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**THE UNIVERSITY OF TEXAS AT AUSTIN**



**UTILITIES AND ENERGY  
MANAGEMENT**

**RESPIRATORY PROTECTION  
PROGRAM**

February 2007

## TABLE OF CONTENTS

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<b>1.0</b>	<b>Scope and Application .....</b>	<b>1-1</b>
1.1	DEFINITIONS .....	1-1
<b>2.0</b>	<b>Voluntary Respirator Use .....</b>	<b>2-1</b>
<b>3.0</b>	<b>Responsibilities .....</b>	<b>3-1</b>
3.1	PROGRAM ADMINISTRATOR.....	3-1
3.2	SUPERVISORS.....	3-1
3.3	EMPLOYEES.....	3-2
<b>4.0</b>	<b>Respirator Selection .....</b>	<b>4-1</b>
4.1	RESPIRATOR SELECTION PROCEDURES.....	4-1
4.2	HAZARDS AND CONTROLS ASSESSMENT.....	4-2
4.3	RESPIRATORY DECISION LOGIC FLOW CHART .....	4-2
<b>5.0</b>	<b>Medical Evaluation.....</b>	<b>5-1</b>
<b>6.0</b>	<b>Fit Testing.....</b>	<b>6-1</b>
<b>7.0</b>	<b>Respirator Use.....</b>	<b>7-1</b>
7.1	GENERAL USE PROCEDURES:.....	7-1
7.2	EMERGENCY PROCEDURES: .....	7-1
7.3	RESPIRATOR MALFUNCTION.....	7-1
7.3.1	APR Respirator Malfunction: .....	7-1
7.3.2	Atmosphere-supplying Respirator Malfunction:.....	7-2
<b>8.0</b>	<b>Cleaning, Maintenance, Change Schedules and Storage.....</b>	<b>8-1</b>
8.1	CLEANING.....	8-1
8.2	MAINTENANCE AND INSPECTION .....	8-1
8.3	CHANGE SCHEDULES .....	8-3
8.4	STORAGE .....	8-3
8.5	DEFECTIVE RESPIRATORS.....	8-3
<b>9.0</b>	<b>Training.....</b>	<b>9-1</b>
<b>10.0</b>	<b>Program Evaluation / Audit .....</b>	<b>10-1</b>
<b>11.0</b>	<b>Documentation and Recordkeeping.....</b>	<b>11-1</b>

## APPENDICES

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- Appendix A** Appendix A to Sec. 1910.134: Fit Testing Procedures
- Appendix B** Appendix B-1 and Appendix B-2 to Sec. 1910.134: User Seal Check and Respirator Cleaning
- Appendix C** Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)
- Appendix D** Appendix D to §1910.134 (Mandatory) Information to Employees Using Respirators When Not Required Under the Standard
- Appendix E** Respiratory Decision Logic Flowchart
- Appendix F** Sample Respirator Selection Chart
- Appendix G** Web Links to OSHA Respiratory Protection Standard, 29 CFR 1910.134

## **PURPOSE**

The purpose of the Respiratory Protection Program is to insure that all The University of Texas at Austin (UT) Utilities and Energy Management employees are protected from exposure to respiratory hazards. It applies to all Utilities employees that will or may use air-purifying respirators (APRs), full tight-fitting facepiece, powered air- purifying respirator (PAPR), atmosphere-supplying respirators (SARs) units or self-contained breathing apparatus (SCBA) for protection against respiratory hazards, airborne contaminants or IDLH atmospheres. In addition, The Respiratory Protection Program is to provide Utilities and Energy Management Department guidance in implementation of its respiratory protection program.

These are general policies and procedures that can be universally applied. Job site and job task-specific procedures must be established for each Utilities department and task which requires respiratory protection.

The primary objective shall be to prevent atmospheric contamination. Engineering controls, such as confinement or enclosure of the operation, ventilation and/or substitution of less toxic materials, are the first line of defense within the department; however, engineering controls have not always been feasible for some of our operations, or have not always completely controlled the identified hazards. In these situations, appropriate respirators and other protective equipment must be used. Respirators are also needed to protect employees' health during emergencies.

## 1.0 SCOPE AND APPLICATION

This program applies to all The University of Texas at Austin Utilities and Energy Management employees who are required to wear respirators during normal work operations, and during some non-routine or emergency operations such as a spill or an escape of a hazardous substance. All employees required to wear respirators must be enrolled in the respiratory protection program.

No one may wear a respirator without medical authorization, documented training and documented fit testing. In addition, any employee who voluntarily wears a respirator when a respirator is not required (i.e., in certain maintenance and custodial operations) is subject to the medical evaluation, cleaning, maintenance, and storage elements of this program, and must be provided with certain information specified in this section of the program.

As a general policy Utilities Safety Office (USO) will review each request for voluntary use respiratory protection on a case-by-case basis. If the use of respiratory protection in a specific case will not jeopardize the health or safety of the worker(s), USO will provide assistance in the selection of respirators for voluntary use. As outlined in section 4.0 of the program, voluntary respirator use is subject to certain requirements. See Attachment II for OSHA's voluntary respirator use guidance.

### 1.1 Definitions

***Air-purifying respirator*** - a respirator with an air-purifying filter, cartridge or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

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

***Canister or cartridge*** - a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

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

***Dust*** - materials created when solid material breaks down and gives off fine air-borne particles.

***Dust Mask*** - a NIOSH/ MSHA - approved mask providing limited protection from dusts and/or mists. Not to be used for paint spray, fumes (including welding fumes) gases, vapors, asbestos or sandblasting.

***EH&S*** - Environmental Health and Safety office at The University of Texas at Austin

**Emergency situation** - any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does not result in an uncontrolled significant release of an air-borne contaminant.

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

**End-of-service-life indicator (ESLI)** - a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

**Escape-only respirator** - a respirator intended to be used only for emergency exits.

**Filter or air purifying element** - a component used in respirators to remove solid or liquid aerosols from the inspired air.

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

**Fit test** - the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

**High efficiency particulate air (HEPA)** - a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

**Hood** - 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 and health (IDLH)** - an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

**Medical authorization** - approval by a licensed health care professional or physician to wear a respirator after examination of medical records and/or a physical examination.

