

UC Merced

Respiratory Protective Equipment Program



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APPENDICES

Appendix A – Definitions and Key Terms

Appendix B – OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

See EH&S for a copy of this form

Appendix C – Supplemental Information to Medical Providers

See EH&S for a copy of this form

Appendix D – Training for Voluntary Respirator Use

Appendix E – Training, Fit-Test & Assignment Record

Maintained by EH&S Department

Appendix F – Fit Test Protocols

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Maintained by EH&S Department

1.0 RESPIRATORY PROTECTIVE EQUIPMENT PROGRAM GUIDANCE

Authority:

Title 8 California Code of Regulations Section 5144, Respiratory Protection (Ref: [T8 CCR §5144](#)).

References:

[NIOSH Guide to Respiratory Protection](#)

[Cal/OSHA Guide to Respiratory Protection at Work](#)

2.0 PURPOSE AND SCOPE

This program is designed to protect the health of personnel working at UC Merced or at offsite or annex operations. Employee and student health will be protected through the implementation of a common set of generalized requirements which outline the proper and effective use of air-purifying and air-supplying respirators. Standard operating procedures and guidelines are outlined in accordance with California state Occupational Safety and Health (Cal/OSHA) regulations, specifically [Title 8 CCR §5144](#) and American National Standards Institute (ANSI) Z88.2-1992, Standard for Respiratory Protection. Major elements of the program include:

- an outline of responsibilities of personnel for implementing and fulfilling the requirements of the program;
- policies and procedures for respirator selection, use, maintenance and inspection, cleaning and sanitizing, and storage;
- policies and procedures for medical surveillance, respirator fit testing, and training of personnel who wear respirators;
- mechanism for surveillance and evaluation of this program to determine its effectiveness.

3.0 POLICY

Respiratory protective equipment will only be used as a "last line of defense" when engineering control systems are not feasible or do not reduce the level of airborne contaminants below published standards. Effective engineering controls, such as local exhaust ventilation with filtering or scrubbing of contaminants, if applicable, should be used to in lieu of respirators.

Whenever respiratory protective equipment is required to protect employees from harmful exposures, potential hazardous atmospheres during response to emergencies, or when

personnel request respiratory protection for a job task or assignment, it must be used in accordance with this model program.

A list of the types of tasks and hazards covered by this written program will be developed and reviewed at least annually in accordance with [Section 13.0](#), "Program Evaluation" and if needed updated.

The requirements set forth in this program will be incorporated into but will not govern use of respiratory protection for Covid-19 exposure, except those parts relevant to fit testing and cleaning of respirators. Use consideration for Covid-19 protection considerations are governed by 8 CCR 205-3205.4.

4.0 RESPONSIBILITIES

4.1 Environmental Health & Safety Department

The Director of Environmental Health & Safety (EH&S) is responsible for overall program administration and supporting managers and supervisors to fully implement this program. This includes:

- establishing and maintaining written policy and procedures governing the selection and use of assigned respirators, employee training, medical evaluations, and program evaluation;
- continuing evaluation of the program to assure proper implementation and effectiveness;
- establishing a training program for respirator users;
- establishing a medical evaluation protocol and physician contract for the medical evaluation program;
- initiating requests for medical approval for potential respirator users;
- notifying employees when they are due for a medical evaluation;
- maintaining records of medical approvals, training, and fit testing;
- completing the "Respirator Assignment" form in [Appendix E](#);
- either performing or initiating requests for industrial hygiene consultant services to ensure exposure evaluations are conducted in accordance with [Section 4.0](#) of this program; and
- supervising the selection of respirators to ensure they are applicable and suitable for the purpose intended;
- ensuring respirators are individually assigned and durably marked to indicate to whom it belongs, and arranging for proper storage facilities;
- periodically inspecting workplace conditions where respiratory protection is worn to determine exposures and/or changing situations;
- ensuring that each user receives proper training and fit testing prior to using respiratory equipment.
- conducting random inspections to verify that respirators are properly used, cleaned, and maintained.

4.2 Department & School Managers, Supervisors & Instructors

Under the general direction and support of the EH&S Department, managers and supervisors are responsible for program support and implementation including the following:

- becoming familiar with the policies and procedures outlined in this program and ensuring these procedures are followed;
- providing respirators when necessary to protect their employees;
- periodically inspecting workplace conditions where respiratory protection is worn to determine exposures and/or changing situations;
- ensuring prospective users receive a medical exam prior to being assigned a task that requires the use of a respirator;
- ensuring respirators are individually assigned and durably marked to indicate to whom it belongs, and arranging for proper storage facilities;
- acquiring replacement cartridges and spare parts for respirators and maintaining an adequate supply for employee use; and
- conducting random inspections to verify that respirators are properly used, cleaned, and maintained.

4.3 All UC Merced Personnel & Students

All UC Merced employees and students covered by this program are required to:

- use respiratory protection in accordance with instructions and training received;
- participate in the medical surveillance program and schedule physical examinations, as indicated;
- report any change in their medical status that may impact their ability to wear a respirator safely;
- inspect and fit-test their respirator to ensure proper working order and a gas-tight facepiece to-face seal prior to each use;
- guard their assigned respirator against damage;
- perform routine cleaning, disinfection, and general maintenance of the respirator issued to them; and,
- if a respirator malfunction occurs, immediately leave the contaminated area, and report the malfunction to their supervisor.

5.0 WORKPLACE SURVEILLANCE & EXPOSURE MONITORING

Selection of the proper respirator(s) to be used in any location or operation under the control of UC Merced will only be made after a real or potential exposure has been determined.

