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OSHA Regulations Handbook

Respiratory Protection

Foreword

A number of the Occupational Safety and Health Administration's (OSHA) regulations have respiratory protection requirements. The most significant is the general Respiratory Protection standard, 29 CFR 1910.134. Major revisions were made to this regulation on January 8, 1998. The rulemaking was completed on August 24, 2006, when the table of assigned protection factors was added.

OSHA's substance-specific standards also have respiratory protection provisions. Changes were made to these regulations each time 29 CFR 1910.134 was revised. **Summaries of the portions of those standards related to respiratory protection are found in this handbook. Significant parts of these standards that do not pertain to respiratory protection were omitted. A few additional regulations with significant respiratory protection provisions (e.g., Ventilation, 29 CFR 1910.94) are also summarized.**

On June 8, 2011, minor changes were made to 29 CFR 1910.134 and to the respiratory protection requirements in OSHA's carcinogen standards. These changes were the result of Phase III of OSHA's standards improvement project. Since then silica and beryllium standards were finalized. This 2018 edition includes these latest changes.

These summaries are intended to serve as a quick reference and should not be used in place of the regulations. The full text of each standard should be consulted to identify specific requirements.

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29 CFR 1910.134 Respiratory Protection

This section applies to General Industry (part 1910), Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

(a) Permissible practice

(1) 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 control 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.

(2) A respirator shall be provided to each employee when such equipment is necessary to protect the health of such employee. 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.

(b) 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 or does 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 approach of the end of adequate respiratory protection, 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 QLFT 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 monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 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 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 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, an 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 air-purifying elements 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 (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

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 user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

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.

(c) Respiratory protection program

This paragraph requires the employer to develop and implement a written respiratory protection program with required worksite-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 use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the 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).

(1) 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 worksite-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:

(i) Procedures for selecting respirators for use in the workplace;

(ii) Medical evaluations of employees required to use respirators;

(iii) Fit testing procedures for tightfitting respirators;

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

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

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

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

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

(ix) Procedures for regularly evaluating the effectiveness of the program.

(2) Where respirator use is not required:

(i) 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 When Not Required Under the Standard"); and

(ii) 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. Exception: 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).

(3) 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.

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

(d) 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.

(1) *General requirements.*

(i) 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.

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

(iii) 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.

(iv) 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.

(2) *Respirators for IDLH atmospheres.*

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

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

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

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

(iii) 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 ranges 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.

(3) *Respirators for atmospheres that are not IDLH.*

(i) 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.

(A) Assigned Protection Factors (APFs). Employers must use the assigned protection factors listed in Table 1 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 1—ASSIGNED PROTECTION FACTORS [5]

Type of respirator [1,2]	Quarter mask	Half mask	Full face-piece	Helmet/ hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	[3] 10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	[4] 25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator.					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	[4] 25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA).					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

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 respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.
3. This APF category includes filtering facepieces, 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 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(ii).

(B) Maximum Use Concentration (MUC).

(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.

(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.

(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 set the maximum MUC at that lower limit.

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

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

(A) An atmosphere-supplying respirator, or

(B) An air-purifying respirator, provided that:

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

(2) If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges 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 in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

(iv) For protection against particulates, the employer shall provide:

(A) An atmosphere-supplying respirator; or

(B) An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or

(C) 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 II

Altitude (ft.)	Oxygen deficient Atmospheres (% 0_2) for which the employer may rely on atmosphere-supplying respirators
Less than 3,001	16.0–19.5
3,001–4,000	16.4–19.5
4,001–5,000	17.1–19.5
5,001–6,000	17.8–19.5
6,001–7,000	18.5–19.5
7,001–8,000 [1]	19.3–19.5.

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

(e) 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.

(1) *General.* The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or 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.

(2) *Medical evaluation procedures.*

(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.

(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.

(3) *Follow-up medical examination.*

(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.

(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.

(4) *Administration of the medical questionnaire and examinations.*

(i) The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

(ii) The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

(5) *Supplemental information for the PLHCP.*

(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:

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

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

(C) The expected physical work effort;

(D) Additional protective clothing and equipment to be worn; and

(E) Temperature and humidity extremes that may be encountered.

(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.

(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)(5)(iii): 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 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.

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

(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:

(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;

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

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

(ii) 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.

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

(i) An employee reports medical signs or symptoms that are related to ability to use a respirator;

(ii) A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

(iii) Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

(iv) 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.

(f) 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.

(1) 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.

(2) 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, and at least annually thereafter.

(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, 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, cosmetic surgery, or an obvious change in body weight.

(4) If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP 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.

(5) 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.

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

(7) 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.

(8) 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.

(i) 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.

(ii) Quantitative 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.

(iii) 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.

(g) 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.

(1) *Facepiece seal protection.*

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

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

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

(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.

(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.

(2) *Continuing respirator effectiveness.*

(i) Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When 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.

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

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

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

(C) To replace the respirator or the filter, cartridge, or canister elements.

(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.

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

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

(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;

(iii) The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

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

(v) The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

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

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

(B) 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

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

(4) *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:

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

(ii) At least two employees are located outside the IDLH atmosphere; and

(iii) 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.

(h) 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.

(1) *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:

(i) 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;

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

(iii) Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

(iv) Respirators used in fit testing and training shall be cleaned and disinfected after each use.

(2) *Storage.* The employer shall ensure that respirators are stored as follows:

(i) 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.

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

(A) Kept accessible to the work area;

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

(C) Stored in accordance with any applicable manufacturer instructions.

(3) *Inspection.*

(i) The employer shall ensure that respirators are inspected as follows:

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

(B) 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

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

(ii) The employer shall ensure that respirator inspections include the following:

(A) 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

(B) A check of elastomeric parts for pliability and signs of deterioration.

(iii) In addition to the requirements of paragraphs (h)(3)(i) and (ii) 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.

(iv) For respirators maintained for emergency use, the employer shall:

(A) 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

(B) 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.

(4) *Repairs.* 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:

(i) 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;

(ii) Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

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

(i) 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.

(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

(ii) 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:

(A) Oxygen content (v/v) of 19.5– 23.5%;

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

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

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

(E) Lack of noticeable odor.

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

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

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

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

(ii) 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 (iii) The moisture content in the cylinder does not exceed a dew point of -50 °F (-45.6 °C) at 1 atmosphere pressure.

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

(i) Prevent entry of contaminated air into the air-supply system;

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

(iii) 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.

(iv) 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.

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

(7) 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.

(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

(9) 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 SCBA as issued in accordance with the NIOSH respirator-certification standard at 42 CFR part 84.

(j) 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.

(k) 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.

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

(i) Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

(ii) What the limitations and capabilities of the respirator are;

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

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

(v) What the procedures are for maintenance and storage of the respirator;

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

(vii) The general requirements of this section.

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

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

(4) 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 element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

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

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

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

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

(6) 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.

(l) 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.

(1) 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.

(2) 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:

(i) Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

(ii) Appropriate respirator selection for the hazards to which the employee is exposed;

(iii) Proper respirator use under the workplace conditions the employee encounters; and

(iv) Proper respirator maintenance.

(m) 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.

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

(2) *Fit testing.*

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

(A) The name or identification of the employee tested;

(B) Type of fit test performed;

(C) Specific make, model, style, and size of respirator tested;

(D) Date of test; and

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

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

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

(4) 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.

(n) Effective date

Paragraphs (d)(3)(i)(A) and (d)(3)(i)(B) of this section become effective November 22, 2006.

(o) Appendices

Compliance with Appendix A, Appendix B–1, Appendix B–2, Appendix C, and Appendix D to this section are 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 QLFT and QNFT.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.
2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.
4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

   (a) Position of the mask on the nose

   (b) Room for eye protection

   (c) Room to talk

   (d) Position of mask on face and cheeks

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

   (a) Chin properly placed;

   (b) Adequate strap tension, not overly tightened;

   (c) Fit across nose bridge;

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

   (e) Tendency of respirator to slip;

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

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in appendix B–1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in appendix B–1. Before conducting the negative and positive pressure checks, the subject shall be told to seat

the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.
10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.
11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.
12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.
13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which 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.5(b) of this appendix for the CNP REDON quantitative fit-testing protocol. For the remaining fit testing methods, employers must ensure that employees perform the test exercises in the appropriate test environment in the following manner:

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

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

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

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

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

Rainbow Passage
When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(6) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

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

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

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

B. *Qualitative Fit Test (QLFT) Protocols*

1. General

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

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

2. Isoamyl Acetate Protocol

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

(a) Odor Threshold Screening

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 °C (77 °F) shall be used for the solutions.

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

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

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

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

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

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

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

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

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

(b) Isoamyl Acetate Fit Test

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

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

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

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

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

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

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

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

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

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

3. Saccharin Solution Aerosol Protocol

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(b) Saccharin solution aerosol fit test procedure.

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

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

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

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

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

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

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

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

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

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

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

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

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

The BitrexTM (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association

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

(a) Taste Threshold Screening.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(b) Bitrex Solution Aerosol Fit Test Procedure.

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

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

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

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

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

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

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

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

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

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

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

5. Irritant Smoke (Stannic Chloride) Protocol

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

(a) General Requirements and Precautions

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

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

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

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

whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

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

(b) Sensitivity Screening Check

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

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

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

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

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

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

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

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

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

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

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

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

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable:

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

1. General

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

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

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus.

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

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

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

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

(5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

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

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

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

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

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

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

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

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

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

(b) Procedural Requirements.

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

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

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

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

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

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

The respirator shall not be adjusted once the fit test exercises begin.

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

(8) Calculation of fit factors.

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

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

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

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

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

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

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

$$Overall\ Fit\ Factor = \frac{Number\ of\ exercises}{\frac{1}{ff1} + \frac{1}{ff2} + \frac{1}{ff3} + \frac{1}{ff4} + \frac{1}{ff5} + \frac{1}{ff6} + \frac{1}{ff7} + \frac{1}{ff8}}$$

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

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

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

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

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

(a) Portacount Fit Test Requirements.

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

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

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

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

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

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

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

(b) Portacount Test Instrument.

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

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

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

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

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Occupational Health Dynamics of Birmingham, Alabama also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece

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

(a) CNP Fit Test Requirements.

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

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

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

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

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

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

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

(7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises.

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

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

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

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

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

poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

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

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

(8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

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

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

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

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

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

TABLE A–1—CNP REDON QUANTITATIVE FIT TESTING PROTOCOL

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

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

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

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

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

Where:

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

PART II. NEW FIT TEST PROTOCOLS

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

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

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

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

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

APPENDIX B–1 TO § 1910.134: USER SEAL CHECK PROCEDURES (MANDATORY)

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

I. Facepiece Positive and/or Negative Pressure Checks

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

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

II. Manufacturer's Recommended User Seal Check Procedures

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

APPENDIX B–2 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 °C [110 °F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

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

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

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

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

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

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

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

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

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

APPENDIX C TO § 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:

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

Part A. Section 1. (Mandatory)

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

1. Today's date: _____

2. Your name: _____

3. Your age (to nearest year): _____

4. Sex (circle one): Male/Female

5. Your height: _____ft. _____in.

6. Your weight: _____lbs.

7. Your job title: _____

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

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

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

11. Check the type of respirator you will use (you can check more than one category):

    a. _____ N, R, or P disposable respirator (filter-mask, non-cartridge type only).

    b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

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

    a. 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: 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 lost vision in either eye (temporarily or permanently): Yes/No

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

a. Wear contact lenses: Yes/No

b. Wear glasses: Yes/No

c. Color blind: Yes/No

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

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

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

a. Difficulty hearing: Yes/No

b. Wear a hearing aid: Yes/No

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

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

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

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

b. Back pain: Yes/No

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

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

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

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

g. Difficulty bending at your knees: Yes/No

h. Difficulty squatting to the ground: Yes/No

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

j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B.

