Respiratory Protection Program

Region 10

Occupational Health And Safety Office

March 1985

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION 10

OCCUPATIONAL HEALTH AND SAFETY OFFICE

1200 Sixth Avenue

Seattle, Washington 98101

RESPIRATORY PROTECTION PROGRAM

March 1985

THE EPA REGION 10 RESPIRATORY
PROTECTION POLICY IS APPROVED
FOR IMPLEMENTATION

ision Directors or Operations Office Directors who have personnel
igned that participate in field activities will assure that those
lividuals are provided with a personal copy of these instructions. When
employees are assigned to perform field duties which require the use
respiratory protective equipment, Directors will assure that they also
provided with a copy of this document. Additional copies of the
piratory Protection Program are available from the Occupational Health
Safety Officer.

MAR 15 1985

esta Barnes
ional Administrator

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tribution: Division Directors
Operation Office Directors
Health and Safety Committee Members
Director, Occupational Health and Safety Division (PM-273)

RESPIRATORY PROTECTION PROGRAM

EPA - REGION 10

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I. INTRODUCTION

As required by the Occupational Safety and Health Administration's (OSHA) Safety and Health Standards for Respiratory Protection (29 CFR 1910.134), The U.S. Environmental Protection Agency (EPA), Region 10, herein presents a Respiratory Protection Program for use by Regional field personnel. This program has been developed based upon the requirements of 29 CFR 1910.134, 30 CFR 11, EPA Order 1440.3 - Respiratory Protection (July 24, 1981) and the recommendations of the American National Standard Institute's (ANSI) Z88.2 "Practices for Respiratory Protection " (Revised May 22, 1980), and the National Institute for Occupational Safety and Health (NIOSH), "Respirator Decision Logic" (August 2, 1976).

These procedures have been adopted from the Region 9 Respiratory Protection Program, July 1983.

Policy

Occupational exposure to airborne concentrations of toxic dusts, fumes, sprays, mists, fogs, smokes, vapors, or gases shall be controlled whenever possible by acceptable engineering control measures. Such control measures usually include one or more of the following: (1) isolating the operation by confinement or enclosure, (2) utilizing local exhaust or general dilution ventilation, or (3) substitution of a less toxic material. However, when effective engineering controls are not feasible, or while they are being implemented, appropriate respiratory protective equipment shall be utilized.

As required in these regulations, EPA Region 10 shall be responsible for the implementation and maintenance of a respiratory protection program for Regional field personnel and will provide respirators to Regional personnel when such equipment is necessary to assure the employees' health and safety. Respirators provided shall be approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH/MSHA) and appropriate for their intended application.

Regional personnel are required to use respiratory protection equipment in accordance with the instructions and training provided. Employees shall guard against damage to respiratory protective equipment and shall immediately report any malfunction of this equipment to their supervisor.

A respirator use policy has been developed which illustrates situations in which Regional personnel may be required to wear respirators (see Table I).

TABLE I RESPIRATOR USE POLICY
EPA - REGION 10

ard Potential	Examples of Field Situations	Respiratory Protection Required
UM	- Office visits - Routine inspections - Most SIP inspections - Most NSPS inspections - Most TSD, TSCA, CWA and RCRA inspections	None required Personal Protection Level - D Interim Standard Operating Safety Guides, (Revised September 12, 1982)
ATE	- Operational waste disposal sites - Restricted Use pesticide inspections - Most NESHAP inspections - Special SIP inspections (i.e. - copper smelters, etc.)	Air-purifying respirators may be required. Personal Protection Level - C Note: A positive pressure SCBA may be used in place of an airpurifying respirators if so desired.
JM	- Uncontrolled hazardous waste sites - initial entry - Toxic chemical spills - Oxygen deficient atmosphere - Chemical carcinogen inspections (i.e. - SIP coke oven emission inspections or NESHAP asbestos where the airborne concentration of asbestos is greater than 50 fibers per cc or vinyl chloride inspections) - Other situations which are classified IDLH or where toxic chemicals are present and the atmospheric concentration is unknown.	Positive pressure SCBA respirator required: Personal Protection Level B. Personal Protection Level A

Discussion

The intent of this EPA Region 10 policy document is to establish written Standard Operating Procedures (SOPs) which will ensure an optimal level of respiratory protection for Regional personnel during field activities. The SOPs contain all the information necessary to maintain an effective respirator program which will meet the Region's requirements for response to routine inspections and environmental emergency sitations (such as hazardous waste sites and chemical spills) where dangerous atmospheres may exist. The SOPs are written as enforceable policy for all persons directly involved in the respirator program; including employees engaged in field activities, and supervisory personnel responsible for overseeing the implementation of this program.

These SOPs will cover the following topic areas:

- Administrative procedures for the implementation of the Respiratory Protection Program;
- Guidelines for medical surveillance of respirator users, as detailed in the Agency's Occupational Medical Monitoring Program Guidelines;
- Qualitative fit-testing;
- Guidance for selection of the approved respirators for protection against potential air contaminants;
- Use of respirators under special conditions;
- Detailed instructions for training employees in the proper use and limitations of respirators;
- Issuance of respirators;
- Maintenance procedures including
  - cleaning and disinfection
  - drying
  - inspection
  - repair
  - storage;
- Procedures for evaluating the Respiratory Protection Program's effectiveness.

II. ADMINISTRATIVE PROCEDURES AND RESPONSIBILITY

The Regional Administrator has overall responsibility for safety and health in Region 10 including the Respiratory Protection Program. The Regional Administrator, will also ensure to the extent feasible, that the Respirator Program's SOPs are adhered to by all Regional personnel.

The Regional Occupational Health and Safety Office, in coordination with the Agency Occupational Health and Safety Division (OHSD), will periodically (no less than annually) review the Respiratory Protection Program to improve its effectiveness and eliminate deficiencies.

A. Regional Occupational Health and Safety Office:

1. Approve purchase of all respirators and other personal protection equipment.

2. Advise Regional personnel in selecting the appropriate respirator.

3. Provide initial training (4-8 hours) for Regional personnel in the proper use and limitations of respirators. Provide on-going refresher (2-4 hours) training in the use of respiratory equipment.