Whenever information indicates that an employee or student may be exposed to airborne contaminants at concentrations exceeding a PEL or TLV, or an employee or student requests to use a respirator, the EH&S Department shall perform, or arrange for industrial hygiene consultant services to perform an evaluation of the work environment, including air monitoring so that exposures can be measured or calculated.

Industrial hygiene monitoring will be conducted periodically (not less than every 6 months) where respiratory protection is routinely worn to control harmful exposures. The purpose for the monitoring is to determine if respiratory protection continues to be required and if the respirator(s) selected provide adequate protection.

Air monitoring results, including industrial hygiene field notes, exposure calculations and records of equipment calibration shall be retained for 30 years and be available to employees or students for review or copying. In addition, employees must be notified in writing whenever they have been, or are being exposed to toxic materials in concentrations exceeding those prescribed by applicable Cal/OSHA regulation, American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limits Values (TLVs), or other recognized standards. The notification must also include the corrective action being implemented to mitigate the potential hazard. (ref. [T8 CCR §340.2](#))

No respirator will be issued and worn without an evaluation of the work environment. Respiratory protection will be selected based on the potential exposure hazard and in accordance with [Section 10](#). The respirator must be appropriate for the airborne contaminants present in the workplace environment.

6.0 LIMITATION OF RESPIRATOR USE

Respirators use is only allowed under the following three (3) conditions: (Ref: [T8 CCR §5141](#))

1. Where engineering and/or administrative control of inhalation hazards is not feasible;
2. During the interim while engineering controls are under study or being installed; or,
3. During maintenance, non-routine operations, or emergencies.

Exception: Voluntary Respirator Users - the EH&S Department may approve the use of air-purifying respirators where an employee requests to wear one to provide an additional level of comfort and protection even though it is determined that a hazardous substance does not exceed the limits published by federal or state OSHA or adopted by the ACGIH TLV Committee. Department Managers or the employee's supervisor should be aware that in these circumstance employees making the request may be experiencing symptoms due to a predisposed condition and could possibly need medical evaluation. (Ref. [Section 7.1](#))

The voluntary use of air-purifying respirators must be approved through the department or school manager and the EH&S Department. Voluntary use of all respirator types (except Dust Masks) must comply with all elements of this program, including medical clearances.

The use of respirators shall comply with the following conditions:

- a. Employees or students can only use respirators provided by UC Merced and approved by the National Institute for Occupational Safety and Health (NIOSH).
- b. Employees shall not be permitted to wear a respirator without medical approval ([Section 7.0](#)) unless covered by the Exception outlined in [Section 7.6](#).
- c. Employees shall not be permitted to wear a respirator without first receiving training in accordance with [Section 8.0](#).
- d. Employees shall not be permitted to wear a respirator without being fit-tested in accordance with [Section 11](#) of this program to determine that the respirator provides a gas-tight facepiece- to-face seal.
- e. Air-purifying respirators will not be worn for protection against airborne gas or vapor contaminants with poor warning properties –odor or irritation effects not detectable or not persistent at concentrations equal to or less than the respective PEL or TLV, unless the cartridge is equipped with an “End-of-Service Life Indicator (ESLI)”.
- f. Employees must be clean-shaven – mustaches must be trimmed so that hair does not interfere with the sealing surface of the respirator or the inhalation and exhalation valves.
- g. Eyeglasses cannot be worn with tight-fitting full-face respirators. UC Merced will provide a spectacle kit for any employee or student that requires vision correction to perform their work while wearing a full-face respirator
- h. Contact lenses may be worn with any respirator but must be approved by the EH&S Department.
- i. Head coverings of any type cannot be worn under respirator straps or face-piece harnesses.

Exception: 6.3 d, f and g do not apply to the use of atmosphere supplying continuous-flow hoods if the EH&S Department approves their future use for specific operations or tasks.

7.0 PHYSICAL EXAMINATIONS & MEDICAL SURVEILLANCE

7.1 General

The wearing of a respirator imposes additional physical and psychological stress on employees. Therefore, a medical evaluation will be performed by a contract physician or other licensed health care professional (PLHCP).

Note: The PLHCP must approve the employee’s fitness to wear a respirator while performing their work prior to the employee being fit-tested for respirator assignment.

The medical evaluations may be performed annually or more frequently if the employee exhibits or reports any symptoms or conditions that would affect the use of respirators. In addition, some Cal/OSHA and OSHA regulations for specific substances also contain requirements for medical examinations. Questions regarding regulations for specific substances (e.g., lead, arsenic, Aerosol Transmissible Diseases (ATD), Zoonotic, etc.), including occupational carcinogens regulated by federal or state OSHA (Ref: [T8 CCR Article 110](#), Regulated Carcinogens) should be directed to the EH&S Department.

The contracting PLHCP will determine what health and physical conditions are pertinent and the frequency of reevaluating the medical status of respirator users. In this regard, the EH&S Department will provide the contract PLHCP with the following materials to assist in determining the employee's ability to use a respirator:

- A copy of this Program;
- A copy of [Appendix B –OSHA Respirator Medical Evaluation Questionnaire](#); and,
- A copy of [Appendix C – Supplemental Information to Medical Providers](#).

A medical evaluation will be performed to establish if an employee can safely and effectively wear an assigned respirator. The evaluation will be conducted prior to respirator fit testing and training.

The PLHCP will provide a written medical clearance to EH&S Department and the employee or student. The PLHCP may also request additional medical tests prior to issuance of, or denial of a clearance. The EH&S Department will coordinate these additional medical evaluations.

The clearance provided by the PLHCP will classify the worker as:

- Approved respirator use - no restrictions;
- Approved respirator use - specific use restrictions; or
- Not approved - no respirator use under any circumstances.