**MMAD** - Mass Median Aerodynamic Diameters

**MSDS** - Material Safety Data Sheet

**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.

**NIOSH** - National Institute of Occupational Safety and Health

**Oxygen deficient atmosphere** - an atmosphere with an oxygen content below 19.5% by volume.

**Physician or other licensed health care professional (PLHCP)** - an individual whose legally permitted scope of 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 in OSHA requirements for fit testing.

**Positive pressure respirator** - a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

**Powered air-purifying respirator (PAPR)** - an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

**Pressure demand respirator** - a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

**Program Administrator** - An individual who has training or experience to fulfill the minimum standard requirements of recognizing, evaluating, and controlling the hazards in a workplace.

**Qualitative fit test (QLFT)** - a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

**Quantitative fit test (QNFT)** - an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

**Self-contained breathing apparatus (SCBA)** - an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

**Service life** - the period of time that a sorbent, or other respiratory equipment provides adequate protection to the wearer.

**Supplied-air respirator (SAR) or airline respirator** - an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

**Tight-fitting facepiece** - a respiratory inlet covering that forms a complete seal with the face.

**User seal check** - an action conducted by the respirator user to determine if the respirator is properly seated to the face.

**UT** - The University of Texas at Austin

**USO** - Utilities Safety Office

**Training** - scheduled training session by a qualified trainer.

**Vapors** - the gaseous state of substances that are liquid or solid at room temperature.



## 2.0 VOLUNTARY RESPIRATOR USE

When respiratory protection is not mandated by the need to protect the health of the employee as determined by job site evaluation, provisions may be made for the voluntary or elective use of respirators at the request of employees or permit employees to use their own respirators, if such respirator use will not in itself create a hazard. The decision to use mandatory respiratory protection will be made by the employing department in consultation with Environmental Health and Safety Office. Such situations may occur on job sites where nuisance dust is generated below the permissible exposure limit or where objectionable odors are present below hazardous exposure levels.

Voluntary use of respirators does not carry the same program requirements as mandatory use. The program to be followed for voluntary respirators will be designed on a case-by-case basis for each job site and task. At the minimum, if elective respirator use is permissible, Utilities will provide the respirator users with information contained in Appendix D of the respiratory protection standard, which is provided as Attachment II of this program. Utilities will establish and implement those elements of a written respiratory protection program necessary to ensure that any employee, using a respirator voluntarily, is medically able to use that respirator. Additionally, the respirator must be cleaned, stored, and maintained so its use does not present a health hazard to the user.

Employees who voluntarily wear filtering facepieces (dust masks) are not subject to the medical evaluation (see Attachment III for OSHA's Medical Evaluation Questionnaire), cleaning, storage, and maintenance provisions of this program. N-95 respirators require medical evaluation and are not classified as a dust mask.

The Utilities Safety Office, USO, will assist the employee in selection and purchasing a respirator(s) for voluntary use for their job specific task.

The USO will provide all employees who voluntarily choose to wear a respirator with a copy of Appendix D of the standard, which is provided as Attachment II of this program. Employees choosing to wear a half facepiece APR must comply with the procedures for Medical Evaluation (see Attachment III for OSHA's Medical Evaluation Questionnaire), Respirator Use, and Cleaning, Maintenance and Storage.

The USO shall authorize voluntary use of respiratory protective equipment as requested by all other workers on a case-by-case basis, depending on specific workplace conditions and the results of the medical evaluations.

Employees participating in the respiratory protection program do so at no cost to them. The employing department will be responsible for purchasing respiratory protective equipment. Training can be arranged through consultation with EH&S and will be conducted by qualified staff or other appropriate group. A designated clinic will conduct the medical evaluations. Other arrangements can be made as necessary.

## 3.0 RESPONSIBILITIES

### 3.1 Program Administrator

For UT Utilities, the Program Administrator responsible for administering the respiratory protection program is the USO. Duties of the program administrator include:

- Identifying work areas, processes or tasks that require workers to wear respirators, and evaluating hazards.
- Selection of respiratory protection options.
- Monitoring respirator use to ensure that respirators are used in accordance with their certifications.
- Arranging for and/or conducting training.
- Ensuring proper storage and maintenance of respiratory protection equipment.
- Conducting qualitative fit testing using Bitrex solution or banana oil aerosol protocol or arrange for quantitative fit testing.
- Administering the medical surveillance program.
- Maintaining records required by the program.
- Evaluating the program.
- Updating written program, as needed.
- Auditing each department's program.

Delegation of Responsibility:

With the approval of the Director of Utilities and Energy Management, the Program Administrator may delegate responsibility of various aspects of the respiratory protection program to another person or qualified organization. However, the ultimate responsibility for the program cannot be delegated.

### 3.2 Supervisors

Supervisors are responsible for ensuring that the respiratory protection program is implemented in their particular areas. In addition to being knowledgeable about the program requirements for their own protection, supervisors must also ensure that the program is understood and followed by the employees under their charge. Duties of the supervisor include:

- Ensuring that employees under their supervision (including new hires) have received appropriate training, fit testing, and annual medical evaluation.

- Ensuring the availability of appropriate respirators and accessories.
- Being aware of tasks requiring the use of respiratory protection.
- Enforcing the proper use of respiratory protection when necessary.
- Ensuring that respirators are properly cleaned, maintained, and stored according to the respiratory protection program.
- Ensuring that respirators fit well and do not cause discomfort.
- Continually monitoring work areas and operations to identify respiratory hazards.
- Coordinating with the USO on how to address respiratory hazards or other concerns regarding the program.

### **3.3 Employees**

Each employee has the responsibility to wear his or her respirator when and where required and in the manner in which they were trained. Employees must also:

- Care for and maintain their respirators as instructed in the manufacturer's manual, and store them in a clean sanitary location.
- Inform their supervisor if the respirator no longer fits well or if a respirator has become defective, and request a new one.
- Inform their supervisor or the USO of any respiratory hazards that they feel are not adequately addressed in the workplace and of any other concerns that they have regarding the program.
- Maintain a facial surface consistent with a proper fit of the respiratory protective device, i.e., no excessive cosmetics, beards and be clean-shaven.
- Wear only the respirator you have been instructed to use. For example, do not wear a self- containing breathing apparatus if you have been assigned and fitted for a half-mask respirator.

## 4.0 RESPIRATOR SELECTION

### 4.1 Respirator Selection Procedures

Respirators to be used on site will be based on the hazards to which workers are exposed and in accordance with all OSHA standards. The USO will perform or will arrange for a hazard assessment, as described in Section 6.2, for each operation, process, or work area where airborne contaminants may be present in routine operations or during an emergency. Based upon the hazard assessment results, appropriate respiratory protection controls will be instituted, per the Respirator Decision Logic Flow Chart provided as Figure 1 in Section 6.3. A record of this process shall be made in the Respirator Selection Chart, which is provided as Attachment IV.

