Colgate University
Respiratory Protection Program

Colgate University
13 Oak Drive
Hamilton, New York 13346
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Colgate University Department of Environmental Health and Safety
Respiratory Protection Program
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PROGRAM ADMINISTRATION

Introduction and Purpose

(A) The Occupational Safety and Health Administration (OSHA) regulations set forth in 29CFR1910.134 address respiratory protection in the workplace. The regulations in this section seek to “prevent atmospheric contamination...[to control] those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smoke, sprays, and vapors” (29 CFR 1910.134(a)(1)).

(B) Colgate University shall first seek to prevent atmospheric contamination by implementing engineering controls whenever possible, prior to utilizing personal protective equipment (PPE). Engineering controls can include enclosing the work area, introducing ventilation (mechanical / natural and local / general), and substitution of less toxic materials. After engineering controls are in place, respiratory PPE can be employed if deemed necessary. If respirators must be used to make the work environment safe, then their use shall be governed by this written, worksite specific respiratory protection program (RPP). The RPP shall describe all aspects pertaining to the safe use and maintenance of university-issued respirators. Colgate University shall issue respirators for use at no cost to medically cleared and properly trained employees enrolled in the RPP, and will develop, implement, and maintain the RPP to ensure the continued safe use of these respirators.

Site Information, Applicability, and Scope of Program

Site Information:

(A) Founded in 1819, Colgate University is a nationally ranked private liberal arts university with an average undergraduate enrollment of 2800 students. Colgate University’s 500+ acre campus is in the small, rural community of Hamilton located in central New York. Colgate University employs approximately 975 combined faculty and staff.

Applicability and Scope:

(A) This RPP applies to all Colgate University employees working in conditions that require the use of a respirator while at any Colgate University location. In the event that an employee does not or cannot follow the guidelines established by this program, he or she will not be allowed to continue working on any task involving the use of a respirator.
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(A.1) Contractors may use respirators while on-site at Colgate University, provided they are enrolled in their own company’s RPP and medically fit to use a respirator. Prior to a contractor’s use of a respirator onsite, the Colgate University Department of Environmental Health and Safety (EHS) will request a copy of the company’s RPP for review. The requirements of the outside company’s RPP may not be less stringent than Colgate University’s requirements, nor may they be in conflict with Colgate University’s requirements. Colgate University EHS may also require receipt of a signed letter from the contractor’s RPP Administrator stating that the contractor(s) is enrolled in their RPP and has been medically cleared to wear a respirator within the past calendar year.

(A.1.1) At no point in time may Colgate University supply a respirator, respirator cartridges or filters, or respirator replacement parts to a contractor.

(A.1.2) It is the contractor’s responsibility to adhere to his or her own company’s RPP policies at all times.

(A.2) This plan also applies to any Colgate University student that is required to wear a respirator while working as a University employee, whether during the course of a work study job, casual wage position, or any other instance in which he or she is employed by the University.

(B) Examples of conditions requiring a respirator can include, but are not limited to:

1. Any atmosphere determined to have "harmful dusts, fogs, fumes, mists, gases, smokes, sprays, [and] vapors" at a level that EHS has determined to be unsafe for unprotected entry, based on OSHA and National Institute of Occupational Safety and Health (NIOSH) standards.*
2. An atmosphere with unknown hazards – an atmosphere that has not yet been tested and/or evaluated.**
3. Immediately dangerous to life and health (IDLH) atmospheres – an atmosphere that poses an immediate threat to life, would cause irreversible health effects, or impair an individual’s ability to escape from a dangerous atmosphere.**
4. Oxygen deficient atmospheres – an atmosphere with an oxygen content below 19.5% by volume.**

* Colgate University employees may perform this work with proper oversight and approval from EHS.

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**Colgate University employees may not perform any work in unknown, IDLH, or oxygen deficient atmospheres, or in atmospheres where the required assigned protection factor (APF) exceeds the capabilities of the issued respirator (see Appendix A 29 CFR 1910.134 Table I).

(C) Colgate University does not advocate or allow the volunteer use of tight-fitting facepiece respirators on campus. OSHA defines a tight-fitting facepiece as “a respiratory inlet covering that forms a complete seal with the face.” (29 CFR 1020.134(b)). All tight-fitting facepiece respirator use must be evaluated, approved, and documented by EHS. Employees with atmospheric environmental concerns should contact EHS so that a proper evaluation can be conducted.

(C.1) Colgate University does allow a filtering facepiece (dust mask) to be worn voluntarily, provided that the employee uses the dust mask in accordance with the stipulations listed in 29 CFR 1910.134 Appendix D and signs a Colgate University Respirator Voluntary Use Form (see Appendix K) prior to use. Signed respirator voluntary use forms will be kept on file at EHS.

(C.1.1) OSHA defines a filtering facepiece as “a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium” (29 CFR 1910.134(b)).

Program Administrator (29 CFR 1910.134(c))

(A) In accordance with 29 CFR 1910.134(c)(3), Colgate University has designated the following individual to serve as the RPP Administrator:

Daniel B. Gough  
Director of Environmental Health and Safety  
13 Oak Drive  
Hamilton, New York  13346

Phone:  (Work)  315-228-7994  
         (Cell)  315-825-8550  
E-mail:  dgough@colgate.edu

Program Evaluation (29 CFR 1910.134 (l))

(A) EHS shall conduct an annual review of the RPP. This review should encompass all aspects of the plan, including but not limited to:

- An inspection of all the university issued respirators on campus  
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- An inspection of the respirator storage locker and storage conditions
- An inventory of replacement parts, to include re-stocking supplies that are low
- A review of all training records for currently trained personnel
- A review of individual departments (EHS, Facilities, Art, etc) to ensure RPP enrollment compliance
- A survey of RPP enrolled personnel to ensure adequate employee understanding of primary program components including proper respirator fit, selection, use, and maintenance.
- A review of the written plan, making changes and amendments as necessary

(B) Annual reviews shall be documented in Appendix K (RPP Amendments) for tracking purposes, even if no changes are made to the written plan.

(C) Additionally, EHS shall conduct an immediate after action review and analysis any time that an injury or accident occurs while the affected individual was wearing a respirator, or was in a situation where respirator use may have been warranted but was not employed.

Recordkeeping (29 CFR 1910.134(m))

(A) EHS shall retain all respirator use medical evaluation documents in a locked cabinet in the department office. In accordance with the Health Insurance Portability and Accountability Insurance Act (HIPAA) and OSHA 29 CFR 1910.1020, all medical evaluation information shall be kept private and made available to employees upon request.

(B) Fit testing records shall be maintained in the EHS office. Records shall include the following information (See Appendix E for a sample form):

- Employee name and ID number
- Type of fit test (QNFT / QLFT)
- Specific respirator make / model / style / size
- Date test was administered
- Pass / Fail (QLFT) or fit factor / strip chart recording (QNFT)

(C) Voluntary Use forms shall be maintained at the EHS Office in the same binder as the fit testing records.

(D) Respirator use and maintenance training records shall be tracked online via the University's automated training management system (Traincaster), as well as via a paper hardcopy kept in the EHS office.

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(E) Copies of the monthly respirator inspection and cleaning forms shall be kept at the EHS office, as well as at the storage locker.

(F) A written copy of the RPP shall be maintained in the EHS office and also online via the EHS webpages. These materials will be available to all Colgate University employees and local, state, and federal officials upon request.
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RESPIRATOR USE REQUIREMENTS

Medical Evaluation (29 CFR 1910.134(e))

(A) Each employee must pass a medical evaluation to determine his or her ability to wear a respirator prior to engaging in work tasks requiring a respirator.

(B) The medical evaluation shall be conducted confidentially and during the employee’s normal work hours, or at such a time as is convenient for the employee, at a location that is convenient for the employee.

(C) All medical evaluations shall be administered and/or reviewed by a medical examiner that is a physician or other licensed health care professional (PLHCP).

(D) EHS shall (1) provide an online version of the 29 CFR 1910.134 Appendix C questionnaire for the employee to fill out and (2) ensure that the employee understands the contents of the associated online medical evaluation questionnaire. The employee’s supervisor shall ensure the employee has adequate time to complete the questionnaire and is given an opportunity to discuss any medical evaluation questions and/or medical examination results with the PLHCP.

(E) EHS shall provide the Colgate University respirator profiles and supplemental information to the PLHCP prior to the PLHCP making recommendations regarding respiratory clearance (see Appendix H). The respirator profiles and supplemental information provided to the PLHCP shall be specific to Colgate University and include the following:

- The type and weight of the respirator(s) to be used by the employee
- Duration and frequency of respirator use
- Expected physical work effort while wearing the respirator
- Any additional PPE that will be worn simultaneously
- Any possible temperature / humidity extremes that may be encountered

(E.1) This information shall be provided in either hardcopy or via a password protected online account. Furthermore, this information will be updated whenever changes in information are applicable.

(E.2) Colgate University shall also provide a copy of the RPP and 29 CFR 1910.134 (see Appendix A-0) to the PLHCP.

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(F) Colgate University shall receive written approval from the PLHCP stating that the employee is cleared to wear a respirator while on duty. This written approval shall not divulge confidential employee information. Rather, it will simply list any limitations on usage, whether or not there is a need for a follow-up exam, and a signed statement stating that the PLHCP provided this recommendation to Colgate University.

(G) Aside from the annual exam, additional evaluations may be required under these circumstances or as required by EHS:

- If the employee reports signs or symptoms affecting is or her ability to use the respirator
- If the PLHCP, employee supervisor, or RPP Administrator requires it
- If the RPP requires it
- If there is a change in the workplace conditions affecting the RPP and/or respiratory usage.

(H) Colgate University has chosen to use the following medical group for conducting medical evaluations as required by 29 CFR 1910.134(f):

3M Respiratory Protection Evaluation Program
Password Protected Website Address: https://www.respexam.com/cologin.asp

(I) Colgate University has chosen to use the following medical group for conducting medical examinations when required by 29 CFR 1910.134(f):

Bassett Healthcare Network
1 Atwell Road
Cooperstown, New York 13326
Phone: (800) 227-7388

(J) All requests for additional medical evaluation information and medical examination appointments will be coordinated by the RPP Administrator or designated EHS staff. Personnel who need respiratory protection related medical evaluations and/or medical examinations should not arrange their own appointments.

*Fit Testing Procedures (29 CFR 1910.134(f))*

(A) In accordance with OSHA’s fit test procedures as laid out in 29 CFR 1910.134(f), Colgate University requires each employee in the respiratory protection program to have a fit test prior to using a respirator.

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(B) The fit test must be performed using the same size, make, and model respirator that the employee will be donning for use.

(C) The employee must undergo re-testing on an annual basis and anytime that one or more of these criteria are met:

- Whenever a different facepiece is used
- Whenever there is a change in the employee's physical condition (noticeable weight gain/loss, facial scarring, change in dental structure, cosmetic surgery, etc)
- Whenever the employee requests a re-test because he or she feels that the fit is unacceptable

(D) If upon successfully passing a fit test the employee does not feel that the fit is appropriate, he or she will be able to select a new facepiece and re-test.

(E) Colgate University issues negative pressure half-face and full-face air purifying respirators (APRs) for employee use, and as such, Colgate University utilizes the qualitative fit test (QLFT) to test for proper fit. Note: QLFT may only be used to fit test negative pressure APRs that must achieve a fit factor of \( \leq 100 \).

(F) Colgate University uses irritant smoke (stannic chloride) QLFT protocol. The irritant smoke MSDS can be found in Appendix I. Smoke tube disposal procedures are outlined in Appendix J.

(G) Fit tests are conducted in accordance with the testing procedures laid out in Appendix A of the OSHA Respiratory Protection Standard (see Appendix A).

(H) Fit testing shall be administered by the RPP Administrator or qualified personnel appointed in writing by the RPP Administrator.

(I) Fit testing records are maintained in the EHS Office as per requirements in 29 CFR 1910.134(m). (Note: See RPP Page 6 Recordkeeping). Records are documented on the Colgate University Respiratory Protection Program Fit Testing Form (see Appendix G).
Respirator Selection (29 CFR 1910.134(d))

(A) Colgate University issues 3M 6000 and 7000 series half-face and full-face respirators to employees. These respirators are NIOSH approved (see Appendix L).

(B) Colgate University issues 3M cartridges appropriate for the contaminant in conjunction with the respirators (See RPP Page 12 Filter Cartridge and Canister Identification).

(C) Colgate University employees may not perform any routine work in unknown, IDLH, or oxygen deficient atmospheres, or atmospheres where the required assigned protection factor (APF) would exceed the capabilities of the half-face or full-face respirator being worn. Atmospheres are evaluated by EHS on an individual basis using criteria including: work being performed, chemicals / hazards involved, duration of exposure, and the information available in the NIOSH 2005-100 Respirator Selection Logic (2004) (see Appendix F). Should the atmosphere in question exceed the capabilities of the engineering controls and PPE available, the work must be contracted out.

(D) Colgate University shall evaluate all potentially hazardous atmospheres to determine the Maximum Use Concentration (MUCs) of any / all hazardous chemicals present to determine if appropriate protection can be provided by available Colgate University approved respirators. EHS shall document all such atmospheric evaluations and the associated MUC calculations (see Appendix O).

(D.1) MUCs are defined in 29 CFR 1910.134(b) as being the “maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of a hazardous substance.”

(D.2) The MUC shall be calculated mathematically by multiplying the respirator’s APF (see Appendix A or 29 CFR 1910.134 Table 1) by the specific chemical’s exposure limit (EL). Examples of acceptable exposure limits include the OSHA Permissible Exposure Limit (PEL), Short Term Exposure Limit (STEL), or Ceiling Limit (C). The respirator manufacturer shall inform the user of which EL to use when calculating the MUC for their specific respirator.

(D.2.1) The half-face respirator has an APF of 10 and the full-face respirator has an APF of 50 (see Appendix A or 29 CFR 1910.134 Table 1)
(D.2.2) The 3M 6000 and 7000 series half-face and full-face respirator user manuals state that 3M has designed the OSHA PEL for use in MUC calculations. The formulas for determining the MUCs at Colgate University are the following:

Half-face Respirator  \[ \text{APF} \times \text{PEL} = \text{MUC} \Rightarrow (10) \times \text{PEL} = \text{MUC} \]

Full-face Respirator  \[ \text{APF} \times \text{PEL} = \text{MUC} \Rightarrow (50) \times \text{PEL} = \text{MUC} \]

(D.2.1.1) The OSHA PELs can be found in 29 CFR 1910.1000 Tables Z-1, Z-2, and Z-3 (see Appendix E).

(D.2.1.2) As stated in 29 CFR 1910.134(b), should no OSHA EL exist for a specific chemical, the MUC shall be determined “on the basis of relevant available information and informed professional judgment.”

(D.3) Should the measured atmospheric substance concentration exceed the MUC during the course of normal work operations, work may not be performed by Colgate University employees until engineering controls have been put in place to lower the substance concentration to acceptable levels and a thorough course of atmospheric testing has been completed.

(D.4) Should the calculated MUC exceed the IDLH limit for a substance or the performance capabilities of the PPE available, the maximum MUC shall be set to the lower limit, as per 29 CFR 1910.134(d)(3)(ii)(B)(3).

Filter, Cartridge, and Canister Identification (29 CFR 1910.134(j))

(A) For approved routine work involving organic vapors and/or particulates, Colgate University issues the 3M 60926 Multi-Gas / Organic Vapor / P100 combination cartridges. These cartridges are kept sealed in their original packaging which is clearly labeled with the cartridge type and part number, as well as the NIOSH cartridge color coding system. These are the only cartridges kept in the respirator storage locker (located in Ho Science Center Room B07).

(A.1) As stated in the cartridge users guide (see Appendix M), these cartridges provide protection against the following gases and vapors:

- OV (Organic Vapor)
- SD (Sulfur Dioxide)
- HC (Hydrogen Chloride)
- CL (Chlorine)
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- CD (Chlorine Dioxide)
- HF (Hydrogen Fluoride)
- HS esc (Hydrogen Sulfide – escape only)
- AM (Ammonia)
- MA (Methylamine)
- FM (Formaldehyde)
- P100 (Particulate Filter, 99.7% filter efficiency level, effective against all particulate aerosols)

(A.2) The following limitations apply to these cartridges (see Appendix M):

- Not for use in atmospheres containing less than 19.5% oxygen (i.e. oxygen deficient atmospheres)
- Not for use in atmospheres IDLH
- Do not exceed MUCs established by regulatory standards
- Follow established cartridge and canister change schedules or observe End of Service Life Indicator (ESLI) to ensure that cartridges and canisters are replaced before breakthrough occurs
- Failure to properly use and maintain this product could result in injury or death.
- The OSHA regulations require gas-proof goggles to be worn with this respirator when used against formaldehyde
- Follow the manufacturer’s user instructions for changing cartridges, canisters, and/or filters
- All approved respirators shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration (MHSA), OSHA, and other applicable regulations
- Never substitute, modify, add, or omit parts. Use only exact replacement parts in the configuration as specified by the manufacturer
- Refer to user instructions and/or maintenance manuals for information on use and maintenance of these respirators

(A.3) Multi-Gas / Organic Vapor / P100 combination cartridges are not equipped with an ESLI and, therefore, shall be changed out on a schedule appropriate to their use. EHS shall evaluate each situation individually to determine the appropriate change schedule. EHS shall conspicuously post the change schedule requirements for each situation at the respirator storage location for those cartridges. EHS shall detail all change schedule requirements in Appendix O of the RPP. EHS shall evaluate the cartridges during the monthly respirator inspections and to ensure that the change schedule is being properly followed. Spent cartridges shall be discarded immediately to prevent accidental re-use.

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(A.4) Multi-Gas / Organic Vapor / P100 combination cartridges shall be stored in the respirator storage locker or other approved storage location when not in use. Cartridges that are able to be re-used (in accordance with their change schedule and continued ability to function properly) shall be stored so that no contaminants may filter in or out of the cartridge while in storage. Storage requirements shall be one piece of duct tape completely covering the front cartridge grate, one piece of duct tape completely covering the rear cartridge attachment port, and all taped cartridges stored in a sealed Ziploc bag.

(B) For approved routine work involving the use of mercury or chlorine, Colgate University issues the 3M 60929 Mercury Vapor / Chlorine / P100 combination cartridges. These cartridges will not be stored in the respirator storage locker to prevent accidental use by unauthorized users in situations calling for a Multi-Gas / Organic Vapor / P100 combination cartridge.

(B.1) As stated in the cartridge users guide (see Appendix M), these cartridges provide protection against the following gases and vapors:

- Mercury Vapor
- Chlorine
- P100 (Particulate Filter, 99.7% filter efficiency level, effective against all particulate aerosols)

(B.2) The following limitations apply to these cartridges (see Appendix M):

- Not for use in atmospheres containing less than 19.5% oxygen (i.e. oxygen deficient atmospheres)
- Not for use in atmospheres IDLH
- Do not exceed MUCs established by regulatory standards
- Follow established cartridge and canister change schedules or observe End of Service Life Indicator (ESLI) to ensure that cartridges and canisters are replaced before breakthrough occurs
- Failure to properly use and maintain this product could result in injury or death.
- The OSHA regulations require gas-proof goggles to be worn with this respirator when used against formaldehyde
- Follow the manufacturer’s user instructions for changing cartridges, canisters, and/or filters
- All approved respirators shall be selected, fitted, used, and maintained in accordance with MHSA, OSHA, and other applicable regulations
- Never substitute, modify, add, or omit respirator parts and only use manufacturer approved replacement parts

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- Refer to user instructions and/or maintenance manuals for information on use and maintenance of these respirators

(B.3) Approval for Mercury Vapor / Chlorine / P100 combination cartridge use in routine work does not imply the approval for use of these cartridges in a spill or emergency situation involving mercury. All mercury spills and emergencies must be handled as Level II or Level III Emergency Responses in accordance with the Colgate University Contingency Plan.