7.2 OSHA Respirator Medical Evaluation Questionnaire

The EH&S Department, department or school manager or the employee or student's supervisor or instructor will provide each potential respirator user with a medical evaluation questionnaire furnished by the contract PLHCP. If the provider does not amend the Mandatory OSHA Respirator Medical Evaluation Questionnaire, then employees will be provided a copy of [Appendix B](#) (Ref: [T8 CCR §5144](#)). The "mandatory" medical evaluation questionnaire will be reviewed and updated at the time of each medical fitness determination.

Confidentiality of medical records will be maintained by either the EH&S Department and/or campus designated PLHCP. To assure medical confidentiality, each employee provided with a

medical evaluation questionnaire will also receive a stamped envelope preaddressed to the contracting PLHCP. Employees or students will fill out the medical evaluation questionnaire and seal the completed form in the envelope provided.

Note: Employees will NOT return completed questionnaires to their department, manager, supervisor, instructor, or the EH&S Department.

7.3 Supplemental Information to Medical Providers

In addition to the Medical Evaluation Questionnaire, the employee's supervisor or student's instructor, department or school manager, or EH&S Department will provide details of the employee or student's job assignment regarding exposure risk including the airborne contaminant and concentration, duration and frequency of work tasks requiring respirator use, expected work effort, and additional protective clothing and equipment, to the medical provider (see Supplemental Information to Medical Providers form in [Appendix C](#)).

7.4 Medical Examination

A physician or other licensed health care professional (PLHCP) shall review the medical evaluation questionnaire submitted by each potential respirator user and the Supplemental Information provided by the department or school manager, employee's supervisor or a student's instructor, or the EH&S Department and determine what, if any, physical examination is necessary. The physical examination is at the discretion of the PLHCP, and may include but is not limited to pulmonary function tests, electrocardiogram, and chest X-rays.

Note: NIOSH does not recommend routine chest X-rays and spirometry solely as data for determining if a respirator should be worn. NIOSH states: "In most cases, with an essentially normal clinical examination (history and physical) these data are unlikely to influence the respirator fitness determination; additionally, the X-ray would be an unnecessary source of radiation exposure to the worker. Chest X-rays in general do not accurately reflect a person's cardiopulmonary physiologic status, and limited studies suggest that mild to moderate impairment detected by spirometry would not preclude the wearing of respirators in most cases. Thus, it is recommended that chest X-ray and/or spirometry be done only when clinically indicated." (Source: Occupational Exposure to Ethylene Glycol Monomethyl Ether, Ethylene Glycol Monoethyl Ether, and Their Acetates, [[NIOSH 91-119, 1991, Appendix H, p. 251](#)].)

7.5 Routine Annual Examinations

Medical reviews may be performed annually by a PLHCP to determine the continued medical fitness of individuals using respiratory protection if working conditions or exposure conditions

documented in the original approval change significantly, or the employee or student's general physical health has declined.

In addition, the results of periodic examinations will be compared with those from preemployment and previous periodic exams to determine whether respirators being used are adequate. Special evaluations will be performed after prolonged absences for medical reasons or whenever a functional disability has been identified.

7.6 Exception to Medical Approval Requirement

The EH&S Department may allow the use of disposable [single-use] filtering facepiece-type respirators (dust masks) for protection against low [less than the applicable PEL or TLV; i.e., non-hazardous] airborne concentrations of non-toxic particulates. Filtering facepiece-type respirators (dust masks) may only be used when a hazard assessment indicates that airborne concentrations of particulates are below the respective PEL or TLV.

Use of disposable filtering facepiece-type respirators (dust masks) under these restrictions does not require medical clearance or fit testing. However, training in the proper use of the respirator must be provided; each affected employee must be provided a copy of [Appendix D](#) and the training documented on the Training, Fit-Test, and Assignment form ([Appendix E](#)).

8.0 TRAINING

All respirator users and their respective supervisor must be instructed and trained in the proper use and limitations of their assigned respirators and documented on the Training, Fit-Test, and Assignment form ([Appendix E](#)). This also includes employees who choose to wear a respirator even though it is not required under regulation. Employees voluntarily choosing to wear respiratory protective equipment must receive the "mandatory" training outlined in [Appendix D](#) as required by (Ref: [T8 CCR §5144 Appendix D](#)).

Disposable [single-use] Filtering Facepiece-Type Respirators (dust masks): Although employees using disposable [single-use] filtering facepiece-type respirators (dust masks) do not require medical clearance or fit testing, the following information must be provided to emphasize the limitations of these respirators:

"Disposable filtering facepiece-type respirators (dust masks) do not supply oxygen and cannot be used in oxygen deficient atmospheres. They cannot be used as protection against any toxic material or contaminant. In addition, they do not supply the standard of protection afforded by properly fitted air-purifying respirators."

8.1 Annual Respiratory Training

Training prior to assignment and use of respirator equipment and annually thereafter shall include:

1. An overview of the respiratory protection program, including their responsibilities under the program;
2. Instructions in the nature of the hazard;
3. A discussion on respirator selection, including types of filters and cartridges;
4. An explanation of the operation, capabilities, and limitations the respirators selected;
5. Fitting (donning) instructions and methods for checking respirator fit;
6. Instruction and training in actual use and wearing of the respirator;
7. Maintenance, care, and storage of respirators;
8. An opportunity to wear the respirator in normal air and a test atmosphere;
9. Instructions in recognizing and coping with emergency situations.