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

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

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

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

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

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:

a. Asbestos: Yes/No

b. Silica (e.g., in sandblasting): Yes/No

c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No

d. Beryllium: Yes/No

e. Aluminum: Yes/No

f. Coal (for example, mining): Yes/No

g. Iron: Yes/No

h. Tin: Yes/No

i. Dusty environments: Yes/No

j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures: _____

4. List any second jobs or side businesses you have: _____

5. List your previous occupations: _____

6. List your current and previous hobbies: _____

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

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

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

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

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

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

a. HEPA Filters: Yes/No

b. Canisters (for example, gas masks): Yes/No

c. Cartridges: Yes/No

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

a. Escape only (no rescue): Yes/No

b. Emergency rescue only: Yes/No

c. Less than 5 hours per week: Yes/No

d. Less than 2 hours per day: Yes/No

e. 2 to 4 hours per day: Yes/No

f. Over 4 hours per day: Yes/No

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

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

If "yes," how long does this period last during the average shift:_____hrs. _____mins.

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

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

If "yes," how long does this period last during the average shift: _____hrs. _____mins.

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

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

If "yes," how long does this period last during the average shift: _____lhrs. _____mins.

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

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

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

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

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

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

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

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

Name of the first toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift _____

Name of the second toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

Name of the third toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

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

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

APPENDIX D TO § 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 1270, Jan. 8, 1998; 63 FR 20098, 20099, Apr. 23, 1998, as amended at 69 FR 46993, Aug. 4, 2004; 71 FR 16672, Apr. 3, 2006; 71 FR 50187, Aug. 24, 2006; 73 FR 75584, Dec. 12, 2008; 76 FR 33607, June 8, 2011; 77 FR 46949, Aug. 7, 2012]

Summary of Respiratory Protection Requirements in OSHA's Substance Specific Health Standards

Applicability of These Regulations

Most of the substance specific standards from General Industry, 29 CFR Part 1910, apply to Shipyard Employment and Construction. For shipyards, the standards are identified by substituting Part 1915 for Part 1910 and leaving the section number unchanged. For example, the Benzene standard, identified as 1910.1028 in the General Industry regulations, is designated 1915.1028 for Shipyard Employment.

Construction regulations are found in 29 CFR Part 1926. Most of the substance specific standards in Construction have section numbers beginning with 1100 rather than 1000. For instance, the Formaldehyde standard, identified as 1910.1048 in General Industry, is designated 1926.1148 in Construction.

The Construction regulations for several substances, including asbestos, lead and cadmium, have different requirements than the General Industry standards for the same substances. The requirements of the Asbestos standard for Shipyards are different from the General Industry and Construction Asbestos standards. Separate summaries are provided for each version of the standard in these cases.

The cadmium standard is also applicable to Agricultural Industries. It is identified as 1928.1027.

Key to Abbreviations

Abbreviations used in the standard summaries are as follows:

APF	Assigned Protection Factor
DBCP	1,2-Dibromo-3-chloropropane
ESLI	End of Service Life Indicator
ETO	Ethylene oxide
HEPA	High Efficiency Particulate Air
PAPR	Powered Air Purifying Respirator
PEL	Permissible Exposure Limit
PLHCP	Physician or Other Licensed Health Care Professional
QLFT	Qualitative Fit Testing
QNFT	Quantitative Fit Testing
SCBA	Self-Contained Breathing Apparatus
STEL	Short Term Exposure Limit
TWA	Time Weighted Average

Asbestos 29 CFR 1910.1001

	Paragraph	Asbestos 1910.1001
Permissible Exposure Limits	(c)(1)	0.1 fiber/cc, 8 hour TWA
	(c)(2)	1 fiber/cc, 30 minute excursion
Exposure Monitoring	(d)(3)	At least once every 6 months if concentration > TWA and/or excursion limit.
Regulated Areas Respiratory Protection	(e)(4)	Persons entering to be provided with and use an appropriate respirator.
General	(g)(1)	Employer must provide respirators that comply with the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, for which controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(g)(2)(ii)	Tight - fitting PAPR must be provided in lieu of a negative pressure respirator if requested and would provide adequate protection.
	(g)(2)(iii)	Any employee who cannot wear a respirator must be given option of transferring to a position not requiring respirator use with no loss of compensation if such a position is available.
Selection	(g)(3)(I)	Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, filtering facepiece respirators must not be used.
	(g)(3)(ii)	HEPA filters must be used for PAPR and negative pressure respirators.
Signs	(j)(3)(ii)	Signs posted at regulated area must include line "Respirators and Protective Clothing Are Required in this Area".
Training	(j)(7)(iii)	Training must include purpose, proper use and limitations of respirators and protective clothing.
Medical Surveillance	(l)(2)(ii)	Pre-placement examination must include chest x-ray and pulmonary function tests.
	(l)(3)(ii)	Annual examination must include pulmonary function tests; chest x-ray every 1, 2, or 5 years depending on age and years since first exposure.
	(l)(6)(iv)	Provide physician information on protective and respiratory equipment used.
	(l)(7)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective equipment such as clothing or respirators.
Recordkeeping	(m)(1)(ii)	Exposure monitoring records must include type of respirator used.
	(m)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

13 Carcinogens 1910.1003 13

	Paragraph	1910.1003 13 Carcinogens
		4-Nitrobiphenyl, CAS No. 92933 alpha-Naphthylamine, CAS No. 134327 Methyl chloromethyl ether, CAS No. 1073023 3'-Dichlorobenzidine and its salts, CAS No. 91941 bis-Chloromethyl ether, CAS No. 542881 beta-Naphthylamine, CAS No. 91598 Benzidine, CAS No. 92875 4-Aminodiphenyl, CAS No. 92671 Ethyleneimine, CAS No. 151564 beta-Propiolactone, CAS No. 57578 2-Acetylaminofluorene, CAS No. 53963 4-Dimethylaminoazo-benzene, CAS No. 60117 N-Nitrosodimethylamine, CAS No. 62759
Permissible Exposure Limits		No limits given. Engineering controls, administrative controls and protective equipment must be designed to reduce exposures to lowest possible level.
	(c)(4)(iv)	Handling operations involving the carcinogens: • 4- Nitrobiphenyl, alpha-Naphthylamine, 3,3?-Dichlorobenzidine (and its salts), beta- Naphthylamine, Benzidine, 4- Aminodiphenyl, 2- Acetylaminofluorene, 4-Dimethylaminoazo-benzene, and NNitrosodimethylamine, must use, half-mask air-purifying respirator with particulate filters. • methyl chloromethyl ether, bis- Chloromethyl ether, Ethyleneimine, and beta-Propiolactone, must use: o full facepiece self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode, or o any full facepiece supplied-air respirator operated in pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus. Employers may substitute a respirator affording employees higher levels of protection than these respirators.
	(c)(5)(i)	
Program	(d)(1)	Employer must institute a respirator program in accordance with 1910.134 (b), (c), (d) [except (d) (1) (iii) and (iv) and (d)(3)], and (e) through (m).
Signs, Information and Training	(e)(1)(ii)	Signs at entrance to areas with maintenance and decontamination activities must include the line "Impervious Suit Including Gloves, Boots And Air-Supplied Hood Required At All Times".

Vinyl Chloride 29 CFR 1910.1017

	Paragraph	Vinyl Chloride 29 CFR 1910.1017
Action Level	(b)(1)	0.5 ppm, 8 hour TWA
Permissible Exposure Limits	(c)(1)	1 ppm, 8 hour TWA
	(c)(2)	5 ppm for any 15 minute period
Exposure Monitoring	(d)(2)(i)	At least monthly if concentration > PEL
	(d)(2)(ii)	At least quarterly if concentration > action level
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet requirements of this paragraph.
Program	(g)(2)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii) and (d) (3) (iii) (B) (1) and (2)], and (f) through (m).
Selection	(g)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) Organic vapor cartridges must have a service life of at least one hour when used up to 10 ppm vinyl chloride. (C) Canisters used in a PAPR with a hood, helmet or full facepiece, or a gas mask with a front- or back-mounted canister must have a service life of at least four hours when used up to 25 ppm vinyl chloride.
	(g)(3)(ii)	Air purifying canisters or cartridges must be replaced before end of their service life or at the end of the shift, whichever occurs first. Continuous monitoring and alarm required if vinyl chloride concentration could exceed the allowable concentrations for the respirators in use.
	(g)(3)(iii)	Respirators specified for higher concentrations may be used for lower concentrations.
Hazardous Operations	(h)(1)(i)	Employees engaged in hazardous operations, including entry of vessels to clean polyvinyl chloride residues from vessel walls must be provided and wear appropriate respiratory protection.
Emergency Situations	(j)	Employer must develop a written plan dealing with emergency situations where vinyl chloride as a liquid or gas is stored or handled, including provisions for the use of appropriate respirators.
Training	(j)(1)(iii)	Training must include purpose, proper use and limitations of respirators.
Medical Surveillance	(k)(4)	Employer must obtain physician's written statement of employee's capability to wear protective equipment and respirator.

Inorganic Arsenic 1910.1018

	Paragraph	Inorganic Arsenic 1910.1018
Action Level	(b)	5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	10 µg/m^3, 8 hour TWA
Exposure Monitoring	(e)(3)(ii)	At least once every 3 months if concentration > PEL
	(e)(3)(iii)	At least once every 6 months if concentration > action limit, < PEL
Regulated Areas	(f)(4)	Respirators required to be worn to enter a regulated area (Area > PEL)
Respiratory Protection General	(h)(1)	Employer must provide respirators that comply with the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, where employer establishes engineering and work practice controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(h)(2))(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(h)(2)(ii)	If employee has trouble breathing during fit test or use of respirator, physician trained in pulmonary medicine to determine if employee can wear a respirator.
Selection	(h)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) Half mask respirators must not be used for arsenic trichloride because of skin absorption. (C) HEPA filters must be used for PAPR and negative pressure respirators. (D) (1) If gases present greater than their PEL, use appropriate chemical cartridge with HEPA filters. (2) Front- or back-mounted gas masks with HEPA filters and acid gas canisters or full facepiece airline must be used when inorganic arsenic is at or below 500 µg/m^3; half mask with HEPA filters and acid gas cartridges when inorganic arsenic is at or below 100 µg/m^3.
	(h)(3)(ii)	Employees required to wear a negative pressure respirator entitled to wear a PAPR if it will provide adequate protection.
Medical Surveillance	(n)(2)(ii)	Initial medical examination must include chest x-ray.
	(n)(3)(ii)	Annual chest x-ray required.
	(n)(5)(iv)	Employer must provide the physician information on protective equipment worn.
	(n)(6)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing or equipment such as respirators.
Training	(o)(1)(ii)	Training must include purpose, proper use and limitations of respirators.
Signs	(j)(1)(iii)	Signs posted at regulated areas must include line "Respirator Required".
Recordkeeping	(q)(1)(ii)	Employer must obtain physician's written statement of employee's capability to wear protective equipment and respirator.
	(q)(2)(ii)	Medical record must include physician's written opinions.

