EPA-340/1-85-002c

Stationary Source Compliance Training Series

Air Pollution Source Inspection Safety Procedures

Respiratory Protection Program Guideline

February 1983

US Environmental Protection Agency
Office of Air Quality Planning and Standards
Stationary Source Compliance Division
Washington DC 20460

EPA-340/1-85-002c

Respiratory Protection Program

Guideline

This EPA guideline was reprinted by the Stationary Source Compliance Division for use in compliance training workshops on air pollution source inspection safety procedure. The EPA publications number was assigned by SSCD as a reference number for the Stationary Source Compliance Training Series Index.

Published by

U.S. ENVIRONMENTAL PROTECTION AGENCY
Occupational Health and Safety Staff
401 M Street S.W.
Washington, D.C. 20460

February 1983

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

RESPIRATORY PROTECTION PROGRAM GUIDELINE

1. PURPOSE AND OBJECTIVE. The purpose and objective of this guideline are to provide management personnel with sufficient information to establish and operate a respiratory protection program to adequately protect its employees as required by EPA Order 1440.3, Respiratory Protection, and by the Occupational Safety and Health Administration (OSHA) Regulations 29 CFR 1910.134.

2. BACKGROUND. OSHA has set maximum exposure standards for many airborne toxic materials. If employee exposure to these substances exceeds the standards, the regulations requires that feasible engineering controls and/or administrative controls be installed or instituted to reduce employee exposure to acceptable levels. If these controls do not prove feasible, or while they are being installed/instituted, the Agency is required to provide appropriate, approved respiratory protection for its employees. Respirators are the least acceptable means for reducing personnel exposures; they only provide good protection if properly selected and fitted, worn by employees when needed, and replaced when their service life is over. Additionally, some employees may not be able to wear a respiratory protective device. Despite these difficulties, respiratory protective devices are the only means of protection available to employees when engineering and work practice controls are not feasible or inadequate, i.e., during field operations.

3. DEFINITIONS.

a. Approved. Approved means that a respiratory protective device has been tested and listed as satisfactory by the Bureau of Mines (BOM) of the U.S. Department of Interior, or jointly by the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor and the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services.

b. Canister (air-purifying). An air-purifying canister is a container with a filter, and/or sorbent, and/or catalyst which removes specific contaminants from the air drawn through it.

c. Canister (oxygen-generating). An oxygen-generating canister is a container filled with a chemical which generates oxygen by chemical reaction.

d. Ceiling concentration. The ceiling concentration means the concentration of an airborne substance that shall not be exceeded.

e. Confined space. A confined space is a space defined by the concurrent existence of the following conditions:

- Existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency which may exist or develop.

. Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).

f. Contaminant. A contaminant is a harmful, irritating, or nuisance material that is foreign to the normal atmosphere.

g. Corrective lens. A corrective lens is a lens ground to the wearer's individual corrective prescription to permit normal visual acuity.

h. Emergency respirator use. Emergency respirator use means wearing a respirator when a hazardous atmosphere suddenly occurs which requires immediate use of a respirator either for escape only from the hazardous atmosphere or for entry into the hazardous atmosphere to carry out maintenance or some other task or for rescue purposes.

i. Hazardous atmosphere. A hazardous atmosphere is any atmosphere, either immediately or not immediately dangerous to life or health, which is either oxygen deficient or which contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL), or where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

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

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

l. Odor threshold limit. The lowest concentration of a contaminant in air that can be detected by the olfactory sense.

m. Permissible exposure limit (PEL). Permissible exposure limit is the legally established time-weighted average (TWA) concentration or ceiling concentration of a contaminant that shall not be exceeded.

n. Protection factor. Protection factor is the ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided to the wearer.

o. Time-weighted average (TWA). Time-weighted average is the average concentration of a contaminant in air during a specific time period.

4. THE RESPIRATORY PROTECTION PROGRAM. EPA Order 1440.3, Respiratory Protection, sets out the Agency policy, responsibilities, and basic requirements for a respiratory protection program to protect its employees whose jobs require the use of respiratory protective devices. EPA management is required to establish and implement a respiratory protection program at each Agency location where the activities of employees may cause them to encounter atmospheres that contain or are suspected of containing unhealthy quantities of airborne contaminants or atmospheres with insufficient oxygen content, or where there is the threat of an imminent release of toxic agents. Respiratory protection may also be necessary for routine but infrequent operations and for non-routine operations in which the employee is exposed briefly to high concentrations of a hazardous substance, i.e., during maintenance or repair activities, or during emergency conditions.

As a minimum, a respiratory protection program must contain all the elements outlined in EPA Order 1440.3. These requirements are:

a. Approved respiratory protective devices must be properly selected.

b. There must be a determination of the need for respiratory protective devices.

c. An employee training program must be established in which the employee becomes familiar with the respiratory protective devices and is trained in the proper selection and use of respirators and their limitations.

d. There must be provisions for:

- Proper inspection, maintenance, storage and repair of respiratory protective devices.
- Assigning respiratory protective equipment to employees for their exclusive use, where practical.
- Testing for the proper fit of the respiratory protective equipment.
- Surveillance of the work area and for employee exposure and stress.
- Medical screening of each employee assigned to wear respiratory protective devices to determine if he/she is physically and psychologically able to wear a respirator.

e. Written standard operating procedures must exist for the selection and use of respiratory protective devices.

5. ESTABLISHMENT OF THE RESPIRATORY PROTECTION PROGRAM. Management at each EPA location where it has been determined a Respiratory Protection Program is required should designate one person responsible for administering the program at that location. This person should have the responsibility for the

entire respirator program and develop the standard operating procedures. To administer effectively the respiratory protection program, the designated person must have:

a. Sufficient training in al aspects of respiratory protection to adequately manage the program.

b. The ability to make sound judgments based on hazard evaluation and an understanding of the workplace hazards.

c. The knowledge and authority to coordinate equipment purchasing, maintenance, cleaning and repair.

d. The knowledge and authority to assure that written operating procedures are prepared for specific operations and that these procedures are being followed.

e. The knowledge and authority to assure compliance with OSHA and Agency respiratory protection requirements.

f. The resources to maintain all records associated with the program, i.e., monitoring, medical surveillance and job assignment data, respirator care and maintenance records, emergency equipment inspection/maintenance tags, training records, etc.

The individual assigned the respiratory program responsibility may be a safety specialist/manager, safety engineer, industrial hygienist, or supervisory person. This individual must have the full support of management at the workplace regardless of who assumes the program responsibility.

6. SELECTION OF RESPIRATORY PROTECTIVE DEVICES. The proper selection of respiratory protective devices basically involves three steps:

a. Identification of the hazard.

b. Evaluation of the hazard.

c. The selection of the appropriate approved respiratory protective device based on the first two considerations. (See Appendix A, Respiratory Protective Device Recommendation.)

Respiratory protective devices that will provide greater protection than required may be selected, but the device selected must always be approved.

a. Identification of the Hazard. It is important to know something about the different kinds of hazardous atmospheres which may require the use of respirators.

o Contaminated Atmospheres

. Gaseous Contaminants - These contaminants are of two types.

.. Gases are aeriform fluids which are in the gaseous state at ordinary temperature and pressure., e.g., carbon dioxide. Such substances are solids or liquids only at much lower temperatures or much higher pressures than are commonly found in the work environment. Carbon dioxide, is a gas at room temperature, but it occurs as solid "dry ice" at low temperature, or as a liquid in pressurized tank..

.. Vapors are the gaseous state of a substance that is solid or liquid at ordinary temperature and pressure. Vapors are formed by the evaporation of substances, i.e., acetone or trichloroethylene, which ordinarily occur as liquid.

. Particulate Contaminants - Particulate contaminants are suspended particles or droplets of a substance. Many of these particles can remain suspended in air indefinitely and are easily inhaled. There are three types of particulates:

.. Dusts are solid particles produced by such processes as grinding, crushing, and mixing of powder compounds.

.. Mists are tiny liquid droplets dispersed whenever a liquid is sprayed, vigorously mixed, or otherwise agitated.

.. Fumes are solid condensation particles of extremely small particle size.

. Combination Contaminants - The two basic forms of contaminated atmospheres - gaseous and particulate - frequently occur together.

o Oxygen Deficient Atmospheres - In an oxygen deficient atmosphere, the problem is not the presence of something harmful, but the absence of something essential. These atmospheres are most commonly found in confined and usually poorly ventilated spaces. Oxygen deficient atmospheres are classified as either immediately dangerous to life or health or not immediately dangerous to life or health depending on the oxygen concentration in the atmosphere. (An oxygen deficient atmosphere immediately dangerous to life and health is an atmosphere that contains less than 16 volume percent of oxygen in the atmosphere at sea level. An oxygen deficient atmosphere not immediately dangerous to life and health is an atmosphere having an oxygen concentration between 16 and 19.5 volume percent of oxygen in the atmosphere at sea level.)

Oxygen deficient atmospheres occur in two different ways: (1) Oxygen may be "used up" by a chemical reaction, and (2) Oxygen is displaced by another gas. There is no definition of oxygen deficient atmosphere that has been universally accepted. OSHA has adopted and EPA accepts an oxygen deficient atmosphere as one that contains less than 19.5 volume percent of oxygen in the atmosphere at sea level. The following table is a partial listing of definitions of oxygen deficient atmospheres, their source and conditions of determination.

Definitions of Oxygen Deficient Atmospheres

Source	Oxygen Content (Vol.%)	Conditions for Determination
ACGIH Threshold Limit Values for 1973	18.0	". . . under normal atmosphere pressure. . . ."
Federal Regulations 29 CFR Part 1915.S1 (Maritime Standards)	16.5	(not specified)
29 CFR Part 1910.94		
(Ventilation Standards)	19.5	(not specified)
(Respirator Approval Tests)	19.5	". . . by volume at sea level...."
ANSI Standards Z88.2-1969 (Respirator Practices)	16.0	". . . normal air. . . ."
ANSI Standards Z88.2-1980 (Practices for Respiratory Protection)	19.8	". . . normal air. . . ."
Z88.5-1973 (Firefighting)	19.5	". . .at sea level. . . ."
K13.1-1973 (Marketing of air-purifying canisters and cartridges)	19.5	". . .at sea level. . . ."