The degree of the respiratory hazard, as it refers to the selection and classification of respirators used, depends upon the atmospheric oxygen concentration; contaminant's physical state, toxicity, and concentration; the presence of other contaminants or stress factors in the work environment; worker time, work level (light, medium or heavy), temperature, and humidity.

Respiratory hazards are classified as gas and vapor contaminants (immediately or not immediately dangerous to life and health), particulate contaminants (immediately or not immediately dangerous to life and health), and oxygen deficiencies. Each classification requires a different degree of respiratory protection. Appropriate respiratory protection will be determined on the basis of contaminate concentration.

All respirators worn shall be NIOSH approved and will be used under conditions of its certification. The Department shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to and correctly fits the user.

Air-purifying respirators shall not be used in (IDLH) atmospheres. Air-purifying respirators shall not be used in oxygen concentrations less than 19.5%; normal room air contains 20.9% oxygen. Employee exposures that have not been, or cannot be evaluated are to be considered (IDLH), unless written approval has been given by the USO. All confined spaces shall be considered IDLH atmospheres unless proven otherwise. The USO will determine what respiratory protection is necessary in confined spaces or unknown atmospheres on a case-by-case basis.

The use of air-purifying respirators may not be appropriate in certain airborne concentrations of contaminants. Some restrictions are stated on the cartridges or filters. There are upper limits on contaminate concentrations against which half and full face-piece respirators may be used.

All filters, cartridges, and canisters must be labeled with the appropriate NIOSH approval label. The label must not be removed or defaced while it is in use.

## 4.2 Hazards and Controls Assessment

The following steps will be performed for each operation, process, or work area where airborne contaminants may be present in routine operations or during an emergency:

- 1) Identify hazardous substances used in the workplace, by department, or work process.
- 2) For each hazardous substance, determine potential exposures based upon surveying and/or monitoring the workplace, reviewing process records, MSDS, and talking with employees and supervisors.
- 3) For each potential exposure, select appropriate respiratory protection controls.
- 4) For each person potentially exposed, perform medical evaluations.
- 5) For each person potentially exposed, provide respiratory protection training.
- 6) Implement appropriate respiratory protection controls.
- 7) Audit for appropriate use of and effectiveness of controls.

## 4.3 Respiratory Decision Logic Flow Chart

The Respiratory Decision Logic Flow Chart, shown in Appendix E, should be used to determine when a respirator is needed for a particular job. Note that exposure limits are provided in the Hazardous Ingredients/Identity Information section of an MSDS and the respiratory protection requirements are given in the Control Measures of an MSDS.

Respiratory Protection Selection Chart(s), provided as Attachment IV, are to be completed by using departments when it is determined that a respirator is required. This sheet will help USO and the user determine proper respiratory protection; it will also document those determinations. It should be completed neatly; use multiple sheets when required: information should be available to the user through previous surveys, supply listings and material safety data sheets etc. Data not readily available may be obtained by consulting with the USO.

## 5.0 MEDICAL EVALUATION

Employees who are either required to wear respirators, or who choose to wear an APR voluntarily, must pass a medical exam before being permitted to wear a respirator on the job. Employees are not permitted to wear respirators until a PLHCP has determined that they are medically able to do so. Any employee refusing the medical evaluation will not be allowed to work in an area requiring respirator use.

A licensed PLHCP at an approved medical office, where the medical services are provided, will provide the medical evaluations. Medical evaluation procedures are as follows:

- The medical evaluation will be conducted using the questionnaire provided in Appendix C of the respiratory protection standard. The USO will provide a copy of this questionnaire to all employees requiring medical evaluations.
- To the extent feasible, USO will assist employees who are unable to read the questionnaire (by providing help in reading the questionnaire). When this is not possible, the employee will be sent directly to the PLHCP for medical evaluation.
- All affected employees will be given a copy of the medical questionnaire to fill out, along with a stamped and addressed envelope for mailing the questionnaire to the physician. Employees will be permitted to fill out the questionnaire on UT time.
- Follow-up medical exams will be granted to employees as required by the standard, and/or as deemed necessary by the PLHCP.
- All employees will be granted the opportunity to speak with the PLHCP about their medical evaluation, if they so request.
- The USO has provided the PLHCP with a copy of this program, the list of hazardous substances by work area, and for each employee requiring evaluation: his or her work area or job title, proposed respirator type and weight, length of time required to wear respirator, expected physical work load (light, moderate, or heavy), potential temperature and humidity extremes, and any additional protective clothing required.
- Any employee required for medical reasons to wear a positive pressure air-purifying respirator will be provided with a powered air-purifying respirator.
- After an employee has received clearance and begun to wear his or her respirator, additional medical evaluations will be provided under the following circumstances:
  - Employee reports signs and/or symptoms related to their ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing.
  - The PLHCP or supervisor informs the USO that the employee needs to be reevaluated.
  - Information from this program, including observations made during fit testing and program evaluation, indicates a need for reevaluation.
  - A change occurs in workplace conditions that may result in an increased physiological burden on the employee.

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- All examinations and questionnaires are to remain confidential between the employee and the physician.

## 6.0 FIT TESTING

Fit testing is required for employees wearing half-facepiece APRs, full-facepiece APRs, tight-fitting full-facepiece PAPRs, tight-fitting facepiece N-95 particulate respirators, SARs and SCBAs. Employees voluntarily wearing half-facepiece APRs may also be fit tested upon request.

Hooded PAPRs do not require fit testing.

Employees who are required to wear tight-fitting-facepiece respirators will be fit tested:

- Prior to being allowed to wear any respirator with a tight fitting facepiece.
- Annually.
- When there are changes in the employee's physical condition that could affect respiratory fit (e.g., obvious change in body weight, facial scarring, etc.).

Employees will be fit tested with the make, model, and size of respirator that they will actually wear. Employees will be provided with several models and sizes of respirators so that they may find an optimal fit. Fit testing of tight fitting full facepiece PAPRs, SARs and SCBAs is to be conducted in the negative pressure mode.