8.2 Training – Atypical or Abnormal Use Conditions

A respirator wearer shall be permitted to leave the hazardous area for any respirator-related cause. Reasons may include, but are not limited to the following:

- Failure of the respirator to provide adequate protection;
- Malfunction of a respirator;
- Detection of leakage of air contaminant into the respirator;
- Increase in respirator or cartridge breathing resistance;
- Severe respirator discomfort;
- Signs or symptoms of adverse health effects such as dizziness, nausea, weakness, breathing difficulty, coughing, sneezing, vomiting, fever, and chills;
- To wash their face and their respirator facepiece to minimize skin irritation; or
- To change the air-purifying elements or other components whenever needed.

9.0 RECORDKEEPING

All records required by this program, including records of industrial hygiene exposure monitoring ([Section 5.0](#)), medical approvals ([Section 7.0](#)), employee training ([Section 8.0](#)), respirator selection ([Section 10.0](#)) and fit-testing ([Section 11.0](#)) are to be maintained at the employees' respective workplace.

Exposure and medical records for each employee will be retained for their duration of employment plus 30 years (Ref: [T8 CCR §3204](#)). Records of respirator training and fittesting and respirator assignment forms will be retained for 5 years.

Employees and students must be notified of the availability and access to both exposure and medical records. UC Merced departments and schools will post a notice informing employees whom they are to contact for access to these records (Ref: [T8 CCR §3204](#)). Current employees or students should be directed to submit a written request to their supervisor, instructor, or the EH&S Department. Former employees and students (or their designees) should be directed to submit a written request to the EH&S Department.

Exception: Records will not be retained for workers employed less than 1 year if the employee is given their records at the time of separation from University employment.

10.0 RESPIRATOR SELECTION

Respirators are to be selected based on the hazard to which the employees are exposed as determined by the workplace evaluations performed in accordance with [Section 5.0](#). Documentation of respirator selection will be retained with records of industrial hygiene exposure monitoring.

Only respirators approved and certified by the National Institute for Occupational Safety and Health (NIOSH) will be used in workplaces or schools controlled by UC Merced. The NIOSH approval must apply to the potential airborne contaminant to which the employee or student is exposed.

Respirator comfort is an important factor in wearer acceptance and use of the device. Other factors that influence wearer acceptance include breathing resistance, impairment of vision, impairment of communications, and respirator weight. Devices with greater wearer acceptance are more likely to be worn and used effectively and therefore provide better protection. If an individual can be successfully fit-tested with two or more devices, they should be assigned their preferred respirator model.

No one size or model of respirator will fit all types of faces. Different sizes and models are required to accommodate varying facial types. An assortment of respirator sizes and models will be procured from different manufacturers or vendors to enable employees to select a satisfactory device for best fit and comfort.

The EH&S Department will maintain a list of the models and sizes of respirators available to employees along with the types of filters and cartridges.

10.1 Selection Criteria

Selection of the proper type(s) of respirator(s) will be based upon:

1. Nature of the hazardous operation or process;
2. Type of inhalation hazard (gas, vapor, aerosol), including concentration of the airborne contaminant, the established exposure limit(s), the IDLH concentration, and warning properties if applicable;
3. Engineering and administrative control measures being used (Ref: [T8 CCR §5141](#));
4. Location of the hazardous area relative to the nearest area having respirable air;
5. Tasks or activities of workers affected by the airborne hazard;
6. Period of time respiratory protection must be worn;
7. Limitations of the wearer;
8. Physical characteristics, functional capabilities, and limitations of the types of respiratory protective equipment;
9. Limitations of the respiratory equipment (Ref: Tables [10.1](#), [10.2](#), [10.3](#), and [10.4](#));
10. NIOSH approvals for a specific respirator and-or cartridge; and,
11. Either NIOSH or ANSI Z88.2-1992 respirator-assigned protection factors (PF) as listed in [Table 10.1](#).

Table 10.1 - OSHA Assigned Protection Factors ⁵ ; Ref: T29 CFR §1910.134 (d) (3) (i) (A)					
Type of respirator ^{1,2}	Quarter mask	Half mask	Full facepiece	Helmet/hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	¹ 10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	^{2,3} 25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	1	50	.....	.....
• Continuous flow mode	.....	0	1,000	⁴ 25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	5	1,000	.....	.....
		0			
4. Self-Contained Breathing Apparatus (SCBA)		5			
• Demand mode	.....	1	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	0	10,000	10,000	.....
				

Notes:

¹Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration. ²The assigned protection factors in Table 10.1 are only effective when the employer implements a continuing, effective respirator program as required by this section ([T29 CFR §1910.134](#)), including training, fit testing, maintenance, and use requirements.

¹ This APF category includes filtering facepieces, and half masks with elastomeric facepieces.

² The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

³ These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by [T29 CFR §1910 subpart Z](#), employers must refer to the appropriate substancespecific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by [T29 CFR §1910.134](#) (d) (2) (ii).

10.2 Cartridge Selection – Limitations

Cartridges selected for APR's must be specific for the contaminant, its concentration in air, its physical state, and the specific NIOSH approvals. The cartridge must be used and changed-out according a calculated change frequency, change noted in the cartridge End-of Service Life indicator if equipped, or the information supplied by the manufacturer. [Table 10.2](#) provides guidance on respirator cartridge types and suggested change out schedule.