It is difficult to visualize the effect of oxygen deficient atmospheres on the individual. He/she is not aware of the nature of their situation. Gradual depression of the central nervous system affects powers of discrimination, logic, and auditory acuity, with muscular weakness and lack of coordination. Since no distressful sensations are produced, the entire experience is comfortable and even pleasant. In reality, however, breathing in an oxygen deficient atmosphere is like breathing under water. The symptoms of oxygen deficiency also depend on the oxygen concentration present. The following table presents the physiological effects of atmospheres at and below 16 volume percent of the oxygen at sea level.

Effects of Oxygen Deficiency

O_2 Vol % at Sea Level	Physiological Effect
16-12	Increased breathing volume. Accelerated heartbeat. Impaired attention and thinking. Impaired coordination.
14-10	Very faulty judgment. Very poor muscular coordination. Muscular exertion causes rapid fatigue that may cause permanent heart damage. Intermittent respiration.
10-6	Nausea. Vomiting. Inability to perform vigorous movement, or loss of all movement. Unconsciousness, followed by death.
Less than 6	Spasmatic breathing. Convulsive movements. Death in minutes.

b. Evaluation of the Hazard. The person who evaluates respiratory hazards must have the cooperation of others in obtaining information on the work area, work activities and materials to properly evaluate and determine the appropriate respiratory protective device that will provide the best protection for the employee. Consideration of these questions will help in the selection of the correct equipment.

1) Does the atmosphere oxygen level meet standards? Is the atmosphere oxygen level expected to remain constant or decrease?

2) What is the contaminant? Is it a gas, vapor, mist, dust, or fume?

3) What is the estimated concentration of the contaminant? Have measurements been taken?

4) Could the contaminant be considered immediately dangerous to life or health?

5) Is the contaminant flammable? Does the concentration approach the lower explosive limit? Do dust concentrations create a potential explosion problem?

6) Does the contaminant have adequate warning properties, e.g., smell, irritation?

7) Will the contaminant irritate the eyes at the estimated concentration? Is eye protection also needed?

8) What type(s) of respirators will provide the required degree of employee protection?

9) Is the recognized contaminant th : only contaminant present?

10) If the contaminant is a gas or vapor, is there an effective sorbent for the respirator cannister?

11) Can the contaminant be absorbed through the skin? If it can, will it result in a serious injury?

c. Selection of Approved Respiratory Protective Devices. The person designated as the respiratory protection program manager should have an approval authority for the purchase of respiratory protective devices. Any respiratory protective devices purchased should be approved for the particular contaminants for which they will be used. If only one brand of respirator is approved for a particular hazard, then that brand is considered to be "available" and must be used. The NIOSH approval on a respirator has the following information:

o An assigned identification number placed on each unit.

o A label identifying the type of hazard for which the respirator is approved.

o Additional information on the label which gives limitations and identifies the component parts approved for use with the basic unit.

In the past, the BOM approved respirators. The BOM no longer grants approval; however, some older respirators which were BOM-approved may still be used.

o BOM-approved self-contained breathing apparatus (SCBA) may be used until further notice.

o BOM-approved gas masks may be used until further notice.

d. Categories of Respiratory Protective Devices. Respiratory protective devices fall into two broad categories - air purifying and atmosphere supplying.

1) Air-purifying respirators - These devices remove the contaminant from the breathing air before it is inhaled. For each model of air-purifying respirator, there are usually many air-purifying cartridges available for protection against specific contaminants. Combination cartridges for protection against both particulates and organic vapors are also available.

o Particulate removing filter respirators - These are generally called "dust," "mist," or "fume" respirators and by a filtering action remove particulates before they can be inhaled.

. Single use, dust - The single-use respirator is a respirator which is completely disposed of after use. They are for individual use and should be discarded when resistance becomes excessive or the respirator is damaged. Generally these respirators are approved only for pneumoconiosis or fibrosis producing dust such as coal dust, silica dust, and asbestos.

. Quarter-mask, dust and mist; half-mask, dust and mist - The quarter-mask covers the mouth and nose; the half-mask fits over the nose and under the chin. The half-mask usually produces a better facepiece to face seal than does the quarter-mask and is therefore preferred for use against more toxic materials. Dust and mist respirators are approved for protection against dusts and mists whose TLV is greater than 0.05 milligram particulate matter per cubic meter of air (mg/M^3).

. Quarter-mask, fume; half-mask, fume - These masks, similar to the quarter-mask dust and mist; half-mask dust and mist, utilize a filter element which can remove metal fumes in addition to dusts and mists from the inhaled air. The filters are approved for metal fumes having a TLV above 0.05 mg/M^3.

. Half-mask, high efficiency - These masks are the same as the units mentioned in the two previous paragraphs above, but use a high efficiency filter. Because of this high efficiency filter, they can be used against dusts, mists, fumes, and combinations of those whose TLV is less than 0.05 mg/M^3.

. Full facepiece - Full facepiece respirators cover the face from the hairline to below the chin. In addition to providing more protection to the face and also a measure of eye protection, the full-facepiece gives a better seal than the half- or quarter-masks. The protection these respirators provide against dusts, mists, fumes, or any combination of these contaminants depends upon the type of filter used.

. Powered air-purifying respirators - These respirators use a blower that passes the contaminated air through the cartridge or canister where the contaminant is removed and passes the purified air into the facepiece. The air purifying element can be a filter to remove particulates, a cartridge or canister to remove gases or vapors, or a combination to remove both. The face covering can be a half-mask, full-face mask, or hood or helmet. The advantage to using a powered air-purifying respirator is that it supplies air at a positive pressure within the facepiece, hood or helmet, so that any leakage is outward.

The protection provided depends on the air-purifying element and the type and concentration of the contaminants. Powered air-purifying respirators must deliver at least 4 cubic feet per minute (CFM) to a tight fitting facepiece such as a mask and at least 7 cfm to a loose fitting helmet or hood. If the powered air-purifying respirator is battery operated, it should provide the airflows mentioned for at least 4 hours without having to recharge the battery.

o Limitations - air purifying respirators for particulates -

. Air-purifying respirators do not provide oxygen, so they must never be worn in oxygen deficient atmospheres.

. Air-purifying respirators for particulates offer no protection against atmospheres containing contaminant gases or vapors.

. These respirators are not NIOSH approved for abrasive blasting operations and should not be used.

o Problems - air purifying respirators for particulates -

. The air flow resistance of a particulate-removing respirator filter element increases as the quantity of particles it retains increases, thus increasing the breathing resistance. As a rule of thumb, when comfortable breathing is impaired because of dust build-up, the filter should be replaced.

. The performance of some filter materials is affected by open storage in very humid atmospheres. Care should be taken in storing filter elements.

o Chemical Cartridge and Canister Respirators, Gas and Vapors - Vapor and gas-removing respirators use cartridges or canisters containing chemicals to trap or react with specific vapors and gases and remove them from the air breathed. The basic difference between a cartridge and a canister is the volume of the sorbent. Generally, a "cartridge" refers to a chemical adsorbing element which attaches directly to the facepiece, whereas a "canister" refers to the chemical adsorbing element held in a harness and which is connected to the facepiece via a corrugated breathing tube. Some of the typical chemical cartridge or canister respirators are:

. Half-mask and quarter-mask respirators - These are available for protection against single chemicals such as ammonia or against entire classes such as organic vapors. Be sure to read the label on the cartridge or canister since it tells what the cartridge or canister protects against, what the maximum concentration is for which the element can be used, and in some instances, the service life or expiration date of the element.

. Full facepiece - The full facepiece respirator may use a canister or cartridge(s) as the protective element. The front, back, and chin-mounted full-facepiece canister respirators are also referred to as "gas masks."

o Limitations - chemical cartridge or canister, gas and vapor -

. These respirators do not supply oxygen, so they must never be worn in oxygen deficient atmospheres.

. They must not be used if the hazardous chemical lacks adequate warning properties - odor, taste, or irritation, unless their use is permitted by applicable OSHA or MSHA standards. These warning properties are necessary

to alert the user that the sorbent is saturated and that the contaminant is passing through the cartridge or canister into the respiratory tract.

. They must not be used in atmospheres immediately dangerous to life or health, except for escape.

. They are intended for use only for the specific gases or vapors for which they were tested and approved. (They may be worthless for other gases or vapors.)

2) Atmosphere Supplying Respirators - Atmosphere supplying respirators, rather than removing the hazardous material from the air, exclude the workplace air altogether and provide clean air from an independent source. There are two kinds of atmosphere supplying respirators: (1) A supplied-air respirator in which the user is supplied with respirable air through a hose and (2) A self-contained respirator in which the user carries a supply of respirable air.

o Supplied-air respirator - Supplied-air respirators use a central source of breathing air that is delivered to the wearer through an air supply line or hose.

. Airline respirator devices - Airline respirator devices use a stationary source of compressed air delivered through a high-pressure hose. Airline respirator devices can be equipped with a half- or full-facepiece masks, helmets, or hoods, or the device can come as a complete suit. Airline respirators can be used for protection against either particulates, gases, or vapors. They provide a high degree of protection against these contaminants but they cannot be used in atmospheres immediately dangerous to life or health because the user is completely dependent on the integrity of the air supply hose and the air source. If something were to happen to either the hose or air supply, the user could not escape from the contaminated area without endangering his/her life, since the user is not guaranteed a supply of breathing air for escape. A great advantage of the airline respirator is that it can be used for long continuous periods. There are three types of airline respirators.

.. Demand Airline Respirator Devices - In a demand device, the air enters the facepiece only on demand of the user, i.e., when the user inhales. This is due to the nature of the valve and pressure regulator. During inhalation there is a negative pressure in the mask, so if there is leakage, contaminated air may enter the mask and be breathed by the user. The leakage problem is a major drawback of the demand device. Full face masks provide a better seal than the half-mask against leakage.

.. Pressure Demand Airline Devices - The pressure demand device has a regulator and valve design such that there is a continuous flow of air into the facepiece at all times. The air flow into the mask creates a positive pressure in the mask, therefore, there is no problem of contaminant leakage into the facepiece. This is the significant advantage of this type of device.