The USO will conduct fit tests following the OSHA approved Bitrex Solution Aerosol Qualitative Fit Test (QLFT) Protocol in Appendix B of the Respiratory Protection Standard. Web links to the Respiratory Protection Standard are provided in Appendix I.

Employees shall conduct a user seal check, using either the negative or positive pressure seal checks described in Appendix B-1 of the Respiratory Protection Standard or those recommended by the respirator manufacturer.

N-95 respirators are considered negative pressure respirators and require fit-testing and medical evaluation.

The USO has determined that a Quantitative Fit Test (QNFT) is not required for the respirators used under current conditions. If conditions affecting respirator use change, the USO will evaluate on a case-by-case basis whether QNFT is required.



## 7.0 RESPIRATOR USE

### 7.1 General Use Procedures:

Employees will use their respirators under conditions specified by this program, and in accordance with the training they receive on the use of each particular model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.

All employees shall conduct user seal checks each time that they wear their respirator. Employees shall use either the positive and negative pressure check (depending on which test works best for them) specified in Appendix B-1 of the Respiratory Protection Standard. Web links to the Respiratory Protection Standard are provided in Appendix I.

All employees shall be permitted to leave the work area to maintain their respirator for the following reasons: to clean their respirator if the respirator is impeding their ability to work, change filters or cartridges, replace parts, or to inspect respirator if it stops functioning as intended. Employees should notify their supervisor before leaving the area.

Employees are not permitted to wear tight-fitting respirators if they have any condition that prevents them from achieving a good seal, such as facial scars, excessive facial hair, missing dentures, or excessive cosmetics. Employees are not permitted to wear headphones, jewelry, or other articles that may interfere with the facepiece-to-face seal.

### 7.2 Emergency Procedures:

Each department is responsible for establishing its own emergency plan of action. If the department's employees are not trained as emergency responders, they are not authorized to act in such a manner.

### 7.3 Respirator Malfunction

#### 7.3.1 APR Respirator Malfunction:

For any malfunction of an APR (e.g., such as breakthrough, facepiece leakage, or improperly working valve), the respirator wearer should inform his or her supervisor that the respirator no longer functions as intended, and go to the designated safe area to maintain the respirator. The supervisor must ensure that the employee receives the needed parts to repair the respirator, or is provided with a new respirator.

### **7.3.2 Atmosphere-supplying Respirator Malfunction:**

All workers wearing atmosphere-supplying respirators will work with a buddy. Buddies shall assist workers who experience an SAR malfunction as follows:

If a worker experiences a malfunction of an SAR, he should signal to the buddy that he has had a respirator malfunction. The buddy must immediately stop work, don an emergency escape respirator and escort the worker to the safe area where the employee can safely remove the SAR

## 8.0 CLEANING, MAINTENANCE, CHANGE SCHEDULES AND STORAGE

### 8.1 Cleaning

Respirators are to be regularly cleaned and disinfected at a designated respirator cleaning station. Employees shall clean respirators per the procedures provided in Appendix B, which is Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory).

Respirators issued for the exclusive use of an employee shall be cleaned as often as necessary, but at least once a day after use.

Atmosphere supplying and emergency use respirators are to be cleaned and disinfected after each use.

The following procedure is to be used when cleaning and disinfecting respirators:

- Disassemble respirator, removing any filters, canisters, or cartridges.
- Wash the facepiece and associated parts in a mild detergent with warm water. Do not use organic solvents.
- Rinse completely in clean warm water.
- Wipe the respirator with disinfectant wipes to kill germs.
- Air dry in a clean area.
- Reassemble the respirator and replace any defective parts.
- Place in a clean, dry plastic bag or other airtight container.

Note: If supplies of appropriate cleaning and disinfection material at the cleaning station are low, employees should contact their supervisor, who will inform the USO.

### 8.2 Maintenance and Inspection

Respirators are to be properly maintained at all times in order to ensure that they function properly and adequately protect the employee. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use. No components will be replaced or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted by the manufacturer.

The following checklist will be used when inspecting respirators:

- Facepiece:  
cracks, tears, or holes

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RESPIRATORY PROTECTION PROGRAM**

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facemask distortion  
cracked or loose lenses/faceshield

- Headstraps:
  - breaks or tears
  - broken buckles
  
- Valves:
  - residue or dirt
  - cracks or tears in valve material
  
- Filters/Cartridges:
  - approval designation
  - gaskets
  - cracks or dents in housing
  - proper cartridge for hazard
  
- Air Supply Systems:
  - breathing air quality/grade
  - condition of supply hoses
  - hose connections
  - settings on regulators and valves

Employees are permitted to leave their work area to perform limited maintenance on their respirator in a designated area that is free of respiratory hazards. Situations when this is permitted include to wash their face and respirator facepiece to prevent any eye or skin irritation, to replace the filter, cartridge or canister, and if they detect vapor or gas breakthrough or leakage in the facepiece or if they detect any other damage to the respirator or its components.

All SCBA cylinders require periodic hydrostatic testing as required by 49 CFR 180.205. The frequency of the maintenance depends upon the cylinder material.

- Steel cylinders should be tested every five years. They have an indefinite service life until they fail a hydro test.
- Aluminum cylinders (not including hoop-wrapped) should be tested every five years. They have an indefinite service life until they fail a hydro test.
- Hoop-wrapped cylinders should be tested every three years. Hoop-wrapped cylinders have a 15-year service life.
- Fully wrapped fiberglass cylinders should be tested every three years. They have a 15-year service life.

- Fully wrapped Kevlar cylinders should be tested every three years. They have a 15-year service life.
- Fully wrapped carbon fiber cylinders should be tested every five years. They have a 15-year service life.

Cylinders should not be filled if they have exceeded their valid service life or re-test dates. If there is any doubt about the suitability of the cylinder for recharge, it should be returned to a certified hydrostatic test facility for examination and retesting. Any evidence of a crack, defect or damage requires the cylinder to be removed from service.

### **8.3 Change Schedules**

Employees wearing tight fitting APRs or PAPRs with P100 filters for protection against particulates shall change the cartridges on their respirators when they first begin to experience difficulty breathing (i.e., resistance) while wearing their masks.

### **8.4 Storage**

Respirators must be stored in a clean, dry area, and in accordance with the manufacturer's recommendations. Each employee will clean and inspect their own air-purifying respirator in accordance with the provisions of this program and will store their respirator in a plastic bag in the department's designated area. Filters and cartridges will not be stored with the respirator in the same bag or container. Each employee will have his/her name on the bag and that bag will only be used to store that employee's respirator.