Type Contaminants	Color Code/Number	Change-out Schedule
Organic Vapors	Black	End of Work Shift ¹
Organic Vapors and Acid Gases	Yellow	End of Work Shift ¹
Ammonia/ Amines	Green	End of Work Shift ¹
Organic Vapors, Acid Gases, and Ammonia/ Amines	Olive	End of Work Shift ¹
Particulate 95% efficient against particulates (dusts, fumes, and mists) No Oil Present	N95	End of Work Shift ²
Particulate 95% efficient against particulates (dusts, fumes, and mists) Oil Present	R95	End of Work Shift ²
Particulate 99.97% efficient against particulates (dusts, fumes, and mists). Oil Proof	Magenta /P100	End of Work Shift ²
Organic Vapors and 99.97% efficient against particulates (dusts, fumes, and mists) Oil Proof	Black/Magenta/P100	End of Work Shift ^{1, 2}
Organic Vapors and Acid Gases and 99.97% efficient against particulates (dusts, fumes, and mists). Oil Proof	Yellow/Magenta/P100	End of Work Shift ^{1, 2}
Organic Vapors Acid Gases, Ammonia/ Amines and Formaldehyde and 99.97% efficient against particulates (dusts, fumes, and mists). Oil Proof	Olive/Magenta/P100	End of Work Shift ^{1, 2}
Metallic Mercury Vapor	Orange	End of Work Shift

Notes:

¹At a minimum, the cartridge change-out schedule is as follows:

- Change noted in the End-of-Service Life Indicator (ESLI);
- The end of the work shift; and/or,
- If any odor is detected.

However more frequent changes are required when work conditions such as increased concentration of contaminants are present, increases in temperature and humidity occurs or when work tasks require increased employee exertion/activity.

²All filters should be replaced whenever they are damaged, soiled, or causing noticeably increased breathing resistance.

Cartridge Type	Use Limit
Acid Gas - Chlorine	10 ppm ¹
Acid Gas Hydrogen- Chloride	50 ppm
Acid Gas - Sulfur Dioxide	50 ppm
Ammonia	300 ppm
Methyl Amine	100 ppm
Organic Vapor	1000 ppm

Notes:

¹ppm = Parts of airborne gas or vapor contaminant per million parts of air.

Arsine	Methyl chloride
Bromine	Nickel carbonyl
Carbon Dioxide	Nitrobenzene
Carbon monoxide	Nitrogen oxides
Dichloromethane	Nitroglycerine
Diisocyanates	Nitromethane
Dimethylaniline	Ozone
Dimethylsulfate	Phosgene
Hydrazine	Phosphine
Hydrogen cyanide	Phosphorus trichloride
Hydrogen fluoride	Stibine
Hydrogen Selenide	Sulfur chloride
Hydrogen sulfide	Toluene diisocyanate
Mercaptans	Vinyl chloride

11.0 FIT-TEST (Mandatory)

Prior to being assigned a respirator, and annually, the user will receive fitting instructions and be allowed to wear the respirator in normal air for an adequate familiarization period; 1520 minutes. This will include demonstrations and practice in wearing and adjusting the respirator and determining whether it fits properly. Respirators will not be worn when conditions prevent a gas-tight face seal. (Ref: [T8 CCR §5144 Appendix A – Fit Testing Procedures](#))

User fit checks, qualitative (QLFT) and quantitative (QNFT) fit-testing will be performed in accordance with the procedure outlined in [Appendix F](#). A record of the fit test will be maintained on the "Training, Fit-Test & Assignment" form in [Appendix E](#). If leakage is noted and cannot be corrected, the employee cannot wear the respirator.

11.1 User Fit-Check and Inspection (Mandatory)

11.1.1 Fit-Check - Dual Cartridge APR

To assure proper protection, the facepiece fit will be checked by the wearer each time the respirator is donned. A positive pressure test, as well as a negative pressure test, will be conducted as described below. (Ref: [T8 CCR §5144 Appendix B-1 – User Seal Check Procedures \(Mandatory\)](#))

Positive Pressure Test: Close the exhalation valve with the palm and exhale gently into the facepiece. The fit is considered satisfactory if a slight positive pressure builds up inside the facepiece-to-face seal without any evidence of outward leakage.

Negative Pressure Test: Close off the inlet opening of the cartridges by covering with the palm of the hands. Inhale gently so that the facepiece collapses slightly and hold breath for approximately 10 seconds. If the facepiece remains in a collapsed condition with no inward leakage, the fit is considered satisfactory. If inward leakage is noted, readjust the facepiece and or headbands until a satisfactory seal is obtained.

11.1.2 Fit-Check - Disposable Half-Mask APR

Positive and negative pressure test for disposable half-mask respirators will be performed according to instructions provided by the respirator manufacturer(s).

11.2 Respirator Inspection – Air-Purifying Respirators (APR’s)

11.2.1 Air-Purifying Respirators (APR’s)

Before each use, and during cleaning or sanitation the user will thoroughly inspect his or her respirator; worn or deteriorated parts will be replaced. Inspections will be performed in accordance with manufacturer’s instructions and at a minimum will include the following:

1. The facepiece sealing surface for signs of cracks, tears, or deterioration;
2. Tightness of connections and rubber or elastomer parts such as head straps and harnesses for elasticity, cuts, or deterioration;
3. Valves and valve seats for cracks;

4. Exhalation valve covers for cracks or damage;
5. Filter cartridge gaskets for deterioration; and
6. Plastic lens on full-face respirators for cracks or damage.

11.2.2 Powered Air-Purifying Respirators (PAPR's)

During inspection of PAPR's, examine the following:

1. Breathing tube for tears, cracks, or holes;
2. Blower assembly housing and seals for cracks or wear; 3. Battery pack to verify it is fully charged and ready for use; and
4. Electrical cord for breaks in the insulation.

11.3 Respirator Inspection – Atmosphere Supplying Respirators (ASR's)

11.3.1 Self-Contained Breathing Apparatus (SCBA's)

Currently UC Merced does not use SCBA's – in the event that a department plans on using SCBA's they should contact EH&S.