.. -Continuous-flow Airline Devices - The continuous-flow airline respirator maintains a constant airflow at all times and does not use a regulator. Instead an airflow control valve or orifice regulates the flow of air. The continuous-flow device creates a positive pressure in the facepiece. There is no problem of inward leakage of contaminant.

o Air Supply System - Supply air sources (compressor or tanks) for the supplied-air respirators must meet the following requirements.

. The air compressor must be located where contaminated air cannot enter the system.

. The air receiver must be of sufficient capacity to enable the wearer to escape in the event of compressor failure.

. The system must have alarms to indicate compressor failure or overheating.

. If the compressor is oil-lubricated it must have a high temperature and/or carbon monoxide (CO) alarm. If there is no CO alarm, frequent carbon monoxide tests of the air must be made to insure that the CO level does not exceed 20 parts per million.

. All airline couplings must be incompatible with outlets for other gas systems.

Breathing air quality must meet the requirements of Grade D breathing air as described by the Compressed Gas Association. Grade D requirements are:

.. The oxygen content of the compressed air should be between 19.5 - 23.5 percent oxygen and the remainder mainly nitrogen;

.. Hydrocarbon concentrations must not exceed 5 parts per million;

.. Carbon monoxide concentration must not exceed 20 parts per million;

.. Carbon dioxide concentrations must not exceed 1000 parts per million; and

.. There must not be any pronounced odor.

o Limitations - Supplied-air respirators -

. These devices must not be used in atmospheres immediately dangerous to life or health since the user is dependent upon an air hose which, if cut, crushed, or damaged, leaves him/her with little or no protection.

. The trailing air supply hose of the airline respirator severely restricts the wearer's mobility. This makes the airline respirator unsuitable for the user who must move frequently between work stations that are separated or cover a large area, i.e., during field work.

o Self-Contained Breathing Apparatus (SCBA). The self-contained breathing apparatus (SCBA) allows the user to carry a respirable breathing supply with him/her, and does not need a stationary air source such as a compressor to provide breathable air. The air supply may last from 3 minutes to 4 hours depending on the device.

. Closed Circuit SCBA - In a closed circuit SCBA the air is rebreathed after the exhaled carbon dioxide has been removed and the oxygen content restored by a compressed oxygen source or an oxygen-generating solid. These devices are designed primarily for 1-4 hour use in toxic atmospheres. Because negative pressure is created in the facepiece during inhalation, there is increased leakage potential. Therefore, the devices should be used in atmospheres immediately hazardous to life and health only when long-duration use of an SCBA is indicated, i.e., in mine rescue. Two types of closed circuit SCBA are available.

.. Compressed Oxygen Cylinder Type - In this device, breathable air is supplied from an inflatable bag. Exhaled air from the user goes through an adsorber to remove carbon dioxide, and the oxygen consumed is replenished from an oxygen cylinder.

.. Oxygen-generating Type - This type of SCBA uses an oxygen-generating solid which reacts with water vapor and carbon dioxide from the exhaled breath, to release oxygen. The oxygen then passes to the inflatable bag. This device is lighter, simpler, and less expensive than the cylinder type. However, it is useful for only about 1 hour and, once initiated, cannot be turned off.

. Open Circuit SCBA - An open circuit SCBA exhausts the exhaled air to the atmosphere instead of recirculating it. A tank of compressed air carried on the user supplies air via a regulator to the facepiece. Because there is no recirculation of air, the service life of the open circuit SCBA is shorter than a closed circuit device. Two types of open circuit SCBA's are available.

.. Demand SCBA - In a demand SCBA, air flows into the facepiece only on the demand of the user, i.e., when the user inhales. This is due to the nature of the valves and pressure regulator. During inhalation there is a negative pressure in the mask, so if there is leakage, contaminated air can enter the mask and be breathed by the user. The leakage problem is a major drawback of the demand device. Because of this problem, a demand type open circuit SCBA should not be used in atmospheres immediately dangerous to life or health.

.. Pressure Demand SCBA - The pressure demand open circuit SCBA has a regulator and valve design which maintains a positive pressure

in the facepiece at all times regardless of the demand of the user. Because of this, there is no problem of contaminant leakage into the facepiece. This is a significant advantage of the pressure demand device. The use time of this device, though, may be reduced considerably by air leakage outward from the facepiece.

o Combination Atmosphere Supplying Respirator - Supplied Air and SCBA - Designed primarily as a long duration device, this respirator combines an airline respirator with an auxiliary air supply (usually compressed air) to protect against the possible failure of the primary air supply (the airline). The additional supply can be approved for 15 minutes or even longer. The choice depends upon how long it would take to escape from the toxic atmosphere if the primary air supply failed. This modification, therefore, allows these devices to be used in atmospheres immediately dangerous to life and health.

o Limitations of atmosphere supplying respirators -

. The air supply is limited to the amount in the cylinder (SCBA's using a compressed air tank) and therefore the respirator cannot be used for extended periods without recharging or replacing the cylinders.

. Because these respirators are bulky and heavy, they are often unsuitable for strenuous work or use in confined spaces.

. Because of the short service time of the auxiliary air supply, the escape portion of the combination unit can be used only for escape from atmospheres immediately hazardous to life or health unless the escape portion has a minimum of 15 minutes service life. Such devices can then be used for entry into immediately dangerous to life or health atmospheres provided not more than 20 percent of the available breathing supply is used. These devices may always be used for entry into immediately dangerous to life or health atmospheres when utilized with the external air supply.

. Because the outward air leakage from the facepiece of the pressure demand device can cause loss of air the use time may be shortened.

7. RESPIRATOR USE. All employees required to wear respiratory protective devices should, if practical, be assigned their protective equipment for their exclusive use. A system should be established to facilitate the accounting of users and of the equipment. When a respirator is assigned to a user it should be permanently marked to indicate to whom it is assigned. The marking must be done in such a way that it does not hurt the respirator performance. Records should indicate the date of initial issue, the dates of reissue, and a listing of repairs.

a. Employee Responsibilities. As a respiratory protective device user, employees have these responsibilities:

1) Use respiratory protective equipment as instructed.

2) Guard against damaging the respirator.

3) Go immediately to an area of "clean" air if the respirator malfunctions.

4) Report any malfunctioning of respiratory protective devices to their supervisor. These malfunctions would include but not be limited to:

- Discomfort;
- Resistance to breathing;
- Fatigue due to respirator usage;
- Interference with vision or communication;
- Restriction of movement.

b. Supervision of Respirator Use. Respirators in use must be randomly inspected at frequent intervals to ensure that those selected for the job are being used and that they are in good condition. This periodic monitoring should include:

1) A determination that the proper respirators are being used.

2) Determination that respirators are being worn properly.

3) Consultation with users about:

- Discomfort
- Resistance to breathing
- Fatigue
- Interference with vision
- Interference with communications
- Restriction of movement
- Interference with job performance
- Confidence in the respirator

If problems are discovered during the random inspection, they should be rectified.

c. Respirator Use Under Special Conditions. There are several conditions where the use of respiratory protective devices require special preparations.

1) Dangerous Atmospheres - If respiratory protective devices are to be used in atmospheres immediately dangerous to life or health, a standard operating procedure for work in high hazard areas must be written. (See Appendix B, Model Standard Operating Procedure, Respirator Use, High Hazard Areas.) The standard operating procedure must as a minimum cover the following points.

. Individuals designated to enter into dangerous atmospheres must have training with the proper equipment. These individuals must be equipped with safety harnesses and safety lines so that they can be removed from the atmosphere if necessary.

. Designation and provision of a standby individual, equipped with proper rescue equipment, who must be present in a nearby safe area for possible emergency rescue.

. Provision for communication between persons in the dangerous atmosphere and the standby person must be made. Communication may be visual or by voice, signal line, telephone, radio, or other suitable means.

Other important data such as toxicological information and emergency phone numbers should be included.

2) Confined Spaces - Confined spaces are defined as enclosures where the existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency which may exist or develop and ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s). These special precautions must be taken:

. Before entering a confined space, tests should be made to determine the presence and concentration of any flammable gas, toxic airborne particulate, vapor, gas, and oxygen concentration.

. If the concentration of a flammable substance exceeds 25 percent of the lower explosive limit, the confined space must be force ventilated to keep the concentration well below the lower explosive limit. The concentration of contaminant or oxygen percent should be continuously monitored while individuals are working in the confined space.

. Only individuals specially trained should be allowed to enter confined spaces and the proper respiratory protective devices must be worn.

.. Air-purifying respirators and airline type supplied-air respirators may be worn in a confined space only if the tests show that the atmosphere contains adequate oxygen and that air contaminants are well below levels immediately dangerous to life or health. While employees wearing these types of respirators are in a confined space, the atmosphere must be monitored continuously.

.. If the atmosphere in a confined space is immediately dangerous to life or health due to a high concentration of air contaminant or oxygen deficiency, employees entering the space must wear a positive pressure SCBA or a combination airline and a positive pressure SCBA.

. A standby individual with proper rescue equipment, including an SCBA, must be present outside the confined space for possible emergency rescue. Communication must be maintained via voice, signal line, telephone,

etc., between employees in the confined space and the standby person. The employee inside the confined space must be equipped with safety harnesses and safety lines to allow removal in case of an emergency.

3) Low and High Temperatures - The use of respiratory protective devices in low temperatures can create several problems. The lenses of the full facepiece equipment may fog due to condensation of the water vapor in the exhaled breath. (Coating the inner surface of the lens with an anti-fogging compound will reduce fogging. Nose cups that direct the warm, moist exhaled air through the exhalation valve without touching the lens are available from manufacturers for insertion into the full facepiece.) The exhalation valve can freeze onto the valve seat due to the moisture in the exhaled air. The user will be aware when this situation occurs by the increased pressure in the facepiece. (When unsticking the valve, care should be taken so as not to tear the rubber diaphragm.)