### **8.5 Defective Respirators**

Respirators that are defective or have defective parts shall be taken out of service immediately. If, during an inspection, an employee discovers a defect in a respirator, he/she is to bring the defect to the attention of his or her supervisor. Supervisors will give all defective respirators to the USO. The USO will decide whether to:

- Temporarily take the respirator out of service until it can be repaired.
- Perform a simple fix on the spot such as replacing a headstrap.
- Dispose of the respirator due to an irreparable problem or defect.

When a respirator is taken out of service for an extended period of time, the respirator will be tagged out of service, and the employee will be given a replacement of similar make, model, and size. All tagged out respirators will be kept in the storage cabinet inside the USO's office.

## 9.0 TRAINING

The USO or other qualified personnel will provide training to respirator users and their supervisors on the contents of the Utilities Respiratory Protection Program and their responsibilities under it, and on the OSHA Respiratory Protection standard. Workers will be trained prior to using a respirator in the workplace. Supervisors will also be trained prior to using a respirator in the workplace or prior to supervising employees that must wear respirators.

The training course will cover the following topics:

- Utilities Respiratory Protection Program
- The OSHA Respiratory Protection standard
- Respiratory hazards encountered within Utilities and Energy Management and their health effects
- Proper selection and use of respirators
- Limitations of respirators
- Respirator donning and user seal (fit) checks
- Fit testing
- Emergency use procedures
- Maintenance and storage
- Medical signs and symptoms limiting the effective use of respirators

Employees will be retrained annually or as needed (e.g., if they change departments and need to use a different respirator). Employees must demonstrate their understanding of the topics covered in the training through hands-on exercises and a written test. Respirator training will be documented by the USO and the documentation will include the type, model, and size of respirator for which each employee has been trained and fit tested.

## **10.0 PROGRAM EVALUATION / AUDIT**

The USO will conduct periodic evaluations of the workplace to ensure that the provisions of this program are being implemented. The evaluations will include regular consultations with employees who use respirators and their supervisors, site inspections, air monitoring and a review of records.

Problems identified will be noted in an inspection log and addressed by the USO. These findings will be reported to Utilities management, and the report will list plans to correct deficiencies in the respirator program and target dates for the implementation of those corrections.

## 11.0 DOCUMENTATION AND RECORDKEEPING

A written copy of this Respiratory Protection Program is kept in USO's office and is available to all employees who wish to review it. The USO will also provide access, typically over the Internet, to the OSHA Respiratory Protection Standard.

For all jobs for which a hazards and control assessment is performed, the USO will maintain copies of all Respiratory Selection Charts.

For all employees covered under the respirator program, the USO will maintain copies of training and fit test records. These records will be updated as new employees are trained, as existing employees receive refresher training, and as new fit tests are conducted.

The completed medical questionnaire and the PLHLP's documented findings are confidential and will remain at the designated medical officer. Utilities will only retain the physician's written recommendation regarding each employee's ability to wear a respirator.



**APPENDIX A**

**Appendix A to Sec. 1910.134: Fit Testing Procedures**

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## Appendix A

### Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

#### *Part I. OSHA-Accepted Fit Test Protocols*

#### **A. Fit Testing Procedures -- General Requirements**

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

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

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

---

- (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.
7. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section 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.
8. 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.
9. 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.
10. 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.
11. 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

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UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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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.

12. 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 could interfere with respirator fit.
13. Test Exercises.
  - (a) Employers must perform the following test exercises for all fit testing methods prescribed in this appendix, except for the CNP quantitative fit testing protocol and the CNP REDON quantitative fit testing protocol. For these two protocols, employers must ensure that the test subjects (i.e., employees) perform the exercise procedure specified in Part I.C.4(b) of this appendix for the CNP quantitative fit testing protocol, or the exercise procedure described in Part I.C.5(b) of this appendix for the CNP REDON quantitative fit-testing protocol. For the remaining fit testing methods, 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. (This applies only to QNFT testing; it is not performed for QLFT.)
  - (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.

## **B. Qualitative Fit Test (QLFT) Protocols**

- 1. General
  - (a) 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.
  - (b) 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.

### **2. 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

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

---

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 (b) (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.

3. Saccharin Solution Aerosol Protocol

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 saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.
  - (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 in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.



**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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- (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/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
- (5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.
- (7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet 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 saccharin is tasted. If the test subject reports tasting the sweet 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 saccharin is tasted. If the test subject reports tasting the sweet 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.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

---

- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

- (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 dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Saccharin 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 described in 3. (a) above.
- (3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a 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 be clearly marked to distinguish it from the screening test solution nebulizer.
- (5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.
- (6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin 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. A minimum of 10 squeezes is required.
- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the original 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 saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.
- (11) If the taste of saccharin 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).
- (12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

4. Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol

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.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

---

- (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 # FT 14 and # FT 15 combined, is adequate.
- (2) The test enclosure shall have a  $\frac{3}{4}$  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 in 4. (a) above.
  - (3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type 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 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 in section I. A. 14. 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).

5. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

(a) General Requirements and Precautions

- (1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
- (2) Only stannic chloride smoke tubes shall be used for this protocol.
- (3) No form of test enclosure or hood for the test subject shall be used.
- (4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care

shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

- (5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

- (1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- (2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.
- (3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

- (1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- (2) The test subject shall be instructed to keep his/her eyes closed.
- (3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the faceseal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually

make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

- (4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.
- (5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.
- (6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- (7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.
- (8) If a response is produced during this second sensitivity check, then the fit test is passed.

### **C. Quantitative Fit Test (QNFT) Protocols**

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

#### **1. General**

- (a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.



- (b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus.

- (1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.
- (2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.
- (3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.
- (4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.
- (5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.
- (6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and

mouth and with the probe extending into the facepiece cavity at least 1/4 inch.

- (7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.
  - (8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.
  - (9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.
  - (10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.
  - (11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.
  - (12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.
  - (13) The limitations of instrument detection shall be taken into account when determining the fit factor.
  - (14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.
- (b) Procedural Requirements.
- (1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.
  - (2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of

fit and eliminate poor fitting respirators before going on to perform a full QNFT.

- (3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.
- (4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.
- (5) A stable test agent concentration shall be obtained prior to the actual start of testing.
- (6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.
- (7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.
- (8) Calculation of fit factors.
  - (i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.
  - (ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.
  - (iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.

