off” lever. Watch the regulator pressure gauge to see whether the alarm sounds when the pressure reaches ¼ of the tank capacity.

* Check the harness, back pack, and air cylinder for wear or damage.

* After inspecting the SCBA unit, fill out the Maintenance Checklist Form. The records should be marked to reflect the month and day of inspection and the inspector's initials.

* Check the distress alarm. Ensure correct functioning in all modes.

* After the inspection, the case or cabinet shall be secured.

* Should defective equipment be found or servicing the unit is required, the inspector shall take immediate action to correct any deficiencies.
### APPENDIX D:

UC DAVIS Fire Department Weekly SCBA Check

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#### WEEKLY SCBA AIR PACK CHECK

| SCBA                        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|-----------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| **INITIAL**                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| FULL AIR CYLINDER          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| HARNESSES ASSEMBLY         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| AIR HOSELINE               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| REGULATOR                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| GAUGE READING              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| VIBRA ALERT                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| PAK-ALERT MANUAL           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| PAK-ALERT AUTO             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| INDICATING LIGHTS          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| FACEPIECE NO. | E3 | E2 | E4 | E4 | E2 | E2 | S2 | S2 | S2 | S2 | T3 | T3 | T3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 | S3 |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| INITIAL       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| FACEPIECE LENSE|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| FACEPIECE SEAL|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| HEAD HARNESS  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

<table>
<thead>
<tr>
<th>SCBA</th>
<th>CS1</th>
<th>CS2</th>
<th>CS3</th>
<th>CS4</th>
<th>HM1</th>
<th>HM2</th>
<th>HM3</th>
<th>HM4</th>
<th>HM5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>Full Air Cylinder</td>
<td>Harness Assembly</td>
<td>Air Hose Lines</td>
<td>Regulator</td>
<td>Gauge Reading</td>
<td>VIBRA Alert</td>
<td>PAK-Alert Manual</td>
<td>PAK-Alert Auto</td>
<td>Indicating Lights</td>
</tr>
</tbody>
</table>

Sealed

O = O.K.  / = REPAIRS NEEDED  X = REPAIRS MADE

COMMENTS

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