Respirator usage in hot environments can put additional stress on the user. The stress can be minimized by using a light-weight respirator with low breathing resistance. An airline type atmosphere-supplying respirator equipped with a vortex tube can be used. The vortex tube may either cool or warm the supplied air (depending on the connection and setting). This protection scheme can be used in both hot and cold environments.

d. Special Problems in Respirator Use

1) Facial Hair - Facial hair lying between the sealing surface of a respirator facepiece and the wearer's skin will prevent a good seal. If the respirator permits negative air pressure inside the facepiece during inhalation, there will be excessive penetration by an air contaminant. Even a few days growth of stubble will permit excessive contaminant penetration. Any employee who has stubble, a moustache, sideburns, or a beard that passes between his face and the sealing surface must not wear a respirator that allows negative pressure inside the facepiece during inhalation.

2) Corrective Lenses - Spectacle temple bars or straps that pass between the sealing surface of a full facepiece and the wearer's face prevent a good seal. Therefore, spectacles that have temple bars or straps must not be used when a full-facepiece respirator must be worn. Spectacles with short temple bars that do not protrude between the sealing surface and the user's face, or spectacles without temple bars which are taped to the wearer's face may be used temporarily. Special corrective lenses that can be mounted inside the full facepiece are available and should be used by employees who need them. The special corrective lenses must be mounted in the full facepiece by a qualified person to ensure good vision, comfort, and proper sealing of the facepiece. Spectacles or goggles may also interfere with quarter- or half-masks. They must be worn so as not to interfere with the seal of the facepiece. If there is interference, a full facepiece respirator should be worn to avoid sealing problems.

Contact lenses must not be worn while wearing a respirator in a comtaminated atmosphere. A properly fitted respirator may stretch the skin around the

eyes, creating the possibility that the contact lens will fall out. Also, contaminants that do penetrate the respirator could get underneath the contact lens and cause severe discomfort. The user's first reaction would be to remove the facepiece to remedy the situation - which could be fatal in a lethal environment.

3) Other Sealing Problems - Scars, hollow temples, very prominent cheekbones, deep skin creases, and lack of teeth or dentures may cause respiratory facepiece sealing problems. Full dentures should be retained when wearing a respirator, but partial dentures may or may not have to be removed, depending upon the possibility of swallowing them. With full lower dentures, problems in fitting quarter-masks can be expected, as the lower part of the mask tends to unseat the denture. Persons with punctured ear drums also should not wear respirators.

8. TRAINING AND FITTING

a. Training. Selecting the respirator appropriate for a given hazard is important, but equally important is using the selected device properly. Proper use can be ensured by carefully training both supervisors and users in selection, use, and maintenance of respiratory protective devices. The content of a training program can vary widely, depending on the needs, however, OSHA requires that the training of both users and supervisors include the following, no matter what the circumstances:

1) An opportunity to handle the respirator,

2) Proper fitting,

3) Test of facepiece to face seal,

4) A long familiarizing period of wear in normal air.

The training of users and supervisors for specific use situations should also include:

1) A discussion of the engineering and administrative controls in use and why respirators are needed.

2) Explanation of the nature of the respiratory hazard and what would happen if the respirator is not used properly,

3) Explanation of why a particular type of respirator has been selected,

4) A discussion of how to recognize and handle emergencies.

The training requirements apply to both large and small groups or units of employees required to wear respiratory protective devices, with no differentiation to meet individual needs.

1) Supervisor - Supervisors who oversee the daily activities of one or more employees who wear respirators frequently should have a knowledge of respirators and respiratory protection practices. Supervisory training should include, but not be limited to, the following areas.

. Basic respiratory protection practices,

. Selection and use of respirators to protect each employee against every respiratory hazard to which he/she may be exposed,

. The nature and extent of the respiratory hazards to which the employees may be exposed,

. The structure and operation of the entire respirator program. The supervisor should understand his/her responsibility to facilitate the implementation of the program, including maintenance that the employee may be expected to do, issuance of respirators, control of their use, and evaluation of the program's effectiveness.

. The legal requirements pertinent to use of respirators in his/her area of jurisdiction.

These supervisory training requirements apply to the large groups or field units with employees required to use respiratory protective devices. A smaller group or field unit may have to combine the supervisor training with that of the employee. This will benefit the employees because they will receive more comprehensive training.

2) Employee Instruction and Training - EPA Order 1440.3 requires that employees receive a minimum of six hours of initial training, and two to four hours annually thereafter. This is a minimum requirement. The extent and frequency of the employee's training will depend on the nature and extent of the hazard. If the hazard is a nuisance particulate, for example, the danger from misuse of the respirator is not likely to be serious. However, against highly toxic particulates, a single misuse may have serious consequences. The same is true for gases and vapors. If the respirator is to be used in an emergency, training in its use should be very thorough and complete. In any case, the employee must be given some instruction and training in respiratory protection practices. Because proper respirator use depends upon the employee's motivation, it is important that the need for respiratory protection be explained fully. The following points should be included in a minimum acceptable respiratory protection training program.

. Instruction in the nature of the hazard, whether acute, chronic, or both, and an honest appraisal of what may happen if the respirator is not used.

. Explanation of why more positive control is not immediately feasible. This should include recognition that every reasonable effort is being made to reduce or eliminate the need for respirators.

. Discussion of why the proper type of respirator must be used for each particular hazard.

. Discussion of respirator capabilities and limitations.

. Instruction and training in actual use of the respirator.

. Classroom and field training in recognizing and coping with emergencies.

. Proper fitting.

. Other special training as needed.

The major thrust of the training is toward explaining as much as possible the reasons for wearing a respirator. This is to motivate the user to accept the fact that protection is necessary, and to instill in him/her the desire to wear and maintain his/her respirator properly. Just giving a respirator to an employee with orders that it must be worn because OSHA says so is one of the easiest ways to ensure its misuse. It is also a cop-out by management. (See Appendix C, Employee Training Program.)

At best, a respirator may cause discomfort and inconvenience, so there is a natural resistance toward wearing it conscientiously. Most of an employee's natural resistance can be overcome by taking the time and effort to inform the user why he/she needs the respirator. This effort will create easier acceptance of respirators and contribute to correct use.

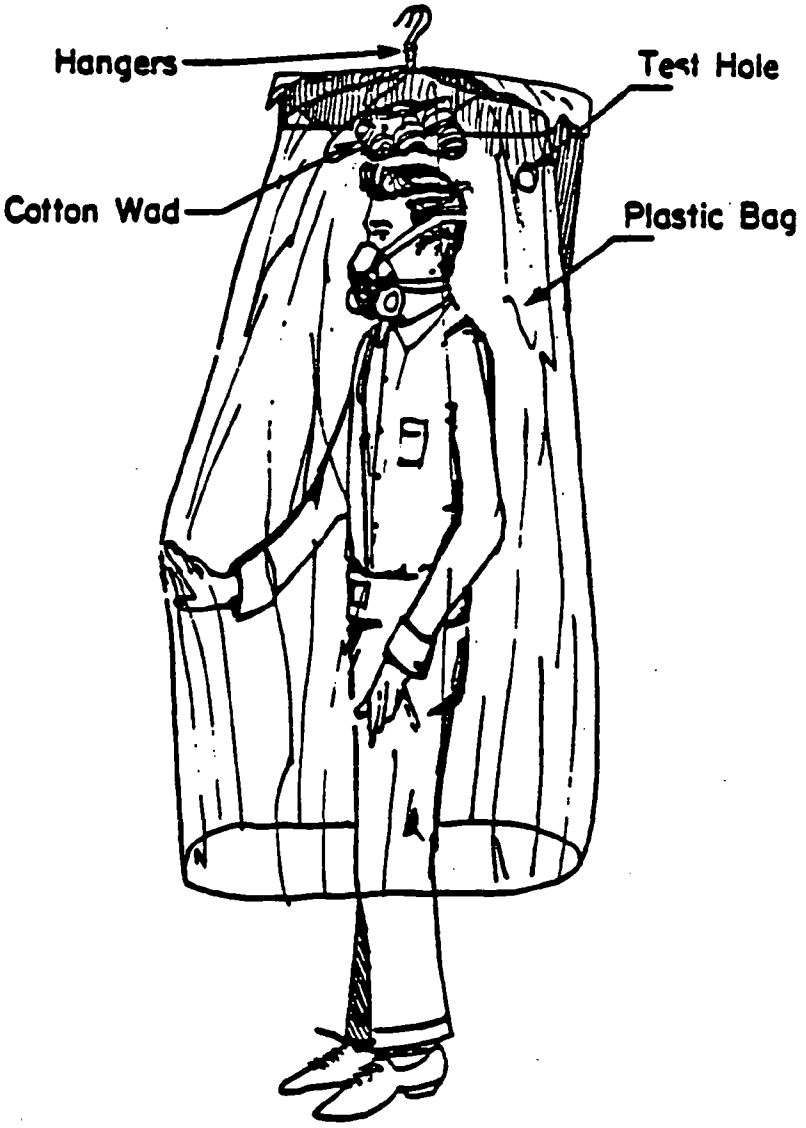
b. Fitting. The proper fitting of respiratory protective devices requires the use of some type of fit test. The fit test is needed to determine a proper match between the facepiece of the respirator and the face of the user.

1) Test Atmospheres - It is required that the user be allowed to test the facepiece to face seal of the respirator and wear it in a test atmosphere. The test atmosphere amounts to an enclosure in which the user can enter with the equipment on, and a "test" atmosphere (of low toxicity) can be generated.

Elaborate enclosures are available commercially, but a "do it yourself" qualitative fit test enclosure can be put together by the use of a plastic bag, several hangers, and some cotton. This enclosure is illustrated on the following page.

2) Test Methods - There are two types of tests: Qualitative tests and quantitative tests. The selection of one or both types of tests depends on the severity and extent of the respiratory hazard and the size of the unit or number of employees involved in wearing respiratory protective devices. During any fitting test, the respirator headstraps must be as comfortable as possible. Tightening the straps will sometimes reduce facepiece leakage, but the user may be unable to tolerate the respirator for any length of time.

. Qualitative Tests - Qualitative tests are fast, require no complicated expensive equipment, and are easily performed. However, these tests rely on the user's subjective response, and so are not entirely reliable. There are two major qualitative tests:



.. Isoamyl Acetate - Isoamyl acetate, a low toxicity substance with a banana oil like odor, is used widely in testing the facepiece fit of organic vapor cartridge/canister respirators. The substance is applied to the cotton wad inside the enclosure. The user should put on the respiratory protective device in an area away from the test enclosure so that there is no prior contamination of the cartridge or "pre-exposure" to the isoamyl acetate. The user should perform the following.