12.0 CARE AND MAINTENANCE OF RESPIRATORS (Mandatory)

12.1 General

The care and maintenance of respirators includes the inspection for defects, cleaning/disinfection, repair, and storage. Equipment will be properly maintained to retain its original effectiveness and maintain the NIOSH approval. Replacement of parts or repairs will be performed using only manufacturer original equipment designed for the respirator. No attempts will be made to replace components or make repairs beyond the manufacturer's recommendation.

12.2 Cartridge Replacement

Sorbent and filter cartridges must be replaced according to the period of use determined in the documentation for respirator selection. A cartridge change schedule will be calculated and implemented for exposures to gases and vapors based on cartridge service data including desorption studies (unless cartridges are equipped with an End-of-Service Life Indicator (ESLI), expected concentration, pattern of use, and duration of exposure. Gas or vapor cartridges will be changed immediately if the wearer detects break-through. The [NIOSH Ancillary Respirator Information](#) on establishing acceptable change schedule for APR cartridges (Ref: [Respirator Change Schedules](#))

As minimum, filter cartridges will be replaced at the end of each shift or when the wearer experiences increased breathing resistance.

12.3 Cleaning, Disinfection and Storage (Mandatory)

Individually assigned respirators will be cleaned at the end of each shift and disinfected (sanitized) at least weekly. Respirators will not be exchanged between individual employees until they have been thoroughly cleaned and disinfected. (Ref: [T8 CCR §5144 Appendix B-2 – Respirator Cleaning Procedures \(Mandatory\)](#))

Respirators will be cleaned at work-rest breaks using safety equipment wipes or an equivalent such as moistened baby wipes available in local pharmacies or other retail suppliers. The entire facepiece can be cleaned with the wipe with special attention given to the face seal area.

If used, the self-contained breathing apparatus (SCBA) and powered air-purifying respirators (PAPR's) will be maintained in accordance with manufacturer's instructions. The head assemblies will be detached from breathing hoses for cleaning and disinfection. The battery pack and cartridge holder on PAPR's will be cleaned after each use following the manufacturer's instructions or using a soft damp cloth to remove dirt and possible contamination (do not immerse in water).

12.3.1 Cleaning – Personally Assigned Respirators

The cleaning procedures must accomplish the objectives set forth in the “Mandatory” [Appendix B-2](#), of the respective standard; i.e., the procedures must ensure that the respirator is properly cleaned in a manner that prevents damage to the respirator and does not cause harm to the user. (Ref: [T8 CCR §5144](#))

In general, remove filters, cartridges, canisters, and breathing hoses prior to cleaning or sanitizing. Disassemble facepieces by removing speaking diaphragms, demand, and pressure demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle brush (not wire) may be used to facilitate the removal of dirt.

Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably running water – drain. Components should be hand-dried with a clean lint-free cloth or air-dried.

12.3.2 Disinfection

Individually assigned respirators used routinely by employees must be sanitized at least once a week. If the cleaner used in [Section 11.3.1](#) does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C (110°F); or,
2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43°C (110°F); or,
3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, such as quaternary ammonium, if their use is recommended or approved by the respirator manufacturer.

Rinse all components thoroughly, at least twice in clean, warm (43°C [110°F] maximum), preferably running water – drain. Components should be hand-dried with a clean lint-free cloth or air-dried.

The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed. Inflammation of the skin of the respirator user (dermatitis) may occur if the quaternary ammonium compound is not completely rinsed from the respirator.

12.3.3 Storage

Respirators shall be stored in a convenient, clean, and sanitary location in sealed plastic bags or other containers for protection from contamination, moisture, dirt, and harmful chemicals. They must also be stored to protect against damaging heat or sunlight and extreme cold. In addition, care should be taken to ensure that respirators are stored in a manner to prevent distortion of elastomeric parts.

13.0 PROGRAM EVALUATION

This program is of little value if it is not implemented and maintained as designed. Therefore, in addition to ongoing surveillance, the EH&S Department will periodically (at least annually) audit and evaluate UC Merced department and school implementation of the respiratory protection program to assure its effectiveness. The purpose of the annual audits is to ensure the program policies and procedures are consistent through University departments and schools and are consistent with current with accepted standards and regulations.

Audit findings will be documented on the Respiratory Protection Program Evaluation Checklist

(see [Appendix G](#)). The audit documentation will be reviewed and signed by the EH&S Department and department and school managers and include planned corrections if needed and dates for completion. The following criteria will be used in accomplishing these evaluations:

1. Program administration;
2. Industrial hygiene monitoring and classification of hazard;
3. Respirator selection and issuance;
4. Medical evaluation;
5. Quantitative or qualitative fit testing;
6. Employee use;
7. Respirator cleaning, maintenance, and inspection;
8. Storage;
9. Supervisor, instructor, and employee training;
10. Recordkeeping; and
11. Special problems.

Definitions include those from OSHA Sec. 1910.134(b), NIOSH, and ANSI

ACGIH	American Conference of Governmental Industrial Hygienist
Aerosol	Liquid or solid particles dispersed in the air including mists, smokes, fumes, and dusts.
Air-Purifying Respirator (APR)	A respirator that utilizes an air-purifying filter, sorbent, or catalyst element to remove contaminants from the air before it is inhaled.
American National Standards Institute (ANSI)	A private organization that recommends safe work practices and engineering designs; Z88.2-1992, Respiratory Protection, Z88.6-1984 Respiratory Protection - Respirator Use - Physical Qualifications for Personnel.
Approved	Respirators tested and listed as permissible by the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health, Education, and Welfare. The NIOSH approval number is preceded by a "TC" (testing & certification) and indicated on the respirator cartridge or, in the case of single-use or disposable respirators, on the facepiece (ref. T42 CFR 84).
Assigned Protection Factor (APF)	[See Protection Factor – ANSI & NIOSH Definitions]
Assigned Protection Factor (APF):	[Reserved – OSHA Definition]
Atmosphere-Supplying Respirator (ASR)	A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators (SAR's) and self-contained breathing apparatus (SCBA) units.
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.
Cartridge	The container(s) housing a filter, sorbent, catalyst, or any combination of these items. The type of cartridge depends upon the contaminant to be removed from the air.
Contaminant	A harmful, irritating, or nuisance airborne material.
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 Respirator	A respirator for which maintenance is not intended and that is designed to be discarded after excessive resistance, sorbent exhaustion, physical damage, or end of service life renders it unsuitable for use.
Dust	An aerosol consisting of solid particles usually produced by mechanical breakup of larger particles. Activities that generate dusts include crushing, chipping, drilling, grinding, sweeping, or handling of solid materials.