Beryllium 1910.1024

	Paragraph	Beryllium 1910.1024
Action Level	(b)	0.1 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)(1)	0.2 µg/m^3, 8 hour TWA
	(c)(2)	2.0 µg/m^3 15 min. STEL
Exposure Asessment	(d)(1)	The employer must assess the airborne exposure of each employee who is or may reasonably be expected to be exposed to airborne beryllium in accordance with either the performance option in paragraph (d)(2) or the scheduled monitoring option in paragraph (d)(3) of this standard.
Performance Option	(d)(2)	The employer must assess the 8-hour TWA exposure and the 15-minute short-term exposure for each employee on the basis of any combination of air monitoring data and objective data sufficient to accurately characterize airborne exposure to beryllium. OR
Scheduled Monitoring Option	(d)(3)(i) &(ii)	The employer must perform initial monitoring to assess the: • 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the airborne exposure of employees on each shift, • short-term exposure from 15-minute personal breathing zone air samples measured in operations that are likely to produce airborne exposure above the STEL for each work shift, for each job classification, and in each work area.
	(d)(3)(v)	At least once every 6 months if concentration > action limit, < PEL
	(d)(3)(vi)	At least once every 3 months if concentration > PEL
Reassessment of Exposure	(d)(4)	The employer must reassess airborne exposure whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional airborne exposure ≥ action level or STEL, or when the employer has any reason to believe that new or additional airborne exposure ≥ action level or STEL has occurred.
Regulated Areas	(e)(1)	Establish where beryllium concentration is or can be expected to be above the TWA PEL or STEL.
Provisions of Personal Protective Clothing and Equipment, including Respirators	(e)(4)(i)	The employer must provide and ensure that each employee entering a regulated area uses:(i) Respiratory protection in accordance with paragraph (g) of this standard; and (ii) Personal protective clothing and equipment in accordance with paragraph (h) of this standard.
Methods of Compliance/Written Exposure Control Plan	(f)(1)	The employer must establish, implement, and maintain a written exposure control plan, which must contain: A list of personal protective clothing and equipment required by paragraph (h) of this standard; and procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium contaminated personal protective clothing and equipment, including respirators.
Respiratory Protection General	(g)(1)	Respirators must be provided in the following circumstances: (i) During periods necessary to install or implement feasible engineering and work practice controls where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; (ii) During operations, including maintenance and repair activities and non-routine tasks, when engineering and work practice controls are not feasible and airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; (iii) During operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL; (iv) During emergencies; and (v) When an employee who is eligible for medical removal under paragraph (l)(1) chooses to remain in a job with airborne exposure ≥ action level, as permitted by paragraph (l)(2)(ii).
Program	(g)(2)	Employer must institute a respirator program in accordance with 1910.134.
	(g)(3)	The employer must provide at no cost to the employee a powered air purifying respirator (PAPR) instead of a negative pressure respirator when (i) Respiratory protection is required by this standard; (ii) An employee entitled to such respiratory protection requests a PAPR; and (iii) The PAPR provides adequate protection to the employee in accordance with paragraph (g)(2) of this standard.

	Paragraph	Beryllium 1910.1024
Personal Protective Clothing and Equipment Provision and Use	(h)(1)	The employer must provide at no cost, and ensure that each employee uses, appropriate personal protective clothing and equipment in accordance with the written exposure control plan required under paragraph (f)(1) of this standard and OSHA's Personal Protective Equipment standards (subpart I of this part): (i) Where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; or (ii) Where there is a reasonable expectation of dermal contact with beryllium.
Removal and Storage	(h)(2)(i)	The employer must ensure that each employee removes all beryllium contaminated personal protective clothing and equipment at the end of the work shift, at the completion of tasks involving beryllium, or when personal protective clothing or equipment becomes visibly contaminated with beryllium, whichever comes first.
Medical Surveillance	(k)(1)	The employer must make medical surveillance required by this paragraph available at no cost to the employee, and at a reasonable time and place, to each employee: (A) Who is or is reasonably expected to be exposed a=t ≥ action level for more than 30 days per year;
Information Provided to the PLHCP	(k)(4)(iii)	Employer must provide the PLHCP a description of any personal protective clothing and equipment, including respirators, used by the employee, including when and for how long the employee has used that personal protective clothing and equipment.
Physician's Written Medical Report for the Employee	(k)(5)(i)	The employer must ensure that the employee receives a written medical report from the licensed physician within 45 days of the examination. It must contain any recommendations on: (A) The employee's use of respirators, protective clothing, or equipment;
Physician's Written Medical Opinion for the Employer	(k)(6)	The written medical opinion must contain any recommended limitations on the employee's use of respirators, protective clothing, or equipment
Recordkeeping	(n)(2)(ii)	Exposure monitoring record must include type of personal protective clothing and equipment, including respirators, worn by monitored employees at the time of monitoring.

Lead 1910.1025

	Paragraph	Lead 1910.1025
Action Level	(b)	30 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)(1)	50 µg/m^3, 8 hour TWA
	(c)(2)	For exposures greater than 8 hours a day, PEL = 400 ÷ hours worked in the day.
	(c)(3)	When respirators are used to supplement engineering controls, assigned protection factor of respirator can be used to calculate exposure during periods the respirator is worn.
Exposure Monitoring	(d)(6)(ii)	At least once every 6 months if concentration > action level.
	(d)(6)(iii)	At least once every 3 months if concentration > PEL.
Methods of Compliance	(e)(1)(ii)	Where an employee is exposed above the PEL for 30 or less days per year, engineering controls must reduce exposures to < 200 µg/m^3. Work practices (including administrative controls) and respirators may be used to reduce exposures to or below 50 µg/m^3.
Respiratory Protection General	(f)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iii) Whenever an employee requests a respirator.
Program	(f)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(f)(2)(ii)	If an employee exhibits difficulty breathing during fit test or respirator use, employer must provide a medical examination.
Selection	(f)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) Full facepieces must be provided in lieu of half masks for lead aerosols that cause eye or skin irritation at the use concentrations. (C) HEPA filters must be used for PAPR and negative pressure respirators.
	(f)(3)(ii)	Employer must supply a PAPR if an employee requests one and the respirator will provide adequate protection.
Medical Surveillance	(j)(3)(v)	The employer to obtain and give employee physician written opinion on any recommended limitations on use of respirators including determination of whether an employee can wear a PAPR if a physician determines the employee cannot wear a negative pressure respirator.
Training	(l)(1)(v)	Training must include purpose, proper selection, use and limitations of respirators.
Recordkeeping	(n)(1)(ii)	Exposure monitoring records must include type of respirator used.

Chromium (VI) 1910.1026

	Paragraph	Chromium (VI) 1910.1026
Action Level	(b)	2.5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)(1)	5 µg/m^3, 8 hour TWA
Exposure Determination	(d)(2)(iii)	At least once every 6 months if concentration > action limit, < PEL.
	(d)(2)(iv)	At least once every 3 months if concentration > PEL.
		OR
	(d)(3)	Use any combination of air monitoring data, historical monitoring or objective data sufficient to characterize each employee exposures.
Regulated Areas	(e)(1)	Establish where chromium (VI) concentration is or can be expected to be PEL.
Respiratory Protection General	(g)(1)	Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls; (ii) During operations such as maintenance and repair, for which engineering and work practice controls are not feasible; (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs; (iv) For operations when employees are exposed <30 days per year and engineering and work practice controls are not implemented; (v) Emergencies.
Program	(g)(2)	Employer must institute a respirator program in accordance with 1910.134.
Medical Surveillance	(k)(4)(iii)	Employer must provide the physician information on protective equipment worn.
	(k)(5)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing or equipment such as respirators.
Recordkeeping	(m)(1)(ii)	Exposure monitoring record must include type of respirator worn.
	(m)(4)(ii)	Medical record must include physician's written opinions.

Cadmium 1910.1027

	Paragraph	Cadmium 1910.1027
Action Level	(b)	2.5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	5 µg/m^3, 8 hour TWA
Exposure Monitoring	(d)(3)(i)	If concentration > action level, to represent exposures. If > PEL, to assure adequacy of respiratory protection. Frequency at least once every 6 months.
Regulated Area	(e)(4)	Employees entering a regulated area must be supplied with and wear the appropriate respirator.
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During time period to install or implement feasible engineering and work practice controls. (ii) In maintenance and repair activities and during brief or intermittent operations where engineering and work practice controls are not feasible or are not required. (iii) In regulated areas. (iv) Where the employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposure below PELs. (v) Whenever an employee exposed above the action level requests a respirator. (vi) When an employee is exposed above the PEL in an industry with a separate engineering control air limit (SECAL). (vii) Emergencies
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(g)(2)(ii)	Employee must not be assigned to a task requiring a respirator if physician determines employee cannot wear the respirator. Provisions for medical removal are in section (l) (11) and (12).
	(g)(2)(iii)	If employee has difficulty breathing during a fit test or respirator use, employer must provide a medical examination.
Selection	(g)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) Full facepieces must be provided in lieu of half masks if employees experience eye irritation. (C) HEPA filters must be used for PAPR and negative pressure respirators.
	(g)(3)(ii)	An employee entitled to wear a respirator may request a PAPR if it will provide adequate protection.
Emergency Situations	(h)	Employer must develop a written plan dealing with substantial releases of cadmium, include provisions for the use of appropriate respirators and personal protective equipment.
Medical Surveillance	(l)(1)(ii)	To determine fitness to use a respirator, employer must provide the limited medical examination described in (l) (6).
	(l)(3)(ii)	Actions triggered by initial biological monitoring above limits specified include a reevaluation of respirator use and the respirator program.
	(l)(4)(ii)	Periodic medical examination must include chest x-ray and pulmonary function tests. After initial x-ray, frequency is determined by physician.
	(l)(5)(i)	Actions triggered by medical evaluation results consistent with cadmium toxicity include a reevaluation of respirator use and the respirator program.
	(l)(6)(i)	Specific medical examination must be provided to determine fitness to use a respirator.
	(l)(6)(iii)	If an employee has had difficulty breathing during a fit test or during respirator use, employer must provide a medical examination.
	(l)(6)(iv)	Where results are abnormal, physician must consider if medical limitation on respirator use is necessary. If employee is allowed to use a respirator, periodic reviews are required.
	(l)(9)(iv)	Employer must provide physician with information on protective equipment worn including when and for how long a respirator has been used.
	(l)(11)(ii)	Employee found unfit to wear a respirator must be removed from any work above the PEL.
Communication of Hazards	(m)(2)(ii)	Signs at entrances to regulated areas must include line “Respirators Required In This Area”.
	(m)(4)(iii)	Training must include purpose, proper selection, fitting, proper use and limitations of respirators.

	Paragraph	Cadmium 1910.1027
Recordkeeping	(n)(1)(ii)	Exposure monitoring records must include type of respirator used.
	(n)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

Benzene 1910.1028

	Paragraph	Benzene 1910.1028
Action Level	(b)	0.5 ppm, 8 hour TWA
Permissible Exposure Limits	(c)(1)	1 ppm, 8 hour TWA
	(c)(2)	5 ppm, 15 minute STEL
Exposure Monitoring	(e)(3)(i)	At least annually if concentration > action level.
	(e)(3)(ii)	Each 6 months if > PEL.
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, for which controls are not feasible or operations which are intermittent and limited in duration. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs or where benzene is used less than 30 days per year.(iv) Emergencies.
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)] and (f) through (m).
	(g)(2)(ii)	Replace cartridges or canisters at end of their service life or at the beginning of shift in which they will be used, whichever comes first.
	(g)(2)(iii)	If air purifying elements with ESLI for benzene become available, they can be used until the indicator shows no further service life.
Selection	(g)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) Organic vapor gas mask or SCBA must be provided for escape (C) Organic vapor cartridge or canister must be used with PAPR and non-powered respirators, and a chin-style canister with full facepiece gas masks. (D) Canisters must have minimum service life of 4 hours when tested at 150 ppm, benzene, flow rate of 64 lpm, 25° C and 85% RH. For PAPR flow rate is 115 and 170 lpm for tightfitting and loose fitting respectively.
	(g)(3)(ii)	An employee who cannot wear a negative pressure respirator entitled to wear a respirator with less breathing resistance such as a PAPR or supplied air respirator.
Medical Surveillance	(i)(2)(i)	Initial examination for employees required to wear a respirator at least 30 days a year must include pulmonary function test.
	(i)(3)(iii)	Periodic examination for employees required to wear a respirator at least 30 days a year must include pulmonary function test every three years.
	(i)(6)(iv)	Employer must provide physician with information on protective equipment worn.
	(i)(7)(i)	Employer must obtain and provide the employee with physician's written opinion that includes any recommended limitations on use of protective equipment.
Communication of Hazards	(j)(1)(i)	Signs at entrances to regulated areas include line "Respirator Required".
Recordkeeping	(k)(1)(i)	Exposure monitoring records must include type of respirator used.
	(k)(2)(i)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