... Normal breathing.

... Deep breathing, as during heavy exertion. This should not be done long enough to cause hyperventilation.

... Side-to-side and up-and-down head movements. These movements should be exaggerated, but should approximate those that take place on the job.

... Talking. This is most easily accomplished by reading a prepared text loudly enough to be understood by someone standing nearby.

... Other exercises may be added depending upon the need.

The major drawback of the isoamyl acetate test is that the odor threshold varies widely among individuals. Also, the sense of smell is easily dulled and may deteriorate during the test so that the user can detect only high vapor concentrations. Another disadvantage is that isoamyl acetate smells pleasant, even in high concentrations. Therefore, a user may say that the respirator fits although it has a leak. A user may say that a respirator fits because he/she likes the fit of the particular respirator or is following the respirator selection of another employee. Conversely, a user may claim that a particular respirator leaks if it is uncomfortable, etc. Therefore, unless the employee is highly motivated toward wearing respirators, the results of this test must sometimes be suspect.

.. Irritant Smoke Test - The irritant smoke test, similar to the isoamyl acetate test in concept, is used widely in testing the facepiece fit of particulate filter respirators. This test can be used for both air-purifying and atmosphere-supplying respirators, but an air-purifying respirator must have a high-efficiency filter. The test substance is an irritant (stannic chloride or titanium tetrachloride) which is available commercially in sealed glass tubes. When the tube ends are broken and air passed through them, a dense irritating smoke is emitted. In this test, the user steps into the test enclosure and the irritant smoke is sprayed into the test hole. If the user detects any of the irritant smoke, it means a defective fit, and adjustment or replacement of the respirator is required. The irritant smoke test must be performed with caution because the aerosol is highly irritating to the eyes, skin, and mucous membrane. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of giving a false indication of proper fit is reduced.

.. Negative Pressure Test - This test (and the positive pressure test) should be used only as a very gross determination of fit. The wearer should use this test just before entering the hazardous atmosphere. In this test, the user closes off the inlet of the canister, cartridge(s) or filter(s) by covering with the palm(s) or squeezing the breathing tube so that it does not pass air; inhales gently so that the facepiece collapses slightly; and holds his/her breath for about 10 seconds.

If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough. This test, of course,

can only be used on respirators with tight-fitting facepieces. Although this test is simple, it has severe drawbacks; primarily that the wearer must handle the respirator after it has supposedly been positioned on his face. This handling can modify the facepiece seal. A second drawback is that, with a negative pressure in the facepiece, a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false reading of a good seal.

.. Positive Pressure Test - This test, similar to the negative pressure test, is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage. For some respirators, this method requires that the wearer remove the exhalation valve cover; this often disturbs the respirator fit even more than does the negative pressure test. Therefore, this test should be used sparingly if it requires removing and replacing a valve cover. The test is easy for respirators whose valve cover has a single small port that can be closed by the palm or a finger.

2) Quantitative Tests - Quantitative respirator performance tests involve placing the user wearing the device in an atmosphere containing an easily detectable, relatively nontoxic gas, vapor, or aerosol. The atmosphere inside the respirator is sampled continuously through a probe in the respiratory-inlet covering. The leakage is expressed as a percentage of the test atmosphere outside the respirator, called "percent of penetration," or simply "penetration." The greatest advantage of a quantitative test is that it indicates respirator fit numerically, and does not rely on a subjective response. The quantitative fit test is highly recommended when facepiece leakage must be minimized for work in highly toxic atmospheres or those immediately dangerous to life or health. (See Appendix D, Respirator Protection Factors.)

The quantitative tests require expensive (up to $10,000) equipment that can be operated only by highly trained personnel. Also, it is difficult to use because of its complexity and bulk. Each test respirator must be equipped with a sampling probe to allow continual removal of an air sample from the facepiece so the same facepiece cannot be worn in actual service, since the test orifice negates the approval of the respirator.

.. Sodium Chloride (NaCl) Test - In this test, a liquid aerosol is generated continuously from a salt water solution, dried to produce discrete submicron salt particles, and dispersed into a test chamber or hood. A means is provided for sampling the atmosphere in the chamber or hood and inside the respirator. These samples are fed to the analyzing section where the aerosol's penetration inside the respirator is determined. The amount of penetration is displayed on a meter or recorder.

.. Dioctyl Phthalate (DOP) Test - The dioctyl phthalate (DOP) quantitative fitting test. which uses an air-generated DOP serosol, differs from the NaCl test only in that the aerosol particle is liquid. The aerosol

is generated using a nozzle-type atomizer, but being an oil, DOP does not dry into solid particles when injected into a diluting air stream.

9. RESPIRATORY PROTECTIVE DEVICE INSPECTION, CLEANING, MAINTENANCE, AND STORAGE. Scrupulous respirator maintenance must be made an integral part of the overall respirator program. Wearing poorly maintained or malfunctioning respirators is, in one sense, more dangerous than not wearing a respirator at all. The employee wearing a defective device thinks he/she is protected when, in reality, he/she is not. Emergency escape and rescue devices are particularly vulnerable to poor maintenance as they generally are used infrequently, and then in the most hazardous and demanding circumstances. The possible consequences of a user wearing a defective emergency escape and rescue device are lethal.

A proper maintenance program ensures that the user's respirator remains as effective as when it was new. All programs are required to include as a minimum:

a. Inspection for defects (including a leak check),

b. Cleaning and disinfecting,

c. Repair,

d. Storage.

a. Inspection of Respiratory Protective Devices. An important part of a respirator maintenance program is the inspection of the devices. If performed carefully, inspections will identify damaged or malfunctioning respirators.

1) Inspection Schedules - All respiratory protective devices must be inspected:

- o Before and after each use; and
- o During cleani .g.

Equipment designated for emergency use must be inspected:

- o After each use;
- o During cleaning; and
- o At least monthly.

Self-contained breathing apparatus must be inspected:

- o At least monthly.

2) Recordkeeping - A record must be kept of inspection dates and findings for respirators maintained for emergency use.

3) Inspection Considerations - The primary defects to look for in the inspection of the components of the respirator are itemized below. Information within the parentheses are suggested actions to be taken.

o Disposable respirator

. Holes in the filter (obtain new disposable respirator);

. Straps for elasticity and deterioration (replace straps - contact manufacturer); and

. Metal nose clip for deterioration, if applicable (obtain new disposable respirator).

o Air-purifying respirators (quarter-mask, half-mask, full facepiece and gas mask)

. Rubber facepiece - check for:

.. Excessive dirt (clean all dirt from facepiece);

.. Cracks, tears, or holes (obtain new facepiece);

.. Distortion (allow facepiece to "sit" free from any constraints and see if distortion disappears; if not, obtain new facepiece); and

.. Cracked, scratched, or loose fitting lenses (contact respirator manufacturer to see if replacement is possible; otherwise obtain new facepiece).

. Headstraps - check for

.. Breaks or tears (replace headstraps);

.. Loss of elasticity (replace headstraps);

.. Broken or malfunctioning buckles or attachments (obtain new buckles); and

.. Excessively worn serrations on the head harness which might allow the facepiece to slip (replace headstrap).

. Inhalation valve, exhalation valve - check for:

.. Detergent residue, dust particles, or dirt on valve or valve seat (clean residue with soap and water);

.. Cracks, tears, or distortion in the valve material or valve seat (contact manufacturer for instructions); and

.. Missing or defective valve cover (obtain valve cover from manufacturer).

. Filter element(s) - check for:

.. Proper filter for the hazard;

.. Approval designation;

.. Missing or worn gaskets (contact manufacturer for replacement);

.. Worn threads - both filter threads and facepiece threads (replace filter or facepiece, whichever is applicable);

.. Cracks or dents in filter housing (replace filter);

.. Deterioration of gas mask cannister harness (replace harness); and

.. Service life indicator, or end of service date - for expiration, gas mask (contact manufacturer to find out if filter element has one; if not ask what will indicate the "end of service").

. Corrugated beathing tube (gas mask) - check for:

.. Cracks or holes (replace tube);

.. Missing or loose hose clamps (obtain new clamps); and

.. Broken or missing end connectors (obtain new connectors).

o Atmosphere Supplying Respirators

. Facepiece, headstraps, valves, and breathing tube - These items should be checked as for the air-purifying respirators.

. Hood, helmet, blouse, or full suit, if applicable - check for:

.. Rips and torn seams (if unable to repair the tear adequately, replace);

.. Headgear suspension (adjust properly for you);

.. Cracks or breaks in faceshield (replace faceshield); and

.. Protective screen to see that it is intact and fits correctly over the faceshield, abrasive blasting hoods, and blouses (obtain new screen).

. Air supply system - check for:

.. Breathing air quality;

.. Breaks or kinks in air supply hoses and end fitting attachments (replace hose and/or fitting);

.. Tightness of connections;

.. Proper setting of regulators and valves (consult manufacturer's recommendations); and

.. Correct operation of air-purifying elements and carbon monoxide or high temperature alarms.

o Self-contained breathing apparatus (SCBA) - (See Appendix E.)

b. Cleaning and Disinfecting. When respiratory protective devices are used routinely, the respirators should be cleaned and disinfected daily. If respirators are used only occasionally, periodic cleaning and disinfecting is appropriate.

1) Methods - The actual cleaning may be done in a variety of ways.

o The respiratory protective device should be washed with detergent in warm water using a brush, thoroughly rinsed in clean water, and then air dried in a clean place. Care should be taken to prevent damage from rough handling. This method is an accepted procedure for a small group or unit of employees where each employee cleans his/her own respirator.

o A standard domestic-type dish or clothes washer may be used if a rack is installed to hold the facepieces in a fixed position. (If the facepieces are placed loose in the washer they may be damaged.) This method is especially useful in a large unit or group and where respirator usage is extensive.