(D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$\text{Overall Fit Factor} = \frac{\text{Number of exercises}}{1/ff_1 + 1/ff_2 + 1/ff_3 + 1/ff_4 + 1/ff_5 + 1/ff_6 + 1/ff_7 + 1/ff_8}$$

Where ff1, ff2, ff3, etc. are the fit factors for exercises 1, 2, 3, etc.

- (9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.
  - (10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.
3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

---

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM ) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

- (1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.
- (2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.
- (3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.
- (4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.
- (5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

- (6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
  - (7) After the test exercises, 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.
- (b) Portacount Test Instrument.
- (1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.
  - (2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.
  - (3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.
4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Occupational Health Dynamics of Birmingham, Alabama also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is

expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

- (1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.
- (2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

(Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

- (3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.
- (4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.
- (5) The employer must train the test subject to hold his or her breath for at least 10 seconds.
- (6) The test subject must don the test respirator without any assistance from the test administrator who is conducting the CNP fit test. The respirator must not be adjusted once the fit-test exercises begin. Any adjustment voids the test, and the test subject must repeat the fit test.
- (7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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(b) CNP Test Exercises.

- (1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.
- (3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.
- (4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.
- (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 for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.
- (7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be



substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

- (8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, 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 a respirator shall be tried.

(c) CNP Test Instrument.

- (1) The test instrument must have an effective audio-warning device, or a visual-warning device in the form of a screen tracing, that indicates when the test subject fails to hold his or her breath during the test. The test must be terminated and restarted from the beginning when the test subject fails to hold his or her breath during the test. The test subject then may be refitted and retested.
- (2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

5. Controlled negative pressure (CNP) REDON quantitative fit testing protocol.

- (a) When administering this protocol to test subjects, employers must comply with the requirements specified in paragraphs (a) and (c) of Part I.C.4 of this appendix ("Controlled negative pressure (CNP) quantitative fit testing protocol"), as well as use the test exercises described below in paragraph (b) of this protocol instead of the test exercises specified in paragraph (b) of Part I.C.4 of this appendix.
- (b) Employers must ensure that each test subject being fit tested using this protocol follows the exercise and measurement procedures, including the order of administration, described below in Table A-1 of this appendix.

Table A-1. -- CNP REDON Quantitative Fit Testing Protocol

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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Exercises <sup>(1)</sup>	Exercise procedure	Measurement procedure
Facing Forward	Stand and breathe normally, without talking, for 30 seconds.	Face forward, while holding breath for 10 seconds.
Bending Over	Bend at the waist, as if going to touch his or her toes, for 30 seconds.	Face parallel to the floor, while holding breath for 10 seconds
Head Shaking	For about three seconds, shake head back and forth vigorously several times while shouting.	Face forward, while holding breath for 10 seconds.
REDON 1	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask.	Face forward, while holding breath for 10 seconds.
REDON 2	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask again.	Face forward, while holding breath for 10 seconds.

<sup>1</sup> Exercises are listed in the order in which they are to be administered.

- (c) After completing the test exercises, the test administrator must question each test subject regarding the comfort of the respirator. When a test subject states that the respirator is unacceptable, the employer must ensure that the test administrator repeats the protocol using another respirator model.
- (d) Employers must determine the overall fit factor for each test subject by calculating the harmonic mean of the fit testing exercises as follows:

$$\text{Overall Fit Factor} = \frac{N}{\left[ \frac{1}{FF_1} + \frac{1}{FF_2} + \dots + \frac{1}{FF_N} \right]}$$

Where:

N = The number of exercises;

FF<sub>1</sub> = The fit factor for the first exercise;

FF<sub>2</sub> = The fit factor for the second exercise; and

FF<sub>N</sub> = The fit factor for the nth exercise.

***Part II. New Fit Test Protocols***

- A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.
  
- B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:
  - 1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or
  - 2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.
  
- C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

*[63 FR 20098, April 23, 1998; 69 FR 46993, August 4, 2004]*

**Appendix B**

**Appendix B-1 and Appendix B-2 to Sec. 1910.134: User Seal Check and  
Respirator Cleaning**

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**Appendix B**  
**29 CFR 1910.134 Respiratory Protection**

**Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)**

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

- A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.
- B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

*[63 FR 1152, Jan. 8, 1998] [Current as of May 18, 2004]*

**Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory)**

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

- A. Remove filters, cartridges, or canisters. 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.
- B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.
- D. When the cleaner used 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 deg. C (110 deg. 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 deg. C (110 deg. F); or,
  3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. 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.
- F. Components should be hand-dried with a clean lint-free cloth or air-dried.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

H. Test the respirator to ensure that all components work properly.

*[63 FR 1152, Jan. 8, 1998] [Current as of May 18, 2004]*

**Appendix C**

**Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation  
Questionnaire (Mandatory)**

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**APPENDIX C**

**Appendix C to Sec. 1910.134: OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE  
(Mandatory)**

**To the employer:** Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

**To the employee:** Can you read (circle one): Yes / No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

**Part A. Section 1. (Mandatory)** The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date: \_\_\_\_\_
2. Your name: \_\_\_\_\_
3. Your age (to nearest year): \_\_\_\_\_
4. Sex (circle one): Male/Female
5. Your height:     \_\_\_ft. \_\_\_in.
6. Your weight:     \_\_\_lbs.
7. Your job title: \_\_\_\_\_
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): \_\_\_\_\_
9. The best time to phone you at this number: \_\_\_\_\_
10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes / No
11. Check the type of respirator you will use (you can check more than one category):
  - a. \_\_\_\_\_ N, R, or P disposable respirator (filter-mask, non- cartridge type only).
  - b. \_\_\_\_\_ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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12. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s): \_\_\_\_\_

If "yes," what type(s): \_\_\_\_\_

**Part A. Section 2. (Mandatory)** Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you *currently* smoke tobacco, or have you smoked tobacco in the last month:  
Yes/No
  
2. Have you *ever had* any of the following conditions?
  - a. Seizures (fits): Yes/No
  - b. Diabetes (sugar disease): Yes/No
  - c. Allergic reactions that interfere with your breathing: Yes/No
  - d. Claustrophobia (fear of closed-in places): Yes/No
  - e. Trouble smelling odors: Yes/No
  