4. Provide guidance to Regional personnel in regard to matters concerning respiratory protection.

5. Annually evaluate the effectiveness of the Program.

B. Division and Office Directors:

1. The Environmental Services Division (ESD) is responsible for:

   a. Procurement of respirators, spare parts, cleaning-sanitizing supplies, operationally ready equipment and access to a cleaning, maintenance and storage facility for ESD staff.

   b. Performing routine monthly inspections of self-contained breathing apparatus and other emergency respirators (which have not been issued to individual staff).

   c. Providing expendable cleaning and maintenance supplies and limited storage space at the Regional Office facility for other Divisions or Operation Offices.

2. Other Division or Operation Office Directors are responsible for:

   a. Procurement of air-purifying and emergency escape respirators, as well as other personal protective equipment required for their staffs.

   b. Notifying ESD of the anticipated operational requirements for expendable supplies, including respirator canisters and cartridges. Note: Self-contained Breathing Apparatus may be borrowed from ESD on a limited use basis if the personnel are qualified and certified to use this equipment.

C. Supervisors:

Supervisors are responsible, to the extent of their authority for ensuring that:

1. Appropriate respiratory protective device are selected, inspected, and maintained.

2. Employees wear the respiratory protective devices when they are required.

3. Employees are properly trained.

4. Records are kept of employee training and of the inspection and maintenance of these devices.

5. Written standard operating procedures governing the selection and use of respiratory protective devices are established for specific situations (i.e., Site Safety Plans).

6. Employees required to use respiratory protective devices are included in the Agency's occupational medical monitoring program and they are medically approved for wearing the devices.

D. Employees:

1. Maintain respirators issued for personal use in accordance with the instructions and training received.

2. Wear the respiratory when necessary.

3. When entering a worksite for an inspection (for example, a stationary source or hazardous waste site), employees shall comply with all EPA health and safety requirements, as well as, any applicable personal protective equipment requirements specified by the site management.

4. Employees shall comply with all applicable provisions of the Program, as well as other health and safety directives from the Agency (OHSD), the Regional Office, or a specific safety and health standard.

5. If the respirator fails to provide proper protection, the employee shall immediately go to an area which has respirable air.

6. Employees shall report any malfunction of respiratory protective equipment to his/her immediate supervisor.

7. Facial hair lying between the sealing surface of a respirator facepiece and the wearer's skin will prevent a good seal. Therefore, Regional personnel shall ensure that they are clean shaven when required to wear a respirator and that facial hair (moustache, sideburns or beard) does not protrude under the sealing surface.

8. Participation in the Agency Occupational Medical Monitoring Program is mandatory. Prior to assignment of tasks requiring the use of respiratory protective equipment, a medical doctor must determine and certify that the employee is able to wear a respirator under "field" conditions.

It is the intent of EPA Region 10, through implementation of this Respiratory Protection Program, to provide Regional personnel with the best possible level of respiratory protection while performing routine inspections and/or during environmental emergency situations where dangerous atmospheres exist. The SOPs were developed to establish a respiratory protection program which meets current Regional requirements; however, the Occupational Health and Safety Manager will ensure that the Program remains effective through continual examination and modification to meet changing conditions.

EPA Region 10 shall provide all necessary respiratory protective equipment for the program. The equipment provided shall be NIOSH/MSHA approved and shall be selected by the Occupational Health and Safety Manager. Respiratory protective equipment will in no way be modified. Modification of a NIOSH/MSHA approved respirator, unauthorized by the approving agencies, automatically voids the respirator approval and may seriously jeopardize the health and safety of the employee.

I. MEDICAL MONITORING

It is the policy of the EPA Region 10, in compliance with 29 CFR 1910.134 and Section 3.7 of ANSI Z88.2-1980, that no employee will be assigned to those tasks requiring the use of respirators until that employee has been found to be physically fit to wear the designated respirator(s) under working conditions and not affected by claustrophobia. A physician designated by EPA Region 10, will make the determination as to whether or not the employee is fit to wear the respirator and to designate under what working conditions that employee may use the respirator. This medical determination, based upon the Agency's Occupational Medical Monitoring Program, will be made annually and additionally, at such time as may be deemed necessary by the Occupational Health and Safety Manager if the employee has been accidentally exposed to a hazardous atmosphere.

The initial medical examination, to be performed by the designated physician, will serve two purposes. First, as mentioned above, this physical will allow the physician to determine if there are any physical, psychological, and/or biological conditions that would affect the ability of the employee to work under hazardous conditions in the designated respiratory equipment. Second, this initial physical will serve as baseline data against which physiological changes in each individual will be periodically assessed.

The frequency of these examinations will be determined by the particular situation. The results of these tests will then be compared with the original baseline study. It should be emphasized that the periodic examinations may only reveal chronic long-term or acute short-term effects of exposure. Also, it must be remembered that the medical tests will identify exposures via all routes and not just the inhalation pathway which is being addressed in this Respiratory Protection Program.

The medical monitoring program will be reviewed annually as to its effectiveness by the Occupational Health and Safety Manager and the physician.

At the present time, the U.S. Public Health Service is under contract to EPA Regin 10 to perform the baseline and annual employee medical examinations required by the Agency Occupational Medical Monitoring Program. The medical exam required by this Respiratory Protection Program will be at the expense of EPA Region 10.

However, Regional employees may choose to go to their personal physician for the medical evaluation, provided that:

A. The exam must comply with the Agency Occupational Medical Monitoring Program Guidelines and must include the EPA Occupational Medical Monitoring Questionnaire.

B. The exam must comply ith ANSI standard Z 88.6

C. The physician must certify in writing that the employee is able to wear respiratory protective equipment (air purifying and atmosphere-supplying) in a field situation.

D. The cost will be at the employee's expense.

:V. GENERAL RESPIRATOR CLASSIFICATIONS

Basically, there are two major classes of respirators: (1) air-purifying, and (2) atmosphere-supplying respirators.

A. Air-Purifying Respirators

Air-purifying respirators are devices which remove contaminants. However, these devices do not supply oxygen, and therefore, must never by used in oxygen-deficient atmospheres (less than 19.5 percent O_2 by volume). Air-purifying devices generally fall into three major subclasses:

- Particulate-removing respirators that filter particulate material from the ambient air before the air enters the respirator facepiece.
- Vapor and gas-removing respirators (chemical cartridges or canisters) which trap gas and vapor molecules before they enter the respirator facepiece.
- Combination respirators that remove both particulates and vapors and gases.