2) Detergents and disinfectants - If possible, detergents containing a bactericide should be used. Organic solvents should not be used, as they can deteriorate the rubber facepiece. If the above combination is not available, a detergent may be used, followed by a disinfecting rinse. Reliable disinfectants may be made from some available household solutions.

o Hypochlorite solution (50 parts per million (ppm) of chlorine) made by adding approximately two tablespoons of chlorine bleach per gallon of water. A two-minute immersion disinfects the respirators.

o Aqueous solution of iodine (50 ppm made by adding approximately one teaspoon of tincture of iodine per gallon of water). Again, a two-minute immersion is sufficient and will not damage the rubber and plastic in the respirator facepieces. Check with the manufacturer to find out the proper temperature for the solutions.

3) If the respirators are washed by hand, a separate disinfecting rinse may be provided. If a dish or clothes washing machine is used the disinfectant must be added to the rinse cycle, and the amount of water in the machine at that time will have to be measured to determine the correct amount of disinfectant to be added.

4) Rinsing - The cleaned and disinfected respirators should be rinsed thoroughly in clean water (120° F maximum) to remove all traces of detergent, cleaner and sanitizer, and disinfectant. This is very important to prevent dermatitis.

5) Drying - The respirators may be allowed to dry by themselves on a clean surface. They also may be hung from a horizontal wire, like drying clothes, but care must be taken not to damage the facepieces.

c. Maintenance. Continued usage of respiratory protective devices may require periodic repair or replacement of component parts of the equipment. Such repairs and parts replacement must be done by a qualified individual(s).

Replacement of parts and repair of air-purifying respirators, in most cases, present little problem. Most equipment manufacturers supply literature which details the component parts of their respirator and include servicing information. The manufacturer will also provide replacements parts. Replacement parts for respiratory protective devices must be those of the manufacturer of the equipment. Substitution of parts from a different brand or type of respirator will invalidate the approval of the respirator.

Defective air-supplying respiratory protective equipment, with the exception of the SCBA, can be repaired and worn if broken parts are replaced by a qualified individual - again with the aid of the manufacturer's literature and parts. Maintenance of SCBA equipment is more difficult, primarily because of the valve and regulator assembly. Because of this, regulations require that SCBA equipment be returned to the manufacturer for adjustment or repair.

d. Storage. All the care that has gone into cleaning and maintenance of a respirator can be negated by improper storage. Respiratory protective equipment must be stored to protect it from dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. Leaving a respirator unprotected can lead to damage of the working parts or permanent distortion of the facepiece, thus making it ineffective.

After cleaning and disinfecting the respirators, they should be placed individually in heat-sealed or resealable plastic bags until reissue. They should be stored in a single layer with the facepiece and exhalation valve in a more or less normal position to prevent the rubber or plastic from taking a permanent distorted "set".

1) Air-purifying respirators - Air purifying respirators kept ready for nonroutine or emergency use should be stored in a cabinet in individual compartments.

2) Air-supplying respiratory protective equipment - A storage chest for self-contained breathing apparatus may be purchased from the manufacturer. All storage cabinets should be located in noncontaminated, but readily accessible, areas.

10. MEDICAL ASPECTS OF RESPIRATORY EQUIPMENT USAGE. EPA Order 1440.3, Respiratory Protection, requires that employees assigned to tasks requiring the use of respiratory protective devices must have a medical evaluation, defined by the Agency's Occupational Medical Monitoring Guidelines. There must be a determination that employees are physically capable of performing the work while wearing the devices. These requirements are necessary because the use of any type of respirator may impose some physiological stress on the user. Air-purifying respirators, for example, make breathing more difficult because the filter or cartridge impedes the flow of air. The special exhalation valve on an open circuit pressure demand respirator requires the user to exhale against significant resistance. The bulk and weight of an SCBA can be a burden. If the employee is using an airline respirator, he/she might have to drag up to 300 feet of hose around. All of these factors can significantly increase the employee's workload.

So that the examining physician can give a qualified opinion regarding whether an employee can use a respirator, the Agency should provide the following information. (See Appendix F, Duty Status Report.)

a. Type of respiratory protection equipment to be used, and its modes of operation;

b. The tasks that the employee will perform while wearing the respirator;

c. Visual and audio requirements associated with the task;

d. Length of time that the employee will wear the respiratory protective equipment; and

e. The substance(s) to which the employee will be exposed, and the related toxicity data.

The following checklist will give the Respiratory Protection Program Manager a good indication of the employee's ability to wear a respirator.

a. Lung

___ History of asthma or emphysema.

___ Difficulty in breathing.

___ Previously documented lung problems.

b. Heart

___ High blood pressure.

___ Artery diseases.

___ Documented heart problems.

c. Other

___ Missing or arthritic fingers.

___ Facial scars.

___ Claustrophobia.

___ Poor eyesight.

___ Perforated ear drum(s).

A "yes" answer to any of these questions would constitute a warning sign regarding the use of respirators by an employee. A medical opinion to confirm any of these situations should then be obtained.

11. EVALUATION OF THE RESPIRATORY PROTECTION PROGRAM. Two important aspects of the respirator program are the periodic surveillance of the work areas which require use of respirators, and an evaluation of the program for effectiveness.

a. Surveillance of the Work Area. Many things can affect the need to use respirators. To determine the continued necessity of respiratory protection or c ed for additional protection, there should be appropriate surveillance of the work area conditions and the degree of employee exposure or stress to allow for program changes as needed.

b. Program Evaluation. The respirator program at each Agency unit should be evaluated at least annually, with program adjustments, as appropriate, made to reflect the evaluation results. The following are areas of the Respiratory Protection Program that should be evaluated.

1) Program Administration

o Program responsibility is vested in one individual who is knowledgeable and who can coordinate all aspects of the program.

o The implementation of engineering controls, if feasible, to alleviate the need for respirators is in progress.

o There are written procedures/statements covering these aspects of the respirator program.

. A Program Manager has been designated.

. Procedures for respirator selection are developed.

. The purchase of approved equipment is assured.

. The procedures for issuing respiratory equipment are in place.

. The medical aspects of respirator usage are defined and a program is in place.

. Employees are properly fitted for respiratory protective devices.

. Provisions for the maintenance, storage, and repair of respiratory protective equipment are being followed.

. There is a program for regular inspection of respiratory protective equipment, and

. The provisions for use of respiratory protective equipment under special conditions are defined.

2) Program Operation

o The selection of respiratory protective equipment consider these factors:

. The work area conditions and employee exposures.

. Respirators are selected on the basis of hazards to which the employee is exposed.

. The selection of respirators is made by knowledgeable individuals.

o Only approved respirators are purchased and used to provide adequate protection for specific hazards and concentrations of contaminants.

o Respirators are issued to users for their exclusive use, where practical, and records are maintained covering the issuance.

o The fitting of respiratory protective equipment taken into consideration these factors:

. Users are given the opportunity to try on several different brands of respirators to assure that the make of respirator they will be wearing is the best fitting one.

. Respiratory protective equipment is fit tested at appropriate intervals.

. Respiratory protective equipment users who require corrective lenses are properly fitted.

. Respiratory protective equipment users are prohibited from wearing contact lenses when using the respirator.

. Facepiece to face seal is tested in a test atmosphere.

o The maintenance of respiratory protective equipment covers these factors.

. Cleaning and Disinfecting -

.. Respirators are cleaned and disinfected after each use when different employees use the same device or as frequently as necessary for devices issued to individual users.

.. Proper methods of cleaning and disinfecting are utilized.

. Storage

.. Respirators are stored in a manner so as to protect them from dust, sunlight, heat, excessive cold or moisture, and damaging chemicals.

.. Respirators are stored properly to prevent them from deforming.

. Inspection

.. Respirators are inspected before and after each use and during cleaning.

.. Employees/users are instructed in inspection techniques.

.. Respiratory protective equipment designated for emergency use is inspected at least monthly (in addition to after each use).

.. Records are kept of the inspection of emergency use respiratory protective equipment.

. Repair

.. The replacement parts used for repairing respirators are those of the manufacturer of the respirator.

.. Repairs are made by knowledgeable individuals.

.. Repairs of SCBA's are made by certified personnel or by a manufacturer's representative.

. Special Use Conditions

.. Procedures are developed for the use of respiratory protective equipment in atmospheres immediately dangerous to life or health.

.. Procedures are developed for equipment usage for entry into confined spaces.

. Training

.. Employees are trained in proper usage of respiratory protective equipment.

.. Employees are trained in the basis for respirator selection.

REFERENCES

1. EPA Order 1440.3, Respiratory Protection, July 24, 1981.

2. Department of Labor, OSHA, Occupational Health and Safety Standards, 29 CFR Part 1910.134, General Respirator Requirements, Federal Register, Volume 37, Number 202, October 18, 1972.

3. Department of Labor, OSHA, Occupational Health and Safety Standards, 29 CFR 1910.94, 111, 252, 261, 262, 265, 266, 1001-1029, Specific Respirator Requirements, Federal Register, Volume 37, Number 202, October 18, 1972.

4. Department of the Interior, Bureau of Mines, Respiratory Protective Devices; Tests for Permissibility; Fees, 30 CFR Part 11, Federal Register, Volume 37, Number 59, March 25, 1972.

5. American National Standards Institute, Standard Z88.2-1969, Respirator Practices, ANSI, 1430 Broadway, New York, N. Y. 10018.

6. American National Standards Institute, Standard Z88.2-1980, Practices for Respiratory Protection, ANSI, 1430 Broadway, New York, N. Y. 10018.

7. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for 1973 (and current year), ACGIH, 1014 Broadway, Cincinnati, Ohio 45202.

NOTE: Information from these references is either used or referred to in this guideline. A copy of the complete text of the references is valuable in setting up and managing a respiratory protection program. It is recommended that copies of these references be obtained and filed with this guideline.

Respiratory Protective Device Recommendation

Name of Employee/User _____

Program Office _____ Telephone Number _____

Anticipated Hazards

1. Materials

   a. Chemical Name _____

   b. Trade Name _____

   c. Formula _____

   d. TLV o TWA _____ OSHA 1910.1000 _____ Other _____

2. Form of Materials

   a. Liquid? _____ b. Solid? _____ c. Gaseous? _____

   d. If gaseous, is it an organic vapor? _____ or acid gas? _____

      other? _____

3. Maximum expected concentration

   a. _____parts per million, or

   b. _____milligrams per cubic meter

4. Will material be heated? _____ If so, to what temperature? _____°F

5. What is the odor threshold of the material?_____

6. At what concentration is the material considered to be immediately dangerous to life or health? _____

7. Can the substance be absorbed through the skin? _____

8. Irritant to eyes? _____ respiratory tract? _____ skin? _____

9. At what concentration is it an irritant? _____

10. If the substance is known to be flammable, what are the lower and upper flammable limits, in per cent by volume? _____

11. What is the vapor pressure of the material? _____

12. Will the material be mixed with other chemicals? _____ If so, give details _____

_____

_____

_____

13. Any possibility of oxygen deficiency? _____

14. Can good ventilation of the area be maintained? _____

15. Will exposure be continuous?_____ or intermittent? _____

16. Will the respiratory device be used for routine exposures, or will it be used as an escape device? _____

_____

Respiratory Protective Device(s) Recommended: _____

_____

_____

Other Personal Protective Clothing or Equipment Recommended: _____

_____

_____

_____

_____ _____

Date Respiratory Protection Program Manager

MODEL

STANDARD OPERATING PROCEDURE
RESPIRATOR USE
HIGH HAZARD AREAS

1. Location: _____

2. Date of Preparation _____

3. Prepared by _____

4. Operation or Procedures where respirators are required _____

_____

_____

_____

5. Type(s) of respirator to be used _____

_____ _____

6. Other Protective clothing and equipment required:

Harness _____ Skin _____

Safety Lines _____ Head _____

Eye Protection _____ Other _____

Body _____ (full) _____ (partial)

7. Training required: _____

_____

_____

8. Provisions for Standby person: _____

9. Provisions for communication _____

10. Conditions under which respirator is to be used :

Oxygen deficient? _____

Type(s) of contaminants ? _____

Expected Concentrations? _____

Peak Concentrations? _____

11. Type and Frequency of Monitoring: _____

_____

12. Emergency Procedures (include type of respirator, protective clothing, cleanup procedures, etc.,

_____

_____

_____

_____

Comments _____

_____

_____

_____

NOTES TO INSTRUCTOR

EMPLOYEE TRAINING PROGRAM

A. Why is respiratory protective equipment required?

1. The Occupational Safety and Health Administration

OSHA has set maximum exposure standards for many airborne toxic materials and has set standards governing specific working environments to protect your health. A recent evaluation of your working environment revealed that:

Name work area
List substances
Describe activities
Describe chemical exposure

a. In work areas (****), atmospheric concentrations of substances (****) were found to be above acceptable limits.

b. Maintenance activities (****) during which you are exposed to (****) a high concentration for a short period of time, lead to excessive exposure.

Describe areas

c. Several areas (****) were found to be "oxygen deficient." (See Appendix II)

Name storage areas
Describe emergency situation which could exist in your plant

d. Hazardous substances are stored at (****) and if these substances spill, etc., an emergency condition will exist, or (****).

2. Status of Engineering Controls

Suggested phraseology

(****) Since the company recognizes that respiratory protection is not the accepted method for control of airborne hazards, we are taking steps to implement *engineering* control solutions.

Plan to have ...
Describe what controls are to be/being implemented
Discuss administrative controls (rotating work schedules, spreading work over two shifts, etc.)

a. We (****) installed the following engineering controls (****)

b. And the following administrative controls (****).

However, while the above steps are being implemented, respiratory protection will be required.

B. Respirator Selection and Procedure

Selection procedure of the proper equipment normally involves three steps: the *identification* of the hazard; the *evaluation* of the hazard; and finally the *selection* of the appropriate respiratory equipment based on the first two steps.

NOTES TO INSTRUCTOR

EMPLOYEE TRAINING PROGRAM

1. Identification of the Hazard

Before we get into the "specifics" about the respiratory protective equipment you will be wearing, a few statements about hazard identification.

Discuss only those contaminant atmospheres representing problems in your facility. See following discussion.

There are several kinds of hazardous atmospheres which may require the use of respirators. (****)

a. Gaseous Contaminants

Gases are the normal form of substances like carbon dioxide or hydrogen sulfide. These substances are solids or liquids only at very low temperatures or extremely high pressures. Carbon dioxide, for instance, is a gas at room temperature. But it also occurs as solid "dry ice" formed at low temperatures.

Vapors are exactly like gases except that they are formed by the evaporation of substances, such as acetone or trichlorethylene, which ordinarily occur as liquids.

b. Particulate Contaminants

Particulates are tiny particles, solid or liquid, generated by such processes as grinding, crushing, and mixing of a compound, either a solid or a liquid. There are three types of particulates.

Dusts are solid particles produced by such processes as grinding, crushing, and mixing of powder compounds. Examples are sand and plaster dust. By comparison to the following two types of particulates, dust particles are usually large.

Mists are tiny liquid droplets, usually formed whenever a liquid is sprayed, vigorously mixed, or otherwise agitated. Acid mists around diptanks used for metal cleaning, and oil mists near newspaper printing presses, are two examples.

Fumes are solid condensation particles of extremely small particle size. Fumes are found in the air near soldering, welding, and brazing operations, as well as near molten metal processes such as casting and galvanizing.

Two basic forms — gaseous and particulate — frequently occur together. Paint spraying operations, for example, produce both paint mist (particulate) and solvent vapors (gases).

A further discussion of ODA's can be found in Appendix II.

a. Oxygen Deficient Atmospheres (****). Oxygen deficient atmospheres (ODA) are most commonly found in confined spaces which have poor ventilation. Examples are silos, petrochemical tanks, degreasers, and the holds of ships.

NOTES TO INSTRUCTOR

EMPLOYEE TRAINING PROGRAM

After explaining to the employee the *type* of hazardous atmosphere (*a* and/or *b* and/or *c*) requiring respiratory protection, you should then discuss the hazard specifics. Check vendor literature, toxicologic references, or Material Safety Data Sheet (or contact OSHA or NIOSH regional offices).

2. Hazard Specifics (****)

a. Hazard Name
- Organic vapor (name)
- Particulate (name)
- Gas (name)

b. Toxicity Data (****)
- Effects

See Figure I.
Refer to Appendix I to describe the type instrument used (optional).
See Appendix V.

3. Evaluation of the Hazard (****)

a. To determine the concentration of the hazard, as identified above, measurements were made. (****) The concentration and/or work environment examined were compared with the published Federal Standards (****).

4. Selection of the Respirator

a. After it was determined that respirators were required, the Standards Completion Program (SCP) was consulted to find out the required respiratory protection equipment (****).

See Appendix IV.

C. Use and Proper Fitting of Respiratory Protective Equipment

1. Use of Respiratory Protective Equipment

Using Appendix VII and information supplied by the manufacturer, show the employee how to put on the selected respirator. Show the various components of the respirator, and how the respirator functions to remove the contaminants.

2. Proper Fitting

At this time, you should have available at least two different types (different manufacturers) of selected respiratory equipment — for the employee to try on.

So that respiratory protective devices, which use tight fitting facepieces, give maximum protection, there must be a proper "match" between the facepiece and your face. A poor face seal can cause contaminants to be inhaled through the respirator sealing surfaces, instead of through the canister, filter, or air supply system. (****)

a. In most cases, there are several different brands of the same type of respiratory protection equipment approved for use against a specific hazard or work environment. (****)

NOTES TO INSTRUCTOR

EMPLOYEE TRAINING PROGRAM

Refer to Appendix VIII for discussion of fitting tests. The qualitative fit tests can be used as a quick test to ascertain the proper fit. However, if respirator use will be in an extremely hazardous atmosphere, or for emergencies, the quantitative fit test should be used. Demonstrate how the qualitative fit test works. Show illustration of a quantitative test set-up (if there is not an actual set-up on the premises).

b. However, just because a respirator "feels comfortable" it does not mean that it is protecting you to the fullest extent from the hazard. The key word is *proper* fit. To determine if the fit is proper, several tests can be used. (****)

Consult Appendix VII and the specific respiratory protective equipment — under Limitations.

D. Limitations of Respiratory Equipment (****)

However, the respiratory protective equipment that you will use does have some limitations on its usage.

E. Maintenance and Storage of Respiratory Equipment

To maintain the proper functioning of respirators requires that they be regularly cleaned and disinfected, and stored in a convenient and clear location.

Refer to Section VII(A) for details concerning cleaning of equipment. Several suggested cleaning methods are given. Discuss provisions.

1. Cleaning (****)

Your respiratory protective equipment should be cleaned daily after use. The company has made provisions for doing this. (****)

Refer to Section VII(B) and discuss storage provisions by company.

2. Storage (****)

Equipment must be stored properly at the conclusion of the work shift.

Refer to Section VIII for discussion on inspection for defects.

3. Inspection for Defects (****)

This is one of the most important functions associated with respirator usage. These inspections can identify damage to malfunctioning respiratory protective equipment.

NOTES TO INSTRUCTOR

Before you discuss this section with the user, you should first prepare the summary — as it applies to your usage.

EMPLOYEE TRAINING PROGRAM

F. Summary(****)

A summary of those aspects of the proper use of respiratory protective equipment. Reasons for Respiratory Protective Equipment.

1. *Respirator Selection Procedure*
   a. Identification of hazard.
   b. Hazard specifics.
   c. Evaluation of the hazard.
   d. . election of the respirator.

2. *Proper Fitting and Usage*

   a. Use.
   b. Fitting.

