



Don H. Mahaffey Drilling Co.

RESPIRATORY PROTECTION



YOUR OSHA COMPLIANCE SOLUTION

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1 INTRODUCTION

Don H. Mahaffey Drilling Co. is fully committed to providing a safe workplace for all employees. The following Respiratory Protection Program has been developed to guide the management in minimizing employee exposure to potential harmful airborne contaminants, as well as ensuring compliance with Title 8, California Code of Regulations, Section 5144 (Respiratory Protection).

2 PROGRAM ADMINISTRATOR

Ashley Mahaffey Tullius has been designated as the administrator for this program.

Ashley Mahaffey Tullius will be responsible for:

- a. Identifying work areas that could expose employees to potentially harmful levels of airborne contaminants;
- b. Ensuring that employees use respiratory protection when their airborne contaminants exposure equals or exceeds permissible exposure limits;
- c. Ensuring that exposed employees receive training about respiratory protection;
- d. Arrange for oversight of medical evaluations; and
- e. Documentation of respiratory protection activities.

3 THE IMPORTANCE OF RESPIRATORY PROTECTION

Millions of workers in the United States are exposed to respiratory hazards every year. While employees may be exposed to hazards in a variety of ways, the most serious way for a potential hazard to enter the body is inhalation. Respiratory problems caused by hazards range from mild irritation such as allergies to life-threatening illnesses such as cancer and emphysema. Proper respiratory protection greatly reduces the risk of harmful contaminants entering the body.

4 SELECTION OF RESPIRATORS

Respirators will be provided to each employee when engineering control methods are not feasible or during emergency situations with high exposure.

4.1 General Requirements

- 4.1.1 An appropriate respirator will be selected and provided based on the respiratory hazard(s) to which the workers are exposed and workplace and user factors that affect respirator performance and reliability.
- 4.1.2 A NIOSH-certified respirator will be selected. The respirator will be used in compliance with the conditions of its certification.

- 4.1.3 The respiratory hazard(s) in the workplace will be identified and evaluated. This evaluation will 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 employee exposure cannot be identified or reasonably estimated, the atmosphere will be considered immediately dangerous to life or health (IDLH).
- 4.1.4 Respirators will be selected from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

4.2 Respirators for Immediately Dangerous to Life or Health (IDLH) Atmospheres

- 4.2.1 The following respirators will be provided for employee use in IDLH atmospheres:
 - a. A full facepiece pressure demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of 30 minutes, or
 - b. A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.
- 4.2.2 Respirators provided only for escape from IDLH atmospheres will be NIOSH-certified for escape from the atmosphere in which they will be used.
- 4.2.3 All oxygen-deficient atmospheres will be considered IDLH.

Exception: If it is demonstrated that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

4.3 Respirators for Atmospheres that are not Immediate Dangerous to Life or Health (IDLH)

- 4.3.1 A respirator that is adequate to protect the health of the employee will be provided and compliance with all other OSHA statutory and requirements will be complied with under routine and reasonably foreseeable emergency situations.
 - a. Assigned Protection Factors (APFs)
The assigned protection factors listed in Table 1 will be used 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), it will be ensured that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.

Table 1 Assigned Protection Factors ⁴					
Type of Respirator ¹	Quarter Mask	Half Mask	Full Facepiece	Helmet/Hood	Loose-fitting Facepiece
Air-purifying respirator	5	² 10	50	----- ---	-----
Powered Air-Purifying Respirator	-----	50	1,000	³ 25/1,000	25
Supplied-Air Respirator (SAR) or Airline Respirator	-----	10	50	-----	-----
• Demand mode	-----	50	1,000	---	25
• Continuous flow mode	-----	50	1,000	³ 25/1,000	-----
• Pressure-demand or other positive-pressure mode	-----			----- ---	
Self-Contained Breathing Apparatus (SCBA)	-----	10	50	50	-----
• Demand mode	-----	-----	10,000	10,000	-----
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)		-			

Notes:

¹Respirators assigned for use in higher workplace concentrations of a hazardous substance may be selected for use at lower concentrations of that substance or when required respirator use is independent of concentration.

²This APF category includes filtering face pieces and half masks with elastomeric face pieces.

³Don H. Mahaffey Drilling Co. will have evidence provided by the respirator manufacturer that the testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000.