General Advantages, Disadvantages and Limitations of Air-purifying Respirators:

1. Advantages:

   a. Small physical size.
   b. Relatively inexpensive.
   c. Easily maintained.
   d. Restricts movement least.
   e. Multiple use and interchangeable cartridges and canisters are available.

2. Disadvantages:

   a. Air-purifying respirators cannot be used in oxygen deficient atmospheres (19.5% O_2 v/v), in atmospheres immediately dangerous to life and health (IDLH), or when the air contaminant has poor warning properties.

   b. Quarter and half-mask respirators do not provide protection for the eyes or facial skin. Due to the small sorbent or filter capacity, restrictions must be placed on maximum use concentrations. In addition, the facepiece to face seal is often times inconsistent which further restricts its use in high concentrations or for contaminants with poor warning properties.

   c. Full facepiece respirators are more expensive than half or quarter-mask configurations. While eye protection is provided, use may be restricted by limited sorbent capacity.

3. Limitations:

   a. Air-purifying respirators cannot be used in oxygen deficient atmospheres; i.e., atmospheres containing less than 19.5 percent O_2 by volume.

      It should be noted that the normal atmospheric O_2 content is about 21 percent by volume at sea level. At concentrations below 16% O_2 v/v, the first physiologic effects of O_2 deficiency are noted: i.e., increased rate and depth of breathing, increased heartbeat and impaired coordination and judgment. Concentrations below 14% O_2 are to be considered as IDLH. Concentrations below 10% O_2 will cause unconsciousness, followed by death.

   b. Air-purifying respirators offer protection only for the specific contaminants for which they are tested and approved by NIOSH/MSHA.

   c. Due to small sorbent or filter capacity, they afford protection for limited contaminant concentrations. For example, organic vapor cartridges are rated to a maximum use concentration of 1,000 ppm, while canisters are rated to 5,000-20,000 ppm.

   d. Chemical cartridge and canister elements cannot be used beyond their rated shelf life date. Cartridges should be stored in the manufacturers sealed plastic bags prior to actual use.

   e. Chemical cartridge and canister elements cannot be used for organic vapors with poor warning properties, extremely toxic gases and vapors, or for compounds which exhibit rapid break-through.

B. Atmosphere-Supplying Respirators

Atmosphere-supplying respirators are devices which supply air from a source independent of the surrounding atmosphere. These devices are classified according to: (1) the method of air supply, and (2) the method of air supply regulation.

1. Self-contained breathing apparatus (SCBA).

A feature common to all SCBA's, is that the air or oxygen supply is an integral part of the respirator. SCBA's are available in two configurations and are classified as "closed-circuit" or "open-circuit" devices.

a. Closed-Circuit

Closed-circuit SCBA's are rebreathing devices. Exhaled air is rebreathed after excess carbon dioxide has been removed and the oxygen content has been restored via a compressed or liquid oxygen source, or from an oxygen generated solid. This type of SCBA was designed primarily for long duration use (1-4 hours) in oxygen-deficient atmospheres such as might be encountered in mine rescue work.

However, while these devices are ideal for providing respiratory protection in oxygen deficient atmospheres; there are limitations that restrict their use. Upon inhalation, a negative pressure is created in the facepiece. This results in potential inward facepiece leakage. Closed-circuit SCBA's will not be used by Region 10 staff.

b. Open-Circuit

Open-circuit SCBA's are not recirculating devices, instead exhaled air is exhausted to the atmosphere. The air supply is normally a cylinder of high pressure (about 2000-2216 psig) compressed air. Compressed air is supplied to a two-stage regulator which reduces the air pressure for delivery to the facepiece. The regulator also serves as a flow regulator by providing air to the facepiece on demand. A full facepiece is normally used and is connected to the regulator via a flexible corrugated breathing tube. The service life is short, usually 30 minutes or less, and is dependent on the user's breathing rate. WARNING - COMPRESSED OXYGEN SHALL NEVER BE USED IN A DEVICE DESIGNED FOR COMPRESSED AIR, MINUTE AMOUNTS OF OIL OR OTHER FOREIGN MATTER IN THE DEVICE COMPONENTS CAN CAUSE AN EXPLOSION.

Respirator Fit Testing

Testing will be performed in accordance with OSHA29CFR 1910.1025, Appendix D,. Qualitative Fit Test Procedures for the OSHA Lead Standard. Several manufactureres have been identified who produce approved respiratory protective equipment. Although each manufacturer designs his facepieces to fit as broad a section of the working population as possible, no single respirator marketed will fit everyone: i.e., each make and model respirator will have a slightly different fit. Conditions which will affect a good respirator fit include: a growth of facial hair (stubble, beard, sideburns, or moustache) lying under the facepiece, temple bars on glasses, a skull cap that projects under the facepiece, facial scars and injuries, and the presence or absence of dentures. Therefore, in order for a respirator to provide the protection it was designed for, the respirator facepiece must fit the face of the wearer properly. Furthermore, OSHA regulations provide that each employee who wears a respirator shall have it properly fitted, test the face to facepiece seal, and wear it in a test atmosphere. The Occupational Health and Safety Manager will provide respirator fit testing, annually. See Appendix A for specific respirator fit testing procedures.

following policies will be followed by Regional personnel in the ting, issuance and use of respirators:

A. Participation in the Agency Occupational Medical Monitoring Program is mandatory.

B. Before fit-testing is attempted, the employee must have been found medically qualified to wear respiratory protective equipment.

C. Prior to the use of any negative pressure air-purifying respirator, the employee must have passed a fit test.

D. If it is determined that an employee cannot obtain a satisfactory facepiece to face seal because of facial characteristics, the employee will not under any circumstances, use and/or enter an atmosphere that would require the use of a respirator.

E. Facial hair which projects under the facepiece seal will not be allowed.

F. EPA Region 10 will provide employees who wear glasses with special corrected lenses which are to be used with full facepiece respirators (air-purifying and SCBA). The special lenses will be requisitioned for each employee; however, it is the employee's responsibility to furnish an accurate lens prescription. The prescription should be obtained from the employee's private optometrist or ophthalmologist.

Contact lenses shall not be worn while wearing any type of respiratory protective device. Contaminants which penetrate a full facepiece respirator may get into the eyes and cause severe discomfort because of the contact lenses. Chemicals inadvertently splashed into the eyes while wearing a half-mask may cause severe ocular damage as the chemical becomes trapped between the contact lens and the surface of the eye.

G. Because of relatively poor sealing characteristics, quarter-mask respirators shall not be used by Regional personnel.

H. While fit testing of positive-pressure SCBA's is not required, according to ANSI Z88.2-1980, an inadequate facepiece to face seal will increase the use of air via leakage and accordingly reduce the effective breathing time. Combination SCBA's which have a selectable demand/pressure-demand mode lever, must be fit tested. It should be reemphasized that a demand type SCBA is no more effective than an air-purifying device, because negative pressure is created in the facepiece during inhalation. Selectable demand/pressure-demand respirators are approved only for the pressure demand mode.

I. Regional personnel may only use the specific make(s) and model(s) of half-mask and full facepiece respirators for which a satisfactory fit has been obtained. Under no circumstances shall a person be allowed to use any make or model respirator not previously fit tested and presently approved for the employees use by the Occupational Health and Safety Manager.

J. Nose cups to prevent fogging or other anti-fogging devices will be provided by the EPA Region 10 for full facepiece respirators. These devices must be worn by employees while performing field work due to potential hazards that may occur because of poor visibility.

. RESPIRATOR SELECTION

The selection of approved respiratory protective equipment is made by the individual, approved by the Occupational Health and Safety Manager and is based upon the following considerations:

- The nature of the hazardous operation or process.
- The type of respiratory hazard (i.e., oxygen deficiency or contaminated atmosphere).
- The location of the hazardous area in relation to the nearest area having respirable air.
- The period of time respiratory protection will be needed.
- The employee's activities in the hazardous area.
- The physical characteristics, functional capabilities, protection factors and limitations of the respiratory protective equipment.

Table 2 is a Decision Logic Table for Respiratory Protective Device Selection. Table 3 is a Decision Logic Table for Respiratory Protective Device Limitations.

Respiratory Protective Device Selection Guide

Types of Respirator	Hazard: Oxygen Deficiency	Gas and Vapor Contaminants: IDLH*	Gas and Vapor Contaminants: NIDLH**	Particulate Contaminants: IDLH*	Particulate Contaminants: NIDLH**	Combination Gas, Vapor, and Particulate Contaminants: IDLH*	Combination Gas, Vapor, and Particulate Contaminants: NIDLH**
Self-Contained Breathing Apparatus	Yes	Yes	No	Yes	No	Yes	No
Air Purifying, full facepiece							
With appropriate filter	No	No	No	Yes	No	No	No
With appropriate chemical canister	No	Yes	No	No	No	No	No
With appropriate chemical canister and filter	No	No	No	No	No	Yes	No
Air Purifying, half-mask							
With appropriate chemical cartridge	No	No	Yes	No	Yes		
With appropriate filter	No	No	No	No	Yes	No	No
With appropriate chemical cartridge and filter	No	No	No	No	No	No	Yes
Self-Rescue, mouthpiece (escape only)	No	Yes	No	Yes	No	Yes	No
Air-line	No	No	Yes	No	Yes	No	Yes
Air-line abrasive-blasting	No	No	No	No	Yes	No	No
Combination Air-line with auxiliary self-contained air supply or an air-storage receiver with alarm	Yes	Yes	No	Yes	No	Yes	No

* IDLH - Immediately dangerous to life or health. This refers to any atmosphere that poses an immediate hazard to life or produces immediate irreversible effects on health that will be debilitating.

**NIDLH - Not immediately dangerous to life or health. This refers to any hazardous atmosphere which may produce physical discomfort immediately, chronic poisoning after repeated exposure, or acute adverse physiological symptoms after prolonged exposure.

TYPES OF RESPIRATORS

LIMITATIONS	Atmosphere-Supplying: SCBA[1] Closed Circuit	SCBA[1] Open Circuit Dd[2]	SCBA[1] Open Circuit Pd[3]	Air-Line Continuous Flow: Demand	Air-Line Continuous Flow: Pressure Demand	Air-Line: Supplied Air Suits	Air-Purifying: Gas & Vapor Removing: Full Facepiece	Gas & Vapor Removing: Half-Mask	Gas & Vapor Removing: Mouthpiece (chemical cartridge)	Gas & Vapor Removing: Self-Contained Atmosphere	Particulate Removing: Full Facepiece	Particulate Removing: Half-Mask	Particulate Removing: Mouthpiece (filter)	Particulate Removing: Self-Contained Atmosphere (filter)
No protection against skin irritation or eruption	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No eye protection provided	No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Special problems for prescription lense wearers	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	No	No	No
Has limited respirable air supply	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No
Weight and bulk	Yes	Yes	Yes	No	No	Yes	No	No	No	No	No	No	No	No
Movement restricted	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Limited to atmospheres not immediately dangerous to life or health (except special conditions specified in ANSI Z88.2)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does not protect against all contaminants	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No protection against oxygen-deficient atmosphere	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Protection dependent on proper cartridge, canister, or filter	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Protection dependent on concentration of contaminant	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Service time dependent on wearer's respiratory rate	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminant must contain sufficient warning properties	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No
No protection against particulate contaminants	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
Discomfort and objectionable resistance to breathing	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No protection against gases and vapors	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Amount of training required for maintenance and use	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No

[1] Self-Contained Breathing Apparatus.
[2] Demand.
[3] Pressure Demand.

Combination Self-Contained and Air-Line Respirators - The equipping of an air-line respirator with a small cylinder of compressed air to provide an emergency air supply qualifies the respirator for use in immediately dangerous to life and health atmospheres.

Combination Particulate and Vapor and Gas-Removing Respirators - The disadvantages as described above will apply.

Combination Atmosphere-Supplying and Air-Purifying Respirators - The governing limitations for these respirators are those expressed above for the mode of operation being used. The mode with greater limitations (air-purifying mode) will mainly determine the overall capabilities and limitations of the respirator since the wearer may fail to change the mode of operation even though conditions would permit the change.