3. *Limitations*

4. *Maintenance and Storage*

RESPIRATOR PROTECTION FACTORS[1]

Type Respirator	Facepiece[2] Pressure	Protection Factor
I. Air-Purifying		
A. Particulate[3] removing		
Single-use,[4] dust[5]	–	5
Quarter-mask, dust[6]	–	5
Half-mask, dust[6]	–	10
Half- or Quarter-mask, fume[7]	–	10
Half- or Quarter-mask, High-Efficiency[8]	–	10
Full Facepiece, High-Efficiency	–	50
Powered, High-Efficiency, all enclosures	+	1000
Powered, dust or fume, all enclosures	+	X[9]
B. Gas and Vapor-Removing[10]		
Half-Mask	–	10
Full Facepiece	–	50
II. Atmosphere-Supplying		
A. Supplied-Air		
Demand, Half-mask	–	10
Demand, Full Facepiece	–	50
Hose Mask Without Blower, Full Facepiece	–	50
Pressure-Demand, Half-Mask[11]	+	1000
Pressure-Demand, Full Facepiece[12]	+	2000
Hose Mask With Blower, Full Facepiece	–	50
Continuous Flow, Half-Mask[11]	+	1000
Continuous Flow, Full Facepiece[12]	+	2000
Continuous Flow, Hood, Helmet, or Suit[13]	+	2000
B. Self-Contained Breathing Apparatus (SCBA)		
Open-Circuit, Demand, Full Facepiece	–	50
Open-Circuit, Pressure-demand Full Facepiece	+	10,000[14]
Closed-Circuit, Oxygen Tank-type, Full Facepiece	–	50
III. Combination Respirator		
A. Any combination of air-purifying and atmosphere-supplying respirator.	Use minimum protection factor listed above for type of mode of operation.	
B. Any combination of supplied-air respirator and an SCBA		

Exception: Combination supplied-air respirators, in pressure-demand or other positive pressure mode, with an auxiliary self-contained air supply, and a full facepiece, should use the PF for pressure-demand SCBA.

NOTE: Reference "A Guide to Industrial Respiratory Protection", NIOSH, June 1976

[1]The overall protection afforded by a given respirator design (and mode of operation) may be defined in terms of its protection factor (PF). The PF is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of contaminant in the ambient atmosphere to that inside the enclosure (usually inside the facepiece) under conditions of use. Respirators should be selected so that the concentration inhaled by the wearer will not exceed the appropriate limit. The recommended respirator PF's are selection and use guides, and should only be used when the employer has established a minimal acceptable respirator program as defined in Section 3 of the ANSI Z88.2-1969 Standard.

[2]In addition to facepieces, this includes any type of enclosure or covering of the wearer's breathing zone, such as supplied-air hoods helmets, or suits.

[3]Includes dusts, mists, and fumes only. Does not apply when gases or vapors are absorbed on particulates and may be volatilized or for particulates volatile at room temperature. Example: Coke oven emissions.

[4]Any single-use dust respirator (with or without valve) not specifically tested against a specified contaminant.

[5]Single-use dust respirators have been tested against asbestos and coal dust and could be assigned a PF of 10 for these particulates.

[6]Dust filter refers to a dust respirator approved by the silica dust test, and includes all types of media, that is, both nondegradable mechanical type media and degradable resin-impregnated wool felt or combination wool-synthetic felt media.

[7]Fume filter refers to a fume respirator approved by the lead fume test. All types of media are included.

[8]High-efficiency filter refers to a high-efficiency particulate respirator. The filter must be at least 99.97% efficient against 0.3 μm DOP to be approved.

[9]To be assigned, based on dust or fume filter efficiency for specific contaminant.

[10]For gases and vapors, a PF should only be assigned when published test data indicate the cartridge or canister has adequate sorbent efficiency and service life for a specific gas or vapor. In addition, the PF should not be applied in gas or vapor concentrations that are: 1) immediately dangerous to life, 2) above the lower explosive limit, and 3) cause eye irritation when using a half-mask.

[11]A positive pressure supplied-air respirator equipped with a half-mask facepiece may not be as stable on the face as a full facepiece. Therefore, the PF recommended is half that for a similar device equipped with a full facepiece.

[12]A positive pressure supplied-air respirator equipped with a full facepiece provides eye protection but is not approved for use in atmospheres immediately dangerous to life. It is recognized that the facepiece leakage, when a positive pressure is maintained, should be the same as an SCBA operated in the positive pressure mode. However, to emphasize that it basically is not for emergency use, the PF is limited to 2,000.

[13]The design of the supplied-air hood, suit, or helmet (with a minimum of 6 cfm of air) may determine its overall efficiency and protection. For example, when working with the arms over the head, some hoods draw the contaminant into the hood breathing zone. This may be overcome by wearing a short hood under a coat or overalls. Other limitations specified by the approval agency must be considered before using in certain types of atmospheres.

[14]The SCBA operated in the positive pressure mode has been tested on a selected 31-man panel and the facepiece leakage recorded as less than 0.01% penetration. Therefore, a PF of 10,000+ is recommended. At this time, the lower limit of detection 0.01% does not warrant listing a higher number. A positive pressure SCBA for an unknown concentration is recommended. This is consistent with the 10,000+ that is listed. It is essential to have an emergency device for use in unknown concentrations. A combination supplied-air respirator in pressure-demand or other positive pressure mode, with auxiliary self-contained air supply is also recommended for use in unknown concentrations of contaminants immediately dangerous to life. Other limitations, such as skin absorption of HCN or tritium, must be considered.

CHECKLIST FOR INSPECTION OF PRESSURE DEMAND SELF-CONTAINED BREATHING APPARATUS WITHOUT MODE SELECT LEVER:

PRIOR TO BEGINNING INSPECTION:

1. *Check to assure that high pressure hose connector is tight on cylinder fitting*
2. *Bypass valve closed*
3. *Mainline valve closed*
4. *No cover or obstruction on regulator outlet*

I. BACK PACK & HARNESS ASSEMBLY

A. Straps

1. *Visually inspect for complete set*
2. *Visually inspect for frayed or damaged straps that may break during use*

B. Buckles

1. *Visually inspect for mating ends*
2. *Check locking function*

C. Backplate & Cylinder Lock

1. *Visually inspect backplate for cracks and for missing rivets or screws.*
2. *Visually inspect cylinder hold down strap and physically check strap tightener and lock to assure that it is fully engaged*

II. CYLINDER & CYLINDER VALVE ASSEMBLY

A. Cylinder

1. *Physically check cylinder to assure that it is tightly fastened to back plate*

(M) 2. *Check Hydrostatic Test Date to assure it is current*

(M) 3. *Visually inspect cylinder for large dents or gouges inmetal*

B. Head & Valve Assembly

(M) 1. *Visually inspect cylinder valve lock for presence*

(M) 2. *Visually inspect cylinder gauge for condition of face, needle, and lens*

3. *Open cylinder valve and listen or feel for leakage aroung packing. (If leakage is noted, do not use until repaired.) Note function of valve lock*

III. REGULATOR & HIGH PRESSURE HOSE

A. High Pressure Hose & Connector

1. Listen or feel for leakage in hose or at hose to cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.

B. Regulator & Low Pressure Alarm

1. Cover outlet of regulator with palm of hand. Open mainline valve and read regulator gauge (must read at least 1800 PSI and not more than rated cylinder pressure)

2. Close cylinder valve and slowly move hand from regulator outlet to allow slow flow of air. Gauge should begin to show immediate loss of pressure as air flows. Low pressure alarm should sound between 650 and 550 PSI. Remove hand completely from outlet and close mainline valve.

3. Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5-10 seconds without any loss of air. Next suck a slight negative on regulator and hold for 5-10 seconds. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus.

4. Open cylinder valve.

5. Place hand over regulator outlet and open mainline valve. Remove hand from outlet and replace in rapid movement. Repeat twice. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Close mainline valve and remove hand from outlet.

6. Ascertain that no obstruction is in or over the regulator outlet. Open and close bypass valve momentarily to assure flow of air through bypass system.

IV. FACEPIECE & CORRUGATED BREATHING TUBE

A. Facepiece

1. Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

2. Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, and cracks or large scratches.

3. Visually inspect exhalation valve for visible deterioration or foreign materials build-up.

B. Breathing Tube & Connector

1. Stretch breathing tube and visually inspect for deterioration and holes.

2. Visually inspect connector to assure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.

NOTE: Final test of facepiece would involve a negative pressure test for overall seal and check of exhalation valve. If monthly inspection, mask may now be placed against face and following tests performed. If preparing for use, don backpack, then don facepiece and use following procedure.

C. Negative Pressure Test on Facepiece

1. With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5-10 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

V. STORAGE OF UNITS

1. Cylinder refilled as necessary and unit cleaned and inspected.

2. Cylinder valve closed.

3. High pressure hose connector tight on cylinder

4. Pressure bled off of high pressure hose and regulator

5. Bypass valve closed.

6. Mainline valve closed

7. All straps completely loosened and laid straight.

8. Facepiece properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals.

ITEMS MARKED (M) would be done only on monthly inspection.

NOTE: Any discrepance found should be cause to set unit aside until repair can ce done by certified repair-person.

INSPECTION AND MAINTENANCE CHECK LISTS

Self-Contained Breathing Apparatus Serial Number _____

Issued to _____ Date of Issue _____

Location _____

WEEKLY INSPECTION

DATE INSPECTED	CYLINDER OK	CYLINDER CHANGED	DATE INSPECTED	CYLINDER OK	CYLINDER CHANGED	DATE INSPECTED	CYLINDER OK	CYLINDER CHANGED	DATE INSPECTED	CYLINDER OK	CYLINDER CHANGED

MONTHLY INSPECTION

DATE INSPECTED	CYLINDER OK	CYLINDER CHANGED	REGULATOR OK	FACEPIECE & BREATHING TUBE OK	CLEANED AND SANITIZED	ENTIRE APPARATUS OK	REMARKS	INSPECTED BY

INSPECTION AFTER EACH USE

DATE USED	CYLINDER OK	CYLINDER CHANGED	FACEPIECE & BREATHING TUBE OK	ENTIRE APPARATUS OK	CLEANED AND SANITIZED	CONNECTIONS OK	REMARKS	INSPECTED BY	DAT INSPE

MODEL
DUTY STATUS REPORT

1. Employee's Name _____

2. Work Location _____

3. Occupation _____

4. Date _____

5. Use of Respiratory Protective Devices

   a. Type of Respirator _____

   b. Mode of Operation _____

   c. Tasks Employee will perform _____

   _____

   d. Visual requirements _____

   e. Audio requirements _____

   f. How long employee is expected to wear the device _____

   _____

   g. What substance(s) will employee be exposed to (include toxicity data _____

   _____

   _____

_____
Signature of Supervisor

Medical Surveillance

At this examination on _____ no contraindications to the use of the equipment described above have been identified.

_____
Physician's Signature