Coke Oven Emissions 1910.1029

	Paragraph	Coke Oven Emissions 1910.1029
Permissible Exposure Limit	(c)	PEL: 150 µg/ m^3, 8 hour TWA
Exposure Monitoring	(e)(1)(iv)	At least every 3 months for certain jobs.
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) In work operations where engineering and work practice controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PEL. (iv) Emergencies.
Program	(g)(2)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
Selection	(g)(3)	Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, filtering facepiece respirators must be used only for coke oven emissions particulates.
Medical Surveillance	(j)(2)(ii)	Initial examination must include chest x-ray.
	(j)(2)(iii)	Initial examination must include pulmonary function tests.
	(j)(3)(i)	Annual examinations must include chest x-ray and pulmonary function tests.
	(j)(3)(ii)	Semi-annual examinations for workers at least 45 with 5 years of exposure must include pulmonary function tests.
	(j)(3)(iii)	Semi-annual examinations for workers at least 45 with 5 years of exposure who transfer out of regulated area must include chest x-ray and pulmonary function tests.
	(j)(4)(iv)	Employer must provide physician with information on protective equipment worn.
	(j)(5)(i)	Employer must obtain physicians written opinion with any limitations on the use of protective clothing or equipment such as respirators.
Training	(k)(1)(iv)	Training must include purpose, proper use and limitations of respirators.
Signs	(l)(2)(ii)	Signs at entrances to regulated areas must include the line “Respirator Required”.
Recordkeeping	(m)(1)(i)	Exposure monitoring records must include type of respirator used.
	(m)(2)(i)	Medical record must include physician’s written opinions.

Cotton Dust 1910.1043

	Paragraph	Cotton Dust 1910.1043
Permissible Exposure Limit	(c)(1)	8 hour TWA: Yarn mfg. and cotton washing: 200 µg/ m^3; textile mill waste house operations or yarn manufacturing. with lower grade washed cotton: 500 µg/ m^3; slashing and weaving operations: 750 µg/ m^3
Action Levels	(c)(2)	Action levels are one half of above limits.
Exposure Monitoring	(d)(3)(i)	At least once each year if concentration < PEL.
	(d)(3)(ii)	At least once every 6 months if concentration > PEL.
Respiratory Protection General	(f)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i)During installation or implementation of engineering and work practice controls. (ii)During maintenance and repair operations for which controls are not feasible. (iii)Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv)For specific operations listed in (g)(1). (v)If an employee requests a respirator.
Program	(f)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(f)(2)(ii)	If physician determines employee cannot wear a respirator, including a PAPR, employee must be given option of transferring to a position not requiring respirator use with no loss of compensation if such a position is available.
Selection	(f)(3)(i)	(A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, filtering facepiece respirators must not be used for cotton dust concentrations greater than five times the PEL. (B) HEPA filters must be used for PAPR and negative pressure respirators used at cotton dust concentrations greater than ten times the PEL.
Work Practices	(g)(1)	Employees performing the “blowdown” or “blowoff” must wear suitable respirators.
Medical Surveillance	(h)(2)(iii)	Initial examination must include pulmonary function tests.
	(h)(3)(i)	Periodic examinations must include pulmonary function tests.
	(h)(4)(iv)	Employer must provide physician with information on protective equipment worn.
	(h)(5)(i)	Employer must obtain and furnish employee with physician’s written opinion on recommended limitations on respirator use. Opinion must include a determination whether an employee can wear a negative pressure respirator, and where the employee cannot, a determination whether the employee can use a PAPR.
Training	(i)(1)(i)	Training must include purpose, proper use and limitations of respirators.
Signs	(j)	Signs at entrances to areas above PEL must include the line “Respirator Required In This Area
Recordkeeping	(k)(1)(ii)	Exposure monitoring records must include type of protective devices used.
	(k)(2)(ii)	Medical record must include physician’s written opinions and a copy of the information provided to the physician.

1,2-dibromo-3-chloropropane (DBCP) 1910.1044

	Paragraph	1,2-dibromo-3-chloropropane (DBCP) 1910.1044
Permissible Exposure Limit	(c)(1)	1 ppb, 8 hour TWA
Exposure Monitoring	(f)(3)(i)	If concentration < PEL, monitor quarterly.
	(f)(3)(ii)	Each month if > PEL.
Respiratory Protection General	(h)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During maintenance and repair operations for which controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PEL. (iv) Emergencies.
Program	(h)(2)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
Selection	(h)(3)(i)	Atmosphere-supplying respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134.
	(h)(3)(ii)	One of the following respirators must be provided for entry into or escape from unknown DBCP concentrations: (A) Full facepiece pressure demand supplied air respirator with auxiliary SCBA; (B) Full facepiece pressure demand SCBA
Emergency Situations	(i)(2)	Employees engaged in correcting emergency conditions must be equipped with appropriate respirator and protective clothing.
Medical Surveillance	(m)(4)(iv)	Employer must provide physician with information on protective equipment worn.
	(m)(5)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing and equipment such as respirators.
Training	(n)(1)(ii)	Training must include the purpose, proper use and limitation of respirators.
Signs	(o)(2)(i)	Signs at entrances to regulated areas must include the line "Respirator Required".
Recordkeeping	(p)(1)(ii)	Exposure monitoring records must include type of respirator used.
	(p)(2)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

Acrylonitrile 1910.1045

	Paragraph	Acrylonitrile 1910.1045
Action Level	(b)	1 ppm, 8 hour TWA
Permissible Exposure Limit	(c)(1)(i)	2 ppm, 8 hour TWA
	(c)(1)(ii)	10 ppm, 15 minute ceiling limit
Exposure Monitoring	(e)(3)(ii)	At least quarterly if concentration > action level, <PEL.
	(e)(3)(iii)	At least monthly if concentration > PEL.
	(h)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, where employer establishes engineering and work practice controls are not feasible (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(h)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d)(1)(iii)] and (f) through (m).
	(h)(2)(ii)	Air purifying canisters or cartridges replaced before end of service life or at end of shift, whichever occurs first. A label must be placed on cartridge/canister to indicate time and date first installed.
Selection	(h)(3)(i)	Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134.
	(h)(3)(ii)	Organic vapor respirator or SCBA must be provided for escape, as permitted by (h)(3)(i).
Emergency Situations	(i)(1)(ii)	Emergency plan shall specify that employees engaged in correcting emergency situations are equipped with appropriate respirators until emergency is abated.
Medical Surveillance	(n)(2)(iii)	Initial examination must include chest x-ray.
	(n)(3)(i)	Annual examinations must include chest x-ray.
	(n)(5)(v)	Employer must provide physician with information on protective equipment worn.
	(n)(6)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective clothing and equipment such as respirators.
Training	(o)(1)(ii)	Training must include purpose, proper use and limitations of respirators.
Signs	(p)(2)(i)	Signs posted at areas above PEL include line "Respirators May Be Required".
Recordkeeping	(q)(2)(ii)	Exposure monitoring records must include type of respirator used.
	(q)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

Ethylene Oxide 1910.1047

	Paragraph	Ethylene Oxide 1910.1047
Action Level	(b)	0.5 ppm, 8 hour TWA
Permissible Exposure Limit	(c)(1)	1 ppm, 8 hour TWA
	(c)(2)	5 ppm, 15 minute excursion limit
Exposure Monitoring	(d)(3)(i)	At least each 6 months if concentration > action level, < PEL (TWA.).
	(d)(3)(ii)	At least each 3 months if concentration > PEL (TWA.).
	(d)(3)(iv)	At least each 3 months if concentration > PEL (15 minute excursion limit).
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, for which controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Selection	(g)(3)(i)	Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, half masks are not permitted because ETO may cause eye irritation or injury.
	(g)(3)(ii)	Full facepiece air purifying respirators must have front- or back-mounted canisters approved for ethylene oxide.
	(g)(3)(iii)	For escape, any respirator permitted under (g) (3) (i) and (ii) must be provided.
Emergency Situations	(h)(1)(ii)	Emergency plan shall specify that employees engaged in correcting emergency situations are equipped with appropriate respirators until emergency is abated.
Medical Surveillance	(i)(3)(iv)	Employer must provide physician with information on protective and respiratory equipment worn.
	(i)(4)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective equipment such as clothing or respirators.
Signs	(j)(1)(i)	Signs posted at regulated areas must include the line "Respirator and Protective Clothing May Be Required To Be Worn in This Area".
Training	(j)(3)(iii)	Training must include how to use protective equipment.
Recordkeeping	(k)(2)(ii)	Exposure monitoring records must include type of protective devices used.
	(k)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.

Formaldehyde 1910.1048

	Paragraph	Formaldehyde 1910.1048
Action Level	(b)	0.5 ppm, 8 hour TWA
Permissible Exposure Limit	(c)(1)	0.75 ppm, 8 hour TWA
	(c)(2)	2 ppm, 15 minute STEL
Exposure Monitoring	(d)(3)(ii)	At least each 6 months if exposed > action level.
	(d)(3)(iii)	At least annually for employees exposed > the STEL.
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During operations such as maintenance and repair, for which controls are not feasible. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
	(g)(2)(ii)	Cartridges or canisters without ESLI employers must be replaced as specified by (d) (3) (iii) (B) (1) and (B) (2) of 29 CFR 1910.134, or at the end of the workshift, whichever occurs first.
Selection	(g)(3)(i)	(A) Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134. (B) Cartridges and canisters must be approved for formaldehyde. (C) SCBA or full facepiece respirators with formaldehyde canisters must be provided for escape
	(g)(3)(ii)	Employee who experiences difficulty wearing a negative pressure respirator must be provided a PAPR adequate to protect against formaldehyde exposure.
Medical Surveillance	(l)(4)	Examinations required annually for employees required to wear a respirator or based on questionnaire may be at increased risk from exposure.
	(l)(4)(ii)	Respirator wearers must have a baseline and annual pulmonary function test.
	(l)(6)(iv)	Employer must provide physician with information on protective equipment and respiratory protection worn.
	(l)(7)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective equipment, including respirators.
Training	(n)(3)(iv)	Training must include purpose, proper use and limitations of protective clothing and equipment.
Recordkeeping	(o)(3)(ii)	Medical record must include physician's written opinions.
	(o)(4)(i)	The employer must maintain records for employees subject to negative pressure respirator fit testing required by this standard.
	(o)(4)(ii)	Respirator fit testing records must include a copy of the fit testing protocol, the results of any fit testing performed, the size and manufacturer of respirators available for selection, the date of the most recent fit testing, the name and social security number of each tested employee, and the respirator type and facepiece selected.
	(o)(5)(iii)	Fit testing records must be kept until replaced by a more recent record.

4,4' - Methylenedianiline (MDA) 1910.1050

	Paragraph	4,4' - Methylenedianiline (MDA) 1910.1050
Action Level	(b)	5 ppb, 8 hour TWA
Permissible Exposure Limit	(c)(2)	10 ppb, 8 hour TWA 100 ppb, 15 minute STEL
Emergency Situations	(d)(1)(ii)	The emergency plan must specify that employees engaged in correcting the condition wear the appropriate protective equipment and clothing.
Exposure Monitoring	(e)(3)(i)	At least once every 6 months if concentration > action limit < PEL.
	(e)(3)(ii)	At least once every 3 months if concentration > PEL.
Regulated Area	(f)(4)	Employees entering a regulated area must be given and wear the appropriate protective clothing and equipment.
Respiratory Protection General	(h)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During time period to install or implement feasible engineering and work practice controls. (ii) In work operations the employer establishes that engineering and work practice controls are not feasible. (iii) In work situations where feasible engineering and work practice controls and such controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(h)(2)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii)], and (f) through (m).
Selection	(h)(3)(i)	A) Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134. (B) HEPA filters must be used for PAPR and negative pressure respirators. (C) Pressure demand or continuous flow SCBA with full facepiece or hood, or full facepiece air-purifying respirators must be provided for escape (D) Combination HEPA filter and organic vapor canister of cartridge with powered or non-powered air-purifying respirators must be provided when MDA is in liquid form or used as part of a process requiring heat.
	(h)(3)(ii)	Employee who cannot wear a negative pressure respirator must be given option of wearing a positive pressure (i.e. a PAPR) or a continuous flow or pressure demand supplied air respirator.
Communication of Hazards	(k)(1)(i)	Signs at entrances to regulated areas include line "Respirators And Protective Clothing May Be Required To Be Worn In This Area".
Medical Surveillance	(m)(7)(i)	Employer must provide physician with information on protective equipment worn.
	(m)(8)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective equipment and respirators.
Recordkeeping	(n)(3)(ii)	Exposure monitoring records must include type of respirator used
	(n)(4)(ii)	Medical record must include physician's written opinions.

1,3-Butadiene 1910.1051

	Paragraph	1,3-Butadiene 1910.1051
Action Level	(b)	0.5 ppm, 8 hour TWA
Permissible Exposure Limit	(c)(1)	1 ppm, 8 hour TWA
	(c)(2)	5 ppm 15 minute STEL
Exposure Monitoring	(d)(3)(i)	At least each 12 months if exposed > action level, < TWA and STEL.
	(d)(3)(ii) and (iii)	At least each 3 months if exposed > TWA or STEL.After 8 samples within 2 years, reduce to at least each 6 months.
Respiratory Protection General	(h)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls. (ii) During non-routine operations which are performed infrequently and in which exposures are limited in duration. (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(h)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d) (1) (iii) and (d) (3) (iii) (B) (1) and (2)], and (f) through (m).
	(h)(2)(ii)	Air purifying canisters or cartridges replaced according to replacement schedule in (h) (3) (i) selection table, and at the beginning of each work shift.
	(h)(2)(iii)	Instead of (h) (3) (i) replacement schedule, cartridges may be changed at 90% of service life. Employer must have breakthrough data based on tests conducted under worst case conditions of temperature, humidity, and air flow. Test data must be described in employer's respirator program.
	(h)(2)(iv)	A label must be placed on cartridge/canister to indicate time and date first installed.
	(h)(2)(v)	If air purifying elements with ESLI for butadiene become available, they may be used until no further service life or until replaced at the beginning of the next shift.
	(h)(2)(vi)	If employee detects odor of butadiene, must replace air purifying element immediately.
	(h)(3)(i)	< 5 X PEL: Half mask or full facepiece with butadiene or organic vapor cartridges or canisters (cartridges or canisters must be replaced every 4 hours) < 10 X PEL: Half mask or full facepiece with butadiene or organic vapor cartridges or canisters (cartridges or canisters must be replaced every 3 hours) < 25 X PEL: Full facepiece with butadiene or organic vapor cartridges or canisters. (cartridges or canisters must be replaced every 2 hours); any PAPR with butadiene or organic vapor cartridges (cartridges must be replaced every 2 hours); continuous flow supplied air respirator with hood or helmet < 50 X PEL: Full facepiece with butadiene or organic vapor cartridges or canisters (cartridges or canisters must be replaced every 1 hour); half mask or full facepiece PAPR with butadiene or organic vapor cartridges (cartridges must be replaced every 1 hour) < 1000 X PEL: Pressure demand or continuous flow supplied air respirator with half mask or full facepiece > 1000 X PEL, unknown concentration, or firefighting: Pressure demand SCBA; full facepiece pressure demand supplied air respirator with auxiliary SCBA Escape from IDLH: Pressure demand or continuous flow SCBA with appropriate service life; full facepiece with front or back mounted butadiene or organic vapor canister
	(h)(3)(ii)	All air purifying respirators must be approved for organic vapor or butadiene.
Medical Screening and Surveillance	(k)(3)(iii)	Physical ability to perform the work and use the respirator must be determined for employees who must wear respirators, as required by 1910.134.
	(k)(6)(iv)	Provide physician or other licensed health care professional (PLHCP) description of personal protective equipment used.
Communication of Hazards	(l)(2)(iv)	Training must include personal protective equipment.
Recordkeeping	(m)(2)(i)	Exposure monitoring records must include type of protective devices used.
	(m)(3)(i)	Fit testing records must include employee name; type, size, and brand of respirator; date of fit test. QNFT requires fit factor, strip chart, or other recording of results.
	(m)(3)(ii)	Fit testing records must be maintained until next test.
	(m)(4)(ii)	Medical record must include a copy of information provided to the PLHCP.

Methylene Chloride 1910.1052

	Paragraph	Methylene Chloride 1910.1052
Action Level	(b)	12.5 ppm, 8 hour TWA
Permissible Exposure Limit	(c)(1)	25 ppm, 8 hour TWA
	(c)(2)	125 ppm, 15 minute STEL
Exposure Monitoring	(d)(3)	Exposures < action level, > STEL: Monitor STEL every 3 months. Exposures > action level, < TWA , < STEL: Monitor TWA every 6 months. Exposures > action level, < TWA , > STEL: Monitor TWA every 6 months. Monitor STEL every 3 months. Exposures > TWA, < STEL: Monitor TWA every 3 months. Exposures > TWA and > STEL: Monitor TWA and STEL every 3 months.
Regulated Area	(e)(3)	Employees entering a regulated area must be given and wear the appropriate respirator.
	(e)(5)	Employees in regulated area must not engage in activities (e.g., taking medication, chewing gum or tobacco) which interfere with respirator seal or performance.
Respiratory Protection General	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) Whenever employee's exposure exceeds or can reasonably be expected to exceed TWA or STEL (e.g., when using methylene chloride in a regulated area). (ii) During time period necessary to install or implement feasible engineering and work practice controls.(iii) In a few operations, such as some maintenance and repair activities, for which employer demonstrates engineering and work practice controls are infeasible. (iv) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (v) Emergencies.
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (m) [except (d) (1) (iii) and (d) (3) (iii) (B) (1) and (2)].
	(g)(2)(ii)	Organic vapor gas mask canisters provided for escape must be replaced after one use.
Selection	(g)(3)(i)	Atmosphere-supplying respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, half masks must not be used because MC may cause eye irritation or damage.
	(g)(3)(ii)	Continuous flow or pressure demand SCBA or a gas mask with organic vapor canister must be provided for escape.
Medical Evaluation	(g)(4)(i)	If demand supplied air respirators or gas masks for escape are to be used, a physician or other licensed health care professional (PLHCP) must determine the employee's ability to use such respirators.
	(g)(4)(ii)	PLHCP written opinion must be provided to employee and employer.
Medical Surveillance	(j)(8(iv)	Employer must provide PLHCP with information on protective equipment such as respirators worn.
	(j)(9)(i)	Employer must obtain PLHCP written opinion including any limitations on the use of protective clothing and equipment or respirators.
Recordkeeping	(m)(2)(ii)	Where employer has 20 or more employees, exposure monitoring records must include type of personal protective equipment, such as respirator used.
	(m)(3)(ii)	Medical record must include physician's written opinions.

Respirable Crystalline Silica 1910.1053

	Paragraph	Respirable Crystalline Silica 1910.1053
Action Level	(b)	25 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	50 µg/m^3, 8 hour TWA
Exposure Assessment		
• Performance Option	(d)(2)	Use any combination of air monitoring data or objective data sufficient to characterize each employee exposures.
		OR
• Air Monitoring Option	(d)(3)(iii)	At least once every 6 months if concentration > action limit, < PEL.
	(d)(3)(iv)	At least once every 3 months if concentration > PEL.
Regulated Areas	(e)(1)	Establish where respirable crystalline silica concentration is or can be expected to be > PEL
Methods of Compliance • Abrasive Blasting	(f)(3)	In addition to using engineering and work practice controls to reduce exposure, the employer shall comply with 29 CFR 94 (Ventilation) where abrasive blasting is conducted.
Respiratory Protection General	(g)(1)	Respirators must be used in the following circumstances: (i) During installation or implementation of engineering and work practice controls; (ii) During operations such as maintenance and repair, for which engineering and work practice controls are not feasible; (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PEL; (iv) During periods when the employee is a regulated area.
Program	(g)(2)	Employer must institute a respirator program in accordance with 29 CFR 1910.134.
Medical Surveillance	(i)(4)(iii)	Employer must provide the physician information on any personal protective equipment worn.
	(i)(5)(ii)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing or equipment such as respirators
Recordkeeping	(k)(1)(ii)(F)	Exposure monitoring record must include type of personal protective equipment such as respirators, worn.
	(k)(3)(ii)(B)	Medical record must include physician's written opinions.

Chromium (VI) 1915. 1026 (Shipyards)

	Paragraph	Chromium (VI) 1915. 1026 (Shipyards)
Action Level	(b)	2.5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	5 µg/m^3, 8 hour TWA
Exposure Assessment	(d)(2)(iii)	At least once every 6 months if concentration > action limit, < PEL
	(d)(2)(iv)	At least once every 3 months if concentration > PEL.
	(d)(3)	OR Use any combination of air monitoring data, historical monitoring or objective data sufficient to characterize each employee exposures.
Respiratory Protection General	(f)(1)	Respirators must be used in the following circumstances:(i) During installation or implementation of engineering and work practice controls; (ii) During operations such as maintenance and repair, for which engineering and work practice controls are not feasible; (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs; (iv) For operations when employees are exposed <30 days per year and engineering and work practice controls are not implemented;(v) Emergencies.
Program	(f)(2)	Employer must institute a respirator program in accordance with 1910.134.
Medical Surveillance	(i)(4)(iii)	Employer must provide the physician information on protective equipment worn.
	(i)(5)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing or equipment such as respirators.
Recordkeeping	(k)(1)(ii)	Exposure monitoring record must include type of respirator worn.
	(k)(4)(ii)	Medical record must include physician's written opinions.

Asbestos 1915.1001 (Shipyards)

	Paragraph	Asbestos 1915.1001 (Shipyards)
Permissible Exposure Limit	(c)(1)	0.1 fiber/cc, 8 hour TWA
	(c)(2)	1 fiber/cc, 30 minute excursion limit
Regulated Areas	(e)(4)	Respirators required to enter regulated area (Area where Class I, II, or III work is performed or Class IV work where exposure exceeds PEL).
Exposure Monitoring	(f)(2)(i)	At the start of each asbestos job unless a negative exposure assessment is made.
	(f)(3)(i) (f)(3)(iii)	Class I and II Operations: Daily unless a negative exposure assessment is made or a positive pressure supplied air respirator is used.
	(f)(3)(ii)	Class III and IV Operations: At intervals sufficient to document validity of the exposure prediction.
Methods of Compliance	(g)(9)(v)	Class III work: Employees must wear respirators selected, fitted and used in accordance with(h) if thermal system insulation (TSI) or surfacing asbestos containing material (ACM) is disturbed; or if negative exposure assessment has not been made; or if PEL is exceeded.
	(g)(10)(i)	Class IV work: Employees must wear respirators selected, fitted and used in accordance with (h) when cleaning up debris and waste in a regulated area where respirators are required.
Respiratory Protection General	(h)(1)	Employer must provide and ensure respirators are used where required. Respirators must be used in the following circumstances: (i) During all Class I asbestos jobs. (ii) During all Class II work where the ACM is not removed in a substantially intact state. (iii) During all Class II and III work which is not performed using wet methods. (iv) During all Class II and III asbestos jobs where the employer does not produce a negative exposure assessment. (v) During all Class III jobs where TSI or surfacing ACM or presumed asbestos containing material (PACM) is being disturbed.(vi) During all Class IV work performed within regulated areas where employees performing other work are required to wear respirators. (vii) During all work covered by this section where employees are exposed above the TWA or excursion limit. (viii) In emergencies.
Selection	(h)(2)(i)	Respirators must be selected as specified in paragraph (d) (3) (i) (A) of 29 CFR 1910.134; however, filtering facepiece respirators must not be used.
	(h)(2)(ii)	HEPA filters must be used for PAPR and negative pressure respirators.
	(h)(2)(iii)	(A) Employer must inform employees of their right to request a tight - fitting PAPR permitted under (h)(2)(i) instead of a negative pressure respirator. (B) A tight - fitting PAPR must be provided in lieu of a negative pressure respirator if employee requests.
	(h)(2)(iv)	Half mask air purifying respirators, other than filtering facepieces, are required for: (A) Class II and III asbestos jobs unless for which no negative exposure assessment is available; (B) Class III jobs where TSI or surfacing ACM or PACM is being disturbed.
	(h)(2)(v)	(A) Tight - fitting PAPR or full facepiece pressure demand supplied air respirators with HEPA egress cartridges or auxiliary SCBA are required for Class I work for which a negative exposure assessment is not available and the exposure assessment indicates exposures < 1 f/cc as 8 hour TWA. (B) Full facepiece pressure demand supplied air respirators with auxiliary SCBA are required for Class I work for which a negative exposure assessment is not available and the exposure assessment indicates exposures >1 f/cc as 8 hour TWA.
Program	(h)(3)(i)	Employer must institute a respirator program in accordance with 1910.134 (b), (d), (e) & (f).**
	(h)(3)(ii)	Employees must be allowed to change filters when breathing resistance is detected.
	(h)(3)(iv)	Any employee who cannot wear a respirator must be given the option of transferring to a position not requiring respirator use with no loss of compensation if such a position is available.
	(h)(4)(i)	Employer must ensure respirator exhibits least possible facepiece leakage.
	(h)(4)(ii)	Fit testing is required for all negative pressure respirators. QLFT for half mask respirators or full facepieces used where half masks are permitted. Must be performed each 6 months according to specific protocols in Appendix C.**
	Appendix C	Employers must perform fit testing in accordance with the fit-testing requirements of 29 CFR 1910.134(f) and the qualitative and quantitative fit-testing protocols and procedures specified in Appendix A of 29 CFR 1910.134.
Hygiene Facilities (Class I Jobs)	(j)(1)(ii)	Employee must put on protective clothing and respirator before exiting clean room.

	Paragraph	Asbestos 1915.1001 (Shipyards)
	(j)(1)(iii)	Employee must not remove respirator in equipment room.
Signs	(k)(7)(ii)	Signs posted at regulated area must include line "Respirators and Protective Clothing Are Required in this Area".
Training	(k)(9)(viii)	Training must include purpose, proper use, fitting instructions and limitations of respirators.
Medical Surveillance	(m)(1)(i)	Must be provided for employees who are engaged in Class I, II or III work or exposed at or above the PEL for 30 or more days per year and for employees who wear negative pressure respirators.
	(m)(2)(i)	Examination to be given within ten working days of thirtieth day of exposure or prior to assignment to an area where negative pressure respirators are worn.
	(m)(2)(ii)	Initial and annual examinations must include pulmonary function testing and chest x-ray (at the discretion of the physician).
	(m)(3)(iv)	Provide physician information on protective and respiratory equipment used.
	(m)(4)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective equipment such as respirators.
Recordkeeping	(n)(2)(ii)	Exposure monitoring records must include type of protective devices used.
	(n)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.
Qualified Person	(o)(3)(i)	Qualified person must ensure that employees working in enclosures and/or using glove bags wear respirators and protective clothing as required.

4,4' - Methylenedianiline (MDA) 1926.60 (Construction)

	Paragraph	4,4' - Methylenedianiline (MDA) 1926.60 (Construction)
Action Level	(b)	5 ppb, 8 hour TWA
Permissible Exposure Limit	(c)	10 ppb, 8 hour TWA 100 ppb, 15 STEL
Emergency Situations	(e)(1)(ii)	The emergency plan must specify that employees engaged in correcting the condition wear the appropriate protective equipment and clothing.
Exposure Monitoring	(f)(3)(i)	At least once every 6 months if concentration > action limit < PEL.
	(f)(3)(ii)	At least once every 3 months if concentration > PEL.
	(f)(3)(iii)	If employees are wearing supplied air respirators in a regulated area, no monitoring is required.
Regulated Area	(g)(4)	Individuals entering a regulated area must be given and wear the appropriate protective clothing and equipment.
Respiratory Protection General	(i)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During time period to install or implement feasible engineering and work practice controls. (ii) In work operations the employer establishes that engineering and work practice controls are not feasible. (iii) In work situations where feasible engineering and work practice controls and such controls are not sufficient to reduce exposure below PELs. (iv) Emergencies.
Program	(i)(2)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d)(1)(iii)], and (f) through (m).
Selection	(i)(3)(i)	(A) Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134. (B) HEPA filters must be used for PAPR and negative pressure respirators. (C) Pressure demand or continuous flow SCBA with full facepiece or hood, or full facepiece air-purifying respirators must be provided for escape (D) Combination HEPA filter and organic vapor canister of cartridge with powered or non-powered air-purifying respirators must be provided when MDA is in liquid form or used as part of a process requiring heat.
	(i)(3)(ii)	Employee who cannot wear a negative pressure respirator must be given option of wearing a positive pressure (i.e. a PAPR) or a continuous flow or pressure demand supplied air respirator.
Communication of Hazards	(l)(1)(i)	Signs at entrances to regulated areas include line "Respirators And Protective Clothing May Be Required To Be Worn In This Area".
Medical Surveillance	(n)(7)(i)	Employer must provide physician with information on protective equipment worn.
	(n)(8)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective equipment or respirators.
Recordkeeping	(o)(4)(ii)	Exposure monitoring records must include type of protective devices used.
	(o)(5)(ii)	Medical record must include physician's written opinions.

Lead in Construction 1926.62 Interim Final Rule

	Paragraph	Lead in Construction 1926.62 Interim Final Rule
Action Level	(b)	30 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)(1)	50 µg/m^3, 8 hour TWA
	(c)(2)	For exposures greater than 8 hours a day, PEL = 400 ÷ hours worked in the day.
	(c)(3)	When respirators are used to supplement engineering controls, assigned protection factor of respirator can be used to calculate exposure during periods the respirator is worn.
Exposure Assessment	(d)(2)	Until monitoring is completed, assumed levels of exposure based on specific tasks are used to select respirators (see Table A, next page).
	(d)(6)(ii)	At least once every 6 months if concentration > action limit and < PEL.
	(d)(6)(iii)	At least once every 3 months if concentration > PEL.
Respiratory Protection General	(f)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) Whenever an employee's exposure exceeds the PEL. (ii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs. (iii) Whenever an employee requests a respirator. (iv) Interim protection for employees performing tasks specified in paragraph (d)(2)
Program	(f)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d)(1)(iii)], and (f) through (m).
	(f)(2)(ii)	If an employee exhibits difficulty breathing during fit test or respirator use, employer must provide a medical examination to determine if the employee can use a respirator.
Selection	(f)(3)(i)	(A) Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134. (B) Full facepieces must be provided in lieu of half masks for lead aerosols that cause eye or skin irritation at the use concentrations. (C) HEPA filters must be used for PAPR and negative pressure respirators.
	(f)(3)(ii)	Employer must supply a PAPR if an employee requests one and the respirator will provide adequate protection.
Medical Surveillance	(j)(3)(iv)	Employer must provide physician with information on protective equipment to be worn.
	(j)(3)(v)	Employer must obtain and give employee copy of physician written opinion on limitations regarding respirator use. If physician determines employee cannot wear a negative pressure respirator, must include determination whether an employee can wear a PAPR.
Training	(l)(2)(iii)	Training must include purpose, proper use and limitations of respirators.
Recordkeeping	(n)(1)(ii)	Exposure monitoring records must include type of respirator used.
	(n)(2)(ii)	Medical record must include physician's written opinion.

Lead in Construction, 29 CFR 1926.62

Table A. Activities That are Presumed to Have Significant Lead Exposures		
Activity	Pressured Exposure	Minimum Required Respiratory Protection
A: Where lead containing coatings are present: Manual demolition of structures (e.g. drywall); Scraping, manual sanding, heat gun use; Power tool cleaning with dust collection systems B: Spray painting with lead paint C: Any task an employer has reason to believe an employee may be exposed above the PEL	500 µg/m^3	Half mask respirator with HEPA filters
A. Using lead containing mortar B. Lead burning C. Where lead containing paints are present: Rivet busting; Power tool cleaning without dust collection; Cleanup of dry expendable abrasives ; Abrasive blasting containment movement or removal	Greater than 500 µg/m^3 but less than 2500 µg/m^3	Loose fitting hood or helmet PAPR with HEPA filters; hood or helmet supplied air respirator continuous flow
Where lead containing paints are present: Abrasive blasting; Welding; Cutting; Torch burning	Greater than 2500 µg/m^3	Half mask or full facepiece supplied air respirator operated in pressure demand mode

Asbestos 1926.1101 (Construction)

	Paragraph	Asbestos 1926.1101 (Construction)
Permissible Exposure Limit	(c)(1)	0.1 fiber/cc, 8 hour TWA
	(c)(2)	1 fiber/cc, 30 minute excursion
Regulated Areas	(e)(4)	Respirators required to enter regulated area (Area where Class I, II, or III work is performed or Class IV work where exposure exceeds PEL).
Exposure Monitoring	(f)(2)(i)	At the start of each asbestos job unless a negative exposure assessment is made.
	(f)(3)(i) (f)(3)(iii)	Class I and II Operations: Daily unless a negative exposure assessment is made or a positive pressure supplied air respirator is used.
	(f)(3)(ii)	Class III and IV Operations: At intervals sufficient to document validity of the exposure prediction.
Methods of Compliance	(g)(9)(v)	Class III work: Employees must wear respirators selected, fitted and used in accordance with(h) if thermal system insulation (TSI) or surfacing asbestos containing material (ACM) is disturbed; or if negative exposure assessment has not been made; or if PEL is exceeded.
	(g)(10)(i)	Class IV work: Employees must wear respirators selected, fitted and used in accordance with (h) when cleaning up debris and waste in a regulated area where respirators are required.
Respiratory Protection General	(h)(1)	Employer must provide respirators that comply with the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During all Class I asbestos jobs. (ii) During all Class II work where the ACM is not removed in a substantially intact state. (iii) During all Class II and III work which is not performed using wet methods. (iv) During all Class II and III asbestos jobs where the employer does not produce a negative exposure assessment. (v) During all Class III jobs where TSI or surfacing ACM or presumed asbestos containing material (PACM) is being disturbed. (vi) During all Class IV work performed within regulated areas where employees performing other work are required to wear respirators. (vii) During all work covered by this section where employees are exposed above the TWA or excursion limit. (viii) In emergencies.
Program	(h)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d)(1)(iii)], and (f) through (m).
	(h)(2)(ii)	Any employee who cannot wear a respirator must be given the option of transferring to a position not requiring respirator use with no loss of compensation if such a position is available.
Selection	(h)(3)(i)	(A) Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134; however, filtering facepiece respirators must not be used. (B) HEPA filters must be used for PAPR and negative pressure respirators.
	(h)(3)(ii)	A tight - fitting PAPR must be provided in lieu of a negative pressure respirator selected according to (h)(3)(i)(A) if employee requests and it provides adequate protection.
	(h)(3)(iv)	(A) Tight - fitting PAPR or full facepiece pressure demand supplied air respirators with HEPA egress cartridges or auxiliary SCBA are required for Class I work for which a negative exposure assessment is not available and the exposure assessment indicates exposures < 1 f/cc as 8 hour TWA. (B) Full facepiece pressure demand supplied air respirators with auxiliary SCBA are required for Class I work for which a negative exposure assessment is not available and the exposure assessment indicates exposures >1 f/cc as 8 hour TWA.
Hygiene Facilities (Class I Jobs)	(j)(1)(ii)	Employee must put on protective clothing and respirator before exiting clean room.
	(j)(1)(iii)	Employee must not remove respirator in equipment room.
Signs	(k)(7)(ii)	Signs posted at regulated area must include line "Respirators and Protective Clothing Are Required in This Area".
	(k)(9)(viii)	Training must include purpose, proper use, fitting instructions and limitations of respirators.
Medical Surveillance	(m)(1)(i)	Provided for all employees engaged in Class I, II or III work or exposed at or above the PEL for 30 or more days per year and for employees who wear negative pressure respirators.
	(m)(2)(i)	Examination to be given within ten working days following the thirtieth day of exposure or prior to assignment to an area where negative pressure respirators are worn.

	Paragraph	Asbestos 1926.1101 (Construction)
	(m)(2)(ii)	Initial and annual examinations must include pulmonary function testing and chest x-ray (at the discretion of the physician).
	(m)(3)(iv)	Employer must provide physician with information on protective and respiratory equipment used.
	(m)(4)(i)	Employer must obtain physician's written opinion which includes any recommended limitations on use of protective equipment such as respirators.
Recordkeeping	(n)(2)(ii)	Exposure monitoring records must include type of protective devices used.
	(n)(3)(ii)	Medical record must include physician's written opinions and a copy of the information provided to the physician.
Competent Person	(o)(3)(i)	Competent person must ensure that employees working in enclosures and/or using glove bags wear protective clothing and respirators as required.

Chromium (VI) 1926.1126 (Construction)

	Paragraph	Chromium (VI) 1926.1126 (Construction)
Action Level	(b)	2.5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	5 µg/m^3, 8 hour TWA
Exposure Determination	(d)(2)(iii)	At least once every 6 months if concentration > action limit, < PEL.
	(d)(2)(iv)	At least once every 3 months if concentration > PEL.
	(d)(3)	OR Use any combination of air monitoring data, historical monitoring or objective data sufficient to characterize each employee exposures.
Respiratory Protection General	(f)(1)	Respirators must be used in the following circumstances:(i) During installation or implementation of engineering and work practice controls; (ii) During operations such as maintenance and repair, for which engineering and work practice controls are not feasible; (iii) Where engineering and work practice controls are not sufficient to reduce exposure below PELs; (iv) For operations when employees are exposed <30 days per year and engineering and work practice controls are not implemented;(v) Emergencies.
Program	(f)(2)	Employer must institute a respirator program in accordance with 1910.134.
Medical Surveillance	(i)(4)(iii)	Employer must provide the physician information on protective equipment worn.
Selection	(i)(5)(i)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of protective clothing or equipment such as respirators.
Recordkeeping	(k)(1)(ii)	Exposure monitoring record must include type of respirator worn.
	(k)(4)(ii)	Medical record must include physician's written opinions.

Cadmium 1926.1127 (Construction)

	Paragraph	Cadmium 1926.1127 (Construction)
Action Level	(b)	2.5 µg/m^3, 8 hour TWA
Permissible Exposure Limit	(c)	5 µg/m^3, 8 hour TWA
Exposure Determination	(d)(1)(i)	Competent person must determine need to monitor.
	(d)(3)(i)	If monitoring shows concentrations > action level, monitor to represent exposures and to assure adequacy of respiratory protection.
Regulated Area	(e)(4)	Employees entering a regulated area must be given and wear the appropriate respirator.
Respiratory Protection General	(f)(3)(ii)	Materials containing cadmium must not be applied by spraying if exposures are above PEL unless employees are protected with positive pressure supplied air respirators with full facepiece, hood, helmet, or suit and measures are used to limit overspray.
	(g)(1)	Employer must provide respirators that meet the requirements of this paragraph. Respirators must be used in the following circumstances: (i) During time period to install or implement feasible engineering and work practice controls. (ii) In maintenance and repair activities and during brief or intermittent operations where engineering and work practice controls are not feasible or are not required. (iii) In regulated areas. (iv) Where the employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposure below PELs. (v) Emergencies. (vi) Whenever an employee exposed above the action level requests a respirator. (vii) When an employee is exposed above the PEL and engineering controls are not required; e.g. employee exposed intermittently and not more than 30 days/year.
Program	(g)(2)(i)	Employer must institute a respirator program in accordance with 1910.134 (b) through (d) [except (d)(1)(iii)], and (f) through (m).
	(g)(2)(ii)	If employee has difficulty breathing during a fit test or respirator use, employer must provide a medical examination.
	(g)(2)(iii)	Employee must not be assigned to a task requiring a respirator if physician determines employee cannot wear the respirator. Provisions for medical removal are in section (l)(11) and (12).
Selection	(g)(3)(i)	(A) Respirators must be selected as specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134. (B) Full facepieces must be provided in lieu of half masks if employees experience eye irritation. (C) HEPA filters must be used for PAPR and negative pressure respirators.
	(g)(3)(ii)	An employee entitled to wear a respirator may request a PAPR if it will provide adequate protection.
Emergency Situations	(h)	Employer must develop a written plan dealing with substantial releases of cadmium, include provisions for the use of appropriate respirators and personal protective equipment.
Medical Surveillance	(l)(1)(ii)	To determine fitness to use a respirator, employer must provide the limited medical examination described in (l)(6).
	(l)(3)(ii)	Actions triggered by initial biological monitoring above limits specified include a reevaluation of respirator use and the respirator program.
	(l)(4)(ii)	Periodic medical examination must include chest x-ray and pulmonary function tests. After initial x-ray, frequency is determined by physician.
	(l)(5)(i)	Actions triggered by medical evaluation results consistent with cadmium toxicity include a reevaluation of respirator use and the respirator program.
	(l)(6)(i)	Specific medical examination must be provided to determine fitness to use a respirator.
	(l)(6)(iii)	If an employee has had difficulty breathing during a fit test or during respirator use, employer must provide a medical examination.
	(l)(6)(iv)	Where results are abnormal, physician must consider if medical limitation on respirator use is necessary. If employee is allowed to use a respirator, periodic reviews are required.
	(l)(9)(iv)	Employer must provide physician with information on protective equipment worn including when and for how long a respirator has been used.
	(l)(10)(i)	Employer must obtain physicians written opinion with any limitations on respirator use.

	Paragraph	Cadmium 1926.1127 (Construction)
Communication of Hazards	(m)(2)(ii)	Signs at entrances to regulated areas must include line “Respirators Required In This Area”.
	(m)(4)(iii)	Employee training must include purpose, proper selection, fitting, proper use and limitations of respirators.
Recordkeeping	(n)(1)(ii)	Exposure monitoring records must include type of respirator used.
	(n)(3)(ii)	Medical record must include physician’s written opinions and a copy of the information provided to the physician.

Respirable Crystalline Silica 1926.1153

	Paragraph	Respirable Crystalline Silica 1926.1153
Action Level	(b)	25 µg/m^3, 8 hour TWA
Exposure Control Methods		This standard allows one of two exposure control methods to be used
Specified Exposure Control Methods	(c)	For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1 (next page), unless the employer assesses and limits the exposure of the employee to respirable crystalline silica in accordance with paragraph (d).
Alternative Exposure Control Methods	(d)	This method is for tasks not listed in Table 1, or where the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1:
• Permissible Exposure Limit	(d)(1)	50 µg/m^3, 8 hour TWA
• Exposure Assessment	(d)(2)	The employer shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica ≥ action level in accordance with either the performance option in paragraph (d)(2)(ii) or the scheduled monitoring option in paragraph (d)(2)(iii) of this section.
• Performance Option	(d)(2)(ii)	Use any combination of air monitoring data or objective data sufficient to characterize each employee exposures.
		OR
• Scheduled Monitoring Option	(d)(2)(iii)(C)	At least once every 6 months if concentration > action limit, < PEL.
	(d)(2)(iii)(D)	At least once every 3 months if concentration > PEL.
	(d)(2)(iii)(E)	Where the most recent (noninitial) exposure monitoring indicates that employee exposures are < action level, the employer shall repeat such monitoring within 6 months of the most recent monitoring until 2 consecutive measurements, taken 7 or more days apart, are < action level, at which time the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring, except as otherwise provided in paragraph (d)(2)(iv) of this section.
• Reassessment of Exposures	(d)(2)(iv)	The employer shall reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures ≥ action level, or when the employer has any reason to believe that new or additional exposures ≥ action level have occurred.
Methods of Compliance	(d)(3)(i)	Wherever such feasible engineering and work practice controls are not sufficient to reduce employee exposure ≤ PEL, the employer shall nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them with the use of respiratory protection that complies with the requirements of paragraph (e) of this section.
• Abrasive Blasting	(d)(3)(ii)	In addition to using engineering and work practice controls to reduce exposure, the employer shall comply with 29 CFR 1926.57 (Ventilation) where abrasive blasting is conducted.
Respiratory Protection General	(e)(1)	Respirators must be used in the following circumstances: (i) Where specified by Table 1 of paragraph (c) of this section; or for tasks not listed in Table 1, or (ii) Where the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1: (A) Where exposures > PEL during periods necessary to install or implement feasible engineering and work practice controls; (B) Where exposures > PEL during tasks, such as certain maintenance and repair tasks, for which engineering and work practice controls are not feasible; and (C) During tasks for which an employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures ≤ the PEL.
Program	(e)(2)	Employer must institute a respirator program in accordance with 29 CFR 1910.134.
Specified Exposure Control Methods	(e)(3)	For the tasks listed in Table 1 in paragraph (c) of this section, if the employer fully and properly implements the engineering controls, work practices, and respiratory protection described in Table 1, the employer shall be considered to be in compliance with paragraph (e)(1) of this section and the requirements for selection of respirators in 29 CFR 1910.134(d)(1)(iii) and (d)(3) with regard to exposure to respirable crystalline silica.
Written Exposure Control Plan	(g)(ii)	A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task;

	Paragraph	Respirable Crystalline Silica 1926.1153
Medical Surveillance	(h)(4)(iii)	A description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment;
	(h)(5)(ii)	Employer must obtain and provide the employee with physician's written opinion which includes any recommended limitations on use of respirators.
Recordkeeping	(j)(1)(ii)(F)	Exposure monitoring record must include type of personal protective equipment such as respirators, worn.
	(j)(3)(ii)(B)	Medical record must include physician's written opinions.

Table 1 from Respirable Crystalline Silica29 CFR 1926.1153

Equipment/task	Engineering and work practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
(ii) Handheld power saws (any blade diameter)	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: —When used outdoors	None	APF 10
(ii) Handheld power saws (any blade diameter)	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: —When used indoors or in an enclosed area	APF 10	APF 10
(iv) Walk-behind saws	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: —When used indoors or in an enclosed area	APF 10	APF 10
(viii) Dowel drilling rigs for concrete	For tasks performed outdoors only: • Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.	APF 10	APF 10
(x) Jackhammers and handheld powered chipping tools	• Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact: —When used outdoors —When used indoors or in an enclosed area OR • Use tool equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism: —When used outdoors —When used indoors or in an enclosed area	None APF 10 None APF 10	APF 10 APF 10 APF 10 APF 10
(xi) Handheld grinders for mortar removal (i.e., tuckpointing)	• Use grinder equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	APF 10	APF 25
(xii) Handheld grinders for uses other than mortar removal	• Use grinder equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism: —When used outdoors —When used indoors or in an enclosed area	None None	None APF 10

Other OSHA Regulations Affecting Respirator Use

While most of OSHA's respiratory protection requirements are found in 29 CFR 1910.134 and the substance specific health standards, several additional regulations also affect respirator use. The following pages summarize the more significant of those regulations.

29 CFR 1910.94 and 1926.57 Ventilation

Abrasive Blasting

1. Scope

This paragraph (a) applies to all operations where an abrasive is forcibly applied to a surface by pneumatic or hydraulic pressure, or by centrifugal force. It does not apply to steam blasting, or steam cleaning or hydraulic cleaning methods where work is done without the aid of abrasives.

2. Definitions

Abrasive: A solid substance used in an abrasive blasting operation.

Abrasive blasting respirator: A respirator constructed so that it covers the wearer's head, neck, and shoulders to protect the wearer from rebounding abrasive.

Blast cleaning room: A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.

Particulate filter respirator: An air purifying respirator, commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

Abrasive blasting: The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

3. Personal Protective Equipment

Only respiratory protective equipment approved by the National Institute for Occupational Safety and Health may be used to protect employees from dusts produced during abrasive blasting operations.

Abrasive blasting respirators must be worn by all abrasive blasting operators:

A. When working inside of blast-cleaning rooms,

B. When using silica sand in manual blasting operations where the nozzle and blast are not physically separated from the operator in an exhaust ventilated enclosure,

C. Where concentrations of toxic dusts dispersed by the abrasive blasting may exceed the limits set in 1910.1000 and the nozzle and blast are not physically separated from the operator in an exhaust-ventilated enclosure.

Properly fitted particulate filter respirators, commonly referred to as dust-filter respirators, may be used for short, intermittent, or occasional dust exposures such as cleanup, dumping of dust collectors, or unloading shipments of sand at a receiving point, when it is not feasible to control the dust by enclosure, exhaust ventilation, or other means. Respirators used must be approved by NIOSH for protection against the specific type of dust encountered.

Dust-filter respirators may be used to protect the operator of outside abrasive-blasting operations where non-silica abrasives are used on materials having low toxicity. Dust-filter respirators must not be used for continuous protection where silica sand is used as the blasting abrasive, or toxic materials are blasted.

A respiratory protection program as defined and described in 1910.134 must be established wherever it is necessary to use respiratory protective equipment.

4. Air Supply and Air Compressors

The air for abrasive-blasting respirators must be free of harmful quantities of dusts, mists, or noxious gases, and must meet the requirements for supplied air quality and use set forth in 29 CFR 1910.134 (i).

29 CFR 1910.120 Hazardous Waste Operations and Emergency Response

1. Scope

This standard covers the following operations:

A. Clean-up operations required by a governmental body involving hazardous substances that are conducted at uncontrolled hazardous waste sites;
B. Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended;
C. Voluntary clean-up operations at sites recognized by governmental bodies as uncontrolled hazardous waste sites;
D. Operations involving hazardous wastes that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA; or by agencies under agreement with U.S.E.P.A. to implement RCRA;
E. Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

2. Definitions

"IDLH" or "Immediately Dangerous to Life or Health" means an atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

"Oxygen Deficiency" means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

"Permissible Exposure Limit" means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subparts G and Z.

"Published Exposure Limit" means the exposure limits published in "NIOSH Recommendations for Occupational Health Standards" dated 1986 incorporated by reference, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1987-88" dated 1987 incorporated by reference.

3. Safety and Health Program

The site safety and health program must address personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program of this standard.

4. Site Characterization and Analysis

Personal protective equipment (PPE) must be provided and used during initial site entry in accordance with the following requirements:

A. Based upon the results of preliminary site evaluation, an ensemble of PPE must be selected and used during initial site entry which will provide protection to a level of exposure below the permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards, and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.

B. If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is not warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least 5 minutes duration must be carried by employees during initial site entry.

C. If the preliminary site evaluation does not provide sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE must be provided as minimum protection, and direct reading instruments must be used as appropriate for identifying IDLH conditions.

D. Once the hazards of the site have been identified, the appropriate PPE must be selected and used in accordance with this standard.

5. Training

The training must thoroughly cover the use of personal protective equipment.

6. Medical Surveillance

The medical surveillance program instituted by the employer for all employees who wear a respirator for 30 days or more a year or as required by 1910.134. The medical examinations and consultations must be made available (1) prior to assignment, (2) at least once every 12 months for each employee unless the attending physician believes a longer interval (not greater than biennially) is appropriate, (3) at termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months, (4) as soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation, (5) and at more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary. Medical examinations required by this standard must include a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions that may be expected at the work site.

A description of any personal protective equipment used or to be used must be provided to the physician. The employer must obtain and furnish the employee with a copy of a written opinion from the attending physician containing the physician's recommended limitations upon the employee's assigned work.

7. PPE for Substances Regulated in Subparts G and Z

Whenever engineering controls and work practices are not feasible or not required, any reasonable combination of engineering controls, work practices and PPE must be used to reduce and maintain employee exposures to or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

8. PPE for Substances not Regulated in Subparts G and Z

An appropriate combination of engineering controls, work practices, and personal protective equipment must be used to reduce and maintain employee exposure to below published exposure levels for hazardous substances and health hazards not regulated under 29 CFR 1910, Subparts G and Z. The employer may use the published literature and MSDS as a guide in

making the employer's determination as to what level or protection the employer believes is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

9. Personal Protective Equipment Selection

PPE must be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis. PPE selection must be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, task-specific conditions and duration, and the hazards and potential hazards at the site.

Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply, must be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

Totally-encapsulated chemical protective suits must be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

10. Personal Protective Equipment (PPE) Program

A written personal protective equipment program, which is part of the employer's safety and health program and which also a part of the site-specific safety and health plan must be established. The PPE program must address the following elements:

A. Selection of PPE, based upon site hazards,
B. Use and limitations of the equipment,
C. Work mission duration,
D. Maintenance and storage of PPE,
E. Decontamination and disposal,
F. Training and proper fitting,
G. Donning and doffing procedures,
H. Inspection procedures prior to, during, and after use,
I. Evaluation of the effectiveness of the PPE program, and
J. Limitations during temperature extremes, heat stress, and other appropriate conditions.

11. Opening Drums and Containers

Where an airline respirator system is used in areas where drums or containers are being opened, connections to the source of air supply must be protected from physical damage.

12. Decontamination

Protective clothing and equipment must be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

13. Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA)

Employers conducting operations at treatment, storage, and disposal (TSD) facilities must implement programs specified below that relate to respiratory protection.

A. Safety and Health Program
B. Medical Surveillance Program
C. Training Program
D. Emergency Response Program which includes PPE and emergency equipment.

14. Emergency Response to Hazardous Substance Releases

This section covers employers whose employees are engaged in emergency response no matter where it occurs except that it does not cover employees engaged in operations discussed previously.

The emergency response plan must address PPE and emergency equipment.

Procedures for handling emergency response:

A. Based on the hazardous substances and/or conditions present, the individual in charge of the Incident Command System (ICS) must implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment must meet, at a minimum, the criteria contained in 29 CFR 1910.156 (e) when worn while performing fire fighting operations beyond the incipient stage for any incident.

B. Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard must wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

C. When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus must meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

15. First Responders

First responders at the operation level must have received at least 8 hours of training or have had sufficient experience to objectively demonstrate competency in knowing how to select and use proper personal protective equipment provided to the first responder and the employer must certify so.

16. Hazardous Material Technician/Specialist

The hazardous material technician or specialist must know how to select and use proper specialized chemical personal protective equipment provided to the hazardous materials technician or specialist, respectively.

17. General Description of the Levels of Protection and Protective Gear

Personal protective equipment is divided into four categories based on the degree of protection afforded; Level A, Level B, Level C, Level D.

Level A - To be selected when the greatest level of skin, respiratory, and eye protection is required. The following constitutes Level A equipment:

1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by NIOSH.
2. Totally-encapsulating chemical protective suit.
3. Gloves, outer, chemical-resistant.
4. Gloves, inner, chemical-resistant.
5. Boots, chemical-resistant, steel toe and shank.
6. Optional PPE as required.

Level B - The highest level of respiratory protection is necessary, but a lesser level of skin protection is needed. The following constitutes Level B equipment:

1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by NIOSH.
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical resistant overalls).
3. Gloves, outer, chemical-resistant.
4. Gloves, inner, chemical-resistant.
5. Boots, outer, chemical-resistant, steel toe and shank.
6. Optional PPE as required

Level C - The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met. The following constitutes Level C equipment:

1. Full-face or half-mask, air purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Gloves, outer, chemical-resistant.
4. Gloves, inner, chemical-resistant.
5. Optional PPE as required.

Level D - A work uniform affording minimal protection, used for nuisance contamination only. The following constitutes Level D equipment:

1. Coveralls.
2. Boots/shoes, chemical-resistant steel toe and shank.
3. Optional PPE as required.

29 CFR 1910.146 Permit-Required Confined Spaces

1. Permit-Required Confined Space Program

Under the permit-required confined space program required by this standard, the employer must provide all equipment necessary to safely enter a permit space. The equipment includes personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees. Respirators, if necessary, are selected in accordance with 1910.134.

2. Entry Permit

The entry permit authorizes and controls entry into a permit space and documents compliance with 1910.146 requirements. It must include a listing of equipment, such as personal protective equipment, necessary for safe entry.

3. Training

The employer must provide training so that all employees whose work is regulated by this standard acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned to them.

Training must be provided to each affected employee before: (1) the employee is first assigned duties, (2) before there is a change in assigned duties, (3) whenever there is a change in operations that presents a hazard that the employee has not previously been trained, (4) or whenever the employer has reason to believe either that there are deviations from the entry procedures or that there are inadequacies in the employees knowledge or use of these procedures.

4. Rescue and Emergency Services

An employer whose employees have been designated to provide permit space rescue and emergency services must provide personal protective equipment necessary for making rescues from permit spaces and train affected employees so they are proficient in its use.

29 CFR 1910.156 Fire Brigades

1. Respiratory Protection Devices

The employer must ensure that respirators which meet the requirements of 29 CFR 1910.134 and this paragraph are provided to, and used by, fire brigade members.

Approved self-contained breathing apparatus with full-facepieces, or with approved helmet or hood configuration, must be provided to and worn by fire brigade members while working inside buildings or confined spaces where toxic products of combustion or an oxygen deficiency may be present. Such apparatus must also be worn during emergency situations involving toxic substances.

Approved self-contained breathing apparatus may be equipped with either a "buddy-breathing" device or a quick disconnect valve, even if these are not certified by NIOSH. If these devices are used, they must not cause damage to the apparatus, or restrict the air flow of the apparatus, or obstruct the normal operation of the apparatus.

Approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus must meet DOT and NIOSH criteria.

Self-contained breathing apparatus must have a minimum service life of 30 minutes in accordance with the methods and requirements of NIOSH under 42 CFR part 84, except for escape self-contained breathing apparatus (ESCBA) used only for emergency escape purposes.

Self-contained breathing apparatus must be provided with an indicator which automatically sounds an audible alarm when the remaining service life of the apparatus is reduced to within a range of 20 to 25 percent of its rated service time.

2. Positive-Pressure Breathing Apparatus

The employer must assure that self-contained breathing apparatus ordered or purchased after July 1, 1981, for use by fire brigade members performing interior structural fire fighting operations, are of the pressure-demand or other positive pressure type. Effective July 1,1983, only pressure-demand or other positive-pressure self-contained breathing apparatus may be worn by fire brigade members performing interior structural fire fighting.

This standard does not prohibit the use of a self-contained breathing apparatus where the apparatus can be switched from a demand to a positive-pressure mode. However, such apparatus must be in the positive-pressure mode when fire brigade members are performing interior structural fire fighting operations.

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