VII. RESPIRATOR USE UNDER SPECIAL CONDITIONS

The following special procedures shall be followed by all Regional personnel involved in hazardous waste site (HWS) investigations and environmental spill (ES) responses. The respirator use procedures presented herein have been adapted from the Agency's Occupational Health and Safety Manual (Chapter 9, Draft 5-15-84).

A. Use of Self-Contained Breathing Apparatus (SCBA).

SCBA's must be worn on-site when:

1. Containers of unknown or known hazardous materials are being opened.

2. When in confined spaces where hazardous materials are present such as abandoned waste chemical storage buildings or storm drains, drainage ditches, manholes, etc., which have received spilled chemicals.

3. When the Project Leader or other responsible person, determines that the airborne concentration of hazardous materials is greater than 10 times the permissible exposure level (PEL) or where the ambient oxygen content is less than 19.5%.

B. Use of Air-Purifying Respirators

Air-purfying respirators, which are easier to use but provide less protection that SCBA's, shall be worn on-site only when:

1. Ambient concentration of hazardous materials are not greater than 10 times the PEL, have good warning properties, and ambient oxygen levels are at least 19.5%.

2. The Project Leader or other responsible person, determines that air-purifying respirators are required as a precaution in the event of generation of low ambient levels of toxic substances due to sampling, handling, decontamination, or other operations.

3. Extended periods of on-site use, which would exhaust the capacity of the filter/sorbent, are not required.

4. Emergency SCBA escape respirators are carried by or located in the immediate area of air-purifying respirator users. Escape respirators must be donned immediately upon experiencing any warning property such as difficulty breathing, dizziness, strong taste or smell, or other adverse reaction. User must then leave the site.

NOTE: Once activated, the self-rescue SCBA escape respirator (Air Capsule) provides a 5-minute air supply. Accordingly, do not venture into an area from which the escape requires more than 5-minutes.

C. Carrying Respirators

Air-purifying and/or emergency escape SCBA respirators must be carried on-site when the Project Leader or other responsible person determines that, although the risk is very low, hazardous materials may become present in the air during operations. The respirators must be donned immediately upon experiencing any of the warning properties previously mentioned.

NOTE: The user must leave the site immediately after donning an escape respirator, or if the warning properties persist after donning a cartridge respirator.

D. Personnel Requirements.

1. Buddy System - A minimum of two employees, in constant communication with each other, are required to perform any work in a contaminated area (toxic atmosphere or oxygen deficiency). [1]

2. In addition, at least one stand-by person, equipped with a positive pressure SCBA and proper rescue equipment, shall be present in the nearest safe area for emergency rescue of personnel wearing respirators in a dangerous atmosphere. [2]

NOTE 1: Radio contact must be maintained when visual contact cannot be maintained.

NOTE 2: The stand-by person must be physically capable of removing an injured person by carrying or dragging the person to a safe, noncontaminated area.

III. EMPLOYEE TRAINING

Proper use of respiratory protection equipment can only be assured by carefully training Regional employees in the selection, use, and maintenance of the provided equipment. This requirement can only be satisfied by the establishment and implementation of a training program.

Respiratory protection training requirements are designed to be very thorough and complete because of the possibility of Regional employees entering highly toxic atmospheres in the course of their emergency response and hazardous waste site activities. Training procedures are divided into three phases: initial respiratory

protection training instruction; annual refresher training sessions; and special field-oriented training exercises. The following is an explanation of each phase of the training procedures:

A. Initial Respiratory Protection Training Instruction

All Regional personnel who are required to use respiratory protective equipment, as soon as practicable upon entry into the program, will receive training which will ensure the proper and safe use of the equipment. The initial training, such as EPA/ERT Course 165.2, will present intensive and in-depth instruction over a three-to-five-day period. This course is designed for personnel involved in hazardous waste or emergency spill work and will include the following topic areas:

- EPA Region 10 Respiratory Protection Program policy.
- Regulations and laws concerning respirator use.
- Reasons for the need of respiratory protection.
- Basic respiratory protection practices and equipment.
- Nature, extent, and effects of respiratory hazards to which Regional personnel may be exposed.
- A general explanation of all available respiratory protection equipment and devices, and their uses and limitations.
- Explanation of why the particular type of respirators have been selected.
- Explanation of the operation, and capabilities and limitations of the selected respiratory equipment in relation to environmental emergency response situations and hazardous waste site investigations.
- Opportunity for each employee to handle the selected respirator, learn how to don and wear it properly, check its respirator-to-face seal (fit test), wear it in a safe atmosphere, and wear it in a test atmosphere of isoamyl acetate and irritant smoke.
- Explanation of how to perform proper maintenance and storage of the selected respirators.
- Classroom and field instruction in how to recognize and cope with emergency respiratory protection requirements during field activities.
- Discussion of the required continuing field-level training sessions.

To allow new entries and other Region 10 employees who will not be as actively involved in hazardous waste/emergency spill work into the program to use EPA-provided respiratory equipment the following training will be provided by the Regional Occupational Health and Safety Manager:

1. Each new member will receive a minimum of 6 hours of instruction on specific EPA-provided respiratory protection equipment. Such training will be scheduled with the Occupational Health and Safety Office by the employee's supervisor.

2. Hands-on experience with the provided respiratory protection equipment.

3. Proper fit testing for air-purifying respirators.

4. Proper check-out and use of atmosphere supplying respirators, if needed by the employee.

he supervisors and managers of employees who wear respirators should also ake this training.

B. Annual Refresher Training Sessions

Regional employees who are required to use the provided respiratory equipment shall receive annual respiratory-protection-training refresher sessions. These sessions will be conducted by the Regional Occupational Health and Safety Office. The sessions will provide employees with a constant reinforcement of and updates to the material presented at the initial respiratory-protection-training course.