3. Have you *ever had* any of the following pulmonary or lung problems?
  - a. Asbestosis: Yes/No
  - b. Asthma: Yes/No
  - c. Chronic bronchitis: Yes/No
  - d. Emphysema: Yes/No
  - e. Pneumonia: Yes/No
  - f. Tuberculosis: Yes/No
  - g. Silicosis: Yes/No
  - h. Pneumothorax (collapsed lung): Yes/No
  - i. Lung cancer: Yes/No
  - j. Broken ribs: Yes/No
  - k. Any chest injuries or surgeries: Yes/No
  - l. Any other lung problem that you've been told about: Yes/No
  
4. Do you *currently* have any of the following symptoms of pulmonary or lung illness?
  - a. Shortness of breath: Yes/No
  - b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline:  
Yes/No
  - c. Shortness of breath when walking with other people at an ordinary pace on level ground:  
Yes/No
  - d. Have to stop for breath when walking at your own pace on level ground: Yes/No
  - e. Shortness of breath when washing or dressing yourself: Yes/No
  - f. Shortness of breath that interferes with your job: Yes/No
  - g. Coughing that produces phlegm (thick sputum): Yes/No
  - h. Coughing that wakes you early in the morning: Yes/No

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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- i. Coughing that occurs mostly when you are lying down: Yes/No
  - j. Coughing up blood in the last month: Yes/No
  - k. Wheezing: Yes/No
  - l. Wheezing that interferes with your job: Yes/No
  - m. Chest pain when you breathe deeply: Yes/No
  - n. Any other symptoms that you think may be related to lung problems: Yes/No
5. Have you *ever had* any of the following cardiovascular or heart problems?
- a. Heart attack: Yes/No
  - b. Stroke: Yes/No
  - c. Angina: Yes/No
  - d. Heart failure: Yes/No
  - e. Swelling in your legs or feet (not caused by walking): Yes/No
  - f. Heart arrhythmia (heart beating irregularly): Yes/No
  - g. High blood pressure: Yes/No
  - h. Any other heart problem that you've been told about: Yes/No
6. Have you *ever had* any of the following cardiovascular or heart symptoms?
- a. Frequent pain or tightness in your chest: Yes/No
  - b. Pain or tightness in your chest during physical activity: Yes/No
  - c. Pain or tightness in your chest that interferes with your job: Yes/No
  - d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
  - e. Heartburn or indigestion that is not related to eating: Yes/ No
  - f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No
7. Do you *currently* take medication for any of the following problems?
- a. Breathing or lung problems: Yes/No
  - b. Heart trouble: Yes/No
  - c. Blood pressure: Yes/No
  - d. Seizures (fits): Yes/No
8. If you've used a respirator, have you *ever had* any of the following problems? (If you've never used a respirator, check the following space and go to question 9: \_\_)
- a. Eye irritation: Yes/No
  - b. Skin allergies or rashes: Yes/No
  - c. Anxiety: Yes/No
  - d. General weakness or fatigue: Yes/No
  - e. Any other problem that interferes with your use of a respirator: Yes/No
9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you *ever lost* vision in either eye (temporarily or permanently): Yes/No
  
11. Do you *currently* have any of the following vision problems?
  - a. Wear contact lenses: Yes/No
  - b. Wear glasses: Yes/No
  - c. Color blind: Yes/No
  - d. Any other eye or vision problem: Yes/No
  
12. Have you *ever had* an injury to your ears, including a broken ear drum: Yes/No
  
13. Do you *currently* have any of the following hearing problems?
  - a. Difficulty hearing: Yes/No
  - b. Wear a hearing aid: Yes/No
  - c. Any other hearing or ear problem: Yes/No
  
14. Have you *ever had* a back injury: Yes/No
  
15. Do you *currently* have any of the following musculoskeletal problems?
  - a. Weakness in any of your arms, hands, legs, or feet: Yes/No
  - b. Back pain: Yes/No
  - c. Difficulty fully moving your arms and legs: Yes/No
  - d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
  - e. Difficulty fully moving your head up or down: Yes/No
  - f. Difficulty fully moving your head side to side: Yes/No
  - g. Difficulty bending at your knees: Yes/No
  - h. Difficulty squatting to the ground: Yes/No
  - i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
  - j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

**Part B** Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No  
If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No
  
2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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If "yes," name the chemicals if you know them:

\_\_\_\_\_

\_\_\_\_\_

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:
- a. Asbestos: Yes/No
  - b. Silica (e.g., in sandblasting): Yes/No
  - c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
  - d. Beryllium: Yes/No
  - e. Aluminum: Yes/No
  - f. Coal (for example, mining): Yes/No
  - g. Iron: Yes/No
  - h. Tin: Yes/No
  - i. Dusty environments: Yes/No
  - j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures: \_\_\_\_\_

\_\_\_\_\_

4. List any second jobs or side businesses you have: \_\_\_\_\_
- \_\_\_\_\_

5. List your previous occupations: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

6. List your current and previous hobbies: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

7. Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them: \_\_\_\_\_

\_\_\_\_\_

10. Will you be using any of the following items with your respirator(s)?

- a. HEPA Filters: Yes/No
- b. Canisters (for example, gas masks): Yes/No
- c. Cartridges: Yes/No

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?

- a. Escape only (no rescue): Yes/No
- b. Emergency rescue only: Yes/No
- c. Less than 5 hours per week: Yes/No
- d. Less than 2 hours per day: Yes/No
- e. 2 to 4 hours per day: Yes/No
- f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

- a. *Light* (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: \_\_\_\_\_ hrs. \_\_\_\_\_ mins.

Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1-3 lbs.) or controlling machines.

- b. *Moderate* (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: \_\_\_\_\_ hrs. \_\_\_\_\_ mins.

Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

- c. *Heavy* (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: \_\_\_\_\_ hrs. \_\_\_\_\_ mins.

Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; shoveling; standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment: \_\_\_\_\_

\_\_\_\_\_

14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

\_\_\_\_\_

\_\_\_\_\_

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance: \_\_\_\_\_

Estimated maximum exposure level per shift: \_\_\_\_\_

Duration of exposure per shift: \_\_\_\_\_

Name of the second toxic substance: \_\_\_\_\_

Estimated maximum exposure level per shift: \_\_\_\_\_

Duration of exposure per shift: \_\_\_\_\_

Name of the third toxic substance: \_\_\_\_\_

Estimated maximum exposure level per shift: \_\_\_\_\_

Duration of exposure per shift: \_\_\_\_\_

The name of any other toxic substances that you'll be exposed to while using your respirator:

\_\_\_\_\_

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

\_\_\_\_\_

\_\_\_\_\_

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

**Appendix D**

**Appendix D to §1910.134 (Mandatory) Information to Employees  
Using Respirators When Not Required Under the Standard**

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## Appendix D

### Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

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.

