

**THE UNIVERSITY OF OKLAHOMA
RESPIRATORY PROTECTION PROGRAM**

TABLE OF CONTENTS

I. INTRODUCTION 1

II. SCOPE 1

III. RESPONSIBILITIES..... 1

IV. TYPES AND STYLES OF RESPIRATORS 5

V. SELECTION 8

VI. CARTRIDGE LIFE 15

VII. RESPIRATOR USE..... 19

VIII. FIT TESTING 23

IX. RESPIRATOR INSPECTIONS..... 25

X. CLEANING AND SANITIZING 28

XI. MAINTENANCE 29

XII. STORAGE 29

XIII. EXPOSURE MONITORING 30

XIV. TRAINING..... 30

XV. MEDICAL EVALUATION 32

XVI. PROGRAM EFFECTIVENESS EVALUATION 35

XVII. RECORDS 35

APPENDIX A DEFINITIONS

APPENDIX B RESPIRATOR AUTHORIZATION FORM

**APPENDIX C INFORMATION FOR EMPLOYEES USING RESPIRATORS WHEN NOT
REQUIRED UNDER THE STANDARD 29 CFR 1910.134, APPENDIX D**

i

**APPENDIX D A PARTIAL LISTING OF CHEMICALS AGAINST WHICH AIR PURIFYING
RESPIRATOR CARTRIDGES DO NOT PROVIDE PROTECTION**

**APPENDIX E OSHA FIT TESTING PROCEDURES APPENDIX A TO 29 CFR 1910.134
(MANDATORY)**

APPENDIX F UNIVERSITY OF OKLAHOMA RESPIRATOR FIT TEST RECORD FORMS

APPENDIX G SUGGESTED PROCEDURES FOR CLEANING AND SANITIZING

APPENDIX H REQUEST FOR MEDICAL CLEARANCE FOR RESPIRATOR USE

APPENDIX I MEDICAL EVALUATION FORM MINIMUM REQUIREMENTS

APPENDIX J TULSA MEDICAL EVALUATION FORM

THE UNIVERSITY OF OKLAHOMA RESPIRATORY PROTECTION PROGRAM

I. INTRODUCTION

- A. Proper respiratory protection will be provided and used in work areas where it is not feasible to reduce exposures to airborne contaminants to acceptable levels through the use of engineering controls or work practices. The following regulations, requirements, and guidelines are incorporated into the *OU Respiratory Protection Program*.
1. 29 CFR 1910.134, 29 CFR 1910.1048, 29 CFR 1910.1001, 29 CFR 1926.1101, and other applicable Occupational Safety and Health Administration (OSHA) regulations adopted by the Oklahoma Department of Labor (ODOL).
 2. Oklahoma Asbestos Control Act (Title 40, Sections 451-457) and *Abatement of Friable Asbestos Material* Rules (OAC 380:50) .
 3. American National Standards Institute (ANSI) *Standard for Respiratory Protection*, Z88.6-2006.
 4. National Institute for Occupational Safety and Health (NIOSH) 42 CFR 84 and related guidelines and publications.
 5. Compressed Gas Association Pamphlets CGA G-7-2014, *Compressed Gas for Human Respiration* and CGA G-7.1-2011, *Commodity Specification for Air, 6th Edition*.
- B. Definitions of terms for the purpose of this program are found in Appendix A of this program.

II. SCOPE

This program applies to University of Oklahoma employees who wear or anticipate wearing respiratory protection during the course of their duties, with the exception of employees of the University of Oklahoma Norman Facilities Management ACM Remediation Shop. This shop has a separate respiratory protection program.

III. RESPONSIBILITIES

- A. ENVIRONMENTAL HEALTH AND SAFETY OFFICE (EHSO)
1. As the program Administrator, the EHSO is responsible for:

- a. evaluating areas and work practices where potential exposure above the OSHA Permissible Exposure Limit (PEL) or, if not addressed by OSHA, the American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Value (TLV), may occur;
 - (1) Departmental supervisors should request such evaluations from the EHSO for work areas where there is concern for potential exposures other than infectious agents requiring the use of an N95 respirator.
 - (2) The evaluation may include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form or may include determining airborne contaminant concentration(s).
- b. based on the workplace evaluation, determining whether a respiratory protective device is required;
- c. evaluating and verifying the proper selection of respiratory protective devices following the guidelines specified in Section V., *Selection* and the *Respirator Authorization* form (OU-Norman only) found in Appendix B;
- d. when no end-of-service-life indicator is available on selected air-purifying cartridges or canisters, determining a change schedule based on objective information or data to ensure that the canisters and cartridges are changed before the end of their service life;
- e. training OU employees using respiratory protective devices in proper care and use of the respiratory protective devices and documenting the training as specified in Section XIV., *Training*;
- f. evaluating the skill of the respirator user during training and fit testing;
- g. conducting respirator fit testing at intervals specified in Section VIII., *Fit Testing*; EHSO personnel will conduct respirator fit testing as specified in Section VIII., *Fit Testing*. Fit testing may be delegated to other specific individuals deemed competent by EHSO personnel;
- h. coordinating the medical surveillance program and associated documentation for applicable employees covered under this program as described in Section XV., *Medical Evaluation*;
- i. verifying that the OU *Respiratory Protection Program* is developed in compliance with ANSI, OSHA, ODOL, NIOSH, and other applicable

rules and regulations (in the event of any conflict between the rules or standards, the most stringent shall apply);

- j. maintaining copies of records required by this program as required in Section XVII., *Records*;
- k. verifying that persons administering quantitative fit testing are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factor properly, ensure that the test equipment is in proper working order, and properly calibrate the equipment according to manufacturer's instructions; and
- l. evaluating the OU *Respiratory Protection Program* for effectiveness on an annual basis.

B. SUPERVISORS

Departmental supervisors who have employees required to wear respirators must:

- 1. contact the EHSO if they or their employees have questions or concerns about respirator use;
- 2. ensure that inspection, maintenance, and cleaning activities for the respiratory protective devices are properly carried out;
- 3. ensure that a workplace evaluation has been completed by the EHSO for potential exposures, with the exception of infectious agents requiring the use of an N95 respirator;
- 4. provide the information provided in Appendix C of this program to employees under their direction who choose to use a respirator when one is not necessary (see Section XXII.D.);
- 5. verify that employees inspect, clean, maintain and store the respirator properly in accordance with the requirements of this program;
- 6. verify that employees demonstrate an ability to use the respirator properly before allowing them to perform work requiring the use of the respirator,
- 7. ensure that employees who wear respirators are fit tested at least annually;
- 8. schedule appropriate medical evaluations, fit testing, training, hazard assessment and maintain documentation of respirator authorization records for employees in their department as required by Section XV., *Medical Evaluation*;

9. conduct random inspections to verify that respirators are properly used, cleaned, and maintained;
10. ensure employees are retrained and the EHSO is notified when the following situations occur which affect respirator use:
 - a. changes in workplace operations,
 - b. changes in types of respirator, or
 - c. inadequacies in an employee's knowledge or use of required respirator.

C. EMPLOYEES

Employees are responsible for:

1. notifying their supervisor and/or the EHSO if they:
 - a. have concerns or questions about workplace exposure,
 - b. have questions about respirator use, or
 - c. exhibit possible signs or symptoms of workplace exposure;
2. wearing the appropriate respiratory protective device when performing activities in locations or during tasks designated by the EHSO as requiring respiratory protection;
3. maintaining a facial surface consistent with a proper fit of the respiratory protective device as described in this program;
4. performing routine care and preventive maintenance of their selected respirator as described in this program and any manufacturers' specific recommendations and completing appropriate records required by this program;
5. guarding against damage to the respirator;
6. participating in fit testing and, for non-disposable respirators, having their respirator available for inspection during fit testing;
7. participating in medical evaluation prior to respirator use annually or as needed;
8. inspecting their respirator prior to each use;

9. immediately leaving the contaminated area if a respirator malfunction occurs, and reporting the malfunction to the responsible person designated by the departmental supervisor in the written standard operating procedures; and
10. complying with other requirements specified in this program.

IV. TYPES AND STYLES OF RESPIRATORS

The most commonly used respirators used at the University of Oklahoma are disposable N95 respirators for protection against particulates or infectious aerosols, half-face negative pressure air purifying respirators (APRs), and full-face, negative pressure APRs. Powered air-purifying respirators (PAPRs) may be used by medical personnel who use respiratory protection against infectious aerosols.

A. AIR-PURIFYING RESPIRATORS (APRs)

APRs can purify the air of gases, vapors, and particulates, but do not supply clean breathing air.

1. APRs are available in two general classes: disposable and reusable.
 - a. Disposable APRs consist of a particulate filtering media, straps, and may contain sorbents for nuisance levels of other contaminants. These respirators have negative pressure within the facepiece relative to the external pressure (e.g., N95 disposable respirators).
 - b. Reusable APRs have a facepiece and attached cartridges that contain specific material needed against a specific contaminant. There are two basic groups of cartridges for use with reusable APRs:
 - (1) filtering media cartridges that trap particulates, dust, fog, fumes, mist, spray, and smoke; and
 - (2) activated charcoal or another sorbent material that traps gases or vapor contaminants.
2. APRs can also be divided into negative-pressure or positive-pressure types.
 - a. Negative-pressure respirators are the most common respirator at OU. They function when the wearer inhales and creates a negative pressure inside the respirator causing contaminated air to pass through an air-purifying element into the respirator.
 - b. Positive pressure PAPRs use a blower both to pass contaminated air through an element that removes the contaminant and to supply purified air to a facepiece, helmet, or hood. Positive pressure respirators have pressure inside the facepiece that is positive to the external pressure.

B. ATMOSPHERE-SUPPLYING RESPIRATORS

Atmosphere-supplying respirators supply the respirator user with breathing air from a source independent of the ambient atmosphere.

1. General

- a. All breathing air supplied to employees will meet the requirements for Type 1-Grade D breathing air as described in Compressed Gas Association *Commodity Specification for Air*, G-7.1-2011 and *Compressed Air for Human Respirator*, G-7-2014. Breathing air, as specified by the Compressed Gas Association, contains the following:
 - (1) oxygen content of 19.5 to 23.5%,
 - (2) oil (condensed) content of 5 milligrams per cubic meter of air or less,
 - (3) carbon monoxide content of 10 ppm or less, (4) carbon dioxide content of 1,000 ppm or less, and (5) lack of noticeable odor.
- b. Compressors used to supply breathing air to respirators must be constructed and situated so as to:
 - (1) prevent entry of contaminated air into the air-supply system;
 - (2) minimize moisture content so that the dew point at 1 atmosphere pressure is 10 °F (5.56 °C) below the ambient temperature;
 - (3) have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality (sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions);
 - (4) have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change (the tag shall be maintained at the compressor); and
 - (5) have a monitor and an alarm to verify that carbon monoxide levels in the breathing air do not exceed 10 ppm.
- c. Cylinders used to supply breathing air to respirators must meet the following requirements:
 - (1) cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

- (2) cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air;
- (3) the moisture content in the cylinder does not exceed a dew point of -50 °F (-45.6 °C) at 1 atmosphere pressure; and
- (4) cylinders are marked in accordance with the NIOSH respirator certification standard (42 CFR part 84).

2. **Self Contained Breathing Apparatus (SCBA)**

No SCBAs are currently maintained at any OU campus. Use of SCBA requires additional inspection, maintenance, and training procedures, which must be approved by the EHSO prior to use.

3. **Air-Line Respirators**

Air-line respirators utilize a half-face or full-face mask with a hose attached. The other end of the hose is attached to a clean air supply source such as series of compressed breathing air cylinders (cascade system) or a compressor. Air-line respirators are not currently used at OU. If air-line respirators are used, additional employee training, respirator and system inspections, will be conducted; and the manufacturer's operating instructions will be followed.

4. **Emergency Escape Respirators**

- a. The OU Health Sciences Center Steam and Chilled Water Plant (SCWP) maintains five (5) North emergency escape breathing apparatus (EEBA), model number 855 (5-minute, high flow), for high exertion escape (stairs, climbing, inclines, ladders). These EEBA also feature cylinders with a 5year hydrostatic test cycle. The SCWP is responsible for maintenance and inspection of these units. The EEBA's are visibly located in the following areas:
 - (1) inside the central elevator operating between floors 001 and 201,
 - (2) the southeast corner of floor 001, by the exit door;
 - (3) the southeast corner of floor 201, near the exit on the floor; (4) inside the double doors of the main entry of floor 201; and (5) the column just outside the laboratory (005) on floor 001.
- b. OU-Norman and OU-Tulsa do not maintain any EEBA respirators.

V. SELECTION

A. GENERAL

1. Examples of contaminants during work practices found at OU include, but are not limited to, infectious aerosols, organic solvents, dust, mold, animal dander, pesticides, herbicides, paints, paint strippers, paint thinners, asbestos, formaldehyde and numerous other chemicals. The respiratory protective devices selected will be those approved for use against the hazard encountered as recorded in the current edition of the NIOSH Certified Equipment List (see <http://www.cdc.gov/niosh/npptl/topics/respirators/cel/>).
2. Only respirators and cartridges jointly approved by the Mine Safety and Health Administration (MSHA) and NIOSH under the provisions of 30 CFR Part 11 or approved by NIOSH under the provisions of 42 CFR Part 84 will be used. Only respirators and cartridges with the NIOSH approval under the provisions of 42 CFR Part 84 will be purchased after July 10, 1998. Respirators and cartridges with the joint MSHA/NIOSH approval may still be used after that date. Nuisance dust masks without NIOSH approval will not be issued to OU employees.
3. Respirator selection will follow the guidance in 29 CFR 1910.134, 29 CFR 1910.1001, 29 CFR 1926.1101, 29 CFR 1910.1017, 29 CFR 1910.1045, 29 CFR 1910.1051, ANSI *Practices for Respiratory Protection* Z88.2-2015, applicable federal and state regulations, and Appendix D which contains a partial listing of chemicals for which air-purifying respirator cartridges do not provide protection.
4. Table 1 provides the assigned protection factors for each type of respirator.

TABLE 1 Assigned Protection Factors					
Type of Respirator	Quarter Mask	Half Mask	Full Facepiece	Helmet/Hood	Loose-Fitting Facepiece
Air-Purifying Respirator	5	10	50	-	-
Powered Air-Purifying Respirator (PAPR)	-	50	1,000	25/1,000	25
Supplied-Air Respirator (SAR) or Airline Respirator					

Demand mode	-	10	50	-	-
Continuous flow mode	-	50	1,000	25/1,000	25
Pressure-demand or other positivepressure mode	-	50	1,000	-	-
Self-Contained Breathing Apparatus (SCBA)					
Demand mode	-	10	50	50	-
Pressure demand or other positivepressure mode	-	-	10,000	10,000	-

5. Respirators and cartridges will be selected by the EHSO based on:

- a. the nature of the hazardous activity or process;
- b. the type of respiratory hazard including physical, chemical, and physiological properties of the air contaminant(s);
- c. the concentration of contaminant likely to be encountered;
- d. the period of time for which respiratory protection must be worn;
- e. determination of a published TLV, PEL, immediately dangerous to life or health (IDLH) concentration, or any other available exposure limit or estimate of toxicity for the contaminant(s);
- f. the existence of a comprehensive health standard (i.e., lead, asbestos) for the contaminant(s) requiring specific respirators;
- g. the oxygen content and the potential for an oxygen-deficient environment exists;
- h. the activities of workers in the hazardous area;
- i. the physical characteristics and functional capabilities and limitations of the various types of respirators;
- j. the ability of the cartridge to protect against the contaminants (see Appendix D); and

- k. respirator assigned protection factors.
6. Documentation of the selection of the appropriate respirator may be accomplished with the *Respirator Authorization* form found in Appendix B.
 7. If neither manufacturer information nor regulatory standards or information are available on cartridge selection, the following guidelines should be used to select the appropriate respiratory protection.
 - a. Measure, or make a reasonable estimate of, the concentration of contaminant to which the employee will be exposed (the concentration of the airborne contaminant that would occur if the employee were not using a respirator). Compare this to the appropriate occupational exposure limit to determine the protection factor needed for the respiratory device.
 - b. Ensure that the use of an APR is appropriate for the specific contaminant at the specific exposure concentration.
 - c. A respirator with air-purifying cartridges should not be selected to protect an employee against a chemical contaminant with poor warning properties (defined as those whose PEL or TLV are greater than their geometric mean air odor threshold, as defined in the AIHA publication, “Odor Thresholds for Chemicals with Established Occupational Health Standards.”) unless:
 - (1) employee exposure concentration is determined;
 - (2) the exposure concentration is at all times less than 10 times the PEL or TLV, *and* is less than 100 ppm, notwithstanding the value of the PEL or TLV; and
 - (3) air-purifying cartridges will effectively remove the contaminant.
 8. APRs cannot be used when there is:
 - a. an oxygen deficient atmosphere (<19.5%);
 - b. any IDLH or unknown situation;
 - c. a contaminant which is extremely toxic in any amount;
 - d. a contaminant that cannot clearly be detected by odor;
 - e. a concentration of a contaminant that is highly irritating to the eyes (unless eye protection is provided);
 - f. not an appropriate cartridge or filter available for the specific

- contaminant(s) present;
 - g. a fast cartridge breakthrough time for the contaminant(s) (see Appendix D for a partial listing); or
 - h. a concentration of the contaminant(s) that exceeds the maximum filter concentration of the appropriate air-purifying cartridge(s) specified by the manufacturer.
9. One size or model of respirator will neither fit all types of faces nor be perceived as comfortable by every employee. Therefore, it is recommended that different makes and models of respirators be made available by the department. Employee comfort should be considered as well as breathing resistance, impairment of vision, impairment of communications, and respirator weight. In addition, some respirators have a latex component and should not be worn by those who are allergic to latex.

B. RESPIRATOR SELECTION FOR SPECIFIC HAZARDS

1. General Particulates

Selection of particulate respirators and cartridges under 42 CFR 84 is based on the contaminant and whether the working environment contains oil-based aerosols. Table 2 will be used to determine which class of particulate filter is required.

TABLE 2			
Filter Classifications Under NIOSH 42 CFR 84			
Minimum Efficiency	No Oil Aerosol Exposure (Not Oil-Proof)*	Some Oil Aerosol Exposure (Oil-Resistant)*	Total Oil Aerosol Exposure (Oil-Proof)
95 %	N95	R95	P95
99 %	N97	R97	P97
99.97 %	N100	R100	P100

* There may be use restriction on these filter series based upon the aerosol and work conditions. Check with the EHSO for assistance with selection.

2. Asbestos

- a. Respirator selection for asbestos operations and maintenance activities will follow the applicable federal and state asbestos regulations. Asbestos workers shall wear, at a minimum, a full-face air-purifying respirator when

performing preparation work or when removing friable asbestos. Half-face respirators are permitted to be used only for sampling and non-friable asbestos abatement procedures.

- b. Protection factors to be utilized for the selection of the proper respirator are provided in Table 3, which also includes the maximum use concentration for asbestos work based on 29 CFR 1926.1101(h)(3)(i), ODOL Rules and Oklahoma's asbestos exposure level of 0.01 fibers per cubic centimeter of air (f/cc).

TABLE 3 Respirator Protection Factors and Maximum Use Concentrations For Asbestos Operations and Maintenance Activities *		
Respirator Selection	Protection Factor	Asbestos Maximum Use Concentration
Half-Face APR	10	0.1 f/cc
Full-Face APR Qualitatively fit tested	10	0.1 f/cc
Full-Face APR Quantitatively fit tested	50	0.5 f/cc
TABLE 3 Respirator Protection Factors and Maximum Use Concentrations For Asbestos Operations and Maintenance Activities *		
Respirator Selection	Protection Factor	Asbestos Maximum Use Concentration
PAPR Must be a tight-fitting facepiece	1000	10.0 f/cc
Full-Face, Supplied-Air Respirator, Pressure Demand	1000	10.0 f/cc
Full-Face, Supplied-Air Pressure Demand with Auxiliary Positive Pressure	1000	>10.0 f/cc or unknown concentration

* There may be use restriction on these filter series based upon the aerosol and work conditions. Check with the EHSO for assistance with selection.

3. **Visible Fungal Growth**

It is recommended that an N95 respirator be worn when cleaning, or removing visible fungal growth. Employees should consult the EHSO for additional recommendations on personal protective equipment and procedures when encountering this type of situation.

4. **Infectious Aerosols**

a. *Mycobacterium tuberculosis* (TB)

- (1) Appropriate respiratory protection should be used by persons who have potential for exposure to *M. tuberculosis* (TB) in settings where administrative and engineering controls may not provide adequate protection or where required by the OUHSC/OU-Tulsa *Infectious Diseases Policy*, including persons:
 - (a) entering rooms in which patients with suspected or confirmed infectious TB are being isolated,
 - (b) present during cough-inducing or aerosol-generating procedures performed on patients with known or suspected infectious TB,
 - (c) present during transport of patients who may have infectious TB in emergency transport vehicles, or
 - (d) present when urgent surgical or dental care must be provided to patients who may have infectious TB before a determination can be made that the patient is noninfectious.
- (2) Respiratory protective devices used in healthcare settings for protection against *M. tuberculosis* should meet the following standard criteria:
 - (a) the ability to filter particles 1 micron in size in the unloaded state with a filter efficiency of 95% (i.e., filter leakage of 5%), given flow rates of up to 50 liters per minute (lpm).
 - (b) the ability to be quantitatively fit tested in a reliable way to obtain a face-seal leakage of 10%.
 - (c) the ability to fit the different face sized and characteristics of workers, which can usually be met by making the respirator available in several sizes;
 - (d) the ability of the respirator to be checked for fit in accordance with OSHA standards and good industrial

hygiene practice by workers each time they put on the respirator.

- (3) The minimum acceptable level of respiratory protection against TB is the N95 respirator. Other respirators that may be used are half or full-face APRs or PAPRs with HEPA cartridges, however, a respirator with exhalation valves cannot be used when working in a sterile field such as an operating room because the exhalation valve allows droplets and particles exhaled by the user to escape and potentially contaminate the surgical field.

b. Other Infectious Aerosols in Healthcare Settings

The CDC *Guidelines for Isolation Precautions in Hospitals* (<http://www.cdc.gov/hicpac/pdf/isolation/isolation2007.pdf>) recommends that healthcare workers protect themselves from any disease spread through the air (airborne transmission) by wearing a respirator at least as protective as a fit-tested N95 respirator. For seasonal flu, the CDC recommends that workers wear a fit tested N95 disposable respirator while performing high-risk, aerosol-generating procedures on flu patients (<http://www.cdc.gov/flu/professionals/infectioncontrol/healthcaresettings.htm>). Additional protection may be warranted and required by the EHSO based on a risk assessment of the infectious agent, route of entry, concentration, presence of facial hair, and whether the work is required to be performed in a sterile field such as an operating room.

c. Potentially Infectious Aerosols, Hazardous Dusts, and Animal Dander in Animal Care Settings

The National Institutes of Health recommends that employees with known allergies to animals wear NIOSH-approved N95 dust/mist respirators. Additional circumstances may also warrant the use of N95 respirators, such as when entering animal rooms housing animals infected with infectious agents, or when urine, feces, or diet may contain hazardous agents which may become airborne as airborne particulates. Such use will be indicated on project-specific standard operating procedures, which should be in place and identified at the animal-holding facility.

C. IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH) ATMOSPHERES

Additional precautions and activities regarding respiratory protection are required in IDLH atmospheres (see Appendix A, *Definitions*). IDLH atmospheres are not generally anticipated on OU campuses. The required respiratory protection for IDLH conditions is a positive pressure SCBA or a combination of air-line supplied-air respirator with an escape SCBA, which are not

currently maintained on OU campuses. In the majority of cases, outside response agencies or other properly trained and fully qualified personnel will be utilized as needed for these types of situations.

D. RESPIRATORS USED FOR "VOLUNTARY USE" ONLY

Numerous situations exist where employees choose to wear respiratory protection for protection against odors or respiratory/eye irritation only where exposure is below any regulated level or where no regulated level exists. Some examples include the use of filtering facepiece for protection against dust, sand, sawdust, or pollen, and the use of APRs with organic vapor cartridges to minimize odors. This practice is acceptable under this program, however, *all* of the following conditions must be met:

1. the EHSO should be contacted by the supervisor to determine whether respiratory protection is required for that specific activity or area;
2. the individual(s) must attend annual and refresher respirator training as specified in Section XIV., *Training*;
3. if other than a filtering facepiece respirator (a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium such as a dust mask or an N95 respirator) is to be worn, the individual(s) must be medically qualified to wear a respirator as specified in Section XV., *Medical Evaluation*;
4. the supervisor must provide the information provided in Appendix C of this program to the employee; and
5. the individual(s) must immediately inform the supervisor when work activities change that may also change exposure conditions.

VI. CARTRIDGE LIFE

A. GENERAL

1. If the selected cartridge or canister has an end-of-service-life indicator (ESLI), it should be utilized.
2. If a substance-specific standard exists which specifies a change schedule, it should be utilized as well.

3. When no ESLI is available or substance-specific standard requires a particular change schedule, the EHSO should be consulted to determine a change schedule to ensure that the filters, canisters and cartridges are changed before the end of their useful service life.
4. If the user experiences an odor, taste, any irritation, or excessive breathing resistance from the contaminant before the end of the estimated service time, the user must:
 - a. immediately leave the contaminated area,
 - b. change the cartridges before reentering the work area,
 - c. consider changing cartridges more often, and
 - d. contact the EHSO to determine if an accelerated cartridge change schedule is needed.
5. All cartridges should be discarded and replaced if they fail during use, become damaged or wet, or if breathing resistance becomes excessive.
6. If cartridge changes must be made frequently, the use of a supplied-air respirator should be considered. Contact the EHSO for recommendations.
7. Cartridges that have reached their end-of-service-life and other used cartridges should be removed from use and disposed accordingly.

B. SUBSTANCE-SPECIFIC STANDARD CHANGE SCHEDULES

1. **Asbestos**

For abatement work where a decontamination shower is in place, filters shall be changed each time the worker exits through the decontamination shower.

2. **Benzene**

Cartridges must utilize an ESLI or be changed at the beginning of each shift (whichever occurs first).

3. **Formaldehyde**

Cartridges should be replaced after 3 hours of use or at the end of the work shift, whichever occurs first, unless the cartridge contains a NIOSH-approved ESLI to show when breakthrough occurs.

4. **Acrylonitrile**

Cartridges must be replaced prior to the expiration of its service life or at the completion of each shift, whichever comes first. A label must be attached to the cartridge to indicate the date and time at which it was installed on the respirator.

5. **Butadiene**

- a. If a NIOSH-approved ESLI is available, the cartridge may be used until the ESLI shows no further useful service life, or the element is replaced at the beginning of the next work shift, whichever comes first.
- b. If no ESLI is available, the cartridge change schedule found in 1910.1051(h)(3)(i) shall be used.
- c. In either case, a label must be attached to each filter element to indicate the date and time it is first installed on the respirator.

6. **Methylene Chloride**

Canisters may be only used for emergency escape and must be replaced after use.

7. **Vinyl Chloride**

Air-purifying canisters or cartridges shall be replaced prior to the expiration of their service life or the end of the shift in which they are first used, whichever occurs first.

C. EHSO-DETERMINED CHANGE SCHEDULES

1. When a determination of a change schedule is needed, the following factors will be used to estimate cartridge life:
 - a. humidity (humidity above 85% will reduce service life by approximately 50%);
 - b. the type of the contaminant;
 - c. the concentration of the air contaminant (reducing contaminant concentration by a factor of 10 will increase service life by a factor of 5);
 - d. breathing demand of the wearer (service life is inversely proportional to work rate);
 - e. multiple contaminants;

- f. variable contaminant concentrations; and
 - g. breakthrough time of the contaminant(s).
2. End-of-service-life programs are available that may be used to determine a change schedule are:
- a. 3M™ Service Life Calculator:
<http://extra8.3m.com/SLSWeb/home.html>
 - b. MSA™ Cartridge Life Expectancy Program:
<http://webapps.msanet.com/responseguide/ChemicalCalculator.aspx>
 - c. OSHA's Advisor Genius:
https://www.osha.gov/SLTC/etools/respiratory/respirator_selection.html
 - d. North esLife™ Cartridge Service Life Estimation:
<http://ezguide.northsafety.com/help/html/esLifeMain.aspx>

3. **Other Considerations**

- a. Cartridges or filters used for filtering particulates, dusts, fogs, fumes, mists, spray, smoke, or infectious aerosols should be changed when:
 - (1) resistance increases and makes breathing difficult, or (2) they become contaminated or wet.
- b. Because a chemical desorbs during storage or non-use, migration can occur through the cartridge even without air movement, organic vapor cartridges may be reused in limited cases only.
 - (1) Cartridges used for organic chemicals that are very volatile should never be reused. For example, cartridges exposed to chemicals with boiling points less than 65 degrees C should never be used for more than one shift.
 - (2) Cartridges used for chemicals of moderate volatility should never be reused after a few days of non-use or storage over a weekend.
 - (3) Cartridges for chemicals of low volatility should never be used longer than one or two weeks.
 - (4) For use with mixtures of chemicals, the acceptable nonuse or storage period should be based on the most volatile component of the mixture.

- c. To make cartridges specific for certain chemicals, carbon is treated with a chemical reagent to remove gas or vapor by chemisorption. Because chemisorption reactions form stronger bonds and is usually irreversible, reuse of treated organic vapor cartridges may be considered under certain circumstances.
- d. For chemicals with good warning properties, the following guidelines should also be considered:
 - (1) If the concentration of the contaminant is estimated to be less than 100 ppm, and is below IDLH concentration, the service life of the cartridge is 16 hours, unless breakthrough of the chemical contaminant is detected.
 - (2) If the concentration of the contaminant is estimated to be between 100 and 1000 ppm, and is below IDLH concentration, the service life of the cartridge is 2 hours, unless breakthrough of the chemical contaminant is detected. If breakthrough is detected, the cartridge must be replaced immediately.

VII. RESPIRATOR USE

A. GENERAL USE

- 1. OSHA prohibits the use of a tight-fitting respirator with facial hair that may interfere with the respirator face seal and allow leakage of contaminated air during inhalation.
- 2. Head coverings, goggles and other PPE must be worn on the outside of the respirator so that nothing passes between the respirator sealing surface and the face. Spectacle kits, when needed, should be provided at no cost to the employee.
- 3. Contact lenses may be worn with respirators under the following conditions:
 - a. the individual has previously demonstrated that he or she has had successful experience wearing contact lenses or the contact lens wearer practices wearing the respirator while wearing the contact lenses before entering an atmosphere that requires the use of a respirator;
 - b. a contact lens that falls out of the eye while wearing a half-face respirator can become contaminated by contacting any surface such as the ground, clothes, or gloves and must not be reused;

- c. if a contact lens falls from the eye while wearing a full-face respirator, the wearer must immediately leave the work area and follow proper decontamination/cleaning procedures before the contact lens is replaced.
- 4. The respirator can never be altered.
- 5. The respirator manufacturer's guidelines must always be followed.
- 6. A respirator wearer is permitted to leave the hazardous areas for any respirator-related cause. Reasons may include, but are not limited to, the following:
 - a. failure of the respirator to provide adequate protection;
 - b. malfunction of the respirator;
 - c. detection of leakage of air contaminant into the respirator;
 - d. increase in resistance of respirator during breathing;
 - e. severe discomfort in wearing the respirator;
 - f. illness of the respirator wearer, including dizziness, nausea, weakness, breathing difficulties, coughing, sneezing, vomiting, fever, or chills;
 - g. to wash his/her face and the respirator facepiece to minimize skin irritation;
 - h. to change the air-purifying elements or other components, whenever needed; and
 - i. to take periodic breaks in an uncontaminated area.

B. DONNING PROCEDURES

1. Disposable Respirators

Because each N95 respirator may be unique in its style, and because different facilities may choose different brands, employees will be trained to follow the specific manufacturer's recommended procedures for fitting the facility's chosen N95 respirator to the face.

2. Half-Face Respirators

- a. Ensure that all straps are fully released prior to donning.

- b. Fit the facepiece on the nose bridge, making sure that you are able to breathe through the nose.
- c. Swing the bottom of facepiece into contact with the chin.
- d. Position the headbands with the longest straps above the ears over the crown of the head, and the shortest straps below the ears along the nape of the neck.
- e. Adjust the straps for comfortable fit by moving the adjustment slides to lengthen or shorten the straps. The straps should be just snug enough so air does not leak around the facepiece. It is not necessary to pull the straps so tight that the respirator digs into the face.

3. **Full-Face Respirators**

- a. Ensure that all straps are fully released prior to donning.
- b. Fit the facepiece against face, making sure you are able to breathe.
- c. Pull the head harness into place, tightening the lower straps first, then the temple straps, and then the forehead straps.

4. **Powered Air-Purifying Respirators**

- a. Ensure that all straps are fully released prior to donning.
- b. Place the facepiece over the face with the power on (with air being supplied).
- c. Bring the bottom of the facepiece into contact under the chin.
- d. Position the headbands with the longest straps above the ears and the other around the nape of the neck.
- e. Adjust the straps for comfort to ensure that the respirator is snug enough so air does not leak around the facepiece.

C. **USER SEAL CHECKS**

1. General

- a. User seal checks must be conducted by each employee every time a tight fitting respirator is put on. The checks are performed after the straps are adjusted and the respirator is in place.
- b. The respirator manufacturer's recommended user seal check may be used instead of the positive and/or negative pressure check procedures provided the EHSO has determined that the manufacturer's procedures are equally effective.

2. Disposable Respirators

Because disposable N95 respirators are unique and different departments may select different brands, styles, or sizes, employees will be trained to follow manufacturers' user seal check recommendations.

3. Half-Face and Full-Face Cartridge Respirators

- a. Negative Pressure Check
 - (1) Close off the inlet opening of the respirator's facepiece canister(s), cartridge(s), or filter(s) by covering with the palm of the hand(s) or by replacing the filter seal(s). 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.
 - (2) Inhale gently so that the facepiece collapses slightly, and hold your breath for ten seconds.
 - (3) If a facepiece remains in its slightly collapsed condition and no inward leakage of air into the facepiece is detected, the tightness of the respirator is considered satisfactory.
- b. Positive Pressure Check
 - (1) 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.
 - (2) For some 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.

D. DOFFING

1. Respirator wearers must exit the contaminated area before removing their respirator.
2. All workers exiting an area where respirators were used to protect against TB or other infectious aerosols shall discard disposable respirators by following the appropriate infection control procedures for their facility.
3. All workers exiting an asbestos containment area shall wear the respirator into the shower and thoroughly wash the respirator while showering with soap and water. For details, see the *OUHSC/OU-Tulsa Asbestos Operations and Maintenance (O&M) Manual*.

VIII. FIT TESTING

A. GENERAL

1. All qualitative and quantitative fit testing will follow the procedures outlined in 29 CFR 1910.134 Appendix A, which is found in Appendix E of this manual.
2. Fit testing should not take place until medical clearance has been obtained.
3. Only EHSO personnel or persons designated by the EHSO will conduct respirator fit testing.
4. Fit testing is required for each size, type, style, or brand of respirator that will be used.
5. OSHA prohibits the use of a tight-fitting respirator with facial hair that may interfere with the respirator face seal and allow leakage of contaminated air during inhalation. In the case of positive pressure devices, this condition will either reduce service time or waste breathing air. The EHSO will not fit test any employee with facial hair and a worker will not enter a contaminated work area when conditions prevent a good seal of the respirator to the face.
6. Employees who cannot achieve a fit for the respirators supplied by the facility or who have facial hair (e.g., a beard) which interferes with the face-to-facepiece seal of the respirator should find alternative protection (e.g., a positive pressure HEPA filtered, hooded respirator) or not be allowed to work in situations where an exposure might take place.

7. Fit testing is required annually or whenever changes render previous fit testing obsolete. The employee or supervisor must notify the EHSO so fit testing can be repeated immediately when the employee has:
 - a. an obvious weight change (approximately 10 %);
 - b. significant facial scarring in the area of the facepiece seal;
 - c. significant dental changes (multiple extractions without a prosthesis or acquiring dentures);
 - d. reconstructive or cosmetic surgery; or
 - e. any other conditions that may interfere with facepiece seal.
8. Fit test records will be maintained in accordance with Section XVII., *Records*.

B. QUALITATIVE FIT TESTING

1. Qualitative fit tests for all air contaminants, including infectious aerosols, may use irritant smoke (stannic chloride), saccharin, Bitrex[®] (denatonium benzoate), or amyl acetate depending on the cartridges used and as specified by the EHSO.
2. Appendix F contains examples of qualitative fit test forms.

C. QUANTITATIVE FIT TESTING

1. If quantitative fit testing is desired, it is available through the Oklahoma Department of Labor Asbestos Division, through a local qualified vendor, at OU-Tulsa through the EHSO-Tulsa, or at OU-Norman Facilities Management ACM Remediation Shop. Arrangements for this service should always be made through the EHSO.
2. Because quantitative fit test records are generated electronically, a specific OU form for quantitative fit testing has not been developed. The quantitative fit test report should include, at a minimum:
 - a. the subject's name and social security number or other appropriate identification number;
 - b. operator name;
 - c. respirator model including size, manufacturer, and approval number;

- d. test date;
- e. test time;
- f. fit factor pass level;
- g. quantitative results during:
 - (1) normal breathing,
 - (2) deep breathing,
 - (3) side-to-side,
 - (4) up and down,
 - (5) talking,
 - (6) grimace,
 - (7) bending over or jogging, and (8) normal breathing; and
- h. overall fit factor.

3. A minimum fit factor pass level of at least 100 is necessary for a half-face respirator and a minimum fit factor pass level of at least 500 is required for a full-face negative pressure respirator.

IX. RESPIRATOR INSPECTIONS

A. FREQUENCY

- 1. All respirators used in routine situations must be inspected before each use and during cleaning according to the guidelines below and according to manufacturer's recommendations.
- 2. All respirators maintained for use in emergency situations should be inspected at least monthly and in accordance with the manufacturer's recommendations, and should be checked for proper function before and after each use.

B. DISPOSABLE RESPIRATORS

- 1. Examine the facepiece of the disposable respirator to determine whether it is functional and has structural integrity. If it is physically damaged or if the respirator becomes damaged, difficult to breath through, contaminated, or wet, discard the respirator. Also discard the respirator if it has nicks, cuts, abrasions, or creases in the facepiece-to-face sealing material.
- 2. Check the straps to be sure they are not cut or damaged and are pliable. The straps should be connected at all connection points.

3. Make sure that the metal nose clip (if present) is in place and functions properly.
4. Make sure the respirator is NIOSH-approved (marked on the mask, filter, filter package or respirator box).

C. REPLACEABLE FILTER HALF-FACE RESPIRATOR

1. Check respirator function, tightness of connections, and the condition of the various parts including the face piece, head straps, valves, connecting tube, and cartridges, canisters or filters; and check elastomeric parts for pliability and signs of deterioration. Do not use if it is cut, torn, dirty, abraded, modified, or deteriorated.
2. Check to ensure headbands are in good condition (elastic and pliable) and attached to the mask properly. Check for breaks or tears in the material and make sure all clips, fasteners and adjusters are in place and work properly. Straps should not be knotted to shorten them. The strap assembly usually has corrugations in the rubber that holds the strap tightly once it has been placed on the head and tightened. Be sure that the corrugations are not worn off.
3. Check facepiece for dirt, cracks, tears or holes. Inspect the shape of the facepiece for possible distortion that may occur from improper storage and make sure that rubber is flexible, not stiff.
4. Check for cracks, chips, tears, distortion, dirt, and build-up of material between valves and the valve seat. Valves should be pliable and lying flat on the surface of the valve seat.
5. Check to make sure cartridge holder gaskets are in place and check for cracks and damage to threads.
6. Check the exhalation valve cover to see that it is present and attached.
7. Check to see that the correct filters are in place and that the filter threads (if present) are not scratched, chipped, dented or otherwise damaged. If the filters seal directly to the facepiece, be sure that the sealing surface is not torn, chipped, dented, or otherwise damaged.

D. FULL-FACE RESPIRATOR

1. Check to see that the lens is not scratched, cracked, broken, or otherwise damaged. The lens should be completely sealed around the facepiece.

2. If the respirator has a speaking diaphragm, make sure that it is in place, not punctured, and that the gasket is in place.
3. Check the integrity of the facepiece to be sure it is not cut, torn, modified, deteriorated, or dirty. The elastomer should not be abraded and the sealing surface should be smooth and undamaged.
4. Make sure that all the required clamps are in place and are specific for the respirator being inspected.
5. Inspect the inhalation and exhalation valves to see that they are in place and pliable, functioning properly, and lying flat on the surface of the valve seat. The sealing surfaces must be clean and not chipped, scratched, or broken.
6. An approved full-face respirator includes the facepiece and the filters. Check the respirator to be sure the correct filters for the hazard are in place. The filter and filter holder threads should not be scratched, chipped, or otherwise damaged. If gaskets are required between the filter and filter holder, be sure they are in place and in good condition.
7. Remove the gaskets to check for dirt under them.
8. The strap assembly will usually have corrugations in the rubber that holds the strap tightly once it is placed on the head and tightened. Be sure that the corrugations are not worn off, all clips are present, and the straps are attached to the mask.
9. Check to see that the straps on the respirator are elastic, pliable, and have not been knotted to shorten them. The buckles and any attachment must be present and working correctly.
10. Make sure that the exhalation valve covers are present and attached to the respirator.
11. Make sure that the gaskets fit properly in the filter holders.
12. If the filters seal directly against the facepiece, be sure that the sealing surface is not torn, chipped, cut, or otherwise damaged.
13. Inspect the filters to be sure that the threads are not scratched, chipped, dented, or otherwise damaged.

E. POWERED AIR-PURIFYING RESPIRATORS (PAPRs)

In addition to the applicable inspection procedures for half-face or full-face respirators:

1. Stretch out the corrugated breathing tube to inspect it for cuts, abrasions, and pinholes.
2. Inspect the blower assembly and batteries as described by the manufacturer.
3. If the PAPR is equipped with a hood or helmet, inspect according to the manufacturer's instructions.

F. RESPIRATORS FOR EMERGENCY USE

1. In addition to following the applicable half-face or full-face respirator inspection procedures, the inspection should be documented by the employee performing the inspection. Such documentation will include:
 - a. the date of the inspection,
 - b. the name or signature of the person who made the inspection,
 - c. the findings,
 - d. the required remedial action, and
 - e. a serial number or other means of identifying the respirator.
2. The above documentation should be provided on a tag or label attached to the storage compartment for the respirator, kept with the respirator, or kept with other inspection reports until replaced following a subsequent documented inspection.

X. CLEANING AND SANITIZING

- A. All respirators except disposable respirators should be disinfected and inspected by the employee before each day's use or as job assignment dictates.
- B. Respirators maintained for emergency use or utilized by more than one employee will be cleaned and disinfected after every use.
 1. Respirators used for asbestos operations and maintenance activities will be totally dismantled, cleaned, disinfected, and inspected after every use.
 2. Disposable N95 respirators may be reused, but must be cleaned, disinfected and inspected prior to use. Those styles that cannot be cleaned and disinfected must be discarded. Disposable N95 respirators contaminated with blood or body fluids should be discarded.

3. Respirator parts should be washed in detergent solution, rinsed in clean water, immersed in disinfecting solution, and air dried in a clean area. A brush may be used to scrub adhering dirt.
4. Additional suggested procedures for cleaning and sanitizing respirators are given in Appendix G.

XI. MAINTENANCE

- A. Minor repairs, including valve replacement on air purifying respirators, are to be performed by the employee.
- B. Only the respirator manufacturer's NIOSH-approved parts designated for that respirator will be used. No attempt should be made to replace components or make adjustments, modifications or repairs beyond the manufacturer recommendations.

XII. STORAGE

- A. After inspection, cleaning, and necessary repairs, respirators are to be stored in a manner that protects against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and should be packed or stored to prevent deformation of the facepiece and exhalation valve.
- B. Respirators will be stored in plastic bags or the original cartons and placed in specially designated cabinets or lockers with other protective equipment. Respirators should not be stored in a tool box, in the open, or hung on a nail.
- C. In addition to these storage requirements, emergency respirators should also be kept accessible to the work area and stored in compartments or in covers that are clearly marked as containing emergency respirators.
- D. Disposable N95 respirators should be stored in a convenient, clean, sanitary location. Store disposable respirators at the entrance to designated use areas so that users can pick them up when entering.
- E. Never store disposable N95 respirators in pockets, plastic bags, or other confined areas. Disposable N95 respirators should not be folded or put in an abnormal shape that may impair the respirator's function.

XIII. EXPOSURE MONITORING

- A. When a method for monitoring is available, air monitoring will be performed by the EHSO on a periodic basis when necessary to confirm or re-evaluate the required level of respiratory protection for specific areas or work activities.
- B. The type and extent of exposure monitoring will be based upon the contaminant(s) and work activity following established NIOSH, OSHA, or other published exposure monitoring guidelines.
- C. Asbestos air monitoring during asbestos operations and maintenance work will be performed in accordance with the OUHSC/OU-Tulsa *Asbestos Operations and Maintenance Program* and the OU *Asbestos Operations and Maintenance Program*.

XIV. TRAINING

- A. Each employee who wears a respirator must be trained annually in the proper use of the respirator. The training includes:
 - 1. the respiratory hazard, why there is a need for respiratory protection, and the effect on the wearer if the respirator is not used properly;
 - 2. the engineering and administrative controls being used and the need for respirators to provide protection;
 - 3. the reason for selection of a particular respirator including a description and the intended use of the particular respirator;
 - 4. the function, capabilities, and limitations of the selected respirator;
 - 5. how to inspect, put on and remove, use, and check the seals of the respirator;
 - 6. how to recognize an improperly functioning respirator;
 - 7. proper wearing procedures (including the need to maintain a proper facial surface), maintenance, cleaning, inspection, repair and storage (where applicable);
 - 8. procedures for obtaining replacement parts and equipment (where appropriate);
 - 9. recognizing and procedures for how to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;
 - 10. how to recognize medical signs and symptoms that may limit or prevent the effective use of the respirator;

11. the need for informing the supervisor of any problems experienced by them or their co-workers;
 12. a general explanation of the medical fitness determination requirements;
 13. an explanation of the fit test process and reasons when a fit test may need to be repeated;
 14. demonstration and hands-on training to include an opportunity to handle the respirator, have it fitted properly, perform user seal checks, test its face-to-facepiece seal, wear it in normal air for a familiarity period, and wear it in an appropriate test atmosphere; and
 15. applicable governmental regulations for specific substances.
- B. Each affected employee must demonstrate an understanding of the training before being allowed to perform work requiring the use of a respirator. During annual training, skill will be evaluated by verifying the employee:
1. attends annual training,
 2. demonstrates the ability to correctly disassemble and reassemble their respirator,
 3. demonstrates the ability to perform the user seal checks required by the standard, and
 4. demonstrates the appropriate user fit checks during fit testing.
- C. This training will be repeated as necessary and at least annually to verify that employees remain familiar with the proper use of respiratory protection.
- D. When the departmental supervisor has reason to believe that an employee who has already been trained does not have the understanding and skill required to properly use and maintain the respirator, the departmental supervisor will ensure that the employee receives additional training. Situations when additional training is required include, but are not limited to, the following:
1. changes in the workplace or the type of respirator render previous training obsolete;
 2. inadequacies in an affected employee's knowledge or use of an assigned respirator indicate that the employee has not retained the requisite understanding or skill; or

3. any other situation arises in which retraining appears necessary to ensure safe respirator use.

E. Training records will be maintained in accordance with Section XVII., *Records*.

XV. MEDICAL EVALUATION

A. Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Prior to the employee being fit tested or using a respirator, all employees whose work requires respiratory protective devices shall be evaluated by a physician or other licensed health care professional (PLHCP).

B. Medical evaluations will be completed for respirator wearers prior to the use of the respirator and when:

1. an employee reports medical signs or symptoms that are related to ability to use a respirator;
2. the PLHCP, supervisor, or the respirator program administrator identifies an issue indicating that the employee needs to be reevaluated;
3. observations made during fit testing and/or respiratory program evaluation indicates a need for employee reevaluation; or
4. a change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

C. The following information should be submitted to the PLHCP.

1. For all employees, a completed medical evaluation questionnaire containing at least the information found in Appendix I of this manual must be completed and submitted to the PLHCP.

- a. For OUHSC employees, the medical evaluation questionnaire is completed online (<https://apps.ouhsc.edu/Respirator/Login.aspx>) and submitted to OUHSC Employee Health for review.
 - b. For OU-Tulsa, all affected employees must fill out the medical evaluation form found in Appendix J and forward it to OU-Tulsa Employee Health (employees) or OU-Tulsa Student Health (residents) for review.
 - c. For OU-Norman, the medical evaluation questionnaire is provided by and completed at the PLHCP facility.
2. The following additional information should also be submitted to the PLHCP:
- a. the type and weight of the respirator to be used by the employee;
 - b. the duration and frequency of respirator use;
 - c. the expected physical work effort;
 - d. additional protective clothing and equipment to be worn; and
 - e. temperature and humidity extremes that may be encountered.

On the Norman campus, the *Request for Medical Clearance for Respirator Use* form (see Appendix H) contains this required information. For the OUHSC campus, the information is included in the online medical evaluation form. For the Tulsa campus, this information is provided on the medical evaluation form found in Appendix J.

- D. A follow-up medical examination will be provided for an employee who gives a positive response to any question among questions 1 through 8 of Section 2 of the form, or whose initial medical examination demonstrates the need for a follow-up medical examination. The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination. E. Recommended PLHCP locations are as follows:

1. **Oklahoma City Campus**

Employee Health
OU Physicians Building Suite 2C
825 N.E. 10th
Oklahoma City, OK
(405) 271-9675

8:00 a.m. - 4:30 p.m. Monday through Friday

2. Tulsa Campus

Employee Health
4502 E. 41st Street, Room 2E04
Tulsa, OK
(918) 619-4417
8:00 a.m. - 5:00 p.m. Monday through Friday

Student Health
4444 E. 41st Street, Room 3501
Tulsa, OK
(918) 619-4565
8:00 a.m. - 5:00 p.m. Monday through Friday

3. Norman Campus

Norman Occupational Medicine
724 24th Avenue NW
Suite 200
Norman, OK 73069-6232
(405) 360-6868

Concentra
1500 W I-240 Service Road
STE: A-14
Oklahoma City, OK 73159
(405) 632-1002

- F. Additional medical evaluation or examination procedures may be required if the respirator use falls under an OSHA substance-specific standard. For example, if the respirator is to be used to remove asbestos or collect asbestos samples, a medical examination under 29 CFR 1926.1101 must also be performed (for details, see the OUHSC/OU-Tulsa *Asbestos Operations and Maintenance (O&M) Manual*). Such additional evaluations or examinations will be coordinated by the EHSO.
- G. The final determination of whether an employee is medically qualified to wear a respirator rests with the examining health care professional. The PLHCP should provide to the employee a completed *Medical Clearance for Respirator Use* Form (see Appendix H) or the following minimum information:
 - 1. a written recommendation regarding the employee's ability to use the respirator;

2. any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used;
 3. the need, if any, for follow-up medical evaluations; and
 4. a statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.
- H. Submission of the medical clearance information to the EHSO:
1. For Norman employees, the employee is responsible for providing a copy of the medical clearance information to his or her supervisor, who should then provide a copy to the EHSO so that fit testing may proceed.
 2. For the OUHSC and OU-Tulsa campuses, Employee Health or Student will submit an email to the EHSO with medical clearance information.
- I. Records of PLHCP's written recommendations will be maintained as specified in Section XVII., *Records*.

XVI. PROGRAM EFFECTIVENESS EVALUATION

The respiratory protection program will be evaluated annually by the program administrator. This evaluation will include:

- A. employee training review;
- B. respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- C. appropriate respirator selection for the hazards to which the employee is exposed;
- D. proper respirator use under the workplace conditions that employees encounter;
- E. proper respirator maintenance;
- F. employee acceptance; and
- G. employee suggestions (if any).

XVII. RECORDS

The EHSO will maintain a file of all training and fit testing records relative to the *OU Respiratory Protection Program*. Other records listed below will be retained by the departmental supervisors. All records in this program will be made available to qualified persons or agencies as specified in 29 CFR 1910.1020 or 29 CFR 1926.33, *Access to Employee Exposure and Medical Records*.

A. MEDICAL RECORDS

Each PHLCP will maintain appropriate medical records generated at his/her facility.

B. FIT TEST RECORDS

Fit test records, including those that indicate failure, will be maintained by the EHSO for 30 years plus the duration of employment.

C. RESPIRATOR TRAINING RECORDS

The EHSO will maintain all respirator training records for a period of at least three years.

D. MEDICAL CLEARANCE RECORDS

Completed *Medical Clearance for Respirator Use* forms or other written recommendations regarding the employee's ability to use the respirator will be maintained by the EHSO for 30 years plus the duration of employment.

1. For Norman employees, the *Medical Clearance for Respirator Use* forms will be maintained by the EHSO.
2. For the OUHSC and OU-Tulsa campuses, an email from Employee Health or Student Health indicating clearance will be attached to the fit test form and retained by the EHSO.

APPENDIX A

DEFINITIONS DEFINITIONS

Aerosol: Particles, solid or liquid, suspended in air.

Air-Purifying respirator: A respirator in which ambient air is passed through an air purifying element that removes the contaminant(s). Air is passed through the air-purifying element by means of the breathing action or by a blower.

Assigned Protection Factor (APF): The expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users.

Atmosphere-Supplying Respirator: A class or respirators that supply a respirable atmosphere, independent of the workplace atmosphere.

Breathing Air: Air as specified by the Compressed Gas Association and the American National Standards Institute that contains the following: (1) oxygen content (v/v) of 19.5 to 23.5 %; (2) hydrocarbon (condensed) content of 5 milligrams or less per cubic meter of air; (3) carbon monoxide (CO) content of 10 ppm or less; (4) carbon dioxide content of 1,000 ppm or less; and (5) lack of noticeable odor.

Canister/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.

Ceiling Concentration: The concentration of an airborne substance that should not be exceeded during any part of the working exposure.

Confined Space: (Also see "Permit Required Confined Space") An enclosed space that has the following characteristics:

1. is large enough and so configured that an employee can bodily enter and perform assigned work;
2. has limited or restricted means for entry or exit; and
3. is not designed for continuous employee occupancy.

Examples of confined spaces include, but are not limited to: tanks, silos, vessels, pits, sewers, pipelines, tank cars, boilers, septic tanks and utility vaults.

Disposable Respirator: A respirator for which maintenance is not intended and that is designed to be discarded after excessive resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. This respirator cannot be resupplied with an unused filter or cartridge and is to be discarded in its entirety after its useful service life has been reached.

Dust: An aerosol consisting of mechanically produced solid particles derived from the breaking up of larger particles. Dusts generally have a larger particle size when compared to fumes.

Escape-Only Respirator: A respirator intended only for use during emergency egress from a hazardous atmosphere.

Exposure Limit: The maximum allowable concentration in the air to which an individual may be exposed. These may be time-weighted averages, short-term limits, or ceiling limits.

Filter: A component used in respirator to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask, N-95, etc.): means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit Test: The use of a challenge agent to evaluate the fit of a respirator on an individual.

Fit Factor: means a quantitative measure of the fit of a particular respirator on a particular individual.

Fume: Solid aerosols formed by condensation of a gas or vapor. Fumes generally have a smaller particle size when compared to dusts.

Gas: A fluid that has neither independent shape nor volume and tends to expand indefinitely.

Hazardous Atmosphere: An atmosphere that contains a contaminant(s) in excess of the exposure limit or that is oxygen deficient.

High Efficiency Particulate Air (HEPA) Filter: means a specialized filter that is capable of removing 99.97 % of particles greater than or equal to 0.3 micrometers in diameter.

Immediately Dangerous to Life or Health (IDLH): An atmosphere is considered to be IDLH when it meets one or more of the following conditions.

1. It is known or suspected to have:
 - a. a concentration of a contaminant above a published IDLH level; or
 - b. when the employee cannot escape without:
 - (1) losing his/her life or suffering permanent health damage within 30 minutes; or
 - (2) severe eye or respiratory irritation or other reactions that could inhibit escape.
2. It is a confined space that contains less than the normal 20.9 % oxygen.

3. Oxygen content is below 19.5 % at sea-level atmospheric pressure.
4. It contains total atmospheric pressure less than 8.6 psi equivalent to 14,000 feet altitude or any combination of reduced percentage of oxygen or reduced pressure that leads to an oxygen partial pressure less than 95 mm Hg.
5. The contaminant(s) cannot be identified or the exposure cannot be reasonably estimated.

Mist: An aerosol composed of liquid particles.

Negative-Pressure Respirator: A respirator in which the air pressure inside the respiratory inlet covering is negative during inhalation with respect to the ambient air pressure.

Poor Warning Properties: A substance whose odor, taste, or irritation effects are not detectable or not persistent at concentrations at or below the exposure limit.

Positive-Pressure Respirator: A respirator in which the pressure inside the respiratory inlet covering is normally positive with respect to ambient air pressure.

Powered Air-Purifying Respirator (PAPR): An air-purifying respirator that uses a blower to force the ambient atmosphere through air purifying elements to the wearer's breathing zone..

Pressure-Demand Respirator: A positive pressure atmosphere-supplying respirator that admits respirable gas to the face piece when the positive pressure is reduced inside the face piece by inhalation.

Qualitative Fit Test: A pass/fail fit test that relies on the subject's response to a challenge agent.

Quantitative Fit Test: means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Permit Required Confined Space: (Permit space) means a confined space that has one or more of the following characteristics:

1. contains or has a potential to contain a hazardous atmosphere;
2. contains a material that has the potential for engulfing an entrant;
3. has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes; or
4. contains any other recognized serious safety or health hazard.

Respirator: A personal device designed to protect the wearer from the inhalation of hazardous atmospheres.

Sanitization: The removal of contaminants and the inhibiting of the action of the agents that cause infection or disease.

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

Tight-fitting Facepiece: means a respiratory inlet covering that is designed to form a complete seal with the face. A half-facepiece covers the nose and mouth; a full facepiece covers the nose, mouth and eyes.

Tuberculosis (TB): means a disease caused by *M. tuberculosis*.

User Seal Check: A test conducted by the wearer to determine if the respirator is properly seated to the face.

Vapor: The gaseous phase of matter that normally exists in a liquid or solid state at room temperature.

APPENDIX B

RESPIRATOR AUTHORIZATION FORM

APPENDIX C

**INFORMATION FOR EMPLOYEES USING RESPIRATORS
WHEN NOT REQUIRED UNDER THE STANDARD
29 CFR 1910.134, APPENDIX D
(MANDATORY)**

**INFORMATION FOR EMPLOYEES USING RESPIRATORS
WHEN NOT REQUIRED UNDER THE STANDARD
29 CFR 1910.134, APPENDIX D (MANDATORY)**

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:

- A. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- B. 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.
- C. 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.
- D. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

APPENDIX D

**A PARTIAL LISTING OF CHEMICALS AGAINST WHICH AIR PURIFYING RESPIRATOR
CARTRIDGES DO NOT PROVIDE PROTECTION**

**A PARTIAL LISTING OF CHEMICALS AGAINST WHICH
AIR PURIFYING RESPIRATOR CARTRIDGES
DO NOT PROVIDE PROTECTION**

Acetone Cyanohydrin (a-Hydroxy isobutyronitrile; 2-Propane cyanohydrin; 2-Cyano-2-propanol;
2-Methylacetonitrile; 2-Hydroxy-2-methyl propanenitrile)
Acetonitrile (Methylcyanide)
Acetylene tetrabromide (Tetrabromoethane)
Acrolein (Acrylic aldehyde; Acryldehyde; Propenal; Allylaldehyde)
(Acrylic aldehyde)
(Acryldehyde)
Adiponitrile (Addipic acid dinitrile; Hexanedioic acid; 1,4-dicyanobutane; Tetramethylene cyanide)
(AGE)
(Allylaldehyde)
Allyl glycidyl ether (AGE; 1-Allyloxy-2,3-epoxy-propane)
(1-Allyloxy-2,3-epoxy-propane)
Allyl isothiocyanate (Oil of Mustard; AITC; Allyl thiocarbanimide; 3-isothiocyanate-1-propene; Allyl
isosulfocyanate)
Allyl propyl disulfide
(Aminobenzene)
2-Aminopyridine (a-Aminopyridine)
Ammonium perfluorooctanoate
Aniline (Aminobenzene; Phenylamine, Aniline oil)
(Aniline oil)
Arsine (Hydrogen arsenide, Arsenic trihydride)
(Arsenic trihydride)
Benzene (Benzol, Coal tar naphtha) [poor warning but OSHA allows OV] (Benzol)
(Benzene carbonyl chloride) (Benzoic
acid chloride)
Benzotrichloride (Toluene trichloride; Benzenyl trichloride; Benzoic trichloride; Phenyl chloroform;
Trichloromethylbenzene)
(BGE)
(BO)
(Boron bromide)
Boron tribromide (Boron bromide)
Boron trifluoride
Bromine pentafluoride Butane (n-Butane) n-Butyl glycidyl
ether (BGE; 1,2-Epoxy-3-butoxy-propane) p-tert-Butyl
toluene (1-Methyl-4-tert-butylbenzene)
Carbon dioxide (Carbonic acid gas; Dry Ice)
Carbon monoxide (monoxide)
Carbon tetrabromide (Tetrabromomethane)

Carbon tetrachloride (Tetrachloromethane)

(Carbonic acid gas)

Carbonyl fluoride (Fluoroformyl fluoride; Carbon oxyfluoride)

(Carbon oxyfluoride)

(Chloracetone)

(Chloroacetyl chloride)

Chlorinated diphenyl oxide (Hexachlorodiphenyl oxide)

(Chloride fluoride)

Chloride trifluoride (Chloride fluoride)

Chloroacetaldehyde (2-chloroethanal)

Chloroacetone (Monochloroacetone; 1-Chloro-2-propanone; Chloracetone)

Chloroacetyl chloride (Chloroacetyl chloride)

(a-Chlorobenzaldehyde)

Chlorobromomethane (Bromochloromethane; Methylene chlorobromide; CBM; Halon 1011) (2-chloroethanal)

1-Chloro-1,1-difluoroethane (HCFC-142b; Dymel 142b; Genetron 142b; Chlorodifluoroethane; achloroethylidene fluoride)

Chlorodifluoromethane (Freon 22)

Chlorodiphenyl 42 % or 54 % chlorine (polychlorinated biphenyl; PCB)

Chloroform (Trichloromethane) bis-(2-Chloroisopropyl)ether (DCIPE; BCME)

bis-Chloromethyl ether (Dichloromethylether; BCME; Chloro(chloromethoxy) methane; Chloromethyl ether) Chloropentafluoroethane (FC-115; Monochloropentafluoroethane)

(1-Chloro-2-propanone)

(1-Chloro-2-propene)

(3-Chloropropene)

B-Chloroprene (2-Chloro-1,3-Butadiene; Chlorobutadiene; beta-Chloroprene)

2-Chloropropionic acid (a-Chloropropionic acid)

o-Chlorostyrene (1-Chloro-2-ethylbenzene; 2-Chlorostyrene)

2-Chloro-1,1,1,2-tetrafluoroethane (Chlorotetrafluoroethane; HCFC124; HFA124; Fluorocarbon 124)

Chlorotrifluoroethylene (CFE; CTFE; Trifluorovinylchloride; Trifluorochloroethylene) Cromyl chloride (Chromium oxychloride; Chlorochromic anhydride)

(Coal tar naphtha)

Cobalt carbonyl

Cobalt hydrocarbonyl

Cyanides (as CN)

Cyanogen (Dicyan; Oxalonitrile)

Cyanogen chloride (CNCL)

Cyclopentane (Pentamethylene)

Decaborane

Decabromodiphenyl oxide (DBDPO; Decebromodiphenyl ether; bis-(pentabromophenyl) ether)

Diallylamine (N-2-propenyl-2-propen-1-amine; Di-2-propenylamine)
Diazomethane(Azimethylene; Diazirine)
Diborane (Boroethane)
Dibromochloropropane (1-Chloro-2,3-dibromopropane:DBCP: 1,2-Dibromo3-chloropropane)
2-N-Dibutylaminoethanol(Dibutylaminoethanol; N,N-dibutyl-N-(2-hydroxyethyl) amine)
Dichloroacetylene(Dichloroethylene)
1,4-Dichloro-2-butene (2-butylenedichloride; DCB; 1,4-DCB; dichlorobutene) Dichlorodifluoromethane
(Refrigerant 12; Freon 12)
1,1-Dichloroethane (Ethylene bichloride)
Dichlorofluoromethane (Refrigerant 21; Freon 21; Dichloromonofluoromethane)
1,1-Dichloro-1-fluoroethane (HCFC141b; HFA141b; Fluorocarbon 141b)
Dichloroethyl ether (bis-(2-Chloroethyl) ether; 2-2'-Dichlorodiethyl ether)
Dichloromethane
Dichloromonofluoromethane (Refrigerant 21; Freon 21)
1,1-Dichloro-1-nitroethane
1,1-Dichloropropene (1,3-Dichloropropylene)
2,2-Dichloropropionic acid (Dalapon™)
Dichlorotetrafluoroethane (Freon 114; Refrigerant 114; Halon 242; FC-114) Dry
Ice
Diethylene triamine
Difluorodibromoimethane (Dibromodifluoromethane; Freon 12B2: DFB)
1,1-Difluoroethane (Freon 152a, etc., Ethylidene fluoride)
Difluoromethane
Diglycidyl ether (di-(Epoxypropyl)ether; bis-(2,3-Epoxypropyl-ether; 2-Epoxypropyl ether;Diallyl ether
dioxide; DGE)
Diisobutylene (2,4,4-Trimethylpentene; Diisobutene)
Dimethyl acetamide (N,N-Dimethyl acetamide; DMAC)
Dimethylamine (Anhydrous dimethylamine)
Dimethyldichlorosilane (Dichlorodimethylsilane)
Dimethylethoxysilane (Ethoxydimethyl silane)
Dimethyl ether (Methyl ether; Wood ether)
Dimethyl formamide (N,N-dimethyl formamide: DMF)
1,1-Dimethylhydrazine (unsym-Dimethylhydrazine; UDMH)
Dimethylsulfate (Methyl sulfate)
Dipropylene glycol methyl ether (Dipropylene glycol monomethyl ether; Dowanol™50B)
Dipropyl ketone (Butyrane; 4-Heptanone)
Divinyl benzene (DVB: Vinyl styrene)
Enflurane (2-Chloro-1,1,2-trifluoroethyldifluoromethyl ether; Ethrane)
Epichlorohydrin (1-Chloro-2,3-epoxy-propane; 2-Chloropropylene oxide; g-Chloropropylene oxide) (1,2
Epoxybutane)
(1,2-Epoxy-3-butoxy-propane)
Ethyl alcohol (Ethanol) OV acceptable at < 1000 ppm, but short service life

Ethyl amine (anhydrous ethylamine; Aminoethane; Monoethylamine)
Ethyl bromide (Bromomethane)
Ethyl chloride (Chloroethane; Monochloroethane; Hydrochloric ether)
Ethyl cyanoacrylate (2-Cyanoacrylic acid; ethyl ester; 2-Cyano-2-propenoic acid, ethyl ester; ECA; Ethyl alpha-cyanoacrylate; Ethyl 2-cyanoacrylate; Ethyl 2-cyano-2-propenoate)
Ethylene dichloride (Ethylene chloride; 1,2-Dichloroethane)
Ethylene glycol dinitrate (Glycol dinitrate; Nitroglycol)
Ethyleneimine (Ethyleimine; Dimethylenimine; Dihydroazirine; Azirane; Aziridine; Aminoethylene)
Ethylene oxide (Dimethylene oxide; 1,2-Epoxy ethane; Oxirane)
Ethyl ether (Diethyl ether; Ethyl oxide; Ether)
Ethyl formate (Ethyl methanoate; Formic acid; ethyl ester)
Fluorine
(Fluoroformyl fluoride)
Formamide (Methanamide)
Formic Acid (Hydrogen carboxylic acid; Methanoic acid)
Germanium tetrahydride (Germane; Germanium hydride)
Glycidol (2-Hydroxymethyloxiran; Hydromymethyl ethylene oxide; epoxypropyl alcohol; 3-Hydroxypropylene oxide; 2,3-Epoxy-1-propanol)
Hexachlorobutadiene (Hexachloro-1,3-butadiene; perchlorobutane)
Hexachlorocyclopentadiene (1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene)
1,4-Hexadiene
(Hexachlorodiphenyl oxide)
1,1,1,3,3,3-Hexafluoropropane
Hexafluoroacetone (1,1,1,3,3,3-Hexafluoro-2-propanone)
Hexamethylene diisocyanate (HDI; HMDI)
Hexane (n-hexane; normal hexane; hexyl hydride)
1-Hexene (Butyl ethylene; Hexene; Hex-1-ene; Hexene-n-1; Hexylene)
HFE-7100
Hydrazine (Anhydrous hydrazine)
(Hydrogen arsenide)
Hydrogen cyanide (Hydrocyanic acid; Prussic acid)
Hydrogen peroxide (Peroxide; Hydrogen dioxide)
Hydrogen selenide (Selenium hydride)
Hydrogen sulfide (Sulfuretted hydrogen; H₂S; Hydrosulfuric acid; Hepatic gas)
2-Hydroxypropylacrylate (HPA)
Iodine
Iodoform (Triiodomethane)
Iron pentacarbonyl (Iron carbonyl)
Isooctyl alcohol (Isooctanol)
Isophorone diisocyanate (IPDI)
Isoprene (2-Methyl-1,3-butadiene)

Isopropyl glycidyl ether (Isopropoxymethyl-oxiran; 1,2-Epoxy-3-isopropoxy-propane; Isopropyl Epoxypropyl ether; IGE)
Ketene (Carbomethene; Ethenone)
LPG (Liquified petroleum gas; Bottled gas)
Maleic anhydride (2,5-Furandione; cis-Butenedioic anhydride)
Manganese cyclopentadienyl tricarbonyl (MCT)
Mercaptoethanol (2-Mercaptoethanol; 2 ME; 1-Hydroxy-2-mercaptoethane; 2-Hydroxy-1-ethanethiol; 2Hydroxyethylmercaptan; 2 Thioethanol; Thioethyleneglycol; Thioglycol)
Mercury, Alkyl
Methacrylic acid (a-Methacrylic acid)
Methyl acetylene (Propyne; Allylene)
Methyl acetylene propadiene mixture (MAPP gas; Methyl acetylene-allene mixture; Propyne-allene mixture) Methylacrylonitrile (2-Methyl-2-propenenitrile; Isoprene cyanide)
Methylal (Dimethoxymethane; Methyl formal; Formal. Dimethylacetal formaldehyde)
Methyl alcohol (Methanol; wood alcohol; Carbinol)
Methyl aniline (Monomethyl aniline; MSA; N-Methyl aniline)
Methyl bromide (Bromomethane)
Methyl chloride (Chloromethane)
(Methylcyanide)
Methyl 2-cyanoacrylate (Mecrylate)
Methylcyclohexane (Cyclohexylmethane; hexahydrotoluene)
Methylcyclohexanol (Hexahydrocresols)
Methylenebisphenyl isocyanate (MDI; 4-4'-Diphenylmethane diisocyanate; Methylene-bis-(4-phenyl isocyanate)
Methylene chloride (Dichloromethane; Methylene dichloride)
4-4'-Methylene-bis-(2-chloroaniline); (MOCA; DACPM; 4-4'-Methylene-bis-(2-chlorobenzamine))
Methylene-bis-(4-cyclohexylisocyanate)
4,4'-Methylene dianiline (4,4'-Diaminodiphenylmethane; MDA)
Methyl ethyl ketone peroxide (MEKP)
Methylethyl ketoxime (2-Butanone oxide; MEKO)
Methyl formate (Methyl methanoate; Formic acid, methyl ester)
Methyl hydrazine (Monomethyl hydrazine)
Methyl iodide (Iodoethane)
Methyl isocyanate (Isocyanic acid, methyl ester)
Methyl mercaptan (Methanethiol)
-Methyl-2-pyrrolidine (NMP; 1-Methyl-2-pyrrolidone; m-pPyrol; -Methyl pyrrolidone)
Methyl silicate (Tetramethoxy silane)
(Monochloroacetone)
(monoxide)
Nickel carbonyl (Nickel tetracarbonyl)
Nickel sulfide roasting, fume and dust (as Ni)

Nitric acid (Aqua fortis; White fuming nitric acid (WFNA); Red fuming nitric acid (RFNA); Hydrogen nitrate)

Nitric oxide (Nitrogen monoxide; NO)

p-Nitrochlorobenzene (PNCB; PCNB; 4-Chloronitrobenzene; p-Chloronitrobenzene; 1-Chloro-4nitrobenzene)

Nitrogen dioxide (Nitrogen tetroxide; NTO; Dinitrogen tetroxide; Nitrogen peroxide)

Nitrogen trifluoride (Nitrogen fluoride)

Nitroglycerine (NG; Glyceryl trinitrate; Trinitroglycerin)

Nitrous oxide (Nitrogen monoxide)

Osmium tetroxide (Osmic acid)

Oxygen difluoride (Difluorine monoxide; Fluorine monoxide)

Pentaborane (Stable pentaborane; Pentaboron nonahydride)

1,1,1,2,2-Pentafluoroethane (Pentafluoroethane; HFC-125; Fluorocarbon 125)

Perchloryl fluoride (Chloride oxyfluoride)

Perfluoroisobutylene (Octafluoroisobutylene; Octafluoro-sec-butene; PIFB) (Phenylamine)

m-Phenylenediamine (1,3-Benzenediamine; m-Diaminobenzene) o-Phenylenediamine (1,2-Benzenediamine; o-Diaminobenzene; Orthamine)

p-Phenylenediamine (P-Diaminobenzene; 1,4-Diaminobenzene)

Phenyl glycidyl ether (Glycidyl phenyl ether; Phenyl epoxypropyl ether; 1,2-Epoxy-3-phenoxy propane; PGE)

Phenylhydrazine (Hydrazinobenzene)

Phenyl phosphine

Phosgene (Carbonyl chloride; Carbon oxychloride; Chloroformyl chloride)

Phosphine (Hydrogen phosphide; Phosphorus hydride; Phosphorated hydrogen)

Phosphorus - yellow (White phosphorus, WP)

Phosphorus oxychloride (Phosphoryl chloride)

Phosphorus pentachloride (Phosphorus chloride)

Phosphorus trichloride (Phosphorus chloride)

3-Picoline (g-Picoline; 4-Methyl-pyridine)

Piperidine (Hexhydropyridine)

Propane (Dimethyl methane)

Propargyl alcohol(2-Propyn-1-ol) (Propenal)

B-Propiolactone (Hydroccrylic acid, beta lactone; 3-Hydroxypropionic acid; Propiolactone; 3-Hydroxy-betalactone; beta-Proprolactone; BPL)

Propylene glycol dinitrate (1,2-Propylene glyconitrate; 1,2-Propanediol dinitrate)

Propylene imine (2-Methylaziridine)

Propylene oxide (1,2-Epoxypropane; Propene oxide; Methyloxirane)

n-Propyl nitrate (Nitric acid, n-Propylester)

Quinoline (Chinoline; Leukoline; 1-Benzazine; 1-Azana-phthlene; Lencol)

Selenium hexafluoride

Silicone tetrahydride (Silane)

Sodium azide (Hydrazoic acid)
Stibine (Hydrogen antimonide; Antimony trihydride)
Subtilisins (Proteolytic enzymes as 100 % crystalline enzyme)
Sodium hexafluoride (SF₆)
Sulfur monochloride (Sulfur chloride; Sulfur subchloride)
Sulfur pentafluoride (Disulfur decafluoride)
Sulfur tetrafluoride
Sulfuryl fluoride
Tellurium hexafluoride (as Te)
(Tetrabromoethane)
(Tetrabromomethane)
(Tetrabromomethane)
(Tetrachloromethane)
1,1,2,2-Tetrachloro-1,2-difluoroethane (Refrigerant 112; Halocarbon 112; Freon 112)
1,1,1,2-Tetrachloro-2,2-difluoroethane (Refrigerant 112a; Halocarbon 112a; 2,2-Difluoro-1,1,1,2-tetrachloroethane; Freon 112a)
1,1,2,2-Tetrachloroethane (Acetylene tetrachloride)
Tetraethyl lead (as Pb) (TEL; Lead tetraethyl; Motor fuel anti-knock compound)
1,1,1,2-Tetrafluoroethane (tetrafluoroethane; HFC 134a; HFA134a; Fluorocarbon 134a)
Tetramethyl lead (as Pb) (TML; Lead tetramethyl; Motor fuel anti-knock compound)
Tetramethyl succinonitrile vapor (TMSN)
Tetranitromethane (Tetan)
Thioglycolic acid (Mercaptoacetic acid; Thioranic acid)
Thionyl chloride (Sulfurous oxychloride; Sulfur oxychloride) Toluene
2,4-diisocyanate (TDI; 2,4-Toluene diisocyanate)
m-Toluidine (m-Aminotoluene)
o-Toluidine (o-Amino-Toluene; o-Methylaniline; 2-Methylaniline) p-Toluidine
(p-Aminotoluene)
(Tribromomethane)
1,1,2-Trichloroethane (Vinyl trichloride; b-Trichloride)
Trichloroethylene (Ethylene trichloride; Triclene™)
1,2,3-Trichloropropane (Allyl trichloride; Glycerol trichlorohydrin; Glycerin trichlorohydrin; Trichlorohydrin)
1,1,2-Trichloro-1,2,2-trifluoroethane (Halocarbon 113; Refrigerant 113; TTE; Freon™113; FC-113)
Triethanolamine (Daltogen; 2,2',2''-Nitrilo-triethanol; Sterolamide; TEA; Trihydroxytriethylamine)
Trifluorobromomethane (Halon™1301; Halocarbon 13B1; Refrigerant 13B1; Bromotrifluoromethane; Freon™13B1)
Vinyl bromide (Bromoethylene)
Vinyl Chloride (Chloroethylene; Chloroethene; Monochloroethylene; VC; Vinyl chloride monomer; VCM) Vinylcyclohexene (4-Vinyl-1-cyclohexene; 4-Vinylcyclohexene-1-butadiene dimer; 4-Ethenyl-1-cyclohexene; 1-Vinylcyclohexene-3,4-vinyl-cyclohex-1-ene; VCH) Vinyl cyclohexene dioxide (Vinylcyclohexane dioxide; Vinylhexane dioxide)

Vinylidene chloride (1,1-Dichloroethylene; VDC)

Xylene a,a'-diamine (MXDA)

APPENDIX E

OSHA FIT TESTING PROCEDURES APPENDIX A TO 29 CFR 1910.134 (MANDATORY) APPENDIX A TO § 1910.134: FIT TESTING PROCEDURES (MANDATORY) OSHA-Accepted Fit Test Protocols

I. FIT TESTING PROCEDURES -- GENERAL REQUIREMENTS

- A. The employer shall conduct fit testing using the following procedures. The requirements in this Appendix apply to all OSHA-accepted fit test methods, both Qualitative Fit Testing (QLFT) and Quantitative Fit Testing (QNFT).
- B. 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.
- C. 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.
- D. 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.
- E. 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.
- F. The more acceptable facepieces are noted in case the one chosen proves unacceptable; the most comfortable mask is donned and worn at least 5 minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in Section I.H. below.
- G. 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.
- H. 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:
 - 1. position of the mask on the nose
 - 2. room for eye protection

3. room to talk
 4. position of mask on face and cheeks
- I. The following criteria shall be used to help determine the adequacy of the respirator fit:
1. chin properly placed,
 2. adequate strap tension, not overly tightened,
 3. fit across nose bridge,
 4. respirator of proper size to span distance from nose to chin,
 5. tendency of respirator to slip, and
 6. self-observation in mirror to evaluate fit and respirator position.
- J. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in the *OU Respiratory Protection Program* in Section VII.C., *User Seal Checks* (or Appendix B-1 of 29 CFR 1910.134), or those recommended by the respirator manufacturer which provide equivalent protection to the procedures required by this program. 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.
- K. 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.
- L. 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.
- M. 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.
- N. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

- O. 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.

P. TEST EXERCISES

The following test exercises are to be performed for all fit testing methods prescribed in this Appendix, except for the Controlled Negative Pressure (CNP) method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the 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 Quantitative Fit testing (QNFT); it is not performed for Qualitative Fit Testing (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).

Q. 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.

II. QUALITATIVE FIT TEST (QLFT) PROTOCOLS

A. GENERAL

1. 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.
2. 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.

B. 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.

1. 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.
2. Three 1 liter glass jars with metal lids are required.
3. Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.
4. 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.

5. 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.
6. 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.
7. A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.
8. 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.
9. 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):
 - a. 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.
 - b. Be sure the covers are on tight, then shake each bottle for two seconds.
 - c. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle.
 - d. Indicate to the test conductor which bottle contains banana oil.
10. 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.
11. 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.
12. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

C. 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 Section II.C.(1)-(7) above.

9. 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.
10. 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.
11. 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.

D. SACCHARIN SOLUTION AEROSOL PROTOCOL

1. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.
2. 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.
3. 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 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.
4. 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.
5. 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.
6. 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 E.1.d. below) in 100 ml of distilled water. Pre-prepared solutions available from a commercial vendor may also be used.

IMPORTANT NOTE: If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.
8. 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 10 squeezes, the screening test is completed. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.
9. If the first response is negative, 10 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 10 squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
10. If the second response is negative, 10 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 10 squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
11. The test conductor will take note of the number of squeezes required to solicit a taste response.
12. If the saccharin is not tasted after 30 squeezes the test subject is unable to taste saccharin and may not perform the saccharin fit test.
13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
14. Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
15. The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every 4 hours.

E. 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.
 - a. The fit test uses the same enclosure described above.

- b. The test subject shall don the enclosure while wearing his/her selected respirator. The respirator shall be properly adjusted and equipped with a particulate filter(s).
- c. 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.
- d. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water. A commercially available solution is also acceptable.
- e. 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.
- f. 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.
- g. After generating the aerosol, the test subject shall be instructed to perform the exercises in Section I.P.(1)-(8) of this Appendix.
- h. 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).
- i. 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.
- j. 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).
- k. 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.

F. BITREX™ (DENATONIUM BENZOATE)

1. 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.
2. **Taste Threshold Screening**
 - a. 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.
 - b. 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. 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.
 - c. 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
 - d. 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.
 - e. The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5 % salt (NaCl) solution in distilled water. A commercially prepared solution is acceptable.
 - f. 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.

- g. An initial 10 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 10 squeezes, the screening test is completed. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.
- h. If the first response is negative, 10 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 10 squeezes, the screening test is completed. The taste threshold is noted as 20 regardless of the number of squeezes actually completed.
- i. If the second response is negative, 10 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 10 squeezes, the screening test is completed. The taste threshold is noted as 30 regardless of the number of squeezes actually completed.
- j. The test conductor will take note of the number of squeezes required to solicit a taste response.
- k. If the Bitrex is not tasted after 30 squeezes (step j.), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.
- l. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- m. Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- n. The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every 4 hours.

G. BITREX SOLUTION AEROSOL FIT TEST PROCEDURE.

- 1. The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- 2. The fit test uses the same enclosure as that described above in Section II.F.2.b. above.
- 3. The test subject shall don the enclosure while wearing his/her selected respirator. 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. A commercially prepared solution is acceptable.
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.P. above.
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).

H. 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.

1. **General Requirements and Precautions**
 - a. The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
 - b. Only stannic chloride smoke tubes shall be used for this protocol.
 - c. No form of test enclosure or hood for the test subject shall be used.

- d. 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 response from the test subject.
- e. 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.

2. **Sensitivity Screening Check**

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

3. **Irritant Smoke Fit Test Procedure**

- a. The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- b. The test subject shall be instructed to keep his/her eyes closed.

- c. The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal 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 2 more passes around the perimeter of the mask, moving to within 6 inches of the respirator.
- d. If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.
- e. The exercises identified in Section I.P. above 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 6 inches.
- f. 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.
- g. 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.
- h. If a response is produced during this second sensitivity check, then the fit test is passed.

III. QUANTITATIVE FIT TEST (QNFT) PROTOCOLS

A. GENERAL

- 1. The following quantitative fit testing procedures have been demonstrated to be acceptable:
 - a. 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;
 - b. quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; or

- c. quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit. 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.
2. 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.

B. GENERATED AEROSOL QUANTITATIVE FIT TESTING PROTOCOL

1. Apparatus

- a. 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.
- b. 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.
- c. 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.
- d. 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.
- e. 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.

- f. 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.
- g. The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.
- h. The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 % variation for the duration of the test.
- i. 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.
- j. 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.
- k. The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.
- l. When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 %.
- m. The limitations of instrument detection shall be taken into account when determining the fit factor.
- n. Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

2. **Procedural Requirements**

- a. 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.

- b. 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.
- c. 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.
- d. 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 % for a half mask or 1 % for a full facepiece respirator.
- e. A stable test agent concentration shall be obtained prior to the actual start of testing.
- f. 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.
- g. The test shall be terminated whenever any single peak penetration exceeds 5 % for half-face and 1 % for full facepiece respirators. The test subject shall be refitted and retested.

3. Calculation of Fit Factors

- a. 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.
- b. 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.
- c. The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

- (1) *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.
- (2) *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.
- (3) *Integration by calculation* of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.
- (4) 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 ff_1, ff_2, ff_3 , etc. are the fit factors for exercises 1, 2, 3, etc.

- d. The test subject shall not be permitted to wear a half-face 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.
- e. 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.

C. AMBIENT AEROSOL CONDENSATION NUCLEI COUNTER (CNC) QUANTITATIVE FIT TESTING PROTOCOL

1. 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.

2. A minimum fit factor pass level of at least 100 is necessary for a half-face 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.

3. **Portacount Fit Test Requirements**

- a. 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.
- b. Instruct the person to be tested to don the respirator for 5 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.
- c. Check the following conditions for the adequacy of the respirator fit:
 - (1) chin properly placed,
 - (2) adequate strap tension, not overly tightened,
 - (3) fit across nose bridge,
 - (4) respirator of proper size to span distance from nose to chin,
 - (5) tendency of the respirator to slip, and
 - (6) self-observation in a mirror to evaluate fit and respirator position.
- d. 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.
- e. Follow the manufacturer's instructions for operating the Portacount and proceed with the test.
- f. The test subject shall be instructed to perform the exercises in Section I.P. of this Appendix.

- g. 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.

4. **Portacount Test Instrument**

- a. 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.
- b. 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.
- c. 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.

D. **CONTROLLED NEGATIVE PRESSURE (CNP) QUANTITATIVE PROTOCOL**

- 1. 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.
- 2. 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 Dynatech Nevada 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.

3. 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 5 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-face 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.

E. 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 test subject shall be trained to hold his or her breath for at least 20 seconds.
6. The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.
7. The QNFT protocol shall be followed according to Section III.B.(1)-(2) of this Appendix with an exception for the CNP test exercises.

F. 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.

G. CNP TEST INSTRUMENT

1. The test instrument shall have an effective audio warning device when the test subject fails to hold his or her breath during the test. The test shall be terminated whenever the test subject failed to hold his or her breath. The test subject 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.

IV. NEW FIT TEST PROTOCOLS

1. 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 Appendix A of 29 CFR 1910.134.
2. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:
 - a. 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
 - b. 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.
3. 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.

APPENDIX F

UNIVERSITY OF OKLAHOMA RESPIRATOR FIT TEST RECORD FORMS

7/15 F-1 Environmental Health and Safety Office The University of Oklahoma Respiratory Protection Program

**The University of Oklahoma Health Sciences Center
The University of Oklahoma - Tulsa
Respirator Fit Test Record**

Date: _____

OUHSC UserName: _____

Name: _____

HR Employee ID #: _____

(Print Legibly)

Department:

DO NOT WRITE BELOW THIS LINE – FOR EMPLOYEE HEALTH USE ONLY

This individual is " approved " not approved to utilize the: " N95 " Other: _____

Evaluation Notes/Restrictions/Limitations:

All employees/students are instructed to discontinue use of the N95 respirator, and contact Employee Health at 271-9675 if adverse symptoms are experienced while using the respirator.

Employee Health
University of Oklahoma Health Sciences Center

**DO NOT WRITE BELOW THIS LINE – FOR ENVIRONMENTAL HEALTH AND SAFETY
OFFICE USE ONLY**

Respirator Type

" Kimberly Clark/Technol " 3M " Moldex " Other _____

Respirator Size

" Small " Medium/Regular " Large " Other _____

Test Results

" Pass

Comments/Reasons for Not Fit Tested: " Fail " Not Fitted r

Sensitivity = <10

Test Completed By:

Date:

" I HAVE BEEN FIT TESTED. I understand that I have been fitted for the above respirator only. If any other respirator is used, I understand that I need to be fitted on that respirator for proper use.

" I HAVE NOT BEEN FIT TESTED. Unless I am fitted for the N-95 respirator, I understand I will be deemed by the University to have declined to be fitted for the N-95 respirator because of my decision not to shave my facial hair. I have been fully informed of and understand the risks of contracting various infectious diseases, such as tuberculosis, influenza and influenza-like illnesses, Severe Acute Respiratory Syndrome, and other airborne illnesses should I continue to voluntarily decline to shave my facial hair and be fitted for an N-95 respirator. I know that I may reconsider my decision and be fitted for the N-95 respirator in the future by contacting the OUHSC Environmental Health and Safety Office. I understand that I should contact the occupational safety and health officer of the institutions that I rotate through to determine the availability of an alternative form of protective equipment that may be used in the course of patient care. I also understand that fit testing may be required by affiliated institutions as a condition for participating in patient care. Should I not meet these requirements, I may become unable to fulfill my contractual responsibilities and thus be suspended or terminated from the residency program.

UNIVERSITY OF OKLAHOMA RESPIRATOR FIT TEST RECORD

NAME: _____ OU EMPLID# OR SS#
DEPARTMENT: _____ SUPERVISOR:
BLDG/RM. #: _____ EXTENSION:
RESPIRATOR:

(manufacturer, model, size, and approval number)

RESULTS

Saccharin

Irritant Smoke

Other:

Pass:

Fail:

Comfort:	Very Comfortable	Comfortable	Tolerable
	Uncomfortable	Very Uncomfortable	

Comments*:

Annual Physical Current? Yes No

Signature: _____ **Fit**

Tested By: _____ **Date**

Tested:

*Any special considerations or difficulties in wearing (contact lenses or glasses, dentures, forehead scars, etc.)

The original of this record will be retained by the EHSO at least one year or until the next fit test, whichever is longer.

APPENDIX G

SUGGESTED PROCEDURES FOR CLEANING AND SANITIZING

SUGGESTED PROCEDURES FOR CLEANING AND SANITIZING

I. GENERAL

- A. Machines may be used to expedite the cleaning, sanitizing rinsing, and drying of large numbers of respirators, however, extreme care should be taken to ensure against tumbling, agitation, or exposure to temperatures above those recommended by the manufacturer (normally 43EC or 110EF, maximum), as these conditions are likely to result in damage to the respirators.
- B. Respirators may become contaminated with toxic materials. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination; otherwise, separate decontamination steps may be required before cleaning.

II. CLEANING

- 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.
- G-1*
- F. Components should be hand-dried with a clean lint-free cloth or air-dried.
 - G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
 - H. Test the respirator to ensure that all components work properly.
 - I. Place assembled respirators in appropriate containers for storage.

III. SANITIZERS

A. Cleaners/sanitizers that effectively clean the respirator and contain a bactericidal agent are commercially available. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents, alcohol, and many solvents can damage rubber or elastomeric respirator parts. These materials must be used with caution. Some sanitizing solutions that have proven effective are (a) a hypochlorite (bleach) solution (50 parts per million chlorine), 2-minute immersion; (b) an aqueous iodine solution (50 parts per million of iodine), 2-minute immersion; or (c) a quaternary ammonium solution (200 parts per million of quaternary ammonium compounds in water with less than 500 parts per million total hardness), 2-minute immersion. Quaternary ammonium disinfectants are not recommended for use on the SCBA, according to the manufacturer.

1. Alternatively, respirators may be washed in a detergent solution, rinsed with water, and then sanitized by immersion in a sanitizing solution.
2. Rinse the respirators after immersion into a sanitizing solution. Different concentrations of quaternary ammonium salts are required to achieve a sanitizing solution with waters of varying hardness, so rinsing time should increase as the sanitizing solution concentration increases. Inflammation of the skin of the respirator user (dermatitis) may occur if the quaternary ammonium compounds are not completely rinsed from the respirator. The hypochlorite and iodine solutions are unstable and break down with time; they may cause deterioration of rubber or other elastomeric parts and may be corrosive to metallic parts. Immersion times should not be extended beyond the mentioned time periods, and the sanitizers should be thoroughly rinsed from the respirator parts.

G-2

APPENDIX H

REQUEST FOR MEDICAL CLEARANCE FOR RESPIRATOR USE

insert form here

APPENDIX I

**MEDICAL EVALUATION FORM MINIMUM REQUIREMENTS MEDICAL
EVALUATION FORM MINIMUM REQUIREMENTS
(From OSHA Respirator Medical Evaluation Questionnaire
29 CFR 1910.134, Appendix C (Mandatory))**

To the employer:

Answers to questions in Part A, Section 1, and to question 9 in Part A, Section 2, 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).

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

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
 - 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

Questions 10 to 15 below must be answered by every employee who has been selected to use either a **full-facepiece respirator or a 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. Difficulty 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

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

11. How often are you expected to use the respirator(s) (circle “Yes” or “No” for all answers that apply)?

- 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):

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):

APPENDIX J TULSA MEDICAL

EVALUATION FORM