Emergency Situation	Any occurrence such as, but not limited to, equipment failure, ruptures of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.
Emergency Respirator Use Situation	A situation requiring the use of a respirator due to the unplanned generation of a hazardous atmosphere, (often of unknown composition), caused suddenly by an accident, mechanical failure, or other means, and requires evacuation of personnel or immediate entry for rescue or corrective action.
Employee Exposure	An 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.
Facepiece	The main part of the respirator that covers the wearer's nose and mouth in a half mask (under the chin) facepiece, or covers the nose, mouth, and eyes in a full facepiece.
Filter or Air-Purifying Element	A media component used in respirator cartridges or, in the case of disposable respirators, in the facepiece, to remove solid or liquid particles from the air breathed through it. (ref. NIOSH Guide to Selection of Particulate Respirators - T42 CFR 84)
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-Check	A positive and negative pressure check performed by the wearer to determine if the respirator is properly seated to the face providing a gas-tight face seal. The fit of a respirator must be checked each time the respirator is donned. This is normally done by using the palm of the hand to seal the exhalation valve cover and then gently exhaling to form a positive pressure (ref. Appendix G – Annual Program Evaluation Checklist). Using the hands, the respirator cartridges are similarly sealed and the wearer inhales forming a negative pressure as directed in the fitting instructions. A fit check ensures proper facepiece-to-face sealing and does not qualify as a fit test.
Fit-Test	Using a challenge agent such as irritant smoke, the fit of a respirator on an individual can be evaluated to determine if a gas-tight face fit can be achieved with a particular type of respirator. As required by federal and state OSHA

	regulations, the fit test must be satisfactorily completed before a respirator is worn in a contaminated area.
Fume	Solid aerosols formed by reaction and condensation of a vapor or gas. Aerosols are minute solid particles arising from the heating of a solid body such as steel, in distinction to a gas or vapor. The physical change is often accompanied by a chemical reaction such as oxidation. Fumes flocculate and sometimes coalesce. Odorous gas and vapor should not be called fumes.
Gas	A state of matter in which the material has very low density and viscosity; can expand and contract greatly in response to changes in temperature and pressure; easily diffuse into other gases; readily and uniformly distributes itself throughout any container.
Hazardous Atmosphere	An atmosphere that contains an airborne contaminant(s) in concentrations greater than the permissible exposure limit (PEL) or threshold limit value (TLV) or that is oxygen deficient.
Helmet	A rigid respiratory inlet covering that also provides head protection against impact and penetration.
High Efficiency Particulate (HEPA) Filter	AirA 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	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)	A hazardous atmosphere that poses an immediate threat or loss of life, produces immediate or delayed, irreversible effects on health, or causes effects to the eye, which could prevent escape.
Loose-Fitting Facepiece	A respiratory inlet covering that is designed to form a partial seal with the face.
Maximum Use Concentration (MUC)	[Reserved – OSHA Definition]
Mist	An aerosol composed of suspended liquid droplets generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing. Mist is formed when a finely divided liquid is suspended in air.
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.
Orinasal Respirator	A respirator that covers the nose and mouth and that generally consists of a quarter- or half-facepiece. [NIOSH Definition]
Oxygen Deficient Atmosphere	An atmosphere with an oxygen content below 19.5% by volume.

Permissible Exposure Limit (PEL)	Permissible Exposure Limit adopted in OSHA regulations is a maximum allowable concentration of a contaminant in the air to which an individual may be exposed. These may be time-weighted averages (TWA), short-term limits (STEL), or ceiling (C) limits (see threshold limit value (TLV)).
Physician or other Licensed Health Care Professional (PLHCP)	An individual whose legally permitted scope or practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by subsection (e).
Positive Pressure Respirator	A respirator in which the pressure inside the respiratory covering exceeds the ambient air pressure outside the respirator. [OSHA Definition]
Poor Warning Properties	A substance whose odor or irritation effects are not detectable or not persistent at concentrations at or below the PEL or threshold limit value (TLV).
Potential Occupational Carcinogen	Any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory, or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance that is metabolized into one or more potential occupational carcinogens by mammals (29 CFR 1990.103, OSHA Cancer Policy). [NIOSH Definition]
Powered Air-Purifying Respirator (PAPR)	The powered air-purifying respirator (PAPR) uses a blower to pass contaminated air through filter or sorbent cartridges that remove the contaminant and supplies purified air to the respirator facepiece.
Positive Pressure Respirator	A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.
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.
Protection Factor	ANSI - The protection factor is a measure of the degree of protection provided by a respirator to the wearer when a respirator is used correctly. The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator.

OSHA:

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

Simulated Protection Factor (SWPF): A surrogate measure of the workplace protection provided by a respirator. The protection factor determined by quantitative measurement of a challenge agent inside a test hood or the ambient atmosphere particulate concentration (C_o) divided by the particulate concentration measured inside the respirator (C_i); i.e., $C_o \div C_i = \text{PPF}$.

Workplace Protection Factor (WPF): A measure of the protection provided in the workplace by a properly functioning respirator when correctly worn and used.

Qualitative Fit Test (QLFT)	Qualitative fit test means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent (see Fit-Test).
Quantitative Fit Test (QNFT)	An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator. [OSHA Definition]
Respirator	A personal device designed to protect the wearer from the inhalation of hazardous atmospheres. [OSHA Definition]
Respiratory Inlet Covering	The portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.
Sanitizing	The removal of dirt and inhibiting the action of agents that cause infection or disease.
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. [NIOSH Definition]
Sorbent	A material that is contained in a cartridge and removes toxic gases and vapors from the inhaled air.
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 (see Atmosphere-Supplying Respirator (ASR)).
Tight-Fitting Facepiece	A respiratory inlet covering that is designed to form a complete seal with the face. A half-mask facepiece covers the nose and mouth; a full-face facepiece covers the nose, mouth, and eyes.
Threshold Limit Value (TLV)	Threshold Limit Values are exposure limits adopted and recommended by the American Conference of Governmental Industrial Hygienist (ACGIH) (see Permissible Exposure Limit (PEL)).

Time Weighted Average (TWA)	The Time Weighted Average is the average concentration of a chemical in air over the total exposure time - usually an 8-hour workday.
User Seal Check	An action conducted by the respirator user to determine if the respirator is properly seated to the face.
Vapor	The gaseous form of a substance that is normally a solid or liquid at room temperature and pressure. Liquids are changed into the vapor state and mixed with the surrounding atmosphere through evaporation.
Voluntary Respirator Users	Employees have the option to wear a respirator in areas where it is not required under this policy or for compliance with state or federal OSHA regulation. Voluntary users of all respirator types (except dust masks) are required to comply with all elements of this program, including medical clearances.

Not Required Under the Standard (Mandatory)

Appendix D to OSHA Sec. 1910.134

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard. (Formatting issue)

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator's limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

-----CUT HERE – RETURN PORTION BELOW -----

I have received and read Appendix D of OSHA's respiratory protection standard.

Name: _____ Date: _____

Please return bottom section to EH&S via campus mail or email ehs@ucmerced.edu.

OSHA-accepted fit test methods

General Requirements - The employer shall conduct fit testing using the following procedures.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.
2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.
4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator.
 - a. Position of the mask on the nose
 - b. Room for eye protection
 - c. Room to talk
 - d. Position of mask on face and cheeks
7. The following criteria shall be used to help determine the adequacy of the respirator fit:
 - a. Chin properly placed;
 - b. Adequate strap tension, not overly tightened;
 - c. Fit across nose bridge;
 - d. Respirator of proper size to span distance from nose to chin;
 - e. Tendency of respirator to slip;
 - f. Self-observation in mirror to evaluate fit and respirator position.
8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in [Appendix B-1](#) or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in [Appendix B-1](#). Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep

- breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.
9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.
 10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.
 11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.
 12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.
 13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which would interfere with respirator fit.
 14. Test Exercises
 - a. Employees must perform the following test exercises for all fit testing methods prescribed in this appendix. Employers must ensure that employees perform the test exercises in the appropriate test environment in the following manner.
 1. Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.
 2. Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.
 3. Turning head side to side. Standing in place, the subject shall slowly turn his/her 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.
 4. Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).
 5. Talking. 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.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two

ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold

at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. Grimace. The test subject shall grimace by smiling or frowning.
 7. Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.
 8. Normal breathing. Same as exercise (1).
- b. Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 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 unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

Qualitative Fit Test (QLFT) Protocols

The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order. The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed. Two OSHA-accepted tests are described on the following pages and are to be performed by EH&S personnel.

Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

- (A) Odor Threshold Screening. Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.
1. Three 1-liter glass jars with metal lids are required.
 2. Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.
 3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1-liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.
5. The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
6. A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.
7. The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.
8. The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): “The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil.”
9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.
10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.
11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(B) Isoamyl Acetate Fit Test

1. The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.
2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.
3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.
5. Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of

the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an

IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

6. Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.
7. If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
8. If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select, and put on another respirator, return to the test area and again begin the fit test procedure described in (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.
9. If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.
10. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self sealing plastic bag to keep the test area from being contaminated.

Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test

The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(A) Taste Threshold Screening. The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.

1. During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and

allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts #14 and #15 combined, is adequate.

2. The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
3. The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.
4. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
5. The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.
6. To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely and is then released and allowed to fully expand.
7. An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
8. If the first response is negative, ten more squeezes are repeated rapidly, and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
9. If the second response is negative, ten more squeezes are repeated rapidly, and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
10. The test conductor will take note of the number of squeezes required to solicit a taste response.
11. If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

12. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
 13. Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
 14. The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.
- (B) Bitrex Solution Aerosol Fit Test Procedure.
1. The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
 2. The fit test uses the same enclosure as that described above.
 3. The test subject shall don the enclosure while wearing the respirator selected according to the General Requirements section of this appendix. The respirator shall be properly adjusted and equipped with any type of particulate filter(s).
 4. A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall not be clearly marked to distinguish it from the screening test solution nebulizer.
 5. The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water.
 6. As before, the test subject shall breathe through his or her slightly open mouth with tongue extended and be instructed to report if he/she tastes the bitter taste of Bitrex.
 7. The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.
 8. After generating the aerosol, the test subject shall be instructed to perform the exercises outlined in (14) of the General Requirements section of this appendix.
 9. Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
 10. The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.
 11. If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried, and the entire test procedure is repeated (taste threshold screening and fit testing).