⁴These APFs do not apply to respirators used solely for escape.

b. Maximum Use Concentration (MUC)

1. A respirator will be selected for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the MUC.
2. MUCs will not be applied to conditions that are immediately dangerous to life or health (IDLH). Instead, respirators listed for IDLH conditions listed in Section 4.2 will be used.

3. When the calculated MUC exceeds the IDLH level for a hazardous substance, or the performance limits of the cartridge or canister, then the maximum MUC will be set at that lower limit.
- 4.3.2 The respirator selected will be appropriate for the chemical state and physical form of the contaminant.
 - 4.3.3 For protection against gases and vapors, the following will be provided:
 - 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 workplace, a change schedule will be implemented 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. An addendum to this program will detail the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.
 - 4.3.4 For protection against particulates, the following will be provided:
 - 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 94; 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 (%O ₂) for which atmosphere may rely on supplying respirators
Less than 3,001	16.0-19.5
3,001-4000	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

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

5 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 section specifies the minimum requirements for medical evaluation that will be used to determine the employee's ability to use a respirator.

5.1 General

A medical evaluation will be provided 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. An employee's medical evaluations may be discontinued when the employee is no longer required to use a respirator.

5.2 Medical Evaluation Procedures

- 5.2.1 A physician or other licensed health care professional (PLHCP) will be identified to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.
- 5.2.2 The medical evaluation will obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix 7.

5.3 Follow-up Medical Examination

- 5.3.1 A follow-up medical examination will be provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix 7 or whose initial medical examination demonstrates the need for a follow-up medical examination.
- 5.3.2 The follow-up medical examination will include any medical tests, consultations or diagnostic procedures that the PLHCP deems necessary to make a final determination.

5.4 Administration of the Medical Questionnaire and Examinations

- 5.4.1 The medical questionnaire and examinations will be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire will be administered in a manner that ensures that the employee understands its content.
- 5.4.2 The employee will be provided with an opportunity to discuss the questionnaire and examination results with the PLHCP.

5.5 Supplemental Information for the PLHCP

- 5.5.1 The following information will 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.
- 5.5.2 Any supplemental information provided previously to the PLHCP regarding an employee may not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.
- 5.5.3 The PLHCP will be provided with a copy of this written respiratory protection program.

5.6 Medical Determination

- 5.6.1 In determining the employee's ability to use a respirator, a written recommendation regarding the employee's ability to use the respirator will be obtained from the PLHCP. The recommendation will 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.
- 5.6.2 In addition to Section 5.6.1, 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, a PAPR will be provided 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 a PAPR will no longer be provided.

5.7 Additional Medical Evaluations

At a minimum, additional medical evaluations will be provided that comply with the requirements of Section 5 if:

- a. An employee reports medical signs or symptoms that are related to ability to use a respirator;
- b. A PLHCP, supervisor or Ashley Mahaffey Tullius informs Don H. Mahaffey Drilling Co. that an employee needs to be reevaluated;

- c. Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- d. 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.

6 FIT TESTING

- 6.1 Before an employee is required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee will be fit tested with the same make, model, style and size of respirator that will be used.
- 6.2 Employees using a tight-fitting facepiece respirator will pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT).
- 6.3 Employees using a tight-fitting facepiece respirator will be 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.
- 6.4 An additional fit test will be conducted whenever the employee reports, or Don H. Mahaffey Drilling Co., PLHCP, supervisor or Ashley Mahaffey Tullius 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.
- 6.5 If, after passing a QLFT or QNFT, the employee subsequently notifies Don H. Mahaffey Drilling Co., Ashley Mahaffey Tullius, supervisor or PLHCP that the fit of the respirator is unacceptable, the employee will be given a reasonable opportunity to select a different respirator facepiece and to be retested.
- 6.6 The fit test will be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix 4.
- 6.7 QLFT will only be used to fit test negative pressure air-purifying respirators that will achieve a fit factor of 100 or less.
- 6.8 If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half face pieces, or equal to or greater than 500 for tight-fitting full face pieces, the QNFT has been passed with that respirator.
- 6.9 Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators will 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.
 - a. Qualitative fit testing of these respirators will 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.
- b. Quantitative fit testing of these respirators will 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 will 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.
 - c. Any modifications to the respirator facepiece for fit testing will be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

7 USE OF RESPIRATORS

7.1 Facepiece Seal Protection

- 7.1.1 Respirators with tight-fitting face pieces will not 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.
- 7.1.2 If an employee wears corrective glasses or goggles or other personal protective equipment, such equipment will be worn in a manner that does not interfere with the seal of the facepiece to the face of the user.
- 7.1.3 For all tight-fitting respirators, employees will perform a user seal check each time they put on the respirator using the procedures in Appendix 5 or procedures recommended by the respirator manufacturer that are demonstrated as effective as those in Appendix 5.

7.2 Continuing Respirator Effectiveness

- 7.2.1 Appropriate surveillance will 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 continued effectiveness of the respirator will be reevaluated.
- 7.2.2 Employees will be required to leave the respirator use area:
 - a. To wash their faces and respirator face pieces as necessary to prevent eye or skin irritation associated with respirator use;
 - 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.

- 7.2.3 If the employee detects vapor or gas breakthrough, changes in breathing resistance or leakage of the facepiece, the respirator will be replaced or repaired before allowing the employee to return to the work area.

7.3 Procedures for IDLH Atmospheres

- 7.3.1 At least one employee will be located outside the IDLH atmosphere.
- 7.3.2 Visual, voice or signal line communication will be maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
- 7.3.3 The employee(s) located outside the IDLH atmosphere will be trained and equipped to provide effective emergency rescue.
- 7.3.4 Ashley Mahaffey Tullius or other designee will be notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.
- 7.3.5 Necessary assistance appropriate to the situation will be provided by authorized personnel as soon as they are notified.
- 7.3.6 Employee(s) located outside the IDLH atmospheres will be 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 Section 7.3.6(b).

7.4 Procedures for Interior Structural Firefighting

- 7.4.1 At least 2 employees will enter the IDLH atmosphere and remain in visual or voice contact with one another at all times.
- 7.4.2 At least 2 employees will be located outside the IDLH atmosphere.
- 7.4.3 All employees engaged in interior structural firefighting will use SCBAs.

8 MAINTENANCE AND USE OF RESPIRATORS

8.1 Cleaning and Disinfecting

Each respirator user will be provided with a respirator that is clean, sanitary and in good working order. The respirators will be cleaned and disinfected using the procedures in Appendix 6 or procedures recommended by the respirator

manufacturer, provided that such procedures are of equivalent effectiveness. The respirators will be cleaned and disinfected at the following intervals:

- a. Respirators issued for the exclusive use of an employee will be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;
- b. Respirators issued to more than one employee will be cleaned and disinfected before being worn by different individuals;
- c. Respirators maintained for emergency use will be cleaned and disinfected after each use; and
- d. Respirators used in fit testing and training will be cleaned and disinfected after each use.

8.2 Storage

8.2.1 Respirators will be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals and they will be packed or stored to prevent deformation of the facepiece and exhalation valve.

- 8.2.2 In addition to the requirements of Section 8.2.1, emergency respirators will 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.

8.3 Inspection

- 8.3.1 Respirators will be inspected as follows:
- a. All respirators used in routine situations will be inspected before each use and during cleaning;
 - b. All respirators maintained for use in emergency situations will be inspected at least monthly and in accordance with the manufacturer's recommendations and will be checked for proper function before and after each use; and
 - c. Emergency escape-only respirators will be inspected before being carried into the workplace for use.

- 8.3.2 Respirator inspections will 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.

8.3.3 In addition to the requirements of Sections 8.3.1 and 8.3.2, self-contained breathing apparatus will be inspected monthly. Air and oxygen cylinders will be maintained in a fully-charged state and will be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. It will be determined that the regulator and warning devices function properly.

- 8.3.4 For respirators maintained for emergency use, Don H. Mahaffey Drilling Co. will:
- 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 medial action and a serial number or other means of identifying the inspected respirator; and
 - Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator or is included in inspection reports stored as paper or electronic files. This information will be maintained until replaced following a subsequent certification.

8.4 Repairs

Respirators that fail an inspection or are otherwise found to be defective will be removed from service and discarded, repaired or adjusted in accordance with the procedures contained within this subsection.

- 8.4.1 Repairs or adjustments to respirators will only be made by persons appropriately trained to perform such operations and will use only the respirator manufacturer's NIOSH-approved parts designed for the respirator.
- 8.4.2 Repairs will be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed.
- 8.4.3 Reducing and admission valves, regulators and alarms will be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

9 BREATHING AIR QUALITY AND USE

- 9.1 Compressed air, compressed oxygen, liquid air and liquid oxygen used for respiration will comply with the following specifications:
- Compressed and liquid oxygen will meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and
 - Compressed breathing air will meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:
 - Oxygen content (v/v) of 19.5-23.5%;
 - Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
 - Carbon monoxide (CO) content of 10 ppm or less;
 - Carbon dioxide content of 1,000 ppm or less; and
 - Lack of noticeable odor.
- 9.2 Compressed oxygen will not be used in atmosphere-supplying respirators that have previously used compressed air.
- 9.3 Oxygen concentrations greater than 23.5% will be used only in equipment designed for oxygen service or distribution.

- 9.4 Cylinders used to supply breathing air to respirators will meet the following requirements:
- a. Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 180);
 - b. 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;
 - c. The moisture content in the cylinder does not exceed a dew point of -50 °F at 1 atmosphere pressure; and
 - d. 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 will be used.
- 9.5 Compressors used to supply breathing air to respirators will be constructed and situated so as to:
- a. Prevent entry of contaminated air into the air-supply system;
 - b. Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 °F below the ambient temperature;
 - c. Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters will be maintained and replaced or refurbished periodically following the manufacturer's instructions; and
 - d. Have a tag containing the most recent change date and the signature of the person authorized to perform the change. The tag will be maintained at the compressor.
- 9.6 For compressors that are not oil-lubricated, carbon monoxide levels in the breathing air will not exceed 10 ppm.
- 9.7 For oil-lubricated compressors, a high-temperature or carbon monoxide alarm, or both, will be used to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply will be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.
- 9.8 Breathing air couplings will be incompatible with outlets for non-respirable worksite air or other gas systems. No asphyxiating substance will be introduced into breathing air lines.
- 9.9 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 will be used.

10 IDENTIFICATION OF FILTERS, CARTRIDGES AND CANISTERS

All filters, cartridges and canisters used in the workplace will be labeled and color coded with the NIOSH approval label, the label will not be removed and the label will remain legible.

11 TRAINING

11.1 Training Topics

In a manner that is understandable to employees, the following topics contained will be provided to all employees who are required to use respirators:

- a. The respiratory hazards to which they are potentially exposed during routine and emergency situations;
- b. Why the respirator is necessary and how improper fit, usage or maintenance can compromise the protective effect of the respirator;
- c. What the limitations and capabilities of the respirator are;
- d. How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;
- e. How to inspect, put on and remove, use and check the seals of the respirator;
- f. What the procedures are for maintenance and storage of the respirator;
- g. How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and
- h. The general requirements of this program.

11.2 Training Frequency

Respiratory protection training will occur:

- a. Prior to requiring the employee to use a respirator in the workplace;
- b. Annually thereafter;
- c. When changes in the workplace or the type of respirator render previous training obsolete;
- d. When inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; and/or
- e. When any other situation arises in which retraining appears necessary to ensure safe respirator use.

12 PROGRAM EVALUATION

12.1 Evaluations of the workplace will be conducted to ensure that this Respiratory Protection Program is being properly implemented and that it continues to be effective.

12.2 Employees required to use respirators will be regularly consulted to assess their view on program effectiveness and to identify any problems. Any problems that are identified during this assessment will be corrected. Factors to be assessed include, but are not limited to:

- a. Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- b. Appropriate respirator selection for the hazards to which the employee is exposed;
- c. Proper respirator use under the workplace conditions the employee encounters; and
- d. Proper respirator maintenance.

13 RECORDKEEPING

13.1 Medical Evaluation

Records of medical evaluations required by this section will be retained and made available in accordance with Cal/OSHA T8 CCR 3204.

13.2 Fit Testing

13.2.1 A record of the qualitative and quantitative fit tests administered to employees will be established. This record will include:

- 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.

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

13.3 Program

A written copy of the current respiratory protection program will be retained.

13.4 Availability

Written materials required to be retained under this program will be made available upon request to affected employees and to the Chief or designee for examination and copying.

APPENDIX 1 – DEFINITIONS

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

Assigned protection factor (APF) – 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.

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

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

Chief – The Chief of the Division of Occupational Safety and Health, California Department of Industrial Relations.

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

Emergency situation – 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 – Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

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

Escape-only respirator – A respirator intended to be used only for emergency exit.

Filter or air purifying element – A component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) – 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 – A quantitative estimate of the fit of a particular respirator to a specific individual and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

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

Helmet – A rigid respiratory inlet covering that also provides head protection against impact and penetration.

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

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

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

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

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

Maximum use concentration (MUC) – 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 will determine an MUC on the basis of relevant available information and informed professional judgment.

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

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

Physician or other licensed health care professional (PLHCP) – An individual whose legally permitted scope of practice (i.e., license, registration or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by Section 5.

Positive pressure respirator – A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

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

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

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

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

Respiratory inlet covering – 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) – An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

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

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

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

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

APPENDIX 2 – RESPIRATORY HAZARD ASSESSMENT

Date: _____

Work Area	Respiratory Hazard Identified?	Identified Respiratory Hazard	Hazard Exposure Level	Respiratory Protection Required?
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No
	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No

APPENDIX 3 – RESPIRATOR SELECTION

Employee Name	Work Area	Respiratory Protection to be Used	Med. Evaluation Conducted?	Fit Test Date	Fit Test Method
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		

APPENDIX 4 – FIT TESTING PROCEDURES

PART 1: OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures – General Requirements

Fit testing will be conducted 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 will 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 will 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 will 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 will 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 will 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 face pieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject will 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 will 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; and
 - d. Position of mask on face and cheeks.
7. The following criteria will 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; and
 - f. Self-observation in mirror to evaluate fit and respirator position.

8. The test subject will 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 will 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 will be selected and retested if the test subject fails the user seal check tests.
9. The test will 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 will be altered or removed.
10. If a test subject exhibits difficulty in breathing during the tests, she or he will 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 will 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 will be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process will include a description of the test exercises that the subject will be performing. The respirator to be tested will be worn for at least 5 minutes before the start of the fit test.
13. The fit test will 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 will 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 will 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 will 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 will breathe normally.
 - 2) Deep breathing. In a normal standing position, the subject will breathe slowly and deeply, taking caution so as not to hyperventilate.
 - 3) Turning head side to side. Standing in place, the subject will slowly turn his/her head from side to side between the extreme positions on each side. The head will 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 will slowly move his/her head up and down. The subject will be instructed to inhale in the up position (i.e., when looking toward the ceiling).
- 5) Talking. The subject will 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.
- b. Each test exercise will be performed for one minute except for the grimace exercise which will be performed for 15 seconds. The test subject will 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 will be tried. The respirator will not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test will be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

- a. Persons administering QLFT will be 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. QLFT equipment will be 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 will be equipped with an organic vapor filter.

a. Odor Threshold Screening

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

- 1) Three 1-liter glass jars with metal lids are required.
- 2) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) will be used for the solutions.
- 3) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1-liter jar, closing the lid and shaking for 30 seconds. A new solution will be prepared at least weekly.
- 4) The screening test will be conducted in a room separate from the room used for actual fit testing. The two rooms will 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 will 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 will be used for only one day.
- 6) A test blank will be prepared in a third jar by adding 500 cc of odor-free water.
- 7) The odor test and test blank jar lids will be labeled (e.g., 1 and 2) for jar identification. Labels will 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 will 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 will 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 will 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 will 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 will be constructed using plastic sheeting. The inside top center of the chamber will have a small hook attached.
 - 2) Each respirator used for the fitting and fit testing will be equipped with organic vapor cartridges or offer protection against organic vapors.
 - 3) After selecting, donning, and properly adjusting a respirator, the test subject will wear it to the fit testing room. This room will be separate from the room used for odor threshold screening and respirator selection, and will 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 will be taped to the inside of the test chamber.
 - 5) Upon entering the test chamber, the test subject will 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 will 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 will quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
 - 8) If the test is failed, the subject will return to the selection room and remove the respirator. The test subject will 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 will 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 will 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 will 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 will be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharine Solution Aerosol Protocol

The entire screening and testing procedure will 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 will 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 will 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 will don the test enclosure. Throughout the threshold screening test, the test subject will 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 will spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer will 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 will 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 will 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 will don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator will 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 will 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 will 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 will be instructed to perform the exercises in section I. A. 14. of this appendix.
 - 9) Every 30 seconds the aerosol concentration will be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).
 - 10) The test subject will 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 will 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 will make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

4. Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol
- The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure will be explained to the test subject prior to the conduct of the screening test.
- a. Taste Threshold Screening
- 1) During threshold screening as well as during fit testing, subjects will 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 will 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 will 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 will don the test enclosure. Throughout the threshold screening test, the test subject will 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 will spray the Threshold Check Solution into the enclosure. This Nebulizer will 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 will 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 will 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 will don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator will 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 will 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 will 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 will be instructed to perform the exercises in section I. A. 14. of this appendix.
 - 9) Every 30 seconds the aerosol concentration will be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
 - 10) The test subject will 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 will 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 will be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
 - 2) Only stannic chloride smoke tubes will be used for this protocol.
 - 3) No form of test enclosure or hood for the test subject will be used.
 - 4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor will 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 will 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 will 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 will demonstrate his or her ability to detect a weak concentration of the irritant smoke.

 - 1) The test operator will 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 will 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 will 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 will 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 will 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 will don the respirator without assistance, and perform the required user seal check(s).
 - 2) The test subject will be instructed to keep his/her eyes closed.
 - 3) The test operator will 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 will begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator will 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 will 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 will 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) will 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 will 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. Persons administering QNFT will be 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. QNFT equipment will be 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 will be used for quantitative fit testing.
 - 2) Test chamber. The test chamber will 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 will 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 will be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.
 - 4) The sampling instrument will 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 will 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 will 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) will 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 will permit the person administering the test to observe the test subject inside the chamber during the test.
 - 8) The equipment generating the test atmosphere will 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) will be kept to a minimum. There will 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 will be of equal diameter and of the same material. The length of the two lines will be equal.
 - 11) The exhaust flow from the test chamber will 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 will not exceed 50 percent.
 - 13) The limitations of instrument detection will be taken into account when determining the fit factor.
 - 14) Test respirators will 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 will 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 will 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 will 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 will be obtained prior to the actual start of testing.
 - 6) Respirator restraining straps will not be over-tightened for testing. The straps will be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator will not be adjusted once the fit test exercises begin.
 - 7) The test will be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject will be refitted and retested.
 - 8) Calculation of fit factors.
 - i. The fit factor will 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 will 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 will be determined by one of the following methods:
 - A. Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.
 - B. Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.
 - C. Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.
 - D. The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

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

- 9) The test subject will 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 will 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 TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure will 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 will 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 will be instructed to perform the exercises in section I. A. 14. of this appendix.
 - 7) After the test exercises, the test subject will 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 will 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 will 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 will 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 will be explained to the test subject prior to the conduct of the screening test.

a. CNP Fit Test Requirements.

- 1) The instrument will have a non-adjustable test pressure of 15.0 mm water pressure.
- 2) The CNP system defaults selected for test pressure will be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate will 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 will be thoroughly trained to perform the test.
- 4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.
- 5) The test subject will be trained to hold his or her breath for at least 10 seconds.
- 6) The test subject will don the test respirator without any assistance from the test administrator who is conducting the CNP fit test. The respirator will not be adjusted once the fit-test exercises begin. Any adjustment voids the test, and the test subject will repeat the fit test.
- 7) The QNFT protocol will 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 will 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 will breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject will 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 will slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head will 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 will slowly move his or her head up and down for 1 minute. The subject will 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 will hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject will hold his or her head full down and hold his or her breath for 10 seconds during test measurement.
 - 5) Talking. The subject will 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 will 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 will grimace by smiling or frowning for 15 seconds.
 - 7) Bending Over. The test subject will bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place will 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 will 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 will remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject will breathe normally for 1 minute. After the normal breathing exercise, the subject will 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 will 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 will be tried.
- c. CNP Test Instrument.
- 1) The test instrument will 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 will 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 will be kept on file, assuming the fit test was successful. The record will 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 will 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 will 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/her toes, for 30 seconds	Face parallel to the floor, while holding breath for 10 second.
Head Shaking	For about 3 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

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

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

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

Where:

N = The number of exercises;

FF₁ = The fit factor for the first exercise;

FF₂ = The fit factor for the second exercise; and

FF_N = The fit factor for the Nth exercise.

Part 2: 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 4.
- B. The application will include a detailed description of the proposed new fit test protocol. This application will 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 5 – USER SEAL CHECK PROCEDURES

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 6 – RESPIRATOR CLEANING PROCEDURES

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.

Procedures for Cleaning Respirators

- A. Remove filters, cartridges, or canisters. Disassemble face pieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.
- B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.
- D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
 1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,
 2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,
 3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on face pieces 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 7 – OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE

To Don H. Mahaffey Drilling Co.:

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
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

- d. 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: _____ hrs. _____ mins.

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

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

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

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

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

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

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

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

Name of the first toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

Name of the second toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

Name of the third toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

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

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

APPENDIX 8 – 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 designated 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.

Employee Signature

Date