(B.4) Mercury Vapor / Chlorine / P100 combination cartridges are equipped with a passive ESLI indicator. When using the cartridge, the ESLI shall remain visible. Users shall not use the cartridge without being able to see the ESLI. Users shall immediately vacate the respirator use area should the ESLI indicate that the cartridge is no longer effective. Spent cartridges shall immediately be discarded to prevent accidental re-use. Per the manufacturer’s user guide, cartridges must be discarded when any of the following conditions exist:

- When the ESLI changes to the discard color found on the mercury vapor cartridge label
- Within 30 days of opening packaging
- When the ESLI becomes dirty or damaged
- When odors of vapors or gases become noticeable (Note: mercury vapor has no odor)

(B.4.1) In accordance with the manufacturer’s specification that all cartridges be discarded within 30 days of opening the packaging, EHS will discard any open cartridges found during monthly inspections.

(B.4.2) All spent Mercury Vapor / Chlorine / P100 combination cartridges are to be considered mercury contaminated materials and, therefore, must be disposed of as hazardous waste. Spent cartridges will be collected by EHS and sent out as mercury contaminated debris (UN 2809, Waste Mercury, 8, PG III (D009)).

(B.5) Mercury Vapor / Chlorine / P100 combination cartridges shall be stored in an approved personal storage location when not in use. These cartridges may not be stored in the respirator storage locker. Cartridges that are able to be re-used (in accordance with their ESLI and continued ability to function properly) shall be stored so that no contaminants may filter in or out of the cartridge while in storage. Storage requirements shall be one piece of duct tape completely covering the front cartridge grate, one piece of duct tape completely covering the rear cartridge attachment port, and all taped cartridges stored in a sealed Ziploc bag.
Training (29 CFR 1910.134(k))

(A) Initial training of employees on proper respirator use and maintenance shall occur at the time of the initial fit testing, after the employee has been medically cleared to wear a respirator and prior to the employee performing any work in which a respirator is required.

(B) Thereafter, training shall be conducted at least annually and more often as required (Ex. changes in the workplace, changes in respirator type, employee’s misuse or lack of respirator use indicates the necessity for training, etc).

(C) Training shall be conducted by the RPP Administrator or qualified personnel appointed in writing by the RPP Administrator.

(D) Training shall be tracked online via the Colgate University automated training management system (Traincaster), as well as via a paper hardcopy kept in the EHS office.

(E) Upon completion of the training, the employee must be able to demonstrate a working knowledge of these topics:

- Why the respirator is necessary
- How the improper fit, use, and maintenance of a respirator can render it ineffective
- The limitation and capabilities of the specific respirator and cartridges being issued
- How to use the respirator effectively in an emergency or malfunction scenario
- How to inspect, don, doff, use, and perform a seal check with the respirator
- Maintenance and storage procedures
- Medical signs and symptoms that limit or prevent the effectiveness of the respirator
- The general requirements of 29 CFR 1910.134

(F) Voluntary use of filtering facepieces requires the RPP Administrator to provide the employee with the information outlined in 29 CFR 1910.134 Appendix D. This information is communicated via the Colgate University Voluntary Use Form (see Appendix D).

Use of Respirators (29 CFR 1910.134(g))

(A) Tight-fitting facepiece respirators are rendered ineffective if a seal cannot be maintained between the skin and facepiece. Employees that are required to use these respirators must adhere to the guidelines set forth below to ensure that an adequate seal can be maintained at all times.

(A.1) Facepiece Seal
• Employees shall not have facial hair in a manner that prevents contact between the skin and facepiece seal, or that interferes with the facepiece valve functions
• Eyeglasses and safety goggles shall be worn in a manner that does not prevent the respirator facepiece from forming an adequate seal with the face
• The employee shall perform a user seal check (positive and negative) each time he or she dons the respirator for use, prior to entering the respirator use area. The respirator seal checks shall be performed in accordance with the procedures in 29 CFR 1910.134 Appendix B-1 (see Appendix B-1)
• In the event that a proper seal cannot be achieved, the employee will not be allowed to enter the respirator use area

(A.2) Continuing Respirator Effectiveness

• Should the atmospheric conditions change in the respirator use area, EHS shall reevaluate the area and determine if changes need to be made to the existing PPE
• Employees shall be instructed to leave the respirator use area when:
  o They are cleaning or adjusting their respirators
  o They detect gas or vapor breakthrough, or a change in breathing resistance, or leakage of the facepiece
  o Changing filters / cartridges / canisters / respirators
• If an employee detects breakthrough, a change in resistance, or leaking, the respirator facepiece shall be replaced or repaired by EHS prior to the employee’s re-entry into the respirator use area
• Employees shall be aware of visible contamination of cartridges / filters / canisters due to particulate accumulation or direct chemical exposure, and recognize that as a sign of decreased filtering efficiency and/or vapor protection, and leave the respirator use area to obtain new equipment from the job supervisor or EHS

Maintenance (29 CFR 1910.134(h))

(A) Cleaning and Disinfecting

(A.1) Colgate University shall supply each respirator wearer with a clean and sanitary respirator that is in good working order.

(A.2) Respirators shall be cleaned and disinfected (sanitized) in accordance with the procedures set forth in 29 CFR 1910.134 Appendix B-2 (See Appendix B-2).
(A.3) It is the responsibility of the employee to maintain his or her own personal-use respirator in a clean and sanitary condition.

(A.4) It is the responsibility of the employee last using a shared-use respirator to clean and sanitize it prior to its storage and/or use by another employee. It is the responsibility of each employee to inspect shared-use respirators prior to use for cleanliness, sanitation, and function.

(A.5) It is the responsibility of the EHS Department and the RRP Administrator to clean and sanitize emergency-use and fit-testing respirators after each use, and also as part of the monthly inspection process.

(B) Storage

(B.1) EHS shall maintain a respirator storage locker. This storage locker shall house shared-use, emergency-use, and fit-testing respirators as well as the Multi-Gas / Organic Vapor / P100 combination cartridges. Respirators will be segregated by use type and clearly marked with signage. Employees may store personal-use respirators in a separate, designated section of the EHS respirator storage locker provided that they are well-marked and well-maintained by the individual.

(B.2) This storage locker shall protect the respirators from damage, contamination, dust, sunlight, temperature extremes, excessive moisture, and chemicals. The respirators shall be stored in a manner to prevent deformation of the facepiece and exhalation valves.

(B.3) If an employee elects not to store a personal-use respirator in the storage locker, he or she shall store the respirator in a manner which follows the requirements listed in (B.2) above. Examples of alternate storage may include a separate respirator storage locker adjacent to the respirator use area or a dedicated tool box used exclusively for respirator storage.

(C) Inspection

(C.1) During initial and periodic training, the RPP Administrator or his/her designee shall communicate the importance of pre- and post-use respirator inspections.

(C.2) EHS shall perform monthly inspections and cleanings of personal-use, shared-use, emergency-use, and fit-testing respirators. The inspections and cleanings shall be performed in accordance
with and documented on the Respirator Inspection Form (see Appendix N). Copies of the monthly inspections will be maintained in the EHS Office and also at the respirator storage locker.

(D) Repairs

(D.1) EHS shall remove from service, immediately upon discovery, any respirator found to be defective.

(D.2) Employees are responsible to notify EHS of any defective respirators found during the course of inspection or use.

(D.3) Repairs shall only be made by appropriately trained personnel and replacements parts must be NIOSH approved. Repairs will be in accordance with manufacturer’s recommendations and specifications. In the event that a respirator cannot be repaired, it shall be discarded immediately to prevent confusion over status and potential accidental use.

(D.4) EHS shall purchase and keep on hand a selection of replacement parts for all stocked respirator models.
Rescue Operations Requiring Respiratory Protection

Procedures for IDLH Atmospheres (29 CFR 1910.134(g)(3))

(A) Colgate University employees may only enter an IDLH atmosphere in an actual emergency rescue situation or to conduct repairs that present an immediate danger to the university community.

(B) Entry into an IDLH atmosphere at Colgate University for emergency rescue or to conduct repairs that present an immediate danger to the university community is not permitted unless all of the following requirements are met:

- One employee, or more than one employee when required by OSHA 29 CFR 1910.134, is located outside the IDLH atmosphere.
- Visual, voice, and/or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
- The employee(s) outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue.
- The employee(s) outside the IDLH atmosphere are equipped with fully charged pressure demand SCBAs and appropriate retrieval equipment (including, but not limited to, a tripod and tripod winch) where retrieval equipment would contribute to the rescue of the employees and not increase the overall risk resulting from entry.

Rescue and Emergency Services (29 CFR 1910.146(k))

(A) OSHA 29 CFR 1910.134(g)(3) requires that employers provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres. To meet this requirement, Colgate University has developed an IDLH Atmospheres Rescue and Emergency Services Team (REST). Members of the REST are trained in IDLH atmosphere rescue operations as well as use of a self contained breathing apparatus (SCBAs). Colgate employees are not permitted to perform IDLH atmosphere rescue operations unless the following conditions have been met:

- The employee is also an authorized confined space entrant.
- The employee has been properly trained in the use of a SCBA.
- The employee has demonstrated proficiency in the use of a SCBA during a simulated rescue operation within the previous 12 months.

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- The employee is trained in basic first aid, cardiopulmonary resuscitation (CPR), and use of an automated external defibrillator (AED)
- The employee is designated in writing by the RPP Administrator as a member of the REST.

(B) The Colgate University Department of Campus Safety must be notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.

(B.1.1) Upon receiving notice prior to REST rescue operations, the Colgate University Department of Campus Safety will immediately notify 911 dispatch and the Hamilton Fire Department (HFD) for emergency assistance.

(C) Entry into an IDLH atmosphere at Colgate University for emergency rescue or to conduct repairs that present an immediate danger to the university community is not permitted unless at least two members of the REST are present at the scene.

(D) Entry into an IDLH atmosphere at Colgate University for emergency rescue or to conduct repairs that present an immediate danger to the university community is not permitted unless at least two operable and fully charged SCBAs are present at the scene.

(D.1) Colgate University employees may only use a SCBA during simulated rescue operations/training events, actual rescue operations, and to conduct repairs that present an immediate danger to the university community.

(D.2) Colgate University employees may only use a SCBA if the following conditions have been met:
- The employee is also an authorized confined space entrant.
- The employee has been properly trained in the use of a SCBA.
- The employee has demonstrated proficiency in the use of a SCBA during a simulated rescue operation within the previous 12 months.
- The employee is trained in basic first aid, cardiopulmonary resuscitation (CPR), and use of an automated external defibrillator (AED).
- The employee is designated in writing by the RPP Administrator as a member of the REST.

(D.3) Colgate University maintains Scott ACSI SCBAs with 4500 psi 45 min carbon bottle cylinders for use by REST members. SCBAs are kept in Ho Science Center Room 133 and the Facilities building conference room.
(D.4) Colgate University SCBAs are inspected, cleaned, maintained, and repaired and/or replaced as necessary by EHS. SCBA inspections and cleaning are conducted monthly and after every use. Copies of the monthly SCBA inspection and cleaning forms shall be kept at the EHS office.

(D.5) SCBA use and maintenance training records shall be tracked online via the University's automated training management system (Traincaster), as well as via a paper hardcopy kept in the EHS office.
Appendix A
Permissible practice.

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering controls measures (for example, 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, appropriate respirators shall be used pursuant to this section.

A respirator shall be provided to each employee when such equipment is necessary to protect the health of such employees. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program, which shall include the requirements outlined in paragraph (c) of this section. The program shall cover each employee required by this section to use a respirator.

Definitions. The following definitions are important terms used in the respiratory protection standard in this section.

- 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.

- Assigned protection factor (APF) means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

- 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.

- 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.

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

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

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

- End-of-service-life indicator (ESLI) means a system that warns the respirator user of the end of service life of the air-purifying elements, for example, that the sorbent is approaching saturation or is no longer effective.

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

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

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

- Fit 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.
Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QFT and Quantitative fit test QNFT.)

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

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in removing monodispersed particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N 100, R 100, and P 100 filters.

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

Immediately dangerous to life or health (IDLH) 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 from a dangerous atmosphere.

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)

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

Maximum use concentration (MUC) means the maximum allowable concentration of a hazardous substance from which an employee could be expected to be protected when wearing a respirator, and is determined by assigning a protection factor for the respirator class of respirator and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, the employer must determine an MUC on the basis of relevant available information and informed professional judgment.

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

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

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

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

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

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

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

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

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the worker's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

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

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

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.

This section means this respiratory protection standard.

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

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

Respiratory protection program. This paragraph requires the employer to develop and implement a written respiratory protection program with required workplace-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary or voluntary compliance with the program administrator's selection of a program administrator and a sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide will be available on or about April 8, 1998 from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC 20210 (202-219-4667).

In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with workplace-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions of this section, as applicable:
Procedures for selecting respirators for use in the workplace;

Medical evaluations of employees required to use respirators;

Fit testing procedures for tight-fitting respirators;

Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

Procedures for regularly evaluating the effectiveness of the program.

Where respirator use is not required:

An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators Where Not Required Under the Standard"); and

In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Expiration: Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

Selection of respirators. This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air purifying respirators.
The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

1910.134(b)(1)(iii)

The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

1910.134(b)(1)(iv)

The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

1910.134(b)(1)(v)

The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

1910.134(c)

Respirators for IDLH atmospheres.

1910.134(c)(1)

The employer shall provide the following respirators for employee use in IDLH atmospheres:

1910.134(c)(1)(i)

A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

1910.134(c)(1)(ii)

A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

1910.134(c)(1)(iii)

Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

1910.134(c)(ii)

All oxygen-deficient atmospheres shall be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the range specified in Table II of this section (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

1910.134(d)

Respirators for atmospheres that are not IDLH.

1910.134(d)(1)

The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

1910.134(d)(3)

Assigned Protection Factors (APFs) Employers must use the assigned protection factors listed in Table I to select a respirator that meets or exceeds the required level of employee protection. When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers must ensure that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.

<table>
<thead>
<tr>
<th>Type of respirator 1, 2</th>
<th>Quarter mask</th>
<th>Half mask</th>
<th>Full facepiece</th>
<th>Helmet/ hood</th>
<th>Loose-fitting facepiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Air-Purifying Respirator</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>2. Powered Air-Purifying Respirator (PAPR)</td>
<td></td>
<td></td>
<td>1,000</td>
<td></td>
<td>25/1,000</td>
</tr>
<tr>
<td>3. Supplied-Air Respirator (SAR) or Airlift Respirator</td>
<td></td>
<td></td>
<td>50</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>• Demand mode</td>
<td></td>
<td></td>
<td>50</td>
<td></td>
<td>25/1,000</td>
</tr>
<tr>
<td>• Continuous flow mode</td>
<td></td>
<td></td>
<td>1,000</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode</td>
<td></td>
<td></td>
<td>1,000</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>4. Self-Contained Breathing Apparatus (SCBA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Demand mode</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)</td>
<td></td>
<td></td>
<td>10,000</td>
<td></td>
<td>10,000</td>
</tr>
</tbody>
</table>

Notes:
1 Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
2 The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respiratory protection program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.
3 This APF category includes filtering facemasks, and half masks with elastomeric facepieces.
4 The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.
5 These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910.124 (d)(1), employers must refer to the appropriate substance-specific standard in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(G).

Maximum Use Concentration (MUC)

1910.134(d)(1)

The employer must select a respirator for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the MUC.

1910.134(d)(2)

Employers must not apply MUCs to conditions that are immediately dangerous to life or health (IDLH); instead, they must use respirators listed for IDLH conditions in paragraph (d)(2) of this standard.

1910.134(d)(3)

When the calculated MUC exceeds the IDLH level for a hazardous substance, or the performance limits of the cartridge or canister, then employers must use the maximum MUC at that lower limit.

1910.134(d)(4)

The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

1910.134(d)(5)

For protection against gases and vapors, the employer shall provide:

1910.134(d)(5)(1)

An atmosphere-supplying respirator, or

1910.134(d)(5)(2)

An air-purifying respirator, provided that:

1910.134(d)(5)(2)(A)

The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

1910.134(d)(5)(2)(B)

If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for cartridges and canisters that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe the respirator program in the information on and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

1910.134(d)(6)

For protection against particulates, the employer shall provide:

1910.134(d)(6)(1)

An atmosphere-supplying respirator; or

1910.134(d)(6)(2)

An air-purifying respirator equipped with a filter certified by NIOSH under 29 CFR part 89 as a high-efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 29 CFR part 84; or

1910.134(d)(6)(3)

For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

Table 1. Assigned Protection Factors

|Chemical Class| Assigned Protection Factor
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

TABLE II

<table>
<thead>
<tr>
<th>Altitude (ft.)</th>
<th>Oxygen deficient Atmospheres (% O2) for which the employer atmosphere may rely on supplying respirators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3,000</td>
<td>16.0-19.5</td>
</tr>
<tr>
<td>3,001-4,000</td>
<td>16.4-19.3</td>
</tr>
<tr>
<td>4,001-5,000</td>
<td>17.1-19.5</td>
</tr>
<tr>
<td>5,001-6,000</td>
<td>17.8-19.5</td>
</tr>
<tr>
<td>6,001-7,000</td>
<td>16.5-19.5</td>
</tr>
<tr>
<td>7,001-8,000</td>
<td>19.3-19.5</td>
</tr>
</tbody>
</table>

*Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

**Respiratory Protection. - 1910.134**

**Medical evaluation.** Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

1910.134(e)(1)

**General.** The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is first required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

1910.134(e)(2)

**Medical evaluation procedures.**

1910.134(e)(2)(i)

The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

1910.134(e)(2)(ii)

The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of this section.

1910.134(e)(2)(iii)

**Follow-up medical examination.**

1910.134(e)(2)(iii)(i)

The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

1910.134(e)(2)(iii)(ii)

The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

1910.134(e)(2)(iv)

**Administration of the medical questionnaire and examinations.**

1910.134(e)(2)(iv)(i)

The medical questionnaire and examinations shall be administered confidentially during the employee's normal hours of work time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

1910.134(e)(2)(iv)(ii)

The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.
Supplemental information for the PLHCP.

1910.134(e)(3)(i)

The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

1910.134(e)(3)(i)(A)

(A) The type and weight of the respirator to be used by the employee;

1910.134(e)(3)(i)(B)

The duration and frequency of respirator use (including use for rescue and escape);

1910.134(e)(3)(i)(C)

The expected physical work effort;

1910.134(e)(3)(i)(D)

Additional protective clothing and equipment to be worn; and

1910.134(e)(3)(i)(E)

Temperature and humidity extremes that may be encountered.

1910.134(e)(3)(i)(ii)

Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

1910.134(e)(3)(i)(iii)

The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Paragraph (e)(3)(i)(ii): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the new PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

1910.134(e)(5)

Medical determination. In determining the employee's ability to use a respirator, the employer shall:

1910.134(e)(5)(i)

Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

1910.134(e)(5)(ii)(A)

Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

1910.134(e)(5)(ii)(B)

The need, if any, for follow-up medical evaluations; and

1910.134(e)(5)(ii)(C)

A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

1910.134(e)(5)(ii)(D)

If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

1910.134(e)(5)(ii)(E)

Additional medical evaluations. At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

1910.134(e)(5)(ii)(F)

An employee reports medical signs or symptoms that are related to ability to use a respirator;
A PLHCW, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluations;

A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

**Fit testing.** This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator whenever a different respirator facepiece (size, style, model or make) is used, or at least annually thereafter.

The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCW, supervisor, or program administrator, makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, osseous surgery, or an obvious change in body weight.

If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCW that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A of this section.

**QLFT** may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less.

If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

Qualitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-
approved configuration, before that facepiece can be used in the workplace.

1910.134(a)

**Use of respirators.** This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

1910.134(a)(1)

**Facepiece seal protection.**

1910.134(a)(1)(i)

The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

1910.134(a)(1)(i)(A)

Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

1910.134(a)(1)(i)(B)

Any condition that interferes with the face-to-facepiece seal or valve function.

1910.134(a)(1)(ii)

If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

1910.134(a)(1)(iii)

For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.

1910.129(a)(3)

**Continuing respirator effectiveness.**

1910.134(a)(2)(iii)

Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. Where there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

1910.134(a)(3)(i)

The employer shall ensure that employees leave the respirator use area:

1910.134(a)(3)(ii)(A)

To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

1910.134(a)(3)(ii)(B)

If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

1910.134(a)(3)(ii)(C)

To replace the respirator or the filter, cartridge, or canister elements.

1910.134(a)(3)(iii)

If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

1910.134(a)(3)(i)

**Procedures for IDLH atmospheres.** For all IDLH atmospheres, the employer shall ensure that:

1910.134(a)(3)(i)

One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

1910.134(a)(3)(ii)

Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
The employer(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue.

The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.

The employer or designee authorized to do so, by the employer, once notified, provides necessary assistance appropriate to the situation.

Employee(s) located outside the IDLH atmospheres are equipped with:

Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either

Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

Equivalent means for rescue where retrieval equipment is not required under paragraph (g)(3)(v)(B).

Procedures for interior structural firefighting. In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

At least two employees are located outside the IDLH atmosphere, and

All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

Maintenance and care of respirators. This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

Cleaning and disinfecting. The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of this section, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

Respirators maintained for emergency use shall be cleaned and disinfected after each use.
Respirators used in fit testing and training shall be cleaned and disinfected after each use.

Storage. The employer shall ensure that respirators are stored as follows:

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 facepiece and exhalation valve.

In addition to the requirements of paragraph (b)(2)(i) of this section, emergency respirators shall be:

Kept accessible to the work area;

Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

Stored in accordance with any applicable manufacturer instructions.

Inspection.

The employer shall ensure that respirators are inspected as follows:

All respirators used in routine situations shall be inspected before each use and during cleaning;

All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer’s recommendations, and shall be checked for proper function before and after each use; and

Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

The employer shall ensure that respirator inspections include the following:

A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and

A check of elastomeric parts for pliability and signs of deterioration.

In addition to the requirements of paragraphs (b)(3)(i) and (i) of this section, self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer’s recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

For respirators maintained for emergency use, the employer shall:

Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected.
respirator; and

Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

Reparis. The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer’s NIOSH-approved parts designed for the respirator.

Repairs shall be made according to the manufacturer’s recommendations and specifications for the type and extent of repairs to be performed; and

Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

Breathing air quality and use. This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accord with the following specifications:

Compressed and liquid oxygen shall meet the United States Pharmacopeia requirements for medical or breathing oxygen; and

Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

Oxygen content (v/v) of 19.5-23.5%;

Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

Carbon monoxide (CO) content of 10 ppm or less;

Carbon dioxide content of 1,000 ppm or less; and

Lack of noticeable odor.

The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 180);

Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

The moisture content in the cylinder does not exceed a dew point of -50 deg. F (-56.6 deg. C) at 1 atmosphere pressure.

The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

Prevent entry of contaminated air into the air-supply system;

Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg. C) below the ambient temperature;

Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

The employer shall ensure that breathing air couplings are incompatible with outlets for non-pressurized workplace air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

The employer shall use only the respirator manufacturer's NIOSH-approved breathing gas containers, marked and maintained in accordance with the Quality Assurance provisions of the NIOSH approval for the SODA as issued in accordance with the NIOSH respirator-certification standard at 42 CFR part 84.

Identification of filters, cartridges, and canisters. The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color-coded with the NIOSH approval label and that the label is not removed and remains legible.

Training and Information. This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

The employer shall ensure that each employee can demonstrate knowledge of at least the following:

Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;
What the limitations and capabilities of the respirator are;

How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

How to inspect, put on and remove, use, and check the seals of the respirator;

What the procedures are for maintenance and storage of the respirator;

How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

The general requirements of this section.

The training shall be conducted in a manner that is understandable to the employee.

The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

An employer who is able to demonstrate that a new employee has received training within the last 12 months that addresses the elements specified in paragraph (k)(1)(i) through (vii) is not required to repeat such training provided that, as required by paragraph (k)(1), the employee can demonstrate knowledge of those elements. Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

Retraining shall be administered annually, and when the following situations occur:

Changes in the workplace or the type of respirator render previous training obsolete;

Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill;

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

The basic advisory information on respirators, as presented in Appendix D of this section, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

Program evaluation. This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:
Respirator fit (including the ability to use the respirator without interfering with effective workplace performance); 

Appropriate respirator selection for the hazard(s) to which the employee is exposed; 

Proper respirator use under the workplace conditions the employee encounters; and 

Proper respirator maintenance. 

Recordkeeping. This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA. 

Medical evaluation. Records of medical evaluations required by this section must be retained and made available in accordance with 29 CFR 1910.1020. 

Fit testing. 

The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including: 

The name or identification of the employee tested; 

Type of fit test performed; 

Specific make, model, style, and size of respirator tested; 

Date of test; and 

The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs. 

Fit test records shall be retained for respirator users until the next fit test is administered. 

A written copy of the current respirator program shall be retained by the employer. 

Written materials required to be retained under this paragraph shall be made available upon request to affected employees and to the Assistant Secretary or designee for examination and copying. 

Effective date. Paragraphs (c)(3)(vii)(A) and (c)(3)(vii)(B) of this section become effective November 22, 2006. 

Appendices. Compliance with Appendix A, Appendix B-1, Appendix B-2, Appendix C, and Appendix D to this section are mandatory. 

(63 FR 1152, Jan. 8, 1998; 63 FR 20090, April 23, 1998; 71 FR 16672, April 3, 2006; 71 FR 50167, August 24, 2006; 73 FR 75564, Dec. 12, 2008; 76 FR 33666, June 8, 2011)
Appendix B
### Regulations (Standards - 29 CFR) - Table of Contents

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** I
- **Subpart Title:** Personal Protective Equipment
- **Standard Number:** 1910.134 App A
- **Title:** Fit Testing Procedures (Mandatory);

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 QFT and QNT.

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

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

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

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

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

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

   (a) Position of the mask on the nose
   (b) Room for eye protection
   (c) Room to talk
   (d) Position of mask on face and cheeks

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

   (a) Chin properly placed;
   (b) Adequate strap tension, not overly tightened;
   (c) Fit across nose or lips;
   (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 facepiece shall be selected and repeated if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cover 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 for medical evaluation.

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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 exercise 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) Employers must perform the following test exercises for all fit testing methods prescribed in this appendix, except for the CNP quantitative fit testing protocol and the CNP REDON quantitative fit testing protocol. For these two protocols, employers must ensure that the test subjects (i.e., employees) perform the exercise procedure specified in Part I.C.4(b) of this appendix for the CNP quantitative fit testing protocol, or the exercise procedure described in Part I.C.6(b) of this appendix for the CNP REDON quantitative fit testing protocol. For the remaining fit testing methods, employers must ensure that employees perform the test exercises in the appropriate test environment in the following manner:

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

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

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

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These are 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 becomes 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 (QFT) Protocols

1. General

(a) The employer shall ensure that persons administering QFT 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 QFT 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 as isopropyl 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 1% 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) Isocyanate Aærohal 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 fit test 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 test 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 test 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 air or ampule may be substituted for the IAA wet paper towel provided it has been demonstrated that the atmosphere of 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 ex 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 is seen 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 build-up 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 100% front vision clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the ME 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 DeVilbis Model 40 Inhalation 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)(6) 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 can be 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 the 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 fifteen 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 DeVilbis Model 40 Inhalation 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 0.83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through his/her 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 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™ (Dextanum benzoate) Solution Aerosol Qualitative Fit Test Protocol

The Bitrex™ (Dextanum benzoate) aerosol QFT 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 Academy of Pediatrics, 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 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 (35.5 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 25 combined, is adequate.

(2) The test enclosures shall have a 3/4 inch (1.9 cm) hole in the 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 set of squirts 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 first set of squirts, the screening test is completed. The taste threshold is noted as ten regardless of the number of squirts actually completed.

(8) If the first response is negative, ten more squirts 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 set of squirts, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squirts actually completed.

(9) If the second response is negative, ten more squirts 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 squirts, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squirts actually completed.

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

(11) If the Bitrex has not tasted after 30 squirts (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 at least 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) 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 (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 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 end enclosure using the same number of squirts (either 10, 20 or 30 squirts) based on the number of squirts 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 Briskex is detected. If the test subject does not report tasting the Briskex, the test is passed.

(11) If the taste of Briskex 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 and evacuator. 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 facepiece area of the test subject, using the low flow pump or the evacuator. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the entire 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 eyes closed.

(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 (QMT) 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 on (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 facemask to quantify the respirator fit.

1. General

(a) The employer shall ensure that persons administering QNT testing are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is properly maintained.

(b) The employer shall ensure that QNT equipment is kept clean, 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-2ethylhexyl 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 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 test factors of at least 2,000. Integrating 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 to excess of an established exposure limit for the test agent at any time during the testing procedures, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test piece respirator shall be placed and constructed so that no leak occurs around the port (e.g., where the respirator is pressed), 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 as constant to within a 10 percent variation for the duration of the test.

(9) The time log (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 or atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the tubing 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 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 QNT 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 QNT time. The use of the CCI QNT 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 QNT.

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

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

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

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

(8) Calculation of fit factors.

(i) The fit factor shall be determined for the quantity live 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 into 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:

Overall Fit Factor = \frac{1}{N} \sum_{i=1}^{N} \frac{1}{F_i}

Where \( F_1, F_2, F_3, \ldots \) etc. are the fit factors for exercises 1, 2, 3, etc.

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

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

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

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

(a) Portacount Fit Test Requirements:

1. Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIDOSH 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 test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. The 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; Tend 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 seating facepiece, try another size of the same model respirator, or another model of respirator.

5. Follow the manufacturer’s instructions for operating the Portacount and proceed with the test.
(5) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) After the test is completed, the test subject shall be questioned by the test coordinator regarding the comfort of the respirator. Upon completion of the protocol, if it has been determined that the respirator is not comfortable, another model of respirator shall be tried.

(b) Portacout Test Instrument.

(1) The Portacout 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 Portacout 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 need s 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 the aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes air 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 the leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer (Occupational Health Dynamics of Birmingham, Alabama) also provides attachments (lamping manifold(s)) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform this test, the test subject closes his or her mouth and holds his or her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed in 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 50 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

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

(2) The CNP system default set for test pressure shall be set at -- 15 mm of water (<0.58 inches of water) and the mouth inspiratory flow rate shall be 55.8 liters per minute for performing fit tests.

(Notes: CNP systems have a built-in capability to conduct fit testing that is specific to unique work rates, mask, and gender situations that might apply in a specific workplace. Use of dSLRU 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 fully 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 manifolds is not needed and should be temporarily removed or propped open.

(5) The employer must train the test subject to hold his or her breath for at least 10 seconds.

(6) The test subject must don the test respirator without assistance from the test administrator, who is conducting the CNP fit test. The respirator must not be adjusted once the fit-test exercises begin. Any adjustment voids the test, and the test subject must repeat the fit test.

(7) The CNP 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 exercises, 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 should type CWP units that prohibit bending of 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 becomes unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

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

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

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

(a) When administering this protocol to test subject(s), 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>
<thead>
<tr>
<th>Exercise(3)</th>
<th>Exercise procedure</th>
<th>Measurement procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face Down</td>
<td>Stand and breathe normally, without talking, for 30 seconds.</td>
<td>Face forward, while holding breath for 10 seconds.</td>
</tr>
<tr>
<td>Bending Over</td>
<td>Bend at the waist, as if going to touch one's toes, for 30 seconds.</td>
<td>Face parallel to the floor, while holding breath for 10 seconds.</td>
</tr>
<tr>
<td>Head Shaking</td>
<td>For about three seconds, shake head back and forth vigorously several times while shutting.</td>
<td>Face forward, while holding breath for 10 seconds.</td>
</tr>
<tr>
<td>REDON 1</td>
<td>Remove the respirator mask, loosen all facepiece straps, and then reinsert the respirator mask.</td>
<td>Face forward, while holding breath for 10 seconds.</td>
</tr>
<tr>
<td>REDON 2</td>
<td>Remove the respirator mask, loosen all facepiece straps, and then reinsert the respirator mask again.</td>
<td>Face forward, while holding breath for 10 seconds.</td>
</tr>
</tbody>
</table>

5. Exercise 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:

\[
\text{Overall Fit Factor} = \frac{N}{1/F_1 + 1/F_2 + \ldots + 1/F_N}
\]

Where:
- \(N\) = The number of exercises,
- \(F_1\) = The fit factor for the first exercise,
- \(F_2\) = The fit factor for the second exercise; and
- \(F_N\) = The fit factor for the \(N\)th 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 has 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 rule making proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rule making proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 30999, April 23, 1998; 69 FR 46903, August 4, 2004]

Next Standard (1910.134 App B-1)

Regulations (Standards - 29 CFR) - Table of Contents
Appendix C
Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)

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

I. Facepiece Positive and/or Negative Pressure Checks

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

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

II. Manufacturer's Recommended User Seal Check Procedures

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

[63 FR 1152, Jan. 8, 1998]
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.


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 E
OSHA Respirator Medical Evaluation Questionnaire (Mandatory). - 1910.134 App C

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

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

To the employee:

Can you read (circle one): Yes/No

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

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

1. Today’s date: ___________________________

2. Your name: ______________________________

3. Your age (to nearest year): ______________________________

4. Sex (circle one): Male/Female

5. Your height: __________ ft. __________ in.

6. Your weight: __________ lbs.

7. Your job title: ______________________________

8. A phone number where you can be reached by the health care professional who will review this questionnaire (include the Area Code):

9. The best time to phone you at this number: ______________________________

10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No

11. Check the type of respirator you will use (you can check more than one category):
   a. _____ N, R, or P respirator (filter mask, non-cartridge type only).
   b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

12. Have you worn a respirator (circle one): Yes/No
   If “yes,” what type(s): ______________________________

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

1. Do you currently smoke tobacco, or have you smoked tobacco in the last month: Yes/No

2. Have you ever had any of the following conditions?
   a. Seizures: Yes/No
   b. Diabetes (sugar disease): Yes/No
   c. Allergic reactions that interfere with your breathing: Yes/No
   d. Claustrophobia (fear of closed-in places): Yes/No
   e. Trouble smelling odors: Yes/No

3. Have you ever had any of the following pulmonary or lung problems?
   a. Asbestosis: Yes/No

b. Asthma: Yes/No

c. Chronic bronchitis: Yes/No

d. Emphysema: Yes/No

e. Pneumonia: Yes/No

f. Tuberculosis: Yes/No

g. Silicosis: Yes/No

h. Pneumothorax (collapsed lung): Yes/No

i. Lung cancer: Yes/No

j. Broken ribs: Yes/No

k. Any chest injuries or surgeries: Yes/No

l. Any other lung problem that you've been told about: Yes/No

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

a. Shortness of breath: Yes/No

b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No

c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No

d. Have to stop for breath when walking at your own pace on level ground: Yes/No

e. Shortness of breath when washing or dressing yourself: Yes/No

f. Shortness of breath that interferes with your job: Yes/No

g. Coughing that produces phlegm (thick sputum): Yes/No

h. Coughing that wakes you early in the morning: Yes/No

i. Coughing that occurs mostly when you are lying down: Yes/No

j. Coughing up blood in the last month: Yes/No

k. Wheezing: Yes/No

l. Wheezing that interferes with your job: Yes/No

m. Chest pain when you breathe deeply: Yes/No

n. Any other symptoms that you think may be related to lung problems: Yes/No

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

a. Heart attack: Yes/No

b. Stroke: Yes/No

c. Angina: Yes/No

d. Heart failure: Yes/No

e. Swelling in your legs or feet (not caused by walking): Yes/No

f. Heart arrhythmia (heart beating irregularly): Yes/No

g. High blood pressure: Yes/No

h. Any other heart problem that you've been told about: Yes/No

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

a. Frequent pain or tightness in your chest: Yes/No

b. Pain or tightness in your chest during physical activity: Yes/No

C. Pain or tightness in your chest that interferes with your job: Yes/No

D. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No

E. Heartburn or indigestion that is not related to eating: Yes/No

F. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

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

a. Breathing or lung problems: Yes/No
b. Heart trouble: Yes/No

c. Blood pressure: Yes/No

d. Seizures (TBS): Yes/No

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

a. Eye irritation: Yes/No

b. Skin allergies or rashes: Yes/No

c. Anxiety: Yes/No

d. General weakness or fatigue: Yes/No

e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire? Yes/No

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

10. Have you ever had vision in either eye (temporarily or permanently): Yes/No

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

a. Wear contact lenses: Yes/No

b. Wear glasses: Yes/No

c. Color blind: Yes/No

d. Any other eye or vision problem: Yes/No

12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No

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

a. Difficulty hearing: Yes/No

b. Wear a hearing aid: Yes/No

c. Any other hearing or ear problem: Yes/No

14. Have you ever had a back injury: Yes/No

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

a. Weakness in your arms, hands, legs, or feet: Yes/No

b. Back pain: Yes/No

c. Difficulty fully moving your arms and legs: Yes/No

d. Pain or stiffness when you lean forward or backward at the waist: Yes/No

e. Difficulty fully moving your head up or down: Yes/No

f. Difficulty fully moving your head side to side: Yes/No

g. Difficulty bending at your knees: Yes/No

h. Difficulty squatting to the ground: Yes/No

i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No

16. Any other muscle or skeletal problem that interferes with your use of a respirator: Yes/No

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

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has low or non-normal levels of oxygen? Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions? Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals? Yes/No

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

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

1. Dusty environments: Yes/No
2. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:

3. List any second jobs or side businesses you have:

4. List your previous occupations:

5. List your current and previous hobbies:

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

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

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

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

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

10. Will you be using any of the following items with your respirator(s)?
    a. HEPA Filters: Yes/No
    b. Canisters (for example, gas masks): Yes/No
    c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?
    a. Escape only (no rescue): Yes/No
    b. Emergency rescue only: Yes/No
    c. Less than 5 hours per week: Yes/No
    d. Less than 2 hours per day: Yes/No
    e. 2 to 4 hours per day: Yes/No
    f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:
    a. Light (less than 200 kcal per hour): Yes/No

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

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

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

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

    Examples of moderate work effort are sitting while nailing or fitting; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 25 lbs.) at trunk level; walking on a level surface about 2 mph or less; and using a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

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

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

    Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder, working on a loading dock.
13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

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

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

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

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

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

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

Name of the first toxic substance: __________________________
Estimated maximum exposure level per shift: __________________________
Duration of exposure per shift: __________________________

Name of the second toxic substance: __________________________
Estimated maximum exposure level per shift: __________________________
Duration of exposure per shift: __________________________

Name of the third toxic substance: __________________________
Estimated maximum exposure level per shift: __________________________
Duration of exposure per shift: __________________________

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

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

[63 FR 15190, Apr. 23, 1998; 78 FR 33607, June 8, 2011]

Next Standard (1910.134 App D)

Regulations (Standards - 29 CFR) - Table of Contents
Appendix F
Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

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

You should do the following:

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

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

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

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

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]
An employee's exposure to any substance listed in Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

**Table Z-1**

**Substances with limits preceded by "C" - Ceiling Values.** An employee's exposure to any substance in Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time-weighted average exposure which shall not be exceeded at any time during the working day.

**Table Z-2**

An employee's exposure to any substance listed in Table Z-2 shall not exceed the exposure limits specified as follows:

**8-hour time weighted averages.** An employee's exposure to any substance listed in Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Table Z-2.

**Acceptable ceiling concentrations.** An employee's exposure to a substance listed in Table Z-2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the substance in the table, except for a time period, and up to a concentration not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift".

**Example.** During an 8-hour work shift, an employee may be exposed to a concentration of Substance A (with a 10 ppm TWA, 20 ppm ceiling and 50 ppm peak) above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 20 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.

**Table Z-3**

An employee's exposure to any substance listed in Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in the table.

**Computation Formulae.** The computation formulae which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are listed in subpart Z of 29 CFR Part 1910 in order to determine whether an employee is exposed over the regulatory limit is as follows:

The cumulative exposure for an 8-hour work shift shall be computed as follows:
Air contaminants. - 1910.1000

\[ E = (C_1 T_1 + C_2 T_2 + \cdots + C_n T_n)^{1/8} \]

Where:

- \( E \) is the equivalent exposure for the working shift.
- \( C \) is the concentration during any period of time \( T \) where the concentration remains constant.
- \( T \) is the duration in hours of the exposure at the concentration \( C \).

The value of \( E \) shall not exceed the 8-hour time weighted average specified in Subpart Z or 29 CFR Part 1910 for the substance involved.

1910.1000(b)(1)(i)

To illustrate the formula prescribed in paragraph (d)(1)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm noted in Table Z-1. Assume that an employee is subject to the following exposure:

- Two hours exposure at 150 ppm
- Two hours exposure at 75 ppm
- Four hours exposure at 50 ppm

Substituting this information in the formula, we have:

\[ (2 \times 150 + 2 \times 75 + 4 \times 50)^{1/8} = 81.25 \text{ ppm} \]

Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.

1910.1000(b)(2)(i)

In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

\[ E_m = (C_1 I_1 + C_2 I_2 + \cdots + C_n I_n)^{1/8} \]

Where:

- \( E_m \) is the equivalent exposure for the mixture.
- \( C \) is the concentration of a particular contaminant.
- \( I \) is the exposure limit for that substance specified in Subpart Z of 29 CFR Part 1910.

The value of \( E_m \) shall not exceed unity (1).

1910.1000(b)(2)(ii)

To illustrate the formula prescribed in paragraph (d)(2)(i) of this section, consider the following exposures:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Actual concentration of 8-hour exposure (ppm)</th>
<th>8-hour TWA PEL (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

Substituting in the formula, we have:

\[ E_m = (500^{1/8} + 45^{1/8} + 40)^{1/8} = 1,000 \]

\[ E_m = 0.500 + 0.250 + 0.200 = 0.925 \]

Since \( E_m \) is less than unity (1), the exposure combination is within acceptable limits.

1910.1000(c)

To achieve compliance with paragraphs (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1910.134.

[71 FR 16673, April 3, 2006]
**TABLE Z-1 LIMITS FOR AIR CONTAMINANTS**

NOTE: Because of the length of the table, explanatory Footnotes applicable to all substances are given below as well as at the end of the table. Footnotes specific to a limited number of substances are also shown within the table.

Footnote(1) The PELs are 8-hour TWA's unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(2) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(3) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(4) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote(5) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and spill of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the exempted subcategories, the benzene PEL in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote(6) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and winding) and ginning. See also 1910.1043 for cotton dust limits for other sectors.

Footnote(7) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates N O Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(8) See Table Z-2.

Footnote(9) See Table Z-3.

Footnote(10) Varies with compound.

Footnote(11) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

**TABLE Z-1. LIMITS FOR AIR CONTAMINANTS**

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS No. (a)</th>
<th>ppm (a) (1)</th>
<th>mg/m(3) (b) (1)</th>
<th>Skin Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>75-07-0</td>
<td>200</td>
<td>360</td>
<td></td>
</tr>
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<td>Acetic Acid</td>
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Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS number for the individual compounds.

Footnote(d) The final benzene standard in 1910.1026 applies to all occupational exposures to benzene or certain circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excluded subgroups, the benzene limits in Table Z-2 apply. See 1910.1026 for specific circumstances.

Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument.

Footnote(f) The time-weighted average applies to the cotton waste processing operations of waste recycling (stirring, blending, cleaning and willowing) and ginning. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote(g) All inert or nuisance dust, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particles Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(h) See Table Z-2.

Footnote(i) See Table Z-3.

Footnote(j) Varies with compound.

Footnote(k) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

Footnote(l) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

Footnote(m) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

Footnote(n) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

Appendix H
TABLE Z-2 1910.1000 TABLE Z-2

<table>
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<tr>
<th>Substance</th>
<th>8-hour time weighted average</th>
<th>Acceptable ceiling concentration</th>
<th>Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift</th>
<th>Maximum duration</th>
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<td>Benzene(1) (297.40-1969)</td>
<td>10 ppm</td>
<td>25 ppm</td>
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<td>Beryllium and beryllium compounds (297.29-1970)</td>
<td>2 mg/m(3)</td>
<td>5 mg/m(3)</td>
<td>25 mg/m(3)</td>
<td>30 minutes.</td>
</tr>
<tr>
<td>Cadmium fume(1) (297.5-1970)</td>
<td>0.1 mg/m(3)</td>
<td>0.3 mg/m(3)</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Cadmium dust(1) (297.5-1970)</td>
<td>0.2 mg/m(3)</td>
<td>0.6 mg/m(3)</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Carbon disulfide (297.3-1960)</td>
<td>10 ppm</td>
<td>30 ppm</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Carbon tetrachloride (297.17-1971)</td>
<td>10 ppm</td>
<td>25 ppm</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Chromic acid and chromates (297.7-1971)(1)</td>
<td>1 mg/10 m(3)</td>
<td></td>
<td>100 ppm</td>
<td>5 minutes.</td>
</tr>
<tr>
<td>Ethylene dibromide (297.31-1970)</td>
<td>20 ppm</td>
<td>30 ppm</td>
<td>50 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Ethylene dichloride (297.31-1969)</td>
<td>50 ppm</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Fluoride as dust (297.28-1969)</td>
<td>2.5 mg/m(3)</td>
<td></td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Formaldehyde see 1910.1046</td>
<td></td>
<td></td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Hydrogen fluoride (297.38-1969)</td>
<td>0 ppm</td>
<td></td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Hydrogen sulfide (297.2-1966)</td>
<td>20 ppm</td>
<td>50 ppm</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Mercury (297.8-1971)</td>
<td>1 mg/10 m(3)</td>
<td></td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Methyl chloride (297.19-1969)</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>300 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Methylene Chloride: see 1910.1052</td>
<td></td>
<td></td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Organos (alkyl) mercury (297.30-1969)</td>
<td>0.03 mg/m(3)</td>
<td>0.04 mg/m(3)</td>
<td>100 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Styrene (297.15-1969)</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>600 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>300 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Toluene (297.12-1967)</td>
<td>200 ppm</td>
<td>300 ppm</td>
<td>500 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
<tr>
<td>Trichloroethylene (297.19-1967)</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>300 ppm</td>
<td>5 min. in any 3 hrs.</td>
</tr>
</tbody>
</table>

Footnote(1) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard.

Footnote(b) This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.

Footnote(c) This standard applies to any operations or sectors for which the exposures limit in the Chromium (VI) standard, Sec. 1910.1026, is stayed or is otherwise not in effect.

Appendix I
### TABLE Z-3 Mineral Dusts

<table>
<thead>
<tr>
<th>Substance</th>
<th>mppcf&lt;sup&gt;a&lt;/sup&gt;</th>
<th>mg/m&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Silica: Crystalline</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartz (Respirable)</td>
<td>250&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10 mg/m&lt;sup&gt;3&lt;/sup&gt;.&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>%SiO&lt;sub&gt;2&lt;/sub&gt;+5</td>
<td>%SiO&lt;sub&gt;2&lt;/sub&gt;+2</td>
</tr>
<tr>
<td>Quartz (Total Dust)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 mg/m&lt;sup&gt;3&lt;/sup&gt;</td>
<td>%SiO&lt;sub&gt;2&lt;/sub&gt;+2</td>
</tr>
<tr>
<td>Cristobalite: Use ½ the value calculated from the count or mass formula for quartz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tridymite: Use ½ the value calculated from the formula for quartz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amorphous, including natural diatomaceous earth</td>
<td>20</td>
<td>80 mg/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Silicates (less than 1% crystalline silica):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mica</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Soapstone</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Talc (not containing asbestos)</td>
<td>20&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Talc (containing asbestos): Use asbestos limit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tremolite, asbestiform (see 29 CFR 1910.1001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Graphite (Natural)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><strong>Coal Dust: Respirable fraction less than 5% SiO&lt;sub&gt;2&lt;/sub&gt;</strong></td>
<td>2.4 mg/m&lt;sup&gt;3&lt;/sup&gt; .&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Coal Dust: Respirable fraction greater than 5% SiO&lt;sub&gt;2&lt;/sub&gt;</strong></td>
<td>10 mg/m&lt;sup&gt;3&lt;/sup&gt; .&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Inert or Nuisance Dust:</strong>&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respirable fraction</td>
<td>15</td>
<td>5 mg/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total dust</td>
<td>50</td>
<td>15 mg/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: Conversion factors - mppcf × 35.3 = million particles per cubic meter = particles per c.c.

<sup>a</sup> Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

<sup>b</sup> The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

<sup>c</sup> Containing less than 1% quartz; if 1% quartz or more, use quartz limit.

<sup>f</sup> All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.

<sup>e</sup> Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size selector with the following characteristics:

<table>
<thead>
<tr>
<th>Aerodynamic diameter (unit density sphere)</th>
<th>Percent passing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>3.0</td>
<td>3.5</td>
<td>4.0</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>75</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>90</td>
<td>75</td>
<td>50</td>
</tr>
</tbody>
</table>

The measurements under this note refer to the use of an AEC (now NRC) instrument. The respirable fraction of coal dust is determined with an NRE; the figure corresponding to that of 2.4 mg/m$^3$ in the table for coal dust is 4.5 mg/m$^3$.

[Note: This document was changed to an html version as of 11/24/2004]

Appendix J
Ordering Information

To receive documents or other information about occupational safety and health topics, contact the National Institute for Occupational Safety and Health (NIOSH) at

NIOSH Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226-1998

Telephone: 1-800-35-NIOSH (1-800-356-4674)
Fax: 1-513-533-8573
E-mail: pubstaff@cdc.gov
or visit the NIOSH Web site at www.cdc.gov/niosh

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DHHS (NIOSH) Publication No. 2005-100
Foreword

The purpose of this Respirator Selection Logic (RSL) is to provide guidance to respirator program administrators on respirator selection that incorporates the changes necessitated by the revisions to the respirator use and certification regulations and changes in the National Institute for Occupational Safety and Health (NIOSH) policy. This RSL is not intended to be used for selection of respirators for protection against infectious agents or for chemical, biological, radiological or nuclear (CBRN) agents of terrorism. While respirators can provide appropriate protection against these agents, the information necessary to use the selection logic is generally not available for infectious disease or bioterrorism agents (e.g., exposure limits, airborne concentration). Similarly, CBRN terrorism events may involve chemicals that can quickly degrade respirator materials or have extremely low toxic levels that are difficult to measure.

In 1987, NIOSH published the NIOSH Respirator Decision Logic (RDL). Since then the Occupational Safety and Health Administration (OSHA) has promulgated a revision to their respirator use regulation (29CFR1910.134 published on January 8, 1998), and NIOSH has promulgated the revised respirator certification standard (42CFR84 on June 8, 1995). In addition, NIOSH has revised its carcinogen policy to recommend the complete range of respirators as determined by this respirator selection logic for those carcinogens with quantitative recommended exposure limits (RELs). Thus, respirators can be consistently recommended regardless of whether a substance is a carcinogen or not.

OSHA recently proposed a rule to establish assigned protection factors (APFs) for various classes of respirators (68FR34036 published on June 6, 2003). When the OSHA standard on APFs is finalized NIOSH intends to consider revisions to this RSL. NIOSH will also modify the certification program to assure that NIOSH certified respirators will be capable of providing the level of protection determined in the OSHA APF rulemaking. NIOSH also intends to periodically update the RSL so that it reflects current OSHA requirements and NIOSH policy.

Sincerely yours,

[Signature]

John Howard, M.D.
Director, National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention
Acknowledgements

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1. **Background and Purpose**

The purpose of this respirator selection logic (RSL) is to provide a process that respirator program administrators can use to select appropriate respirators for the protection of workers in specific workplaces. It is not intended to be used for selection of respirators for protection against infectious agents or chemical, biological, radiological or nuclear (CBRN) exposures associated with terrorism events.

This RSL contains a series of questions regarding situations which may require the use of respirators. (See Respirator Selection Logic Sequence, page 5.) In answering these questions, the user of this selection logic is assisted in identifying specific classes of respirators, applicable restrictions, and the appropriate respirator selection table to use. When using one of the tables to identify a suitable class of respirators, the user must keep in mind the restrictions identified in the question section of this respirator selection logic.

This RSL identifies the criteria necessary to determine the classes of respirators that will provide the minimum acceptable degree of protection for a chemical at a given concentration. Classes of respirators offering greater protection can usually be used in place of the minimum acceptable class of respirators. Respirator classes are consistent with respirator certification groupings as specified in 42 CFR 84.

The recommendations in this RSL are based primarily on the physical, chemical, and toxicologic properties of the contaminant and on the limitations of each class of respirator, including filtration efficiency, air supply capability, and face seal characteristics and leakage. Thus, this selection logic is limited to identifying classes of acceptable respirators, rather than individual respirator models.

After various classes of respirators are identified as being suitable for a given situation, an evaluation is made of other factors of the particular work environment (e.g., job, task, temperature, mobility, etc.) so that the most appropriate respirator model within the recommended classes can be chosen. In some situations, the selection of a respirator classified as providing a higher level of protection may be advisable.

The assigned protection factors (APFs) used in this respirator selection logic were based on quantitative fit factor data developed by Los Alamos National Laboratories under contract to NIOSH and on field and laboratory data gathered by NIOSH and others. A Notice of Proposed Rulemaking on Assigned Protection Factors was published by OSHA on June 6, 2003. When this regulation is finalized, NIOSH will consider the new standard and revise the RSL as necessary. NIOSH will also modify its certification.

* Note: Selection of respirators for infectious disease and terrorism-related exposures requires consideration of additional factors in addition to the traditional exposure assessment approaches described in this guidance. See the NIOSH respirator topic page [http://www.cdc.gov/niosh/topics/respirators/](http://www.cdc.gov/niosh/topics/respirators/) for additional information and guidance on particular infectious disease and terrorism issues.
program to assure that NIOSH certified respirators will be capable of providing the level of protection determined in the OSHA APF rulemaking. Fit factors determined for the individual wearer of a respirator by quantitative fit testing or by any other method used to determine fit should not be substituted for the APF given for each class of respirators. In addition, the fit factor determined through quantitative fit testing must be greater than the APF (10X the APF is generally recommended); otherwise, the respirator cannot be used by the worker.

Note: In order to provide protection at the APF level, respirators must be used in a complete respirator program such as the one required by OSHA in 29CFR1910.134.

II. Information and Restrictions

A. Criteria for Selecting Respirators
To use this selection logic, the user must first assemble the necessary toxicologic, safety, and other relevant information for each respiratory hazard, including the following:

- General use conditions, including determination of contaminant(s);
- Physical, chemical, and toxicological properties of the contaminant(s);
- NIOSH recommended exposure limit (REL), OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), State-OSHA exposure limit, American Industrial Hygiene Association (AIHA) Workplace Environmental Exposure Limit (WEEL), or other applicable occupational exposure limit;
- Expected concentration of each respiratory hazard;
- Immediately dangerous to life or health (IDLH) concentration;
- Oxygen concentration or expected oxygen concentration;
- Eye irritation potential; and
- Environmental factors, such as presence of oil aerosols

NIOSH recommends that air sampling be conducted to determine exposure levels found in the workplace. A combination of air sampling and exposure modeling is often used to make reasonable estimates of exposure. Ideally, this determination should be made by a professional industrial hygienist. Also, OSHA offers free consultation to qualifying small- and medium-sized businesses to help recognize hazards, suggest approaches to solving problems and identifying the kinds of help available if further assistance is required. The OSHA website [www.osha.gov](http://www.osha.gov) provides information on compliance assistance and consultation programs.
Obtaining complete information on all criteria needed to use this selection logic may be difficult. When conflicting or inadequate data are found, experts should be consulted before decisions are made that could affect the proper use of this selection logic. In addition, the adequacy of the respirator selected is dependent on the validity of the exposure limit used and the accuracy of the hazard concentration determination. While the selection logic can be used with any exposure limit, NIOSH recommends that the more protective limit of the NIOSH REL or the OSHA PEL, be used in respirator selection. If no REL or PEL exists, other applicable occupational exposure limits such as the ACGIH TLV can be used.

The information obtained on general use conditions for respirators should include a description of the actual job task, including the duration and frequency, location, physical demands, and industrial processes, as well as issues affecting the comfort of the respirators. Some conditions may preclude the use of specific types of respirators in certain circumstances because the individual must be medically and psychologically suited (i.e., not claustrophobic) to wear a given respirator for a given task, particularly if the respirator is a self-contained breathing apparatus (SCBA).

Employers must establish a cartridge/canister changeout schedule which is based on the service life of the cartridge/canister under the conditions of use. The changeout schedule can be determined with the assistance of the respirator manufacturer (changeout software or other tools) or by conducting service life tests. Information obtained on the service life of the cartridge/canister under conditions of intended use must be evaluated regardless of the odor warning properties of the chemicals. These evaluations must be based on all gases and vapors present at the temperature and relative humidity extremes (high and low) in the workplace. NIOSH recommends that when the employer or a representative of the employer conducts service life tests, the challenge concentrations of the gases and vapors should be at least the maximum use concentration (MUC) of the respirator and that a safety margin be applied when evaluating service life data. OSHA provides information on determining change schedules on their website (www.OSHA.gov/SLTC/etools/respiratory/change-schedules.html). In humid workplaces where organic vapor cartridges are used to protect workers from a single volatile source, software (CD-ROM) for predicting service life can be ordered from NIOSH by calling 1-800-356-4674. The software can also be downloaded from the OSHA website at: http://www.osha.gov/SLTC/etools/respiratory/advisor_genius_wood/breakthrough.html. This information can be used to set up cartridge replacement schedules and should be used in conjunction with sensory warning properties.

Although odor should not be relied on for cartridge/canister change out, workers should be trained to exit the contaminated area whenever they detect the odor or experience any irritation symptoms of the contaminant. (See the NIOSH policy statement dated August 4, 1999, in the Appendix (page 27) for a discussion of the OSHA standard and NIOSH’s recommendations for change schedules.) If workers are detecting the odor before the end of the change schedule, the respirator program administrator should reevaluate this respirator use; i.e., the change schedule, the workplace concentrations or the other use conditions (relative humidity (RH), work rate, etc.).
B. Restrictions and Requirements for All Respirator Usage

The following requirements and restrictions must be considered to ensure that the respirator selected will provide adequate protection under the conditions of intended use:

1. Workers are not exposed to a single unvarying concentration of a hazardous substance, rather, individual exposures may vary throughout a workshift and between days. The highest anticipated concentration should therefore be used to compute the required protection factor for each respirator wearer.

2. Qualitative or quantitative fit tests must be provided as appropriate to ensure that the tight-fitting facepiece respirator fits the individual. NIOSH endorses the OSHA standard 29 CFR 1910.134 for fit testing except for irritant smoke (see the Appendix, page 27). Employees must pass a fit test with the exact model and size that they will wear in the workplace.

3. Respirators with tight-fitting facepieces should not be used when facial scars or deformities interfere with the face seal.

4. Respirators with tight-fitting facepieces (including pressure-demand respirators) should not be used when facial hair interferes with the face seal.

5. The usage limitations of air-purifying elements, particularly gas and vapor cartridges or canisters, should not be exceeded (see NIOSH Certified Equipment List for general limitations at http://www.cdc.gov/niosh/nppf/Topics/respirators/cel).

6. Respirators must be certified by the NIOSH. A list of certified respirators can be found at http://www.cdc.gov/niosh/celintro.html.

7. A complete written respiratory protection program must be developed which includes regular worker training; maintenance, inspection, cleaning, and evaluation of the respirator; use of the respirator in accordance with the manufacturer’s instructions; fit testing; medical evaluation; and environmental monitoring. Minimum respiratory protection requirements for some contaminants can be found in the OSHA Respiration Protection Standards, 29 CFR 1910.134. Detailed information on respirator programs can be accessed at: http://www.osha.gov/SLTC/etools/respiratory. In addition, the OSHA Small Entity Compliance Guide provides procedures and checklists that can help small businesses comply with the respirator standard. This information can be accessed at: http://www.osha.gov/Publications/SECG_RPS/secgrey-current.pdf.

8. The APFs that appear in this respirator selection logic are based for the most part on laboratory studies. However, a few APFs have been validated and revised as necessary after consideration of data obtained from studies of workplace protection factors (WPFs). OSHA is currently considering setting APFs for respirators.
III. Respirator Selection Logic Sequence

After all criteria have been identified and evaluated and after the requirements and restrictions of the respiratory protection program have been met, the following sequence of questions can be used to identify the class of respirators that should provide adequate respiratory protection. Note that if OSHA has promulgated a substance – specific standard for a contaminant found in your workplace, respirator selection must meet or exceed the respirators required in that standard. (OSHA General Industry Air Contaminants Standard, 29 CFR 1910.1000).

Step 1. Is the respirator intended for use during fire fighting?


b. If no, proceed to Step 2.

Step 2. Is the respirator intended for use in an oxygen-deficient atmosphere, i.e., less than 19.5% oxygen?

a. If yes, any type of SCBA other than escape only, or supplied-air respirator (SAR) with an auxiliary SCBA is required. Auxiliary SCBA must be of sufficient duration to permit escape to safety if the air supply is interrupted. If yes, and contaminants are also present, proceed to Step 3 to determine if the hazard requires the SCBA or SAR/SCBA to meet a specific APF level.

b. If no, proceed to Step 3.

Step 3. Is the respirator intended for entry into unknown or IDLH atmospheres (e.g., an emergency situation)?

a. If yes, one of two types of respirators are required: a pressure-demand SCBA with a full facepiece or a pressure-demand SAR with a full facepiece in combination with an auxiliary pressure-demand SCBA. Auxiliary SCBA must be of sufficient duration to permit escape to safety if the air supply is interrupted.

b. If no, proceed to Step 4.

Step 4. Is the exposure concentration of the contaminants, as determined by acceptable industrial hygiene methods, less than the NIOSH REL or other applicable exposure limit?
a. If yes, a respirator is not required for routine work. For escape respirators, determine the potential for generation of a hazardous condition caused by an accident, spill or equipment failure. See Section IV. Page 17, for a discussion and selection of escape respirators. Proceed to Step 6.*

b. If no, proceed to Step 5.

* If respirators are required by the employer to be worn (even if below the occupational exposure limit), OSHA requires that the employer establish and implement a written respiratory protection program with worksite specific procedures. If an employer provides respirators at the request of employees or permits employees to use their own respirators when exposure levels are below the applicable limits, this is considered voluntary respirator use. OSHA requires that employers provide to their employees the information contained in Appendix D of 29 CFR 1910.134, that they establish and implement those elements of a written program necessary to ensure that any employee using a respirator voluntarily is medically able to wear the respirator (except that medical evaluation is not required for voluntary use of filtering facepieces) and that the respirator is cleaned, stored, and maintained so that it does not represent a health hazard to the wearer.

Step 5. Are conditions such that a worker who is required to wear a respirator can escape from the work area and not suffer loss of life or immediate or delayed irreversible health effects if the respirator fails, i.e., are the conditions not immediately dangerous to life or health (IDLH)? IDLH values for certain compounds can be found in the NIOSH Pocket Guide for Chemical Hazards. This document can be accessed at [http://www.cdc.gov/niosh/npg/npg.html](http://www.cdc.gov/niosh/npg/npg.html). IDLH values for some substances can also be found on the NIOSH internet at [http://www.cdc.gov/niosh/idlh/idlh-l.html](http://www.cdc.gov/niosh/idlh/idlh-l.html).

a. If yes, conditions are not considered to be IDLH. Proceed to Step 6.

b. If no, conditions are considered to be IDLH. Two types of respirators are recommended: a pressure-demand, full-facepiece SCBA or a pressure-demand, full-facepiece SAR in combination with an auxiliary pressure-demand, full-facepiece SCBA. The auxiliary SCBA must be of sufficient duration to permit escape to safety if the air supply is interrupted. An auxiliary unit means that the SAR unit includes a separate air bottle to provide a reserve source of air should the airline become damaged. The auxiliary unit shares the same mask and regulator, and enables the SAR to function as an SCBA if needed.

Step 6. Is the contaminant an eye irritant, or can the contaminant cause eye damage at the workplace concentration? Information on eye irritation is included
in the International Programme on Chemical Safety, International Chemical Safety Cards which can be accessed at

a. If yes, a respirator equipped with a full facepiece, helmet, or hood is recommended. Proceed to Step 7.

b. If no, a half-mask or quarter-mask respirator may still be an option, depending on the exposure concentration. Proceed to Step 7.

Step 7. Determine the maximum hazard ratio (HR) by the following:

- Divide the time-weighted average (TWA) exposure concentration for the contaminant determined in Step 4 by the NIOSH REL or other applicable exposure limit. If the exposure limit is an 8 hour limit the TWA used must be on 8 hour average. If the exposure limit is based on 10 hours, use a 10 hour TWA.

- If the contaminant has a ceiling limit, divide the maximum exposure concentration for the contaminant determined in Step 4 by the ceiling limit.

- If the contaminant has a short term exposure limit (STEL), divide the maximum 15 min TWA exposure concentration for the contaminant determined in Step 4 by the STEL.

- For escape respirators, determine the potential for generation of a hazardous condition caused by an accident or equipment failure.

- If a potentially hazardous condition could occur or a hazard ratio greater than 1 has been calculated, proceed to Step 8.

Step 8. If the physical state of the contaminant is:

- a particulate (solid or liquid aerosol) during periods of respirator use, proceed to Step 9;

- a gas or vapor, proceed to Step 10;

- a combination of gas or vapor and particulate, proceed to Step 11.

Step 9. Particulate Respirators

9.1. Is the particulate respirator intended only for escape purposes?
a. If yes, see Section IV (page 17), for a discussion and selection of escape respirators.

b. If no, the particulate respirator is intended for use during normal work activities. Proceed to Step 9.2.

9.2. A filter series (N, R or P) that will provide protection against exposure to the particulate in question is recommended.

a. The selection of N-, R-, and P-series filters depends on the presence or absence of oil particles, as follows:

- If no oil particles are present in the work environment, use a filter of any series (i.e., N-, R-, or P-series).

- If oil particles (e.g., lubricants, cutting fluids, glycerine, etc.) are present, use an R- or P-series filter. Note: N-series filters cannot be used if oil particles are present.

- If oil particles are present and the filter is to be used for more than one work shift, use only a P-series filter.

Note: To help you remember the filter series, use the following guide:
N for Not resistant to oil,
R for Resistant to oil
P for oil Proof

b. Selection of filter efficiency (i.e., 95%, 99%, or 99.97%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage.

Additional information on selecting the appropriate filter certified under 42CFR84 can be found at http://www.cdc.gov/NIOSH/usersguid.html. Proceed to Step 9.3.

9.3. Respirators that have not been eliminated from Table 1 by the previous steps and that have APFs equal to, or greater than, the maximum hazard ratio determined in Step 7 are recommended. Note, however, that the maximum use concentration (MUC) is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected by a class of respirator and is determined by the lesser of:

- APF X exposure limit
- The respirator manufacturer’s MUC for a hazardous substance (if any)

1 If the respirator is intended for use in an oxygen-deficient atmosphere, only SCBA or SAR with an auxiliary SCBA, can be selected from the Table.
• The IDLH, unless the respirator is a pressure-demand, full-facepiece SCBA or combination pressure-demand SAR with a full facepiece in combination with an auxiliary pressure-demand SCBA.

For multi-component mixtures the MUC can be calculated by:
\[ \frac{C_1}{MUC_1} + \frac{C_2}{MUC_2} + \ldots + \frac{C_n}{MUC_n} = 1 \]

Step 10. Gas/Vapor Respirators

10.1. Is the gas/vapor respirator intended only for escape?

   a. If yes, refer to escape respirators Section IV (page 17).

   b. If no, the gas/vapor respirator is intended for use during normal work activities. Proceed to Step 10.2.

10.2. An air-purifying chemical cartridge/canister respirator is recommended that has a sorbent suitable for the chemical properties of the anticipated gas/vapor contaminant(s) and for the anticipated exposure levels. Information on cartridges or canisters approved for use for classes of chemicals or for specific gases or vapors can be found in the NIOSH Certified Equipment List http://www.cdc.gov/NIOSH/nptl/topics/respirators/cel/. Proceed to Step 10.3.

10.3. Respirators that have not been eliminated from Table 2 by the previous steps and that have APFs equal to, or greater than, the maximum hazard ratio determined in Step 7 are recommended.\(^1\) Note, however, that the maximum use concentration (MUC) is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected by a class of respirator and is determined by the lesser of:
   • APF X exposure limit
   • The respirator manufacturer’s MUC for a hazardous substance (if any)
   • The IDLH, unless the respirator is a pressure-demand, full-facepiece SCBA or combination pressure-demand SAR with a full facepiece in combination with an auxiliary pressure-demand SCBA.

For multi-component mixtures the MUC can be calculated by:
\[ \frac{C_1}{MUC_1} + \frac{C_2}{MUC_2} + \ldots + \frac{C_n}{MUC_n} = 1 \]

\(^1\) If the respirator is intended for use in an oxygen-deficient atmosphere, only SCBA or SAR with an auxiliary SCBA, can be selected from the Table.
Step 11. Combination Particulate and Gas/Vapor Respirators

11.1. Is the combination respirator intended for "escape only" purposes?

a. If yes, refer to escape respirators on page 17, for a discussion and selection of "escape only" respirators.

b. If no, the combination respirator is intended for use during normal work activities. Proceed to Step 11.2.

11.2. From Table 3, select a respirator type, not eliminated by the previous steps, and have APFs equal to, or greater than, the maximum hazard ratio determined in Step 7, are recommended. Note, however, that the maximum use concentration (MUC) is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected by a class of respirator and is determined by the lesser of:

- APF × exposure limit
- The respirator manufacturer's MUC for a hazardous substance (if any)
- The IDLH, unless the respirator is a pressure-demand, full-facepiece SCBA or combination pressure-demand SAR with a full facepiece in combination with an auxiliary pressure-demand SCBA.

For multi-component mixtures the MUC can be calculated by:

\[ \frac{C_1}{MUC_1} + \frac{C_2}{MUC_2} + \ldots + \frac{C_n}{MUC_n} = 1 \]

---

1 If the respirator is intended for use in an oxygen-deficient atmosphere, only SCBA or SAR with an auxiliary SCBA, can be selected from the Table.
Table 1. Particulate Respirators

<table>
<thead>
<tr>
<th>Assigned protection factor</th>
<th>Type of Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Quarter mask respirator</td>
</tr>
<tr>
<td>10</td>
<td>Any air-purifying elastomeric half-mask respirator equipped with appropriate type of particulate filter.¹</td>
</tr>
<tr>
<td></td>
<td>Appropriate filtering facepiece respirator.² ³</td>
</tr>
<tr>
<td></td>
<td>Any air-purifying full facepiece respirator equipped with appropriate type of particulate filter.²</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a half-mask.</td>
</tr>
<tr>
<td>25</td>
<td>Any powered air-purifying respirator equipped with a hood or helmet and a high efficiency (HEPA) filter.</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a hood or helmet.</td>
</tr>
<tr>
<td>50</td>
<td>Any air-purifying full facepiece respirator equipped with N-100, R-100, or P-100 filter(s).</td>
</tr>
<tr>
<td></td>
<td>Any powered air-purifying respirator equipped with a tight-fitting facepiece (half or full facepiece) and a high-efficiency filter.</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a tight-fitting facepiece (half or full facepiece).</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) self-contained respirator equipped with a full facepiece.</td>
</tr>
</tbody>
</table>

¹ The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.

² Appropriate means that the filter medium will provide protection against the particulate in question. See step 9.2 for information on the presence or absence of oil particulates.

³ An APF of 10 can only be achieved if the respirator is qualitatively or quantitatively fit tested on individual workers.
Table 1. Particulate Respirators

<table>
<thead>
<tr>
<th>Assigned protection(^1) factor</th>
<th>Type of respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a half-mask.</td>
</tr>
<tr>
<td>2,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td>10,000</td>
<td>Any pressure-demand self-contained respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td></td>
<td>Any pressure-demand supplied-air respirator equipped with a full facepiece in combination with an auxiliary pressure-demand self-contained breathing apparatus.</td>
</tr>
</tbody>
</table>

\(^1\) The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.
### Table 2. Gas/Vapor Respirators

<table>
<thead>
<tr>
<th>Assigned protection factor(^1)</th>
<th>Type of respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Any air-purifying half mask respirator equipped with appropriate gas/vapor cartridges.(^2)</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a half mask.</td>
</tr>
<tr>
<td>25</td>
<td>Any powered air-purifying respirator with a loose-fitting hood or helmet equipped with appropriate gas/vapor cartridges.(^2)</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a hood or helmet.</td>
</tr>
<tr>
<td>50</td>
<td>Any air-purifying full facepiece respirator equipped with appropriate gas/vapor cartridges(^2) or gas mask (canister respirator).(^2)</td>
</tr>
<tr>
<td></td>
<td>Any powered air-purifying respirator equipped with a tight-fitting facepiece (half or full facepiece) and appropriate gas/vapor cartridges or canisters.(^2)</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a tight-fitting facepiece (half or full facepiece).</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) self-contained respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td>1,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a half-mask.</td>
</tr>
</tbody>
</table>

1. The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.

2. Select a cartridge/canister certified to be used for the specific class of chemicals or the specific gas/vapor found in your workplace.
Table 2. Gas/Vapor Respirators

<table>
<thead>
<tr>
<th>Assigned protection factor</th>
<th>Type of respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td>10,000</td>
<td>Any pressure-demand self-contained respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td></td>
<td>Any pressure-demand supplied-air respirator equipped with a full facepiece in combination with an auxiliary pressure-demand self-contained breathing apparatus.</td>
</tr>
</tbody>
</table>

1 The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.
### Table 3. Combination Gas/Vapor & Particulate Respirators

<table>
<thead>
<tr>
<th>Assigned protection factor&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Type of respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Any air-purifying half-mask respirator equipped with appropriate gas/vapor cartridges&lt;sup&gt;2&lt;/sup&gt; in combination with appropriate type of particulate filter.&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Any full facepiece respirator with appropriate gas/vapor cartridges&lt;sup&gt;2&lt;/sup&gt; in combination with appropriate type of particulate filter.&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a half-mask.</td>
</tr>
<tr>
<td>25</td>
<td>Any powered air-purifying respirator with a loose-fitting hood or helmet that is equipped with an appropriate gas/vapor cartridge&lt;sup&gt;2&lt;/sup&gt; in combination with a high-efficiency particulate filter.</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a hood or helmet.</td>
</tr>
<tr>
<td>50</td>
<td>Any air-purifying full facepiece respirator equipped with appropriate gas/vapor cartridges&lt;sup&gt;2&lt;/sup&gt; in combination with an N-100, R-100 or P-100 filter or an appropriate canister&lt;sup&gt;2&lt;/sup&gt; incorporating an N-100, P-100 or R-100 filter.</td>
</tr>
<tr>
<td></td>
<td>Any powered air-purifying respirator with a tight-fitting facepiece (half or full facepiece) equipped with appropriate gas/vapor cartridges&lt;sup&gt;2&lt;/sup&gt; in combination with a high-efficiency filter or an appropriate canister&lt;sup&gt;2&lt;/sup&gt; incorporating a high-efficiency filter.</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td></td>
<td>Any continuous flow supplied-air respirator equipped with a tight-fitting facepiece (half or full facepiece).</td>
</tr>
<tr>
<td></td>
<td>Any negative pressure (demand) self-contained respirator equipped with a full facepiece.</td>
</tr>
</tbody>
</table>

<sup>1</sup> The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.

<sup>2</sup> Select a cartridge/canister certified to be used for the specific class of chemicals or the specific gas/vapor found in your workplace.

<sup>3</sup> Appropriate means that the filter medium will provide protection against the particulate in question. See step 9.2 for information on the presence or absence of oil particulates.
Table 3. Combination Gas/Vapor and Particulate Respirators
Continued

<table>
<thead>
<tr>
<th>Assigned protection factor¹</th>
<th>Type of respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a half-mask.</td>
</tr>
<tr>
<td>2,000</td>
<td>Any pressure-demand supplied-air respirator equipped with a full facepiece.</td>
</tr>
<tr>
<td>10,000</td>
<td>Any pressure-demand self-contained respirator equipped with a full facepiece.</td>
</tr>
</tbody>
</table>

Any pressure-demand supplied-air respirator equipped with a full facepiece in combination with an auxiliary pressure-demand self-contained breathing apparatus.

¹ The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.
IV. Escape Respirators

Escape devices have a single function: to allow a person working in a normally safe environment sufficient time to escape from suddenly occurring respiratory hazards. Given this function, selection does not rely on assigned protection factors. Instead, these respirators are selected based on a consideration of the time needed to escape, and the likelihood of IDLH or oxygen deficiency conditions. Escape devices can be separated into two categories: air-purifying respirators and self-contained breathing apparatus.

Air-purifying respirators remove contaminants from the air by sorbent and/or filter media, but because they do not provide air, these respirators cannot be used in an oxygen-deficient atmosphere. Escape capabilities of air purifying respirators can be summarized as follows:

- Air-purifying respirators with particulate filters or chemical cartridges are approved for escape from atmospheres containing specific contaminants in concentrations that are not immediately dangerous to life or health (IDLH) and oxygen content of at least 19.5% by volume. This includes half and full facepiece respirators that are routinely used in many work environments. Mouthpiece-type cartridge respirators (TC-23C) are approved for escape only.
- Air-purifying respirators with canisters (TC-14G) include the escape gas mask (canister) respirator, the gas mask (canister) respirator, and the filter self-rescuer.

The escape gas mask consists of a half-mask or a mouthpiece respirator. The mouthpiece respirator can be used for short periods of time to escape from low concentrations of organic vapor or acid gas. The escape gas mask, which utilizes a half-mask, filters contaminants from the air. These respirators may also be used to escape from low concentrations of organic vapor or acid gas, but not from oxygen deficient atmospheres. Escape gas mask respirators equipped with full facepieces can also be used for escape from IDLH conditions but not from oxygen-deficient atmospheres. These respirators may be used for escape from contaminant concentrations above the IDLH value provided that the maximum use concentration (MUC) for the canister is not exceeded and adequate oxygen (≥19.5%) is present. Note that not all gas masks provide protection against carbon monoxide (CO). Check the certification to determine if the respirator is specifically certified for use against levels of CO that exceed the exposure limit. Gas masks with full facepieces are also acceptable for routine use in non-IDLH atmospheres. Gas masks with mouthpieces are for escape only. No air-purifying device is suitable for escape from a potentially oxygen-deficient atmosphere. The filter self-rescuer unit is the mouthpiece device, which is designed to protect specifically against atmospheres with not more than 1% carbon monoxide. The filter self-rescuer is normally used in mining.
A new type of air-purifying escape hood that fits over the head and seals at the neck has been developed specifically for escape from chemical, biological, nuclear, or radiological exposures associated with terrorism events. This type is not discussed further here as terrorism-related selection is beyond the scope of this document. See http://www.cdc.gov/niosh/npptl/interesc0404.html for additional information.

A self-contained breathing apparatus (SCBA) provides air to the user for escape from oxygen-deficient environments. Escape SCBA devices are commonly used with full facepieces or hoods and, depending on the supply of air, are usually rated as 3- to 60-minute units.

Self-contained self-rescuer (SCSR) devices have been approved by MSHA/NIOSH for escape from mines, but these devices may also have application in other similar environments. SCSR are mouthpiece respirators that provide a source of oxygen-enriched air for up to 60 minutes. SCSR are normally stored in mines and used for emergency escape from mine disasters. All SCBA devices can be used in oxygen-deficient atmospheres.

When selecting escape apparatus, careful consideration must be given to potential eye irritation. This consideration is important for determining whether a gas mask or SCBA equipped with a full facepiece should be selected rather than a device equipped with a half-mask or mouthpiece.

The majority of gas masks or escape gas masks can be used in situations involving gases, vapors, or particulates. For escape from particulate-contaminated environments, an air-purifying element must be selected that will provide protection against the given type of particulate.

In addition to contaminants and concentration levels, the time to escape the hazard must be considered. For example, escape SCBA can have rated service lives of 3 to 60 minutes.

NIOSH intends to review the selection criteria for escape respirators and will provide additional guidance in future revisions of the RSL.
V. Additional Information on Hazards and Exposures

The following subparagraphs provide additional information to assist the reader in using the Respirator Selection Logic Sequence:

Subparagraph 1: Oxygen-Deficient Atmosphere

NIOSH defines an oxygen-deficient atmosphere as any atmosphere containing oxygen at a concentration below 19.5% at sea level. NIOSH certification of supplied-air or air-purifying respirators is limited to those respirators used in atmospheres containing at least 19.5% oxygen, except for those supplied-air respirators equipped with auxiliary self-contained breathing apparatus (SCBA).

The minimum requirement of 19.5% oxygen at sea level provides an adequate amount of oxygen for most work assignments and includes a safety factor. The safety factor is needed because oxygen-deficient atmospheres offer little warning of the danger, and the continuous measurement of an oxygen-deficient atmosphere is difficult.

At oxygen concentrations below 16% at sea level, decreased mental effectiveness, visual acuity, and muscular coordination occur. At oxygen concentrations below 10%, loss of consciousness may occur, and below 6% oxygen, death will result. Often only mild subjective changes are noted by individuals exposed to low concentrations of oxygen, and collapse can occur without warning.

Since oxygen-deficient atmospheres are life-threatening, only the most reliable respirators are recommended; the most reliable respirators are the self-contained breathing apparatus or the supplied-air respirators with auxiliary self-contained units. Because a high protection factor is not necessary to ensure an adequate supply of oxygen even in an atmosphere containing no oxygen, any certified self-contained unit is adequate. All aspects of a respiratory protection program must be instituted for these recommendations to be valid.

Subparagraph 2: Exposure Limits

The legal, enforceable exposure limit is the permissible exposure limit (PEL) set by OSHA. NIOSH develops recommended exposure limits (RELs) for hazardous substances. To formulate these recommendations, NIOSH evaluates all known available medical, biological and engineering, chemical trade, and other information relevant to the hazard. Other exposure limits that can be considered in making respirator selections.
include State-OSHA exposure limits (e.g., California), ACGIH TLVs, AIHA WEELs, corporate exposure limits, etc. The effectiveness of this RSL is limited to the adequacy of the selected exposure limits in protecting the health of workers. Exposure limits based on a thorough evaluation of more recent or extensive data should be given priority.

For all chemicals that cause irritation or systemic effects but do not cause carcinogenic effects, it is currently believed that a threshold exposure concentration exists such that virtually all persons in the working population (with the possible exception of hypersensitive individuals) would experience no adverse health effects.

Other variables such as the specific situation, worker, or job may influence the selection of the appropriate exposure limit for a given contaminant. For example, the effects of some hazardous substances may be increased due to exposure to other contaminants present in the workplace or the general environment or to medications or personal habits of the worker. Such factors, which would affect the toxicity of a contaminant, would not have been considered in the determination of the specific exposure limit. Also, some substances are absorbed by direct contact with the skin and mucous membranes, thus potentially increasing the total exposure.

Subparagraph 3: Immediately Dangerous to Life or Health (IDLH)

An IDLH exposure condition is one that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment. The purpose of establishing an IDLH exposure level is to ensure that the worker can escape from a given contaminated environment in the event of failure of the respiratory protection equipment. The IDLH is considered a maximum level above which only a highly reliable breathing apparatus providing maximum worker protection is permitted. Any appropriate approved respirator may be used to its maximum use concentration up to the IDLH concentration.

In establishing the IDLH concentration, the following conditions must be assured:

a. The ability to escape without loss of life or immediate or delayed irreversible health effects. (Thirty minutes is considered the maximum time for escape so as to provide some margin of safety in calculating the IDLH.)

b. The prevention of severe eye or respiratory irritation or other reactions that would hinder escape.

Sources of information for determining whether the exposure limit for a contaminant represents an IDLH condition are as follows:

a. Specific IDLH guidelines provided in the literature such as the NIOSH Pocket Guide for Hazardous Chemical Substances (http://www.cdc.gov/niosh/npg/npg.html) and
the American Industrial Hygiene Association (AIHA) Hygienic Guides.

b. Human exposure and effects data, and/or
c. Animal exposure and effects data, and/or
d. Where such data specific to the contaminant are lacking, toxicologic data from analogous substances and chronic animal exposure data may be considered.

Subparagraph 4: Eye Irritation

Eye protection in the form of respirators with full facepieces, helmets, or hoods is required for routine exposures to airborne contaminants that cause any irritation to the mucous membranes of the conjunctivae or the cornea or cause any reflex tearing. Eye protection is required for contaminants that cause minor subjective effects as well as for those that cause any damage, including disintegration and sloughing of conjunctival or corneal epithelium, edema, or ulceration. NIOSH is not aware of any standards for gas-tight goggles that would permit NIOSH to recommend such goggles as providing adequate eye protection.

For escape, some eye irritation is permissible if the severity of irritation does not inhibit the escape and if no irreversible scarring or ulceration of the eyes or conjunctivae is likely.

When data on threshold levels for eye irritation are insufficient, quarter or half-mask respirators can be used, provided that the worker experiences no eye discomfort and no pathologic eye effects develop. Workers should be told that if any eye discomfort is experienced, they will be provided with respirators that have full facepieces, helmets, or hoods and that provide protection equivalent to the quarter- or half-mask respirators.
VI. Glossary of Respiratory Protection Terms

The following definitions are important terms used in the respiratory protection standard and terms that will assist in the understanding and the application of the NIOSH decision logic.

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

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

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

**Auxiliary SCBA:** An auxiliary unit means that the SAR unit includes a separate air bottle to provide a reserve source of air should the airline become damaged. The auxiliary unit shares the same mask and regulator, and enables the SAR to function as an SCBA if needed.

**Breakthrough:** The penetration of challenge material(s) through a gas or a vapor air-purifying element. The quantity or extent of breakthrough during service life testing is often referred to as the percentage of the input concentration.

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

**Continuous Flow:** A respirator that maintains air flow at all times, rather than only on demand. However, it may not maintain positive pressure within the mask at all times. Negative pressure conditions may occur during inhalation involving strenuous activity.

**Demand Respirator:** A respirator in which the pressure inside the facepiece in relation to the immediate environment is positive during exhalation and negative during inhalation.

**Disposable Respirators:** A respirator that is discarded after the end of its recommended period of use, after excessive resistance or physical damage, or when odor breakthrough or other warning indicators render the respirator unsuitable for further use.

**Emergency Respirator Use Situation:** A situation that requires the use of respirators due to the unplanned generation of a hazardous atmosphere (often of unknown composition) caused by an accident, mechanical failure, or other means and that requires evacuation of personnel or immediate entry for rescue or corrective action.
**Employee Exposure:** Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

**End-Of-Service-Life Indicator (ESLI):** A system that warns the respirator user of the approach of the end of adequate respiratory protection; for example, that the sorbent is approaching saturation or is no longer effective.

**Escape Gas Mask:** A gas mask that consists of a half-mask facepiece or mouthpiece, a canister, and associated connections, and that is designed for use during escape-only from hazardous atmospheres.

**Escape Only Respirator:** Respiratory devices that are designed for use only during escape from hazardous atmospheres.

**Filter or Air-Purifying Element:** A component used in respirators to remove solid or liquid aerosols from the inspired air.

**Filtering Facepiece:** A particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

**Fit Factor:** A quantitative measure of the fit of a specific respirator facepiece to a particular individual.

**Fit Test:** Means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

**Gas:** An aeriform fluid that is in a gaseous state at standard temperature and pressure.

**Hazard ratio:** A number obtained by dividing the concentration of a contaminant by its exposure limit.

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

**Hood or Helmet:** Is a respirator component which covers the wearer’s head and neck, or head, neck, and shoulders, and is supplied with incoming respirable air for the wearer to breathe. It may include a headharness and connection for a breathing tube.

**Immediately Dangerous to Life or Health (IDLH):** Conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health. (See subparagraph 3 on page 20 for more information on IDLH conditions.)
Interior Structural Firefighting: 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.

Maximum Use Concentration (MUC): Maximum use concentration (MUC) means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC usually can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the NIOSH recommended exposure limit (REL), permissible exposure limit, short term exposure limit, ceiling limit, peak limit, or any other exposure limit used for the hazardous substance.

Mist: A liquid condensation particulate.

Negative Pressure Respirator: A tight-fitting respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Orinasal Respirator: A respirator that covers the nose and mouth and that generally consists of a quarter- or half-facepiece.

Oxygen Deficient Atmosphere: An atmosphere which contains an oxygen partial pressure of less than 148 millimeters of mercury (19.5 percent by volume at sea level).

Physician or Other Licensed Health Care Professional (PLHCP): Means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required for medical evaluation to wear a respirator.

Planned or Unplanned Entry into an IDLH Environment, an Environment of Unknown Concentration of Hazardous Contaminant, or an Environment of Unknown Composition: A situation in which respiratory devices are recommended to provide adequate protection to workers entering an area where the contaminant concentration is above the IDLH or is unknown.

Potential Occupational Carcinogen: Any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory, or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance that is metabolized into one or more potential occupational carcinogens by mammals (29 CFR 1990.103, OSHA Cancer Policy).

Powered Air-Purifying Respirator (PAPR): Means a device equipped with a facepiece,
hood, or helmet, breathing tube, canister, cartridge, filter, canister with filter, or cartridge with filter, and a blower.

**Pressure Demand Respirator:** A respirator in which the pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.

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

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

**Recommended Exposure Limit (REL):** An 8- or 10-hour time-weighted average (TWA) or ceiling (C) exposure concentration recommended by NIOSH that is based on an evaluation of the health effects data.

**Respirator:** Means any device designed to provide the wearer with respiratory protection against inhalation of a hazardous atmosphere.

**Respirator Program Administrator:** The person responsible for all aspects of the respirator program with full authority to make decisions to ensure its success. The administrator must have sufficient knowledge (obtained by training or experience) to develop and implement the program. Preferably, he/she should have a background in industrial hygiene, safety, health care or engineering.

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

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

**Service Life:** The length of time required for an air-purifying element to reach a specific effluent concentration. Service life is determined by the type of substance being removed, the concentration of the substance, the ambient temperature, the specific element being tested (cartridge or canister), the flow rate resistance, and the selected breakthrough value. The service life for a self-contained breathing apparatus (SCBA) is the period of time, as determined by the NIOSH certification tests, in which adequate breathing gas is supplied.

**Simulated Workplace Protection Factor (SWPF):** A surrogate measure of the workplace protection provided by a respirator.

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

**Tight-Fitting Facepiece:** A respiratory inlet covering that forms a complete seal with the
face.

**User Seal Check**: An action conducted by the respirator user to determine if the respirator is properly seated to the face.

**Vapor**: The gaseous state of a substance that is solid or liquid at temperatures and pressures normally encountered.

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

NIOSH Respirator Use Policy
Approved: August 4, 1999

**Background.** OSHA’s new respiratory protection standard, 29 CFR 1910.134, became effective on April 8, 1998, with complete compliance required by October 5, 1998. The new regulation is an upgrade in many ways and is a significant advance for respirator wearers. The NIOSH Respirator Use Policy (RUP) Workgroup has carefully reviewed the new regulation and determined that it is generally consistent with previous NIOSH policy. The Workgroup identified only five differences between the previous NIOSH policy and the new 1910.134. The Workgroup reviewed these differences to determine if it would be appropriate for NIOSH to modify its policies to be in harmony with OSHA. The consistency between NIOSH and OSHA that would result from such harmonization was considered an advantage to respirator users in that it would tend to minimize confusion in the workplace. At the same time, the Workgroup recognized that the rulemaking process placed restrictions on OSHA that do not apply to NIOSH in making its public health recommendations.

**NIOSH Respirator Policy Statement:**

NIOSH endorses all provisions of OSHA’s 29 CFR Part 1910.134, as published on January 8, 1998, except that NIOSH does not recommend (a) the use of irritant smoke for qualitative respirator fit testing, or (b) unsupervised medical evaluations conducted by health care professionals who are not licensed for independent practice to perform or supervise medical evaluations.

**Discussion.** Both NIOSH policy and the new OSHA regulation are in fundamental agreement that the primary means to prevent occupational diseases caused by breathing contaminated air is through the use of feasible engineering controls such as enclosures, confinement of operations, ventilation, or substitution with less toxic materials. Only when effective engineering controls are not feasible, or while they are being installed or maintained, should respirators be utilized as the primary means of worker protection.
The differences between the previous NIOSH respirator use recommendations and OSHA’s 1910.134 are discussed below along with the basis of the new NIOSH recommendations.

1. Change Schedules. Chemical-cartridge respirators typically use activated charcoal as a sorbent to filter toxic gases and vapors. They are essentially 100% efficient filters until the gas or vapor "breaks through." To use these respirators safely, the user must have some way of knowing when "breakthrough" has occurred and the chemical cartridge has to be replaced. This breakthrough can be identified in three ways. First, if the substance has good warning properties (smell, taste, irritation), the wearer detects breakthrough and knows to replace the cartridge (or canister). Second, an end-of-service-life-indicator (ESLI) for the specific gas or vapor of concern signals the wearer to replace the cartridge. Third, a cartridge "change schedule" is established to assure the cartridge is replaced well before breakthrough occurs. These change schedules must be specific for each workplace situation because the service life of a cartridge depends on many variables including: the contaminant concentration, humidity, temperature, interference from other gases and vapors, patterns of use (continuous or intermittent), and characteristics of each respirator model. Previously, OSHA and NIOSH recognized only the first two methods. The new 1910.134 now recognizes only the second and third (ESLIs and change schedules) and no longer recognizes the first (warning properties). Based on the recommendations of the RUP Workgroup, NIOSH has updated its policy to be consistent with OSHA by recognizing the use of change schedules and by recommending against reliance on warning properties.

Developing cartridge change schedules is a new exercise for most respirator users; because standard approaches to setting a change schedule have not been developed and validated, there is uncertainty about their efficacy. Endorsing the use of cartridge change schedules is done with the full knowledge of the uncertainty and problems associated with this approach. It is believed, however, that the uncertainties of change schedules present less of a public health problem than would the continued reliance on warning properties. Further, the new OSHA regulation will likely, over time, cause the development of improved methods of establishing cartridge change schedules. However, there is the possibility that some employers may develop and follow inadequate change schedules that can result in chronic overexposure. Research to develop and validate clear and practical methods for employers to establish change schedules is, therefore, critically needed.

Reliance on warning properties has long been recognized as problematic. The 1987 NIOSH Respirator Decision Logic described the typical wide variation of odor threshold in the general population (greater than two orders of magnitude). The recommendation made in that publication was for "screening tests for workers who wear air-purifying gas or vapor respirators to determine their ability to detect the odor below the exposure limit for that gas or vapor." However,
NIOSH does not know of any employer who has tried to do this screening nor any established procedures for doing this screening. Even if screening were performed, other problems would remain: shift in odor threshold due to extended low exposures, shifts due to simple colds and other illnesses, failure to recognize odor because of distraction of the workplace competing for worker attention, and inaccuracies in the screening test itself.

Of the five differences between NIOSH and OSHA, this is the only one where following the previous NIOSH recommendation would preclude following the OSHA regulation and would therefore be in violation of OSHA's regulations.

2. Irritant Smoke Fit Testing. This qualitative respirator fit test is conducted by directing the smoke stream from ventilation smoke tubes (intended to study building ventilation systems) at the respirator face seal. An inadequate face seal is indicated by an involuntary reaction (coughing or gagging) of the worker. The involuntary nature of the reaction is the reason many prefer this test over other qualitative fit tests.

NIOSH, in its formal comments to OSHA on the proposed revision of 29 CFR 1910, 1915, and 1926, strongly recommended against the use of this fit test method because of the health risk associated with exposure to the irritant smoke. That recommendation was primarily based on studies conducted as part of a NIOSH HHE (HETA 93-040-2315) and described in Appendix A of the NIOSH comments to OSHA dated May 15, 1995 (docket H-049). NIOSH continues to recommend against the use of irritant smoke fit testing for these same reasons.

A person's involuntary reaction after breathing irritant smoke is caused by a white hydrochloric acid fume produced by ventilation smoke tubes containing stannic chloride. Hydrogen chloride is immediately irritating at air concentrations of 5 parts per million (ppm) or more. Therefore, the NIOSH recommended exposure limit, the OSHA permissible exposure limit, and the ACGIH TLV® for hydrogen chloride are all ceiling limits of 5 ppm. (A ceiling limit is an air concentration that should not be exceeded during any part of a workday.) Air sampling has shown that ventilation smoke tubes can produce highly variable and unpredictable hydrogen chloride concentrations far exceeding 5 ppm. The NIOSH HHE included measurements of the hydrogen chloride concentrations emitted from smoke tubes measured at a distance of 12 inches from the tube and generated from a single squeeze of an aspirator bulb. These concentrations ranged from near the ceiling limit (1 ppm, 4 ppm, and 9 ppm) in a room with low relative humidity to 100 times the ceiling limit (460 ppm, 520 ppm, and 1700 ppm) in a room with high relative humidity.
NIOSH reviewed the revised protocol for the irritant smoke test in OSHA’s final respiratory protection standard and concluded that a risk still exists for overexposure to hydrogen chloride during a facepiece fit test. To check their sensitivity, test subjects are required to breathe irritant smoke both before and after a successful fit test. Generated concentrations to which test subjects are subjected are not measured in the test protocol. A concentration of 5 ppm is the accepted threshold level at which a response is evoked from most persons. A fit test is a failure when a test subject experiences an involuntary cough or irritation. Retesting requires repeating the sensitivity check. In each case, the responses of coughing and irritation are the adverse health effects for which hydrogen chloride’s exposure limits are intended to protect against. Consequently, NIOSH maintains its recommendation against the use of irritant smoke as a fit testing agent.

3. Saccharin qualitative fit testing. This test is conducted with an inexpensive, commercially available kit that challenges the respirator wearer with a sweet tasting saccharin aerosol. After previously having been screened to assure that he/she can taste saccharin at the required concentration, the respirator wearer is asked to report if saccharin is tasted during fit testing. If so, the respirator is considered to have an inadequate fit and fails the fit test.

NIOSH has previously recommended against the saccharin fit test because of its classification as a potential carcinogen [NTP 1981; IARC 1987; Niemeier 1991]. However, NIOSH recently re-examined the potential risk to workers that would be posed by saccharin used in fit testing [NIOSH 1999]. Finding that the risk to workers from use of saccharin in respirator fit testing is extremely small and may be zero, and in accordance with the new REL policy [NIOSH 1995], NIOSH recommends both saccharin or Bitrex® for use in qualitative respirator fit testing, consistent with OSHA’s respiratory protection standard (29 CFR 1910.134).

NIOSH intends to include the saccharin fit test in its ongoing research program to assess the efficacy of fit test methods in general. That is, NIOSH plans to evaluate the ability of the saccharin fit test to identify those individuals who will achieve a fit sufficient to assure adequate protection when the respirator is worn in the workplace. NIOSH researchers have conducted, and are conducting, such studies of a variety of fit test methods.

4. Voluntary Respirator Use. Previously, NIOSH recommended, and OSHA required, a full-blown respirator program whenever a respirator was used. Thus, for example, employees having a workplace exposure below the exposure limit but wanting to further reduce their exposure with voluntary respirator use could not do so unless the employer implemented a complete respirator program with all its elements (fit testing, written program, medical evaluation, record keeping).
etc.). This tended to discourage the use of respirators to further reduce exposure to levels well below maximum exposure limits.

The new OSHA regulations require a complete respirator program whenever respirator use is required by the employer. However, when respirators are used voluntarily by employees, the employer needs only to establish those respirator program elements necessary to assure the respirator itself is not a hazard. The exception is that filtering facepiece respirators can be used without any respirator program when used voluntarily. Although there are no known studies of such voluntary respirator use, NIOSH supports OSHA's voluntary use provisions because they provide safe ways not previously available to use respirators to reduce exposure well below established exposure limits.

5. Medical Evaluation Responsible Person. The previous OSHA 1910.134 stated: "Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent."

The new 1910.134 states: "The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations...." In the definitions section, OSHA states: Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section."

Thus the new OSHA regulation allows a non-physician, under certain conditions, to be the responsible person who determines medical fitness to wear a respirator. However, the definition in 1910.134(b) of a "physician or other licensed health care professional" does not limit the non-physician responsible person to those who are licensed for independent practice in all the health care services required by 1910.134(e). NIOSH recommends that the only non-physicians responsible for medical surveillance and medical clearance (either conducting the examinations or supervising them) should be nurse practitioners and physician assistants in those states where they are licensed for independent practice.

signed: Linda Rosenstock, M.D., M.P.H.  August 4, 1999

Director, NIOSH Date
REFERENCES for Appendix


DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

NIOSH

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or visit the NIOSH Web site at www.cdc.gov/niosh/NPPTL
DHHS(NIOSH) Publication No. 2005-100

SAFER • HEALTHIER • PEOPLE™
Appendix K
Colgate University
Voluntary Use Form (29 CFR 1910.134 Appendix D)

Colgate University allows employees to voluntarily wear filtering face pieces, or "dust masks", provided that each employee follows the guidelines described above in 29 CFR 1910.134 Appendix D. OSHA defines filtering face piece as "a negative pressure particulate respirator in which the filter is an integral part of the face piece, or with the entire face piece composed of the filtering medium" (29 CFR 1910.134(b)). Employees may wear these filtering face pieces provided that they are appropriate for the situation, that they do not create additional safety hazards, and that the situation in which they will be used has not already been evaluated and deemed to need a higher level of respiratory protection.

The Colgate University Respiratory Protection Program (RPP) prohibits the unauthorized use of tight-fitting face piece respirators. OSHA defines a tight-fitting respirator as "a respiratory inlet covering that forms a complete seal with the face" (29 CFR 1910.134(b)). If you need to use one of these respirators, you must be enrolled in the RPP and adhere to all the requirements, including an annual medical evaluation, fit test, and training. Please contact the Program Administrator, Daniel Gough, via e-mail to dgough@colgate.edu or via phone at 315-228-7994 for further information about the RPP.

(Mandatory) OSHA 29 CFR 1910.134 APPENDIX D Information for Employees Using Respirators When Not Required Under the Standard:

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure 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 respirator limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. The National Institute for Occupational Safety and Health (NIOSH) certifies respirators for the U.S. Department of Health and Human Services. 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 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.

I have read and understand the following information:

Employee Signature / Date: ____________________________________________

EHS Signature / Date: ________________________________________________
Colgate University
Voluntary Use Form (29 CFR 1910.134 Appendix D)

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I have read and understand the following information:

Employee Signature / Date: __________________________________________

EHS Signature / Date: __________________________________________
Appendix L
Name: ____________________________

Department: ____________________________

Gender: Male ___ Female ___

Respirator:  
Make ____________________________
Model ____________________________
Style (Half / Full Face piece) ____________________________
Size ____________________________

Test Method: Qualitative Test  Irritant Smoke

Face/Respirator Fit Checks:  
Negative Pressure: Pass ___ Fail ___
Positive Pressure: Pass ___ Fail ___

Fit Test Procedure: (+ Pass, -- Fail)
1. Breath Normally: ____________________________
2. Breath Deeply: ____________________________
3. Turn Head (side to side): ____________________________
4. Nod Head: ____________________________
5. Recite Rainbow Passage: ____________________________
6. Jog in Place: ____________________________
7. Breath Normally: ____________________________

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 HIS REACH, HIS FRIENDS SAY HE IS LOOKING FOR THE POT OF GOLD AT THE END OF THE RAINBOW.

NOTES:  

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# RESPIRATORY FIT TEST/TRAINING RECORD

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**OTHER PERSONAL PROTECTIVE EQUIPMENT (issued which must interface with the respirator):**

- Safety Glasses
- Goggles
- Face shield
- Hard Hat
- Ear Muffs
- Other (specify): ________________________________

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</table>
Name: ___________________________________________

Department: __________________________________________

Gender: Male ___  Female ___

Respirator: Make _______________________________________
Model _______________________________________
Style (Half / Full Face piece) ____________________________
Size __________________________________________

Test Method: Qualitative Test ___ Irritant Smoke ___

Face/Respirator Fit Checks:

Negative Pressure: Pass ___ Fail ___
Positive Pressure: Pass ___ Fail ___

Fit Test Procedure: (+ Pass, -- Fail)

1. Breath Normally: _____________________________
2. Breath Deeply: _____________________________
3. Turn Head (side to side): ___________________
4. Nod Head: _________________________________
5. Recite Rainbow Passage: ___________________
6. Jog in Place: ______________________________
7. Breath Normally: ___________________________

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 HIS REACH, HIS FRIENDS SAY HE IS LOOKING FOR THE POT OF GOLD AT THE END OF THE RAINBOW.

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# RESPIRATORY FIT TEST/TRAINING RECORD

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**OTHER PERSONAL PROTECTIVE EQUIPMENT** *(Issued which must interfere with the respirator):*

- Safety Glasses
- Goggles
- Face shield
- Hard Hat
- Ear Muffs
- Other (specify) ____________________________

Notes:

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Notes:
Colgate University
Respiratory Protection Program Fit Test Form

Name: ________________________________

Department: ____________________________

Gender: Male ___  Female ___

Respirator:  
Make _________________________________
Model _________________________________
Style (Half / Full Face piece) ____________
Size _________________________________

Test Method: Qualitative Test __ Irritant Smoke ___

Face/Respirator Fit Checks:
Negative Pressure: Pass ___ Fail ___
Positive Pressure: Pass ___ Fail ___

Fit Test Procedure: (+ Pass, -- Fail)
1. Breath Normally: ____________________________
2. Breath Deeply: ____________________________
3. Turn Head (side to side): ____________________________
4. Nod Head: ____________________________
5. Recite Rainbow Passage: ____________________________
6. Jog in Place: ____________________________
7. Breath Normally: ____________________________

RAINBOW PASSAGE

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**OTHER PERSONAL PROTECTIVE EQUIPMENT** (listed which must interface with the respirator):

- Safety Glasses
- Goggles
- Ear Muffs
- Other (specify)
- Face shield
- Hard Hat

**Notes:**

- Notes:
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- Notes:
Carpenter

Work Effort: Light (defined as frequent lifting of 10 lb.; infrequent lifting of <20 lb., walking on level, carrying up to 10 lb)
Usage: Less than 5 hours per month
Protective Gear: Eye Protection (goggles, faceshield), Skin Protection (apron, coveralls, Tyvek suits), Boots, shoe covers
Working in temperatures exceeding 77°F: No
Working in temperatures less than 50°F: No
Humid Conditions: No
Oxygen deficient environment: No
Permit Required Confined space: No
Hyperbaric Conditions: No
High Altitudes: No
Known Toxic Substances: Dusts - Fly Ash - Particulates - Fibers
Brief Work Description: Sanding, scraping, finishing sheet rock
Recertify: within one year
### My Respirator Profiles

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#### Carpenter (Asbestos)

- **Work Effort:** Light (defined as frequent lifting of 10 lb.; infrequent lifting of <20 lb.; walking on level; carrying up to 10 lb.)
- **Usage:** Less than 5 hours per month
- **Protective Gear:** Eye Protection (goggles, face shield), Skin Protection (apron, coveralls, Tyvek suits), Gloves
- **Working in temperatures exceeding 77°F:** No
- **Working in temperatures less than 50°F:** No
- **Humid Conditions:** No
- **Oxygen deficient environment:** No
- **Permit Required Confined space:** No
- **Hyperbaric Conditions:** No
- **High Altitudes:** No
- **Known Toxic Substances:** asbestos, Dusts - Fly Ash - Particulates - Fibers
- **Brief Work Description:** Sanding, scraping, minor asbestos drilling projects with HEPA vac and drill shroud.
- **Recertify:** within one year
### Environmental Health & Safety

**Work Effort:** Light (defined as frequent lifting of 10 lb; infrequent lifting of <20 lb; walking on level; carrying up to 10 lb)

**Usage:** Weekly, but less than 5 hours per week

**Protective Gear:** Eye Protection (goggles, face shield). Head protection (helmet, hard hat, head cover).

Hearing Protection (ear plugs, ear muff), Skin Protection (apron, coveralls, Tyvek suits), Gloves, Boots, shoe covers, Fire Retardent Clothing

**Working in temperatures exceeding 77°F:** No

**Humid Conditions:** No

**Oxygen deficient environment:** No

**Permit Required Confined space:** No

**Hyperbaric Conditions:** No

**Known Toxic Substances:** Dusts - Fly Ash - Particulates - Fibers, Solvents (benzene, toluene, xylene), Acids - Alkaline - Mists (ammonia, bleach etc), Hazardous Waste/Material, Infectious agents (bacteria, viruses, molds etc). Organic chemicals, Formaldehyde

**Brief Work Description:** Chemical spill response, decontamination, chemical clean-up, mold clean-up, lead based paint

**Recently:** within one year

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On-Line Respiratory Examination

3M United States

My Respirator Profiles

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Heating Plant

- Work Effort: Medium (defined as frequent lifting of 25 lb.; infrequent lifting of <50 lb.; fast walking on level; carrying up to 25 lb.)
- Usage: Over 4 hours per day
- Protective Gear: Skin Protection (apron, coveralls, Tyvek suits)
- Working in temperatures exceeding 77°F: Yes
- Working in temperatures less than 50°F: No
- Humid Conditions: Yes
- Oxygen deficient environment: No
- Permit Required Confined space: Yes
- Hyperbaric Conditions: No
- High Altitudes: No
- Known Toxic Substances: Dusts - Fly Ash - Particulates - Fibers
- Brief Work Description: Boiler Cleanout
- Recertify: within one year

https://www.respexam.com/custadmin/profilewiz/wiz1.asp

1/18/2012
### My Respirator Profiles - Colgate University

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### Painters

- **Work Effort**: Light (defined as frequent lifting of 10 lb.; infrequent lifting of <20 lb.; walking on level; carrying up to 10 lb.)
- **Usage**: 2 to 4 hours per day
- **Protective Gear**: Eye Protection (goggles, faceshield), Skin Protection (apron, coveralls, Tyvek suits), Gloves
- **Working in temperatures exceeding 77°F**: No
- **Working in temperatures less than 50°F**: No
- **Humid Conditions**: No
- **Oxygen deficient environment**: No
- **Permit Required Confined space**: No
- **Hyperbaric Conditions**: No
- **High Altitudes**: No
- **Known Toxic Substances**: Dusts - Fly Ash - Particulates - Fibers, Solvents (benzene, toluene, xylene)
- **Brief Work Description**: Removing paint, using some paint/removal products
- **Recertify**: within one year
### Plumbers

**Work Effort:** Medium (defined as frequent lifting of 25 lb.; infrequent lifting of <50 lb.; fast walking on level; carrying up to 25 lb.)

**Usage:** 2 to 4 hours per day

**Protective Gear:**
- Eye Protection (goggles, faceshield)
- Head protection (helmet, hard hat, head cover)
- Hearing Protection (ear plugs, ear muffls)
- Skin Protection (apron, coveralls, Tyvek suits)
- Boots, shoe covers

**Working in temperatures exceeding 77°F:** Yes

**Working in temperatures less than 50°F:** No

**Humid Conditions:** Yes

**Oxygen deficient environment:** No

**Permit Required Confined space:** Yes

**Hyperbaric Conditions:** No

**High Altitudes:** No

**Known Toxic Substances:**
- Dusts - Fly Ash - Particulates - Fibers, Fumes (welding)

**Brief Work Description:** Welding, confined space work

**Recertify:** within one year
## My Respirator Profiles

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### PM (Millwrights)

- **Profile Name:** PM (Millwrights)
- **Type:** Full Face
- **Last Modified:** 6/1/2011
- **Created:** 6/1/2011
- **Action:** Edit Copy Preview Delete

#### Work Effort:
- Light (defined as frequent lifting of 10 lb.; infrequent lifting of <20 lb.; walking on level; carrying up to 10 lb.)
- Usage: Less than 5 hours per month

#### Protective Gear:
- Eye Protection (goggles, faceshield), Head protection (helmet, hard hat, head cover), Hearing Protection (ear plugs, ear muffs), Skin Protection (apron, coveralls, Tyvek suits), Boots, shoe covers

#### Working in Temperatures exceeding 77°F: No

#### Humid Conditions: Yes

#### Oxygen Deficient Environment: No

#### Permit Required Confined Space: Yes

#### Hyperbaric Conditions: No

#### High Altitudes: No

#### Known Toxic Substances: Dusts - Fly Ash - Particulates - Fibers, Fumes (welding)

#### Brief Work Description: Welding, cleaning (possible dust/particle), welding

#### Recertify: within one year
**United States**

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**Prof Watkins Research**

- **Work Effort:** Light (defined as frequent lifting of 10 lb.; infrequent lifting of <20 lb.; walking on level; carrying up to 10 lb.)
- **Usage:** Less than 5 hours per month
- **Protective Gear:** Eye Protection (goggles, faceshield), Gloves, Fire Retardant Clothing
- **Working in temperatures exceeding 77°F:** No
- **Working in temperatures less than 50°F:** No
- **Humid Conditions:** No
- **Oxygen deficient environment:** No
- **Permit Required Confined space:** No
- **Hyperbaric Conditions:** No
- **High Altitudes:** No
- **Known Toxic Substances:** Nickel, Hazardous Waste/Material, Organic chemicals
- **Brief Work Description:** Research experiment involving the use of nickel chloride (mixed with soil and water).
- **Recertify:** within one year
Appendix N
# 1. IDENTIFICATION AND GENERAL INFORMATION

**Product Name:** Smoke Generating Tubes  
**Chemical Family:** N/A  
**Synonyms:** Tin (IV) Chloride, Tin tetrachloride, Librius Fuming Spirit  
**Ingredient:** Stannic Chloride  
**CAS Number:** 7646-78-8  
**Percent:** 5-15%  
**EC No.:** 231-588-9  
**UN No.:** UN1927  
**TWA:** N/A  
**Molecular Weight:** N/A  
**Molecular Formula:** SnCl4  
**Notes:** N/A

## 2. COMPOSITION

- **Product Name:** Smoke Generating Tubes  
- **Chemical Family:** N/A  
- **Synonyms:** Tin (IV) Chloride, Tin tetrachloride, Librius Fuming Spirit  
- **Ingredient:** Stannic Chloride  
- **CAS Number:** 7646-78-8  
- **Percent:** 5-15%  
- **EC No.:** 231-588-9  
- **UN No.:** UN1927  
- **TWA:** N/A  
- **Molecular Weight:** N/A  
- **Molecular Formula:** SnCl4  
- **Notes:** N/A

## 3. HAZARDS IDENTIFICATION

<table>
<thead>
<tr>
<th>Health Hazard Data</th>
<th>Component</th>
<th>SnCl4</th>
<th>Toxic Oxides and Compounds</th>
<th>HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. 8hr TWA</td>
<td>N/A</td>
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<td></td>
<td></td>
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<tr>
<td>Carcinogen</td>
<td></td>
<td></td>
<td>Inadequate data</td>
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<tr>
<td>Physical Dangers</td>
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<td></td>
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<tr>
<td>Chemical Dangers</td>
<td></td>
<td></td>
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<tr>
<td>Routes of Entry</td>
<td>Inhalation, skin, and ingestion</td>
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<tr>
<td>Target Organs</td>
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</tr>
<tr>
<td>Health Hazards:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Inhalation:</td>
<td>Symptoms of inhalation exposure include severe coughing, wheezing, shortness of breath, headaches, nausea, and vomiting. Exposure to skin causes irritation or tissue burns.</td>
<td></td>
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<tr>
<td>Skin Contact:</td>
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<td>Contact:</td>
<td></td>
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<tr>
<td>Ingestion:</td>
<td>May be fatal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Exposure and Acute Exposure:</td>
<td>Stannic Chloride is considered Highly Toxic (USA) or Toxic (EU) and is corrosive to the skin, eyes, and respiratory tract. Contact with moisture releases hydrochloric acid fumes, which is also highly corrosive. Contact with moist air also releases tin compounds, which may be toxic. Symptoms of inhalation exposure include severe coughing, wheezing, shortness of breath, headaches, nausea, and vomiting. Produces lung irritation and damage to the mucous membranes of the upper respiratory tract. In extreme cases, pulmonary edema can occur. Exposure to skin causes irritation or tissue burns. May be fatal if swallowed or on excessive contact.</td>
<td></td>
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<td>Aggr. of Pre-Ex Cond:</td>
<td>N/A</td>
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<td></td>
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<tr>
<td>Notes:</td>
<td>Users are not exposed to the hazardous components until the tubes are broken. Read, understand and comply with all labels, warnings and instructions accompanying these tubes before use. Failure to comply may cause serious injury or death.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 4. FIRST AID MEASURES

- **Inhalation:** If inhaled enough to cause coughing, remove victim to fresh air. If coughing persists, provide oxygen and contact a physician.  
- **Skin Contact:** If smoke contacts skin for a prolonged time, flush with copious amounts of water for 15 minutes and contact a physician.  
- **Eye Contact:** Immediately flush with water for 15 minutes and contact a physician.  
- **Ingestion:** Wash mouth out with water. Do not induce vomiting. Seek medical attention.

## 5. FIRE FIGHTING MEASURES

- **Fire Hazards:** Stannic chloride and HCl are non-flammable and have no known upper and lower explosion limits. Excessive heat may be released on contact with water. Fire hazard caused indirectly by release of HCl of exposure of broken tubes to moist air.  
- **Fire Extinguisher:** Dry powder.  
- **Explosion:** N/A  
- **Flash Point:** N/A  
- **Volatile (% by volume):** N/A  
- **Exp. Limits (Vol % in air):** N/A  
- **Auto Ignition Temperature:** N/A  
- **Special Fire Fighting Proc:** N/A  
- **PPE for Fire Fighters:** Wear SCBA and protective clothing.  
- **Notes:** None

---

**Date Revised:** 04/08/2011
6. ACCIDENTAL RELEASE MEASURES

Procedure for Spill/Leak: Contain any large leaks using a plastic vessel. Cover with solid absorbent such as vermiculite or alkaline absorbent. Dilute and wash with plenty of water or soapy water. Dispose of washings and/or solids according to local regulations regarding hazardous waste. Each tube contains ~0.7 g SnCl₄

Waste Disposal: None suggested.

7. HANDLING AND STORAGE

Storage: Store in the box at ≤40°C when not in use.

Shelf Life: N/A

PPE: N/A

Notes: None.

8. EXPOSURE CONTROLS

PPE: Use only the pump(s) at the flow rates specified in OSHA CFR 1910.133 and 29 CFR 1910.139. If the pump is operated at non-specified flow rates it could increase the smoke and fume concentrations and cause serious injury or death.

Inhalation: N/A

Skin: Wear safety gloves to protect against chemical exposure and flying glass.

Eye: Wear safety glasses to protect against chemical exposures and flying glass.

Ingestion: N/A

Ventilation: Use only in well-ventilated area.

Engineering Controls: N/A

Work/Hygienic Practices: Wash hands after use.

Exposure Limits: N/A

Notes: None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component: SnCl₄

Color/Appearance/Odor: Slightly yellowish clear liquid

Boiling Point: 114°C

Melting Point: -33°C

Specific Gravity (H₂O=1): N/A

Refractive Index: N/A

Relative Density: N/A

Evaporative Rate: N/A

Water Content: N/A

Vapor Density: 1.268 (air=1000)

Density: 2.226 g/cc

Vapor Pressure: 20 mm Hg @ 20°C

Solubility in Water: Decomposes 37% by weight

Inert Ingredients: Colorless Gas Inorganic solids

10. STABILITY AND REACTIVITY

Stability: Reacts with water and moisture in the air to form a smoke of HCl and tin oxychlorides.

Hazardous Decomposition: N/A

Products: N/A

Hazardous Polymerization: Will not occur, but HCl may catalyze the polymerization of other compounds.

Incompatibilities: Bases, ethylene oxide, water alcohols, metals.

Conditions to Avoid: Do not expose to air until use.

Materials to Avoid: N/A

11. TOXICOLOGICAL INFORMATION

Health Effects: N/A

Oral LD₅₀: N/A

Dermal LD₅₀: N/A

Human Lethal Dose: N/A

Notes: None

12. ECOLOGICAL INFORMATION

None

13. DISPOSAL CONSIDERATIONS

Dispose of washings and/or solids according to local regulations regarding hazardous waste. Each tube contains ~0.7 g SnCl₄ before use.

14. TRANSPORT INFORMATION

Proper Shipping Name: N/A

Hazard Class: N/A

Transport Emergency Card: N/A

Packing Group: N/A

UN Number: N/A

Reportable Quantity: N/A

Notes: None.

Date Revised: 04/08/2011
15. REGULATORY INFORMATION
   TSCA Registered: N/A
   FDA Approved: N/A
   JCSC: N/A

16. OTHER INFORMATION
   - Use in respirator fit testing according to OSHA 29 CFR 1910.134 (App A) and OSHA 1910.139.
   - Use only the pump(s) at the flow rates specified in OSHA CFR 1910.134 and 29 CFR 1910.139. If the pump is operated at non-specified flow rates it could increase the smoke and fume concentrations and cause serious injury or death.

Precautions with using product for Respirator Fit Testing:
- Eyes should be kept tightly closed during fit testing.
- DO NOT inhale smoke directly.
- DO NOT use in a confined space.
- DO NOT direct smoke stream directly at the skin during fit testing.
- DO NOT use under a respirator fit testing hood or other enclosed space, because fume concentrations may build up to levels that can cause serious injury or death.
- DO NOT use for fit testing on persons with pre-existing respiratory or related medical conditions or are allergic to tin compounds or hydrochloric acid.

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1. IDENTIFICATION AND GENERAL INFORMATION

- **P/N:** 2050, 2050-01, 2055
- **Nominalature:** Irritant Smoke Tube
- **Company Name:** Allegro Industries
- **Address:** 7221 Orange Grove Avenue
  Garden Grove, CA 92841
  714-899-9855
  Chemtrac: 800-424-9300

2. COMPOSITION

- **Product Name:** Smoke Generating Tubes
- **Chemical Family:** N/A
- **Synonyms:** Tin (IV) Chloride, Tin tetrachloride, Libavus Fuming Spirit
- **Ingredient:** Stannic Chloride
  Inert ingredients
- **CAS Number:** 7646-78-8
  N/A
- **Percent:** 5-15%
  85-95%
- **EC No.:** 231-588-9
  N/A
- **UN No.:** UN1827
  N/A
- **TWA:** N/A
- **Molecular Weight:** N/A
- **Molecular Formula:** SnCl4
- **Notes:** N/A

3. HAZARDS IDENTIFICATION

- **Health Hazard Data:**
  - **Component:**
  - **SnCl4:**
  - **Toxic Oxides and Compounds:**
  - **HCl:**
  - **U.S. 8hr TWA:** N/A
  - **2mg/m³ as Sn:**
  - **5ppm Ceiling OSHA:**
  - **2ppm Ceiling ACGIH:**
  - **Carcinogen:** Inadequate data
  - **Inadequate data:**
  - **No:**

- **Physical Dangers:**
  Vapors are corrosive to skin and overexposure can result in serious injury or death.

- **Chemical Dangers:** N/A

- **Routes of Entry:** Inhalation, skin, and ingestion.

- **Target Organs:** N/A

- **Health Hazards:**
  - **Inhalation:** Symptoms of inhalation exposure include severe coughing, wheezing, shortness of breath, headaches, nausea, and vomiting.
  - **Skin Contact:** Exposure to skin causes irritation or tissue burns.
  - **Eye Contact:** Corrosive.
  - **Ingestion:** May be fatal.

- **Chronic Exposure and Acute Exposure:**
  - **Stannic Chloride:** Considered Highly Toxic (USA) or Toxic (EU) and is corrosive to the skin, eyes, and respiratory tract. Contact with moisture releases hydrochloric acid fumes, which is also highly corrosive. Contact with moist air also releases tin compounds, which may be toxic. Symptoms of inhalation exposure include severe coughing, wheezing, shortness of breath, headaches, nausea, and vomiting. Produces lung irritation and damage to the mucous membranes of the upper respiratory tract. In extreme cases, pulmonary edema can occur. Exposure to skin causes irritation or tissue burns. May be fatal if swallowed or on excessive contact.

- **Agg. of Pre-Ex Cond:** N/A

- **Notes:** Users are not exposed to the hazardous components until the tubes are broken. Read, understand and comply with all labels, warnings and instructions accompanying these tubes before use. Failure to comply may cause serious injury or death.

4. FIRST AID MEASURES

- **Inhalation:** If inhaled enough to cause coughing, remove victim to fresh air. If coughing persists, provide oxygen and contact a physician.

- **Skin Contact:** If smoke contacts skin for a prolonged time, flush with copious amounts of water for 15 minutes and contact a physician.

- **Eye Contact:** Immediately flush with water for 15 minutes and contact a physician.

- **Ingestion:** Wash mouth out with water. Do not induce vomiting. Seek medical attention.

5. FIRE FIGHTING MEASURES

- **Fire Hazard:** Stannic chloride and HCl are non-flammable and have no known upper and lower explosion limits. Excessive heat may be released on contact with water. Fire hazard caused indirectly by release on HCl of exposure of broken tubes to moist air.

- **Fire Extinguisher:** Dry powder.

- **Explosion:** N/A

- **Flash Point:** N/A

- **Volatiles (% by volume):** N/A

- **Exp. Limits (Vol % in air):** N/A

- **Auto Ignition Temperature:** N/A

- **Special Fire Fighting Proc:** N/A

- **PPE for Firefighters:** Wear SCBA and protective clothing.

- **Notes:** None.
6. ACCIDENTAL RELEASE MEASURES
Procedure for Spill/Leak: Contain any large leaks using a plastic vessel. Cover with solid absorbent such as vermiculite or alkaline absorbent. Dilute and wash with plenty of water or soapy water. Dispose of washings and/or solids according to local regulations regarding hazardous waste. Each tube contains ~0.7 g SnCl₄
Waste Disposal: None suggested.

7. HANDLING AND STORAGE
Storage: Store in the box at <40°C when not in use.
Shelf Life: N/A
PPE: N/A
Notes: None.

8. EXPOSURE CONTROLS
PPE: Use only the pump(s) at the flow rates specified in OSHA CFR 1910.134 and 29 CFR 1910.139. If the pump is operated at non-specified flow rates, it could increase the smoke and fume concentrations and cause serious injury or death.
Inhalation: N/A
Skin: Wear safety gloves to protect against chemical exposure and flying glass.
Eye: Wear safety glasses to protect against chemical exposures and flying glass.
Ingestion: N/A
Ventilation: Use only in well-ventilated area.
Engineering Controls: N/A
Work/Hygiene Practices: Wash hands after use.
Exposure Limits: N/A
Notes: None.

9. PHYSICAL AND CHEMICAL PROPERTIES
Component: SnCl₄
Color/Appearance/Odor: Slightly yellowish clear liquid
Boiling Point: 114°C
Melting Point: -33°C
Specific Gravity (H₂O=1): N/A
Refractive Index: N/A
Relative Density: N/A
Evaporative Rate: N/A
Water Content: N/A
Vapor Density: N/A
Density: 2.226 g/cc
Vapor Pressure: 20 mm Hg @ 20°C
Solubility in Water: Decomposes

10. STABILITY AND REACTIVITY
Stability: Reacts with water and moisture in the air to form a smoke of HCl and tin oxochlorides.
Hazardous Decomposition Products: N/A
Hazardous Polymerization: Will not occur, but HCl may catalyze the polymerization of other compounds.
Incompatibilities: Bases, ethylene oxide, water alcohols, metals.
Conditions to Avoid: Do not expose to air until use.
Materials to Avoid: N/A

11. TOXICOLOGICAL INFORMATION
Health Effects: N/A
Oral LD₅₀: N/A
Dermal LD₅₀: N/A
Human Lethal Dose: N/A
Notes: None.

12. ECOLOGICAL INFORMATION
None.

13. DISPOSAL CONSIDERATIONS
Dispose of washings and/or solids according to local regulations regarding hazardous waste. Each tube contains ~0.7 g SnCl₄ before use.

14. TRANSPORT INFORMATION
Proper Shipping Name: N/A
Hazard Class: N/A
Transport Emergency Card: N/A
Packing Group: N/A
UN Number: N/A
Reportable Quantity: N/A
Notes: None.
15. REGULATORY INFORMATION

TSCA Registered: N/A
FDA Approved: N/A
ICSC: N/A

16. OTHER INFORMATION

- For use in respirator fit testing according to OSHA 29 CFR 1910.134 (App A) and OSHA 1910.139.
- Use only the pump(s) at the flow rates specified in OSHA CFR 1910.134 and 29 CFR 1910.139. If the pump is operated at non-specified flow rates it could increase the smoke and fume concentrations and cause serious injury or death.

Precautions with using product for Respirator Fit Testing:
- Eyes should be kept tightly closed during fit testing.
- DO NOT inhale smoke directly.
- DO NOT use in a confined space.
- DO NOT direct smoke stream directly at the skin during fit testing.
- DO NOT use under a respirator fit testing hood or other enclosed space, because fume concentrations may build up to levels that can cause serious injury or death.
- DO NOT use for fit testing on persons with pre-existing respiratory or related medical conditions or are allergic to tin compounds or hydrochloric acid.

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Appendix O
Colgate University
Proper Disposal of Irritant Smoke Tubes and Debris

The fit testing irritant smoke tubes contain stannic chloride (tin chloride) in liquid form housed in small glass tubes. There are several hazards associated with this chemical test kit. Physically, the waste is a cut hazard because of the broken glass / potential for broken glass. For this reason, all waste tubes must be packaged in a puncture proof plastic container (an “overpack”) before being packed in a shipment ready waste drum. Chemically, the waste is a hazard because it is severely corrosive (NFPA Health Hazard Rating 3) and reacts with water / moisture to form hydrochloric acid fumes.

To dispose of spent stannic chloride irritant smoke tubes:

Packaging:

1. Place all smoke tubes into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating *Spent Irritant Smoke Tubes Containing Stannic Chloride*.
4. Package the overpacked tubes into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

**Proper Shipping Name:** UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

**Waste Codes:** D002, D003 (Characteristic for Corrosivity / Characteristic for Reactivity: Fumes in Moist Air)

To dispose of stannic chloride contaminated debris (no glass / free liquids – spill pads, etc):

Packaging:

1. Place all contaminated debris into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating *Stannic Chloride Contaminated Debris (Spill Pads)—No Free Liquids*.
4. Package the overpacked debris into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

**Proper Shipping Name:** UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

**Waste Codes:** D003 (Characteristic for Reactivity: Fumes in Moist Air)
Colgate University
Proper Disposal of Irritant Smoke Tubes and Debris

The fit testing irritant smoke tubes contain stannic chloride (tin chloride) in liquid form housed in small glass tubes. There are several hazards associated with this chemical test kit. Physically, the waste is a cut hazard because of the broken glass/potential for broken glass. For this reason, all waste tubes must be packaged in a puncture proof plastic container (an “overpack”) before being packed in a shipment ready waste drum. Chemically, the waste is a hazard because it is severely corrosive (NFPA Health Hazard Rating 3) and reacts with water/moisture to form hydrochloric acid fumes.

To dispose of spent stannic chloride irritant smoke tubes:

Packaging:

1. Place all smoke tubes into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating Spent Irritant Smoke Tubes Containing Stannic Chloride.
4. Package the overpacked tubes into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

Proper Shipping Name: UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

Waste Codes: D002, D003 (Characteristic for Corrosivity / Characteristic for Reactivity: Fumes in Moist Air)

To dispose of stannic chloride contaminated debris (no glass/free liquids – spill pads, etc):

Packaging:

1. Place all contaminated debris into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating Stannic Chloride Contaminated Debris (Spill Pads)—No Free Liquids.
4. Package the overpacked debris into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

Proper Shipping Name: UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

Waste Codes: D003 (Characteristic for Reactivity: Fumes in Moist Air)
Colgate University
Proper Disposal of Irritant Smoke Tubes and Debris

The fit testing irritant smoke tubes contain stannic chloride (tin chloride) in liquid form housed in small glass tubes. There are several hazards associated with this chemical test kit. Physically, the waste is a cut hazard because of the broken glass / potential for broken glass. For this reason, all waste tubes must be packaged in a puncture proof plastic container (an “overpack”) before being packed in a shipment ready waste drum. Chemically, the waste is a hazard because it is severely corrosive (NFPA Health Hazard Rating 3) and reacts with water / moisture to form hydrochloric acid fumes.

To dispose of spent stannic chloride irritant smoke tubes:

Packaging:

1. Place all smoke tubes into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating Spent Irritant Smoke Tubes Containing Stannic Chloride.
4. Package the overpacked tubes into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

Proper Shipping Name: UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

Waste Codes: D002, D003 (Characteristic for Corrosivity / Characteristic for Reactivity: Fumes in Moist Air)

To dispose of stannic chloride contaminated debris (no glass / free liquids – spill pads, etc):

Packaging:

1. Place all contaminated debris into a Ziploc bag and close the bag. Seal the bag with tape.
2. Place the bag into a puncture-proof plastic container, such as a mayo jar. Make sure that there is no residual moisture in the jar, as stannic chloride will fume in moist air and release hydrochloric acid vapors.
3. Label the overpack with hazardous waste label indicating Stannic Chloride Contaminated Debris (Spill Pads)—No Free Liquids.
4. Package the overpacked debris into a 5 gallon 1H2 poly DOT shipment ready pail with a screw top lid. Label appropriately with DOT 8 diamond and hazardous waste shipping label.

Proper Shipping Name: UN 1827, WASTE Stannic Chloride, Anhydrous, 8, PG II

Waste Codes: D003 (Characteristic for Reactivity: Fumes in Moist Air)
Appendix P
Respiratory Protection Plan reviews and amendments (with associated dates) are listed below in chronological order:
Respiratory Protection Plan reviews and amendments (with associated dates) are listed below in chronological order:
Respiratory Protection Plan reviews and amendments (with associated dates) are listed below in chronological order:
Appendix Q
Appendix R
Appendix S
Respirator ID Number: ________________________________

Respirator Type (check one): [ ] Emergency [ ] Fit Testing [ ] Shared [ ] Personal

Check off upon completion:
[ ] Respirator has been cleaned in accordance with 29 CFR 1910.134 Appendix B-2
[ ] The following parts have been evaluated:

  [ ] Face piece       [ ] Valves
  [ ] Head straps     [ ] Elastomeric parts (for pliability / deterioration)

[ ] The respirator functions correctly during the user seal check
[ ] There are cartridges available for use
[ ] The respirator is stored correctly in a locker, is protected from physical and/or chemical harm, and is stored in a manner so that the face piece and valves will not become compromised.

Comments (check one):
[ ] I certify that at this date / time, this respirator is in good working condition, is free from defects and deterioration, is clean and sanitary, and is ready for use.
[ ] I certify that at this date and time, this respirator is being taken out of service, to be repaired and/or discarded for the following reason(s):

________________________________________________________________________
________________________________________________________________________

________________________________________________________________________

Inspector Name and Signature: ________________________________

Date and Time of Inspection: ________________________________
Respirator ID Number: ________________________________

Respirator Type (check one):  □ Emergency  □ Fit Testing  □ Shared  □ Personal

Check off upon completion:

□ Respirator has been cleaned in accordance with 29 CFR 1910.134 Appendix B-2

□ The following parts have been evaluated:
   □ Face piece  □ Valves
   □ Head straps  □ Elastomeric parts (for pliability / deterioration)

□ The respirator functions correctly during the user seal check

□ There are cartridges available for use

□ The respirator is stored correctly in a locker, is protected from physical and/or chemical harm, and is stored in a manner so that the face piece and valves will not become compromised.

Comments (check one):

□ I certify that at this date / time, this respirator is in good working condition, is free from defects and deterioration, is clean and sanitary, and is ready for use.

□ I certify that at this date and time, this respirator is being taken out of service, to be repaired and/or discarded for the following reason(s):

________________________________________________________________________________________
________________________________________________________________________________________

Inspector Name and Signature: ________________________________

Date and Time of Inspection: ________________________________
Respirator ID Number: _________________________________

Respirator Type (check one): □ Emergency  □ Fit Testing  □ Shared  □ Personal

Check off upon completion:

☐ Respirator has been cleaned in accordance with 29 CFR 1910.134 Appendix B-2

☐ The following parts have been evaluated:
  □ Face piece          □ Valves
  □ Head straps         □ Elastomeric parts (for pliability / deterioration)

☐ The respirator functions correctly during the user seal check

☐ There are cartridges available for use

☐ The respirator is stored correctly in a locker, is protected from physical and/or chemical harm, and is stored in a manner so that the face piece and valves will not become compromised.

Comments (check one):

☐ I certify that at this date / time, this respirator is in good working condition, is free from defects and deterioration, is clean and sanitary, and is ready for use.

☐ I certify that at this date and time, this respirator is being taken out of service, to be repaired and/or discarded for the following reason(s):

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Inspector Name and Signature: _________________________________

Date and Time of Inspection: _________________________________
Appendix T
**Respirator Cartridge Change Schedules**

Change schedules are determined based on industry guidance, manufacturer specifications, employee usage, and nature of the respiratory hazards. Respirator Cartridge change schedules are reviewed monthly during the respirator inspections and, based on cartridge / filter visual inspections, revised as necessary. Cartridges equipped with an end-of-service-life indicator (ESLI) should be replaced upon any visible change in the ESLI color and more often as necessary in accordance with the manufacturer’s specifications.

<table>
<thead>
<tr>
<th>Profile Group</th>
<th>Cartridge Change Schedule</th>
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<tbody>
<tr>
<td>Carpenter</td>
<td>12 months</td>
</tr>
<tr>
<td>Carpenter with Asbestos Worker / Handler Certification</td>
<td>6 months</td>
</tr>
<tr>
<td>Environmental Health and Safety</td>
<td>3 months</td>
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<tr>
<td>Heating Plant</td>
<td>6 months</td>
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<tr>
<td>Painters</td>
<td>6 months</td>
</tr>
<tr>
<td>Plumbers</td>
<td>12 months</td>
</tr>
<tr>
<td>PM (Millwrights)</td>
<td>12 months</td>
</tr>
<tr>
<td>Chemistry / Biology Faculty and Staff</td>
<td>12 months</td>
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</tbody>
</table>

Respirator Cartridge Change Schedules*

Change schedules are determined based on industry guidance, manufacturer specifications, employee usage, and nature of the respiratory hazards. Respirator Cartridge change schedules are reviewed monthly during the respirator inspections and, based on cartridge / filter visual inspections, revised as necessary. Cartridges equipped with an end-of-service-life indicator (ESLI) should be replaced upon any visible change in the ESLI color and more often as necessary in accordance with the manufacturer’s specifications.

<table>
<thead>
<tr>
<th>Profile Group</th>
<th>Cartridge Change Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenter</td>
<td>12 months</td>
</tr>
<tr>
<td>Carpenter with Asbestos Worker / Handler Certification</td>
<td>6 months</td>
</tr>
<tr>
<td>Environmental Health and Safety</td>
<td>3 months</td>
</tr>
<tr>
<td>Heating Plant</td>
<td>6 months</td>
</tr>
<tr>
<td>Painters</td>
<td>6 months</td>
</tr>
<tr>
<td>Plumbers</td>
<td>12 months</td>
</tr>
<tr>
<td>PM (Millwrights)</td>
<td>12 months</td>
</tr>
<tr>
<td>Chemistry / Biology Faculty and Staff</td>
<td>12 months</td>
</tr>
</tbody>
</table>