C. Special Field-Oriented Training Execerises

A specially designed "hands-on" training course(s) will be provided to employees through the U.S. Environmental Protection Agency's Environmental Response Team (ERT). This course, Personnel Protection and Safety (165.2), is designed to provide personnel with the opportunity to train under simulated field conditions. The course(s), as designed, will provide hands-on experience in the concepts, methods, and procedures for responding to incidents involving hazardous substances either singly or in multi-media situations. The course(s) will involve the utilization of the respiratory protective equipment and will provide the employee with an expanded familiarity and experience with the use and reliance of his respiratory protective equipment under response conditions. The course(s) will be offered periodically by ERT and is required initially for members of the Region 10 Field Hazardous Waste Investigation Team. In addition, special field exercises will be held at least once every two months for the Region 10 Field Hazardous Waste Investigation Team. This training will simulate, as much as possible, actual on-site field conditions using respirators, instrumentation and other equipment used by Region 10. Actual on-site inspections/ investigations using Level C or higher levels of protection may be counted as a special field exercise.

IX. ISSUANCE OF RESPIRATORS

It is the policy of EPA Region 10, to assign each employee with a personal complement of respiratory protective equipment. This practice is not only needed from a personal hygiene and proper fit point of view, but also to insure that the individual's respiratory protective equipment will receive proper maintenance and care. When an individual is assigned respiratory protective equipment which he or she will have to depend on while working in a contaminated atmosphere, the degree of maintenance, care, and equipment readiness is more easily stressed. Therefore, the following respiratory protective equipment will be procured by each Division or Office Director, on an exclusive use basis, for personnel requiring respiratory protection:

1. Full-facepiece mask, air-purifying, cartridge/canister respirator; NOTE: Special corrective lenses will be procured, if required (after proper fit testing) along with nose cups for each facepiece purchased.

The Robertshaw Model 5000 Air Capsule (5-minute SCBA escape hood) and MSA Model 401 SCBA unit (a positive pressure full-facepiece SCBA with a 30-minute air supply and a lightweight composite air cylinder) will not be assigned on an individul basis because it is unlikely that all personnel will be required to wear these units at one time. MSA Model 401s, as well as a selection of NIOSH/MSHA approved particulate, gas and vapor, combination, and high-efficiency cartridges and canisters are available from ESD.

Respiratory protective equipment which is assigned to an individual for his or her exclusive use, shall be permanently marked as that individual's personal equipment. Marking the equipment should be done with adhesive tape (with the user's name written on it).

Records of all equipment issued to each employee will be maintained by the employee's Supervisor. These records will include the date of initial issuance, the date(s) of reissue, and listing of all repairs.

X. CLEANING, INSPECTION, MAINTENANCE, AND STORAGE

It is the responsibility of the employee to ensure that each piece of respiratory apparatus is cleaned and sanitized after each use; carefully inspected for defects before and after each use; repaired when needed by a factory certified individual; and stored properly so each respirator will retain its original shape and effectiveness.

CLEANING AND SANITATION

Each respirator shall be cleaned and sanitized after each use. This will be done by the person to whom it has been issued only after the individual has received thorough training in the proper procedure.

The cleaning and sanitizing of the units will be accomplished in the following manner:

1. The apparatus (air-purifying and SCBA's) is to be disassembled into its major components as described in the manufacturer's schematic display which accompanies the unit when purchased. (This step also affords the opportunity to thoroughly inspect, externally, each of the components for any defects, excessive wear and tear, etc.). Destroy and discard any previously used filters, canisters, or cartridges.

   Remember, no maintenance can be performed on the MSA Model 401 regulator, audi-lever, or cylinder valve without proper MSA certification.

2. Thoroughly wash the facepiece and mask components in a cleaning and sanitizing solution made up by adding one premeasured cleaner-sanitizer packet to one gallon of warm water (120-140°F). The components should be scrubbed with a sponge or soft brush to remove dust, dirt or other contaminants. Respirator cleaning materials are availble from ESD or the Manchester Laboratory. The respirator should be immersed in this solution for at least two minutes.

3. Thoroughly rinse all component pieces in warm water. (This step is important since residuals of the cleaning-sanitizing solution can cause dermatitis in some individuals).

4. Dry all components thoroughly; inspect them again for any defects; reassemble the units; and store properly until the next use.

litional information on this subject can be found in the 165.2 Personnel tection and Safety course manual; Clear Section, Part 2, Appendix II - e and Cleaning of Respirators.

INSPECTION FOR DEFECTS

The inspection of the respirator is probably the most important step in the respirator maintenance program. A conscientious inspection of the unit will identify damaged or malfunctioning components before use in a hazardous atmosphere. Therefore, all respiratory equipment shall be inspected thoroughly before the apparatus is used and during and after the cleaning process. The employee and the employee's supervisor are jointly responsible for ensuring periodic inspections are performed on the respirators. These procedures are based upon inspection prior to use, inspection during and after cleaning, and inspection based on the type of apparatus (i.e., SCBA or air purifying).

The external inspection of the respirators will include a check for tightness of connections; a check on the condition of the respirator inlet and outlet coverings, a head harness and assembly, valves, and connecting tubes; the end-of-service life indicators and shelf-life dates on all filters, canisters, and cartridges; and a thorough check of the regulators, alarms, and other warning systems. All rubber and elastomeric parts of the respirator will be checked for pliability, proper sealing, and any sign of deterioration. Each air cylinder will be checked to insure its integrity and its readiness for use. Additional information on SCBA inspection procedures can be found in the 165.2 Personnel Protection and Safety course manual: Clear Section, Part 3, Appendix I - DOT Specification Cylinders and Appendix II - SCBA Checkout Procedures.

MAINTENANCE AND REPAIR

Replacement of parts and repair of all respiratory protective equipment will be performed only by persons properly trained and certified by the manufacturer. Reducing or admission valves and regulators will be returned to the manufacturer or to a trained and certified technician for repair or adjustment. The Regional Occupational Safety and Health Manager has received MSA Level II training and can repair the low pressure side of the regulators. IT IS STRICTLY FORBIDDEN TO SUBSTITUTE ANY PART OF THE RESPIRATOR ASSEMBLY WITH ANOTHER BRAND OR TYPE OF RESPIRATOR PART. TO DO SO WILL INVALIDATE THE APPROVAL OF THE DEVICE AND COULD SIGNIFICANTLY COMPROMISE THE HEALTH/LIFE OF THE USER.

The Supervisor will maintain an up-to-date record of all repairs, adjustments, and replacement of parts. The record should indicate the date, respirator make and model, part number, and the technician's name.

STORAGE OF EQUIPMENT

All respiratory protective equipment will be stored in such a way as to protect it against dust, sunlight, excessive heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage. Respirators will be stored individually, not stacked one upon the other or in cramped spaces, to prevent distortion of rubber or other elastomeric parts. Respirators should be stored in plastic bags and readily identifiable as to the individual to whom it has been issued. As OSHA guidelines suggest, respirators will be stored in their original cartons whenever possible.

EVALUATION OF RESPIRATOR PROGRAM EFFECTIVENESS

It is the policy of EPA Region 10 in compliance with 29 CFR 1910.134 and ANSI Z88.2-1980, to regularly audit and evaluate the respiratory program's effectiveness in order to insure that all persons involved are being provide with the best respiratory protection possible. As further assurance of this degree of protection, the user will be monitored periodically. The respiratory program will be evaluated annually by the Occupational Health and Safety Manager; if necessary, the written operating procedures will be modified and corrective actions will be taken to eliminate defects in the program, noting target dates for implementation.

The Occupational Health and Safety Manager will perform unannounced inspections of respirator use to insure that the following procedures are adhered to: the proper types of respirators are being selected for the job; individuals who are required to wear respirators have received proper training; respirators are inspected and maintained properly; respirator storage is satisfactory; monitoring for respiratory hazards is continuous when air-purifying respirators are used; the respirators in use are in good operating condition; and medical and biochemical surveillance of the respirator user is being carried out. Further, the Occupational Health and Safety Manager shall periodically consult with respirator users about their acceptance of their respirators as they relate to comfort, interference with vision and communications, restriction of movement, resistence to breathing, interference with job performance, and their general confidence in their respirators effective protection. This information will be documented and analyzed so as to insure the respirator user's continued ability to wear the respirator issued to him/her.

.PPENDIX D TO SECTION 1910.1025— QUALITATIVE FIT TEST PROTOCOLS

.ppendix specifies the only allowable qualitative fit tocols permissible for compliance with paragraph

ıyl Acetate Protocol

ɔr threshold screening.

·ee 1-liter glass jars with metal lids (e.g. Mason or ;) are required.

ɔr-free water (e.g. distilled or spring water) at aptely 25°C shall be used for the solutions.

· isoamyl acetate (IAA) (also known as isopentyl ace- ɔck solution is prepared by adding 1 cc of pure IAA : of odor free water in a 1-liter jar and shaking for 30 The solution shall be prepared new at least weekly.

ɜ screening test shall be conducted in a room sepam the room used for actual fit testing. The two nall be well ventilated but may not be connected to ɜ recirculating ventilation system.

ɜ odor test solution is prepared in a second jar by .4 cc of the stock solution into 500 cc of odor free sing a clean dropper or pipette. Shake for 30 seconds w to stand for two to three minutes so that the IAA ·ation above the liquid may reach equilibrium. This may be used for only one day.

est blank is prepared in a third jar by adding 500 cc free water.

ɜ odor test and test blank jars shall be labelled 1 and · identification. If the labels are put on the lids they periodically *dried off* and switched to avoid people ; the same jar always has the IAA.

ɜ following instructions shall be typed on a card and n the table in front of the two test jars (i.e. 1 and 2);

purpose of this test is to determine if you can smell ɔil at a low concentration. The two bottles in front of :ain water. One of these bottles also contains a small of banana oil. Be sure the covers are on tight, then ach bottle for two seconds. Unscrew the lid of each ɔne at a time, and sniff at the mouth of the bottle. to the test conductor which bottle contains banana

ɜ mixtures used in the IAA odor detection test shall ared in an area separate from where the test is per- in order to prevent olfactory fatique in the subject.

the test subject is unable to correctly identify the .aining the odor test solution, the IAA QLFT may ısed.

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

B. Respirator selection.

1. The test subject shall be allowed to select the most comfortable respirator from a large array of various sizes and manufacturers that includes at least three sizes of elastomeric half facepieces and units of at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to assess a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This may not constitute his formal training on respirator use, only a review.

3. The test subject should understand that he is being asked to select the respirator which provides the most comfortable fit for him. Each respirator represents a different size and shape and, if fit properly, will provide adequate protection.

4. The test subject holds each facepiece up to his face and eliminates those which are obviously not giving a comfortable fit. Normally, selection will begin with a half-mask and if a fit cannot be found here, the subject will be asked to go to the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepices are recorded; 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 #6 below. If the test subject is not familiar with using a particular respirator, he shall be directed to don the mask several times and to adjust the straps each time, so that he becomes adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject:

- Chin properly placed.
- Positioning of mask on nose.
- Strap tension.
- Fit across nose bridge.
- Room for safety glasses.
- Distance from nose to chin.
- Room to talk.
- Tendency to slip.
- Cheeks filled out.
- Self-observation in mirror.
- Adequate time for assessment.

7. The test subject shall conduct the conventional negative and positive-pressure fit checks (e.g. see ANSI Z88.2-1980). Before conducting the negative- or positive-pressure checks, the subject shall be told to "seat" his mask by rapidly moving the head side-to-side and up and down, taking a few deep breaths.

8. The test subject is now ready for fit testing.

After passing the fit test, the test subject shall be ques-
d again regarding the comfort of the respirator. If it
ecome uncomfortable, another model of respirator shall
ied.

The employee shall be given the opportunity to select
'erent facepiece and be retested if during the first two
s of on-the-job wear the chosen facepiece becomes
:eptably uncomfortable.

Fit test.

The fit test chamber shall be substantially similar to a
55 gallon drum liner suspended inverted over a 2 foot
eter frame, so that the top of chamber is about 6 inches
e the test subject's head. The inside top center of the
ber shall have a small hook attached.

Each respirator used for the fitting and fit testing shall
uipped with organic vapor cartridges or offer protec-
against organic vapors. The cartridges or masks shall
anged at least weekly.

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

A copy of the following test exercises and rainbow (or
ly effective) passage shall be taped to the inside of the
:hamber:

Exercises

Normal breathing.

Deep breathing. Be certain breaths are *deep* and
ar.

Turning head from side-to-side. Be certain movement
nplete. Alert the test subject not to bump the respira-
n the shoulders. Have the test subject inhale when his
is at either side.

Nodding head up-and-down. Be certain motions are
lete and made about every second. Alert the test sub-
ıot bump the respirator on the chest. Have the test
ct inhale when his head is in the fully up position.

Talking. Talk aloud and slowly for several minutes. The
ving paragraph is called the Rainbow Passage. Reading
l result in a wide range of facial movements, and thus
eful to satisfy this requirement. Alternative passages
ı serve the same purpose may also be used.

bow Passage

ıen the sunlight strikes raindrops in the air, they act
prism and form a rainbow. The rainbow is a divison of
light into many beautiful colors. These take the shape
ong round arch, with its path high above, and its two
apparently beyond the horizon. There is, according to
d, a boiling pot of gold at one end. People look, but no
ver finds it. When a man looks for something beyond
., his friends say he is looking for the pot of gold at the
f the rainbow.

vi. Normal breathing.

5. Each test subject shall wear his respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6 inch by 5 inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached 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 cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in No. 4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, he shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. Upon returning to the selection room, the subject shall remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

11. If a person cannot be fitted with the selection of half-mask respirators, include full facepiece models in the selection process. When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having him break the face seal and take a breath before exiting the chamber.

12. When the test subject leaves the chamber he shall remove the saturated towel, returning it to the test conductor. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag. There is no significant IAA concentration buildup in the test chamber from subsequent tests.

13. Persons who have successfully passed this fit test may be assigned the use of the tested respirator in atmospheres with up to 10 times the PEL of airborne lead. In other words this IAA protocol may be used to assign a protection factor no higher than 10.

II. Saccharin Solution Aerosol Protocol.

A. Taste threshold screening.

1. Threshold screening as well as fit testing employees shall use 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 movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly of part # FT 14 and FT 15 combined is adequate.

RDS AND INTERPRETATIONS

est enclosure shall have a three-quarter inch hole in e test subject's nose and mouth area to accommo- ebulizer nozzle.

ntire screening and testing procedure shall be ex- the test subject prior to the conduct of the screen-

est subject shall don the test enclosure. For the screening test, he shall breathe through his open a tongue extended.

; a DeVilbiss Model 40 Inhalation Medication Neb- test conductor shall spray the threshold check so-) the enclosure. This nebulizer shall be clearly distinguish it *from the fit test solution nebulizer or*

hreshold check solution consists of 0.83 grams of :charin, USP in water. It can be prepared by put- the test solution (see C6 below) in 100 cc of water.

oduce the aerosol, the nebulizer bulb is firmly o that it collapses completely then released and al- lly expand.

queezes are repeated rapidly and then the test sub- d whether the saccharin can be tasted.

first response is negative, ten more squeezes are pidly and the test subject is again asked whether in is tasted.

e second response is negative ten more squeezes d rapidly and the test subject is again asked saccharin is tasted.

test conductor will take note of the number of quired to elicit a taste response.

saccharin is not tasted after 30 squeezes (Step 9), ject may not perform the saccharin fit test.

aste response is elicited, the test subject shall be e note of the taste for reference in the fit test.

ct use of the nebulizer means that approximately is used at a time in the nebulizer body.

nebulizer shall be thoroughly rinsed in water, and refilled at least each morning and afternoon very four hours.

ator selection.

rs shall be selected as described in section IB pt that each respirator shall be equipped with a lter cartridge.

t.

test uses the same enclosure described in B1 and

est subject shall wear his respirator for at least 10 ore starting the fit test.

3. The test subject shall don the enclosure while wearing the respirator selected in section A above. This respirator shall be properly adjusted and equipped with a particular filter cartridge.

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

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

6. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

7. As before, the test subject shall breathe through the open mouth with tongue extended.

8. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B 10 above).

9. After generation of the aerosol the test subject shall be instructed to perform the following exercises for one minute each.

I. Normal breathing.

II. Deep breathing. Be certain breaths are *deep* and *regular.*

III. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his head is at either side.

Iv. Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head in the fully up position.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage

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

10. Every 30 seconds, the aerosol concentration shall be replenished using one-half the number of squeeze as initially (C8).

11. The test subject shall so indicate to the test conductor

ıy time during the fit test the taste of saccharin is de-

f the saccharin is detected the fit is deemed unsatisfac-
ıd a different respirator shall be tried.

Successful completion of the test protocol shall allow
ı of the tested respirator in contaminated atmospheres
0 times the PEL. In other words this protocol may be
ısign protection factors no higher than ten.

rritant Fume Protocol

espirator selection.

irators shall be selected as described in section IB
except that each respirator shall be equipped with
ficiency cartridges.

t test.

ıe test subject shall be allowed to smell a weak concen-
of the irritant smoke to familiarize him with its
eristic odor.

ıe test subject shall properly don the respirator se-
ıs above, and wear it for at least 10 minutes before
the fit test.

ıe test conductor shall review this protocol with the
)ject before testing.

ıe test subject shall perform the conventional positive
e and negative pressure fit checks. Failure of either
hall be cause to select an alternate respirator.

eak both ends of a ventilation smoke tube containing
oxychloride, such as the MSA part No. 5645, or
ent. Attach a short length of tubing to one end of the
ube. Attach the other end of the smoke tube to a low
e air pump set to deliver 200 milliliters per minute.

lvise the test subject that the smoke can be irritating
yes and instruct him to keep his eyes closed while the
erformed.

e test conductor shall direct the stream of irritant
from the tube towards the faceseal area of the test
He shall begin at least 12 inches from the facepiece
and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The following exercises shall be performed while the respirator seal is being challenged by the smoke. Each shall be performed for one minute.

i. Normal breathing.

ii. Deep breathing. Be certain breaths are *deep* and *regular.*

iii. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have test subject inhale when his head is at either side.

iv. Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head is in the fully up position.

v. Talking—slowly and distinctly, count backwards from 100.

vi. Normal breathing.

9. If the irritant smoke produces an involuntary reaction (cough) by the test subject, the test conductor shall stop the test. In this case the test respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube to determine whether he reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B7, B8 of this protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents (IAA, irritant smoke).

12. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL. In other words this protocol may be used to assign protection factors not exceeding ten. [appendix D amended at 48 F.R. 9641, 3/8/83.]