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 respirators 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.

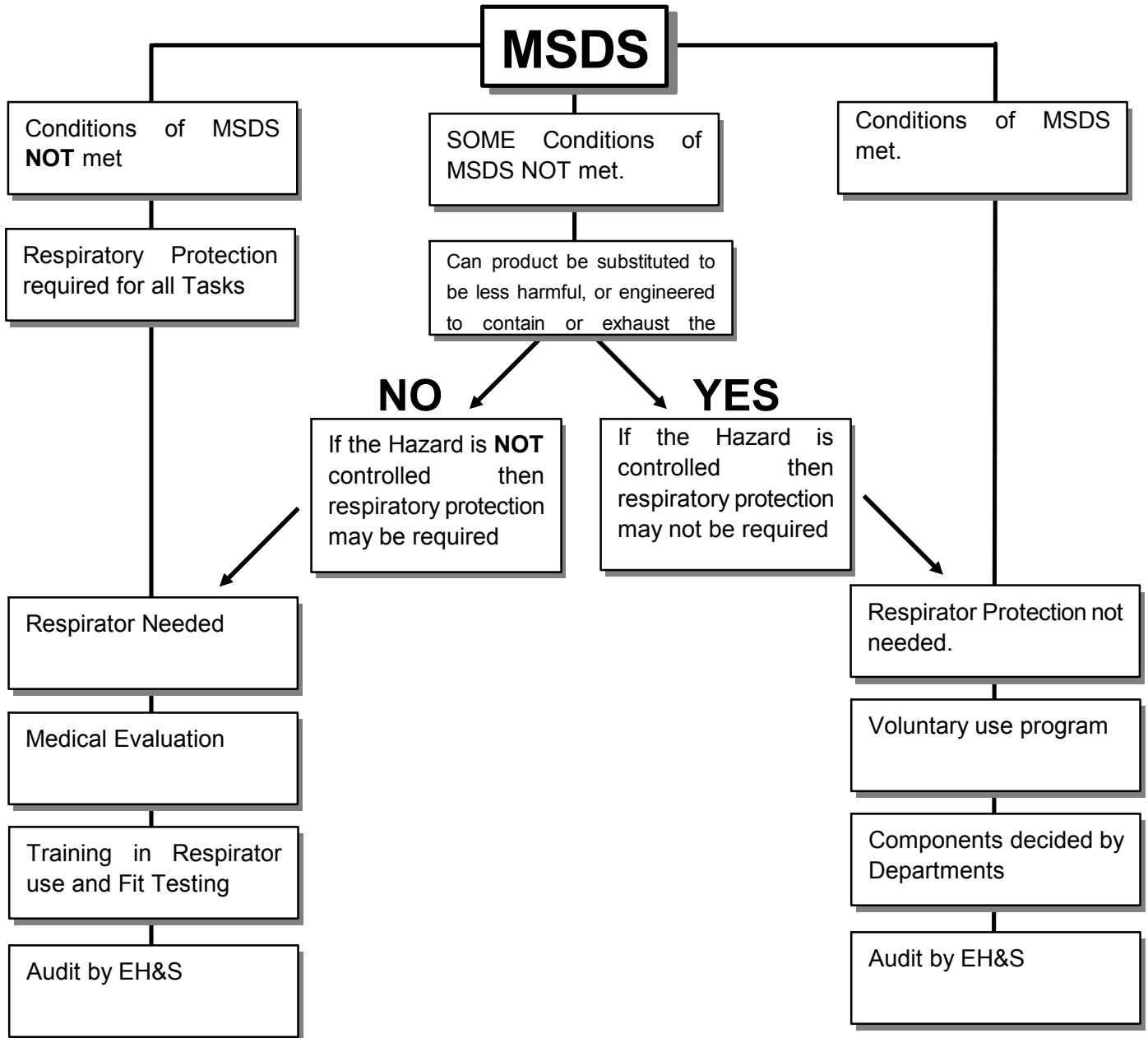
**Appendix E**

**MSDS Evaluation Flowchart**

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APPENDIX E

Respirator Decision Logic Flow Chart



If in question whether or not Respiratory Protection is required, call USO 475-6777.

## Appendix F

### Sample Respirator Selection Chart

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**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM**

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**APPENDIX F**

**SAMPLE RESPIRATOR SELECTION CHART**

<b>Name</b>	<b>Department</b>	<b>Contaminants</b>	<b>Exposure Level (8 hrs TWA)</b>	<b>PEL</b>	<b>Controls</b>
	Prep: Sanding	wood dust	2.5 - 7.0 mg/m <sup>3</sup>	5 mg/m <sup>3</sup> (TLV=1 mg/m <sup>3</sup> )	Local exhaust ventilation (LEV) for sanders. Half-facepiece APR with P100 filter.
	Prep: Cleaning	methylene chloride	70 ppm	25 ppm (STEL=125 ppm)	LEV to be installed for cleaning stations. Continuous flow SAR hood until then needed for respiratory protection. Will reevaluate after LEV installation.
		methanol	150 ppm	200 ppm	
		acetone	400 ppm	1,000 ppm	
	Coating: Spray booth painting	toluene	(300 ppm)	200 ppm (10-min peak=500 ppm)	Continuous flow SAR hood
		xylene	(40 ppm)	100 ppm (STEL=150 ppm)	
		MEK	(25 ppm)	200 ppm	
		methanol	(20 ppm)	200 ppm	

THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
RESPIRATORY PROTECTION PROGRAM

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APPENDIX F

RESPIRATOR SELECTION CHART

Name	Department	Contaminants	Exposure Level (8 hrs TWA)	PEL	Controls

## **Appendix G**

**Web Links to OSHA Respiratory Protection Standard, 29 CFR 1910.134**

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**Appendix G**  
**Web Links to OSHA Respiratory Protection Standard, 29 CFR 1910.134**

Web Links to OSHA Respiratory Protection Standard, 29 CFR 1910.134

The most recent version of this standard can be found at the Department of Labor's Occupational Safety and Health Administration web site at:

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=12716&p\\_table=STANDARDS](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARDS)

or at the National Archives and Records Administration GPO Access web site starting from

<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl>