UTHealth™

The University of Texas
Health Science Center at Houston

The University of Texas Health Science Center at Houston

Respiratory Protection Manual

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I. Foreword

The University of Texas Health Science Center at Houston (UTHSC-H) has a fundamental commitment and responsibility to protect the health and safety of its faculty, students, employees, and the visiting public when participating in official activities. Many occupational diseases can be effectively prevented by minimizing or eliminating the breathing of air that may be contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors. This shall be accomplished as far as feasible by accepted engineering control measures such as enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials. When effective engineering controls are not feasible, or while they are being instituted, it is the aim of this program to ensure that respiratory protection is provided, utilized, and maintained in an appropriate and safe manner.

II. Purpose

The purpose of this program is to ensure the protection of all UTHSC-H personnel and students from respiratory hazards through the proper use of approved respirators. Job-specific respirators shall be provided by UTHSC-H and are to be used when engineering controls for respiratory hazards are not feasible or ineffective, while engineering controls are being installed or repaired, and for emergency or other temporary situations. Voluntary respirator use (when exposures are below the permissible exposure limit) is permitted at the request of the employee or student and upon review by Environmental Health and Safety and subsequent to a medical evaluation if necessary (See Appendix D). The procedures set forth in this program comply fully with the requirements of the Occupational Safety and Health Administration's (OSHA) 29 CFR 1910.134 (Respiratory Protection Standard, revised April 8, 1998). Procedures apply to all UTHSC-H faculty, staff, and students. Non-UTHSC-H personnel working at the University of Texas Health Science Center at Houston must observe procedures that are equivalent to or exceed the requirements of the UTHSC-H Respiratory Protection Program.

III. Responsibilities

A. Environmental Health & Safety will:

a. Manage the Respiratory Protection Program. The Vice President of Safety, Health, Environment and Risk Management will serve as the Respiratory Protection Program administrator.
b. Provide training
c. Conduct fit testing
d. Maintain documentation of training and fit testing
e. Recommend appropriate respirators and cartridges
f. Conduct periodic monitoring to assess concentrations of airborne contaminants
g. Conduct periodic inspections of respirator storage and use, and ensure that these inspections are properly documented

B. UT Employee Health Services will:

a. Perform and document initial and subsequent medical surveillance of all respirator wearers at no cost to the student/employee

C. Employee Supervisors will:

a. Identify personnel who may need to utilize respiratory protection
b. Purchase appropriate respirators, cartridges, and approved replacement parts at no cost to student/employee
c. Ensure that employees have had medical surveillance as required by this program
d. Ensure that employees are properly trained before utilizing respiratory protection, and that employees receive any required refresher training (at least annually)
e. Contact EH&S to perform any initial or follow-up monitoring
f. Report any problems with respiratory protection to EH&S
g. Ensure that employees are up-to-date for fit testing (annual requirement)
h. Ensure that employees who are required to wear a respirator because of potential exposure, do so, as a condition of employment
i. Ensure that any SCBA tanks have had hydrostatic testing as per manufacturer's recommendations, and that this has been properly documented

D. Respirator Wearer will:

a. Clean / inspect respirator before and after each use. Document using Appendix F.
b. Store respirator in a re-sealable plastic bag in a clean area away from possible contaminants
c. Use respirator in accordance with manufacturer's recommendations
d. Properly wear respirator and all related equipment as trained

e. Report any problems with respiratory protection to the department supervisor

IV. References

A. Occupational Safety and Health Administration (OSHA) 29 CFR 1910.134, Respiratory Protection Standard, revised April 8, 1998

V. Determination of Need for Respiratory Protection

It is each supervisor's responsibility to ensure that EH&S is notified of all practices that may present the need for students or employees to wear respiratory protection. If engineering controls for achieving respiratory protection are neither technologically nor economically feasible, the use of respiratory protection is required for tasks such as, but not limited to:

A. Those that liberate harmful dusts, mists, fumes, vapors, or gases
B. Those that occur in areas in which unacceptable levels of exposure could result from the processing, handling, storing, or disposing of hazardous substances
C. Those that require entry into oxygen-deficient or potentially oxygen-deficient environments

Exposure determinations will be conducted by EH&S to confirm or justify the need for, or continued use of, respiratory protection. EH&S must also be notified when engineering or procedural changes occur, which could affect employee or student exposures, or when new hazards are introduced into the workplace, to allow for subsequent exposure determinations to be initiated.

VI. Medical Surveillance

Employees and/or students will not be assigned to tasks requiring use of respirators unless it has been determined that their health and physical condition will enable them to do so safely. UT Health Services will determine this at no cost to the employee/student before fit testing or use of a respirator. It is possible, if requested, that an employee or student may use his or her personal health care practitioner to provide a medical evaluation. In this case, however, the employer is required to contact the physician or other licensed health care professional (PLHCP) and provide him/her with a copy of the respiratory protection standard and other required supplemental information, such as any workplace variables that may increase pulmonary and cardiovascular stress during respirator use. The employer shall bear the costs of the evaluation, and periodic updates may also be required. The physician or PLHCP will conduct a medical evaluation. The physician or PLHCP will be asked to sign a respirator user's approval document stating that the user is physically able to work while wearing a respirator (Appendix B). The respirator user's medical status will be reviewed periodically as determined by the health care practitioner in his written medical opinion.

VII. Types of Respirators

There are two primary types of respiratory protective equipment one may utilize when appropriate engineering controls are not feasible. These types of respirators are referred to as air-purifying respirators and atmosphere supplying respirators. The following is a description of air purifying and atmosphere supplying respirators and their limitations for use:

A. Air-Purifying Respirators

a. Description

Air-purifying respirators remove particulate, vapor, and gas contaminants from the air we breathe prior to inhalation. Some common examples of these contaminants include welding fumes, asbestos fibers, solvent vapors, and pesticide mists. Contaminants of this type are removed by a cartridge or canister, which is fixed to the respirator face piece. The cartridges and canisters remove contaminants by various filtering and absorption mechanisms.

Air-purifying respirators may be powered or non-powered units. The use of a non-powered air-purifying respirator may result in additional physical stress due to an increased difficulty in breathing. A powered air-purifying respirator is equipped with a blower, which passes ambient air through the air-purification unit and the supplies the purified air to the respirator face piece.

b. Limitations

Air-purifying respirators must not be used in oxygen-deficient atmospheres (<19.5%) or in atmospheres that are Immediately Dangerous to Life and Health (IDLH). Examples of work place situations that may be oxygen-deficient or IDLH include confined spaces and work areas that have high air-borne concentrations of toxic chemicals. Work environments such as this will require a higher level of protection (see Atmosphere-Supplying Respirators).

The Maximum Use Concentration (MUC) may be determined with a simple calculation if the concentration of the air-borne contaminant is known. The MUC is calculated by determining the OSHA Permissible Exposure Limit (PEL) for a specific hazard and multiplying it by the Assigned Protection Factor (APF) for the respirator. The assigned protection factor is the level of protection a respirator provides if worn properly. The greater the number, the greater the protection. (See Tables 1 and 2). In order to ensure that the appropriate cartridge or canister is being used with your respirator, EH&S will recommend one specific to the particular hazards of your job.

B. Atmosphere-Supplying Respirators

a. Description

Atmosphere-Supplying respirators provide the user with breathable air independent of the ambient air. These types of respirators may be used to provide protection in oxygen-deficient atmospheres and in highly toxic atmospheres. There are several different types of atmosphere-supplying respirators that offer a superior degree of protection against atmospheric contaminants and require specialized training for use:

1. Self-Contained Breathing Apparatus (SCBA)

The self-contained breathing apparatus (SCBA) is a unit that allows the user to carry their breathing atmosphere with them. SCBA's are normally used when there is a short-term need to enter and escape from atmospheres that are or may be immediately dangerous to life and health (IDLH). The most important limitation associated with using the SCBA is the oxygen capacity of the device. Most SCBA's only have a 15-30 minute oxygen supply, which may be rapidly depleted if the work rate increases or if the atmospheric pressure changes.

2. Supplied Air Respirator (SAR)

The supplied air respirator (SAR) is a unit whose use is not limited to the amount of oxygen one can carry with them into a hazardous atmosphere. SAR's are typically in line with a high-volume/high pressure breathing air cylinder cascade. Alternatively, these respirators may be in line with an air blower, which blows uncontaminated ambient air into the face piece. These types of respirators, regardless of mode of operation, allow the user to remain in the contaminated atmosphere much longer than would be possible with an SCBA. These units are lightweight but limit the range of user mobility. They are normally used when there are extended work periods required in atmospheres that are not IDLH.

3. Combination Respirators

A combination air-line respirator with auxiliary SCBA is available which provides users with the highest degree of protection possible. These units allow the wearer to escape dangerous atmospheres if the SAR fails during use. These respirators are used when there are extended work periods required in atmospheres that are or may be IDLH.

Table 1: OSHA Assigned Protection Factors (APF)

Type of Respirator	APF
Air-Purifying	
Filtering Face piece	10
Half-Mask	10
Full-Face piece	50
Powered Air-Purifying	
Half-Mask	50
Full-Face piece	1000
Loose-Fitting Face piece	25
Helmet	25
Hood	1000
Air-Line: Demand mode	
Half-Mask	10
Full Facepiece	50
Continuous Flow	50
Pressure Demand	50
Air-Line: Continuous Flow mode	
Half-Mask	50
Full Facepiece	1000
Loose-Fitting Face piece	25
Helmet	25
Hood	1000
Air-Line: Pressure Demand	
Half-Mask	50
Full Facepiece	1000
SCBA: Demand	
Full Facepiece	50
Helmet or Hood	50
SCBA: Pressure Demand	
Full Facepiece	10000
Helmet or Hood	10000

Table 2: Maximum Use Concentration (MUC) Calculations

Assigned Protection Factor (APF)	Permissible Exposure Limit (PEL)	Maximum Use Concentration (MUC)
1.) 10	10 mg/m^3 (8 hr. TWA)	100 mg/m^3
2.) 50	0.75 ppm (8 hr. TWA)	37.5 ppm
3.) 1000	1.0 ppm (8 hr. TWA)	1000 ppm

1) APF for Half Mask Non-Powered Air Purifying respirator & PEL for Grain Dust from OSHA 1910.1000
2) APF for Full Face Air-Purifying respirator and PEL for Formaldehyde from OSHA 1910.1048
3) APF for Air-Line respirator with a full face piece in pressure demand mode and PEL for Benzene from OSHA 1910.1028

VIII. Selection of Respirators

Only respirators that have been certified by the National Institute for Occupational Safety and Health (NIOSH) will be used in the UTHSC-H Respirator Program. Respirators are certified as an assembly, and substitution of parts from other manufacturers or models is strictly prohibited. The respirator shall be used in compliance with the conditions of its certification, and the NIOSH label on the cartridge or filter must not be obscured, removed, or defaced while it is in service. A respirator will be issued to an individual for his or her exclusive use and shall not be used by another employee or student.

Selection of appropriate respirators will be based on the specific respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability (29CFR 1910.134 (d)(1)(i)). In order to assist employees in determining exposure levels, EH&S will conduct area monitoring to determine workplace hazards such as oxygen deficiency and air contamination by particulates, vapors, or gases. Half-face and full-face air-purifying respirators equipped with the appropriate respirator filters/cartridges will be used to provide protection against specific hazards in atmospheres that are NOT:

- Oxygen deficient
- Immediately dangerous to life and health (IDLH)
- Exceeding the limitations of the selected respirator filters or cartridges

When exposure cannot be identified or reasonably estimated, the atmosphere shall be considered IDLH. In atmospheres where any of the aforementioned hazards exist, employees shall use either a self-contained breathing apparatus (SCBA) or a positive pressure supplied air respirator equipped with an emergency escape pack.

IX. Training

To ensure the proper and safe use of a respirator, each user will be thoroughly trained at the time of initial fit testing and annually thereafter. The training will be conducted by a member of EH&S or via a UTHSC-H-approved computer-based training course. This training will be documented and information retained by EH&S. The training will include, but not necessarily be limited to:

A. Why a respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;
B. What the limitations and capabilities of the respirator are;
C. How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;
D. How to inspect, don anddoff , use, and check the seals of the respirator;
E. What the procedures are for maintenance and storage of the respirator;
F. How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators;
G. The nature, extent, and effects of respiratory hazards in the workplace;

H. The need to inform their supervisors of any problems experienced by them or their coworkers;
I. An explanation of why a particular type of respirator has been selected for a specific respiratory hazard;
J. Successful completion of a fit test;
K. An opportunity to handle a respirator;
L. Demonstrate knowledge of the above training elements;
M. Employees who voluntarily use respirators will be given the advisory information from Appendix D.

X. Respirator Fit Testing

All UTHSC-H employees or students required to wear a respirator that has a tight-fitting face piece must be properly fit tested according to OSHA approved procedures. These fit testing procedures shall be performed before the first use of the respirator using the same make, model, style, and size respirator that will be used on the job. Additional fit testing will be performed if a different face piece is to be used or if a supervisor notices a change in the user's physical condition that may compromise the fit of the respirator face piece. Although quantitative fit testing is the preferred and more complete method of verifying the adequacy of the seal, situations may arise where it is not feasible to perform a quantitative fit test (i.e. emergencies, test equipment malfunctions). In the latter situations, qualitative fit testing is an acceptable alternative.

UTHSC-H prohibits the use of respirators with tight-fitting face pieces to be worn by students or employees who have facial hair that comes between the sealing surface of the face piece and the face or that which interferes with valve function (i.e. beards, "handlebar" mustaches, sideburns). Other conditions that may prohibit tight-fitting respirator use include, but are not limited to; missing dentures, facial scars, severe acne, or the use of headgear or eyewear that projects under the face piece seal. Respirator use is permitted as long as a condition does not prevent an adequate seal.

Fit testing is performed before initial use of the respirator and at least annually thereafter, and will be conducted by a trained member of Environmental Health and Safety. Complete fit-testing procedures are given in Appendix E.

XI. Use and Maintenance of Respirators

A. Visual Inspection

Without regular respirator inspection, users cannot be sure that they are receiving adequate protection from airborne hazards. In fact, wearing poorly maintained or malfunctioning respirators may be more dangerous than not wearing a respirator at all. UTHSC-H must replace, repair, or discard a respirator that is not functioning properly, and a defective respirator must, with no exceptions, be replaced or repaired before the user enters or returns to any possibly contaminated area. All respirator users should closely inspect and document (Appendix F) the following parts of the respirator before and after each use and during cleaning:

a. Rubber Face Piece:
   1. Cracked or broken air-purifying element holder(s)
   2. Excessive dirt
   3. Cracks, tears, or holes
   4. Distortion
   5. Cracked, scratched, or loose-fitting lens (full face)
   6. Incorrectly mounted full face piece lens or broken/missing mounting clips

b. Head Strap:
   1. Breaks or tears
   2. Loss of elasticity
   3. Broken or malfunctioning buckles/attachments
   4. Excessively worn serrations on head piece
   5. Harness which might allow the face piece to slip

c. Inhalation/Exhalation Valves:
   1. Detergent residue, dust particles, dirt, or hair on valve or valve seat
   2. Cracks, tears, distortion in valve material or valve seat
   3. Improper insertion of the valve body in the face piece
   4. Cracks, breaks, or chips in the valve body, particularly in the sealing surface
   5. Improper installation of the valve in the valve body

d. Filter Elements:
   1. Incorrect cartridge, canister, or filter for the hazard
   2. Missing or worn gaskets
   3. Worn threads
   4. Cracks or dents in filter housing
   5. Incorrect installation, loose connections, or cross-threading in holder
   6. Outdated use of cartridge or canister (see Section XI: Change-out Schedule)

e. SCBA's

1. Require an inspection of the air and oxygen cylinders to assure that the cylinder pressure is maintained at or above 90% of the manufacturer's recommended pressure level and that the regulator and low pressure warning devices function properly. The warning device must be activated and heard by the person performing the inspection.

B. Seal Checks

The wearer of a respirator equipped with a tight fitting face piece must check the seal of the face piece routinely prior to each entry into a potentially contaminated area. The seal may also be checked during use if the user questions the fit. Either the positive and negative pressure checks listed below or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

a. Positive Pressure Check

Close off the exhalation valve with the palm of the hand and exhale gently into the face piece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of air leakage at the seal.

b. Negative Pressure Check

Close off the inlet opening of the canister(s) or cartridge(s) by covering with the palms of the hands and inhale gently so that the face piece collapses slightly. Hold the breath for ten seconds. The face piece should remain slightly collapsed with no inward leakage.

C. Cleaning and Disinfection

The individual user should clean respirators following each use. Procedures recommended by the respirator manufacturer or those set forth in the following description may be used: (29CFR 1910.134 App B-2)

a. Remove filters, cartridges, or canisters. Disassemble face pieces 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^{o}C/110^{o}F maximum) water with a mild detergent or a disinfectant 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^{o}C/110^{o}F maximum) water, 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 (50ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C/110°F; or
   2. Aqueous solution of iodine (50ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43° C / 110° F; or
   3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
   4. Rinse components thoroughly in clean, warm (43°C/110°F maximum) water, preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on face pieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
   5. Components should be hand-dried with a clean, lint-free cloth or air-dried.
   6. Reassemble face piece, replacing filters, cartridges, and canisters where necessary.
   7. Test the respirator to ensure that all components work properly.

D. Storage

"All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the face piece and exhalation valve." (29CFR (h)(2)(i)) Respirators should be stored in sealable plastic bags or in containers with tight fitting lids. Respirators should not be hung by their straps as this could cause distortion of the mask area and damage to the straps. Follow the manufacturer's directions for specific storage requirements.

XII. Change-out Schedule

A change out schedule is a document that is now required by OSHA as of October 1998. It explains how long a particular chemical cartridge or canister used with an air-purifying respirator may be used in a specific work environment. A schedule of this nature is based on objective data obtained through various research institutes, such as NIOSH, and from individual cartridge and canister manufacturers. The schedule may also take into consideration work rate, relative humidity, chemical concentration, and multiple chemical contaminants. To ensure that these cartridges are changed before they are no longer effective, a change out schedule is necessary.

Respirator users may no longer rely on warning properties as the sole basis for determining change schedules, however, respirator users should be trained to understand that abnormal odor or irritation is evidence that respirator cartridges need to be replaced. When there is a mix of contaminants, the service life will be based on the contaminant with the shortest breakthrough time. Many manufacturers are now installing End of Service Life Indicators (ESLI's) on respirator cartridges. An ESLI is a system that changes color, therefore alerting the user that the cartridge must be replaced. The respirator user must strictly follow the manufacturer's guidelines to prevent health risks. The following tables contain current examples:

Table 3: Chemical Cartridge and Canister Change-Out Schedule

Chemical	Recommended Change Out Schedule
Acrylonitrile 1910.1045 (h)(2)(ii)	End-of-service life or at the end of each work shift, whichever occurs first.
Benzene 1910.1028 (g)(2)(ii)	End-of-service life or at the beginning of each shift, whichever occurs first
1,3-Butadiene 1910.1051 (h)(2)(ii)	Every 1,2, or 4 hours dependent on concentration and at the beginning of each shift
Formaldehyde 1910.1048 (g)(3)(ii)	Cartridges – every 3 hours or end of shift, whichever is sooner Canisters – every 2 or 4 hours according to schedule in (g)(3)(iv)
Vinyl Chloride 1910.1017 (g)(3)(ii)	End-of-service life or end of shift in which they are first used, whichever comes first.

Methylene Chloride 1910.1052 (g)(2)(ii)	Canisters may only be used for emergency escape and must be replaced after use.

Table 4: Particulate Filter Change-Out Schedule

N-series: use for protection against solid and water based particles - N95 - N99 - N100	All N series filters have no specific service time. They may be used multiple shifts and may continue until a breathing resistance is noted or become visibly soiled. **OR** At the first sign of physical damage.
R-series: use for protection against any particles (including oil aerosols). - R95 - R99 - R100	All R series filters have a useful service time of an 8-hour shift.
P-series: use for protection against any particles (including oil aerosols). - P95 - P99 - P 100	All P series filters have varying service times. See manufacturer's time use limitations for more information.

XIII. ***Mycobacterium tuberculosis***

Respiratory protection against M. tuberculosis will follow OSHA's 29CFR 1910.134 since the withdrawal of the Proposal on Occupational Exposure to M. Tuberculosis Respiratory protection program (29CFR 1910.139).

OSHA published a proposed standard on Oct. 17, 1997, to control occupational exposure to tuberculosis. It was estimated at that time that a standard would protect roughly 5.3 million workers in more than 100,000 hospitals, nursing homes, hospices, correctional

facilities, homeless shelters, and other work settings with a significant risk of TB infection. Since the proposal, however, a number of factors have emerged that alleviate the necessity of developing a TB-specific regulation.

In addition to the decrease in the number of TB cases nationwide, OSHA has concluded that occupational risk is lower than originally reflected because of greater implementation of TB controls and greater compliance with CDC's guidelines; and a rule would not substantially reduce the spread of TB from undiagnosed sources.

With OSHA's withdrawal of the TB proposal, the agency will begin applying the general industry respiratory protection standard for protection against the disease. New requirements include updating the facility's respirator program, complying with amended medical evaluation requirements, annual fit testing of respirators, and some training and recordkeeping provisions.

XIV. Recordkeeping

UTHSC-H will record and maintain appropriate documentation of this Respiratory Protection Program. The following is a list of those items that will be documented and who is responsible for each:

A. **Medical Evaluation –** all documentation will be maintained by UT Health Services.
B. **Fit testing –** all fit testing documentation will be maintained by EH&S.
C. **Training –** all initial and follow up training documentation will be maintained by EH&S.
D. **Inspection –** all routine respirator use and inspection shall be documented (see Appendix F) and maintained by the user, and will be checked periodically by EH&S.

XV. Program Surveillance

Periodic inspections and program evaluations will be conducted by EH&S to determine the continued effectiveness of the Respiratory Protection Plan. Program updates will be implemented as deemed appropriate by EH&S.

XVI. OSHA Definitions

The following definitions are important terms used in the respiratory protection standard:

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

B. ***Atmosphere-supplying respirator*** means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and

includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units

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

D. ***Demand respirator*** means an atmosphere-supplying respirator that admits breathing air to the face piece only when negative pressure is created inside the face piece by inhalation.

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

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

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

H. ***Escape-only respirator*** means a respirator intended to be used only for emergency exit.

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

J. ***Filtering face piece (dust mask)*** means a negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium.

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

L. ***Fit test*** means the use of a protocol to qualitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

M. ***Helmet*** means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

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

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

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

Q. ***Interior structural firefighting*** means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures, which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

R. ***Loose-fitting face piece*** means a respiratory inlet covering that is designed to form a partial seal with the face.

S. ***Negative Pressure Respirator (tight fitting)*** means a respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.

T. ***Oxygen Deficient Atmosphere*** means an atmosphere with the oxygen content below 19.5% by volume.

U. ***Physician or other licensed health care professional (PLHCP)*** means an individual whose legally permitted scope of practice (ie, license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

V. ***Positive Pressure Respirator*** means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

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

X. ***Pressure Demand Respirator*** means a positive pressure atmosphere-supplying respirator that admits breathing air to the face piece when the positive pressure is reduced inside the face piece by inhalation.

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

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

AA. ***Respiratory Inlet Covering*** means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a face piece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

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

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

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

EE. ***Tight-Fitting Face Piece*** means a respiratory inlet covering that forms a complete seal with the face.

FF. ***User Seal Check*** means an action conducted by the respirator user to determine if the respirator is properly sealed to the face.

Appendix A - Fit Test Procedures

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

Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures--General Requirements

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

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen face piece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable face pieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

   (a) Position of the mask on the nose

(b) Room for eye protection

(c) Room to talk

(d) Position of mask on face and cheeks

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

(a) Chin properly placed;

(b) Adequate strap tension, not overly tightened;

(c) Fit across nose bridge;

(d) Respirator of proper size to span distance from nose to chin;

(e) Tendency of respirator to slip;

(f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer, which provide equivalent protection to the procedures in Appendix B- 1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another face piece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the face piece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Exercises.

(a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the 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 QNFT testing; it is not performed for QLFT)

(7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

(8) Normal breathing. Same as exercise (1).

(b) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

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

(a) Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

(1) Three 1 liter glass jars with metal lids are required.

(2) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl Acetate Fit Test

(1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

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

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open

mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

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

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Saccharin solution aerosol fit test procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in 3. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

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

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

(a) Taste Threshold Screening.

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

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a \3/4\ inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

(7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Bitrex Solution Aerosol Fit Test Procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure as that described in 4. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water.

(6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.

(11) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

5. Irritant Smoke (Stannic Chloride) Protocol

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

(a) General Requirements and Precautions

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

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

(b) Sensitivity Screening Check

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

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating

properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

(1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the faceseal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the face piece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non- hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated

in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a face piece to quantify the respirator fit.

1. General

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

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

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus

(1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.

(2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.

(4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in

excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the face piece cavity at least 1/4 inch.

(7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.

(8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.

(9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.

(12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(13) The limitations of instrument detection shall be taken into account when determining the fit factor.

(14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) Procedural Requirements

(1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.

(2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.

(4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full face piece respirator.

(5) A stable test agent concentration shall be obtained prior to the actual start of testing.

(6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.

(7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full face piece respirators. The test subject shall be refitted and retested.

(8) Calculation of fit factors.

(i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the

concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

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

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

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

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

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

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

(9) The test subject shall not be permitted to wear a half mask or quarter face piece respirator unless a minimum fit factor of 100 is obtained, or a full face piece respirator unless a minimum fit factor of 500 is obtained.

(10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

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

(a) Portacount Fit Test Requirements

(1) Check the respirator to make sure the sampling probe and line are properly attached to the face piece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.

(2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting face piece, try another size of the same model respirator, or another model of respirator.

(5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

(6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) Portacount Test Instrument

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.

(3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator face piece to generate and then maintain a constant negative pressure inside the face piece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the face piece as a method for determining the face piece 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 face piece at a pre-selected constant pressure. The face piece fit is expressed as the leak rate through the face piece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test

pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full face piece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

(1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

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

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

(3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

(4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

(5) The 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 I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing

exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.

(4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position,

without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

(1) The test instrument shall have an effective audio warning device, or a visual-warning device in the form of screen tracing that indicates when the test subject fails to hold his or her breath during the test. The test must be terminated and restarted from the beginning when the test subject failed to hold his or her breath during the test. 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.

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

(a) When administering this protocol to test subjects, employers must comply with the requirements specified in paragraphs (a) and (c) of Part I.C.4 of this appendix ("Controlled negative pressure (CNP) quantitative fit testing protocol"), as well as use the test exercises described below in paragraph (b) of this protocol instead of the test exercises specified in paragraph (b) of Part I.C.4 of this appendix.

(b) Employers must ensure that each test subject being fit tested using this protocol follows the exercise and measurement procedures, including the order of administration, described below in Table A-1 of this appendix.

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

Exercises[(1)]	Exercise procedure	Measurement procedure
Facing Forward	Stand and breathe normally, without talking, for 30 seconds.	Face forward, while holding breath for 10 seconds.
Bending Over	Bend at the waist, as if going to touch his or her toes, for 30 seconds.	Face parallel to the floor, while holding breath for 10 seconds
Head Shaking	For about three seconds, shake head back and forth vigorously several times while shouting.	Face forward, while holding breath for 10 seconds.

REDON 1	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask.	Face forward, while holding breath for 10 seconds.
REDON 2	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask again.	Face forward, while holding breath for 10 seconds.

[1] Exercises are listed in the order in which they are to be administered.

(c) After completing the test exercises, the test administrator must question each test subject regarding the comfort of the respirator. When a test subject states that the respirator is unacceptable, the employer must ensure that the test administrator repeats the protocol using another respirator model.

(d) Employers must determine the overall fit factor for each test subject by calculating the harmonic mean of the fit testing exercises as follows:

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

Where:
N = The number of exercises;
FF1 = The fit factor for the first exercise;
FF2 = The fit factor for the second exercise; and
FFN = The fit factor for the nth exercise.

Part II. New Fit Test Protocols

A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.

B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:

1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or

2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.

C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

Appendix B – 1 User Seal Check Procedures

Appendix B – 1 to 1910.134: User Seal Check Procedures: (Mandatory)

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

I. Facepiece Positive and/or Negative Pressure Checks

A. *Positive pressure check.* Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. *Negative pressure check.* Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

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

Appendix B – 2 Respiratory Cleaning Procedures

Appendix B – 2 to 1910.134: Respirator Cleaning Procedures (Mandatory)

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

I. Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

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

C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

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

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

Appendix C – Medical Questionnaire

Medical Questionnaire for Respiratory Protection

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.

Medical Questionnaire for Respiratory Protection

Part A. Section I. (Mandatory)

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

Employee ID: _____ Today's Date: _____

Last Name:_____ First Name:_____ M.I._____

Age: _____ Gender: Male / Female

Height: _____ft ____inch Weight: _____lbs

Company:_____ Location:_____

Department:_____ Supervisor: _____

Job Title/Occupation:_____

A phone number where you can be reached by the health care professional who reviews this questionnaire (include area code) ( )
_____

The best time to phone you at this number:_____

1. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one) **YES** **NO**

2. 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)
   b. _____ Other type: Circle type(s): Half or Full Face Piece, Powered air-purifying, Self-contained breathing apparatus (SCBA).

3. Have you ever worn a respirator? (circle one): **YES** **NO**

If "Yes", what type(s):_____

_____

_____

Part A. Section II. (Mandatory)

Questions 1 through 9 **must be answered by every employee who has been selected to use any type of respirator**. (Please circle "YES" or "NO" or check the appropriate box):

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?

Condition	Had in past	Have at Present	Never had
Seizures (fits)			
Diabetes (sugar disease)			
Allergic reactions that interfere with your breathing			
Claustrophobia (fear of closed-in Places)			
Trouble smelling odors			

3. Have you *ever had* any of the following pulmonary or lung problems?

Condition	Had in past	Have at Present	Never had
Asbestosis			
Asthma			
Chronic bronchitis			
Emphysemia.			
Pneumonia			
Tuberculosis			
Silicosis			
Pneumothorax (collapsed lung)			
Lung cancer			
Broken ribs			
Any chest injuries or surgeries			
Any other lung problems that you've been told about Explain:			

4. Do you *currently* have any of the following symptoms of pulmonary or lung illness?

Condition	Yes	No
Shortness of breath		
Shortness of breath when walking fast on level ground or walking up a slight hill or incline		
Shortness of breath when walking with other people at an ordinary pace on level ground		
Have to stop for breath when walking at your own pace on level ground		
Shortness of breath when walking or dressing yourself		
Shortness of breath that interferes with your job		
Coughing that produces phlegm (thick sputum)		
Coughing that wakes you early in the morning		
Coughing that occurs mostly when you are lying down		
Coughing up blood in the last month		
Wheezing		
Wheezing that interferes with your job		
Chest pain when you breathe deeply		
Any other symptoms that you think may be related to lung problems? Explain:		

5. Have you *ever had* any of the following cardiovascular or heart problems?

Condition	Had in past	Have at Present	Never had
Heart Attack			
Stroke			
Angina			
Heart Failure			
Swelling in your legs or feet (not caused by walking)			
Heart arrhythmia (heart beating irregularly)			
High blood pressure			
Any other heart problem that you've been told about? Explain:			

6. Have you *ever had* any of the following cardiovascular symptoms?

Condition	Had in past	Have at Present	Never had
Frequent pain or tightness in your chest			
Pain or tightness in your chest during physical activity			
Pain or tightness in your chest that interferes with your job			
In the past two years, have you noticed your heart skipping or missing a beat			
Heartburn or indigestion that is not related to eating			
Any other symptoms that you think may be related to heart or circulation problems? Explain:			

7. Do you *currently* take medication for any of the following problems?

Condition	Yes	No
Breathing or lung problem		
Heart trouble		
Blood pressure		
Seizures (fits)		

8. If you've used a respirator, have you *ever had* any of the following problems? (If you've never used a respirator go to question 9):

Condition	Yes	No
Eye irritation		
Skin allergies or rashes		
Anxiety		
General weakness or fatigue		
Any other problem that interferes with your use of a respirator? Explain:		

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: **YES** **NO**

10. Have you *ever lost* vision in either eye (temporarily or permanently) **YES** **NO**
If yes, was vision loss permanent? **YES** **NO**

11. Do you *currently* have any of the following vision problems?

Condition	Yes	No
Wear contact lenses		
Wear glasses		
Color blind		
Any other eye or vision problem Explain:		

12. Have you *ever had* an injury to your ears, including a broken eardrum?
YES **NO**

13. Do you *currently* have any of the following hearing problems?

Condition	Yes	No
Difficulty Hearing		
Wear a hearing aid		
Any other hearing or ear problems? Explain:		

14. Have you *ever had* a back injury? **YES** **NO**

15. Do you *currently* have any of the following musculoskeletal problems?

Condition	Yes	No

Weakness in any of your arms, hands, legs, or feet		
Back pain		
Difficulty fully moving your arms and legs		
Pain or stiffness when you lean forward or backward at the waist		
Difficulty fully moving your head up or down		
Difficulty fully moving your head side to side		
Difficulty bending at your knees		
Difficulty squatting to the ground		
Climbing a flight of stairs or a ladder carrying more than 25 lbs.		
Any other muscle or skeletal problem that interferes with using a respirator? Explain:		

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 are 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?:

Condition	Yes	No
Asbestos		
Silica (e.g. in sandblasting)		
Tungsten/cobalt (e.g. grinding or welding this material)		
Beryllium		
Aluminum		
Coal (for example, mining)		
Iron		
Tin		
Dusty environments		
Any other hazardous exposures? If yes, explain 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 ever been in the military service? **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)? **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)?

Item	Yes	No
HEPA Filters		
Canisters (for example, gas masks)		
Cartridges		

11. How often are you expected to use the respirator(s):

Situation	Yes	No
Escape only (no rescue)		
Emergency rescue only		
Less than 5 hours per week		
Less than 2 hours per day		
2 to 4 hours per day		
Over 4 hours per day		

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 a 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 a heavy work effort 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 to 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 (temperatures exceeding 77°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, confines spaces, life-threatening gases: _____

    _____

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

Name of Toxic Substance	Estimated maximal exposure level per shift	Duration of exposure per shift
1.		
2.		
3.		
4.		
5.		

    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 D – Information for Voluntary Respirator Use

(Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Appendix D to Sec. 1910.134

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

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else’s respirator.

UTHealth™
The University of Texas
Health Science Center at Houston

Respirator Users Approval Document

On ___/___/___ (date), I do hereby attest that upon reviewing medical questionnaire and based on my best medical judgment, _____ (name) is (initial all that apply):

_____ Approved to wear the following respirators:

- _____ Filtering Face Piece (N-95 dust mask)
- _____ Escape Only Respirator
- _____ Half Mask Respirator
- _____ Full Mask Respirator
- _____ SCBA

_____ Required to come for a medical evaluation before respirator clearance can Be given.

_____ Are approved with the following conditions _____

_____

_____

_____

_____

_____ Not approved for respirator use

_____ _____

Signature of PLHCP Date

Fax to Chemical Safety at 713-500-5841

UTHealth
The University of Texas
Health Science Center at Houston

Environmental Health & Safety
Respiratory Protection

Record of Fit Test Completion and Training

On _____, _____ passed respiratory fit test for the following respirator(s):
(Date) *(Printed Name)*

☐3M N95 1860	☐3M N95 1870+	☐North 76008A Small	☐North 93000 Small
☐3M N95 1860S	☐PAPR only	☐North 76008A M/L	☐North 93000 M/L

The above user has received training in compliance with OSHA standard 29 CFR 1910.134, and is fit tested for only the above mask(s) per OSHA standard 29 CFR 1910.134 Appendix A.

Training

To ensure the proper and safe use of a respirator, the user was thoroughly trained at the time of initial fit test and annually thereafter, following an approved medical clearance. The training was conducted by Environmental Health & Safety (EH&S) at UTHealth. This training is documented and retained by EH&S. The provided training included, but was not necessarily limited to:

- Why the respirator is necessary – how improper fit, usage, or maintenance can compromise the protective effect of the respirator
- The respirator's capabilities and limitations
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
- How to properly inspect, put on, seal check, use and remove the respirator
- What the procedures are for maintenance and storage of the respirator
- How to recognize medical signs and symptoms that may limit effective use of respirators
- Explanation of physical conditions that would require immediate fit testing
- The nature, extent, and effects of respiratory hazards in the workplace
- The need to inform supervisors of problems experienced by them or their coworkers
- Explanation of why particular type of respirator has been selected for specific respiratory hazard
- Successful completion of a fit test
- An opportunity to handle a respirator
- Demonstrate knowledge of the above training elements
- Employees who voluntarily use respirators will be given the advisory information from Appendix D of The UTHSC-H Respiratory Protection Manual located at http://www.uthouston.edu/safety/chemical-safety/

_____	_____
EHS Representative Signature	Date
_____	_____
Fit Test Recipient Signature	Date

University of Texas Health Science Center at Houston
Environmental Health and Safety Department
Respiratory Protection Program

Respirator Use and Maintenance Log

Respirator Type:_____ Respirator I.D. #:_____

Manufacturer:_____

Model Number:_____ Date Placed in Service:_____

Date	Assigned to Whom Or Location of Storage	Inspection/Maintenance And Charging (SCBAs) Information	Serviced By