# NFPA 1404
# Standard for a Fire Department Self-Contained Breathing Apparatus Program

## 1996 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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**NFPA 1404**

**Standard for a**

# Fire Department Self-Contained Breathing Apparatus Program

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This edition of NFPA 1404, *Standard for a Fire Department Self-Contained Breathing Apparatus Program*, was prepared by the Technical Committee on Fire Service Training and acted on by the National Fire Protection Association, Inc., at its Fall Meeting held November 13-15, 1995, in Chicago, IL. It was issued by the Standards Council on January 12, 1996, with an effective date of February 2, 1996, and supersedes all previous editions.

This edition of NFPA 1404 was approved as an American National Standard on February 2, 1996.

## Origin and Development of NFPA 1404

The first edition NFPA 1404, *Standard for a Fire Department Self-Contained Breathing Apparatus Program*, was developed in response to a perceived need and was published in 1989. The Technical Committee on Fire Service Training recognized that there were no standards on a fire department program for self-contained breathing apparatus and that the lack of guidance in areas such as training, maintenance, and SCBA program evaluation could cause serious problems for the fire service. It is the hope of the technical committee that the void has been filled in a practical and reasonable manner.

This 1996 edition of NFPA 1404 is the result of efforts by the technical committee to update and provide a more user friendly document.

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*This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in membership may have occurred. A key to classifications is found at the back of this document.*

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

**Committee Scope:** This Committee shall have primary responsibility for documents on all fire service training techniques, operations, and procedures to develop maximum efficiency and proper utilization of available personnel. Such activities can include training guides for fire prevention, fire suppression, and other missions for which the fire service has responsibility.

## Contents

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# Fire Department Self-Contained Breathing Apparatus Program

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 9 and Appedix G.

## Chapter 1 Introduction

**1-1 Scope.** This standard contains minimum requirements for a fire service respiratory protection program. These requirements are applicable to organizations providing fire suppression, fire training, rescue and respiratory protection equipment training, and other emergency services including public, military, and private fire departments and fire brigades.

**1-2* Purpose.** The purpose of this standard is to specify the minimum requirements of a respiratory protection program for an emergency response organization. These include safety procedures for those involved in fire suppression, rescue, and related activities in a toxic or contaminated environment.

**1-2.1** Many of the performance objectives of this standard can be achieved in a variety of ways. The achievement of these objectives is intended to help prevent accidents, injuries, and exposure to harmful environments. They also can help to develop an awareness of the critical importance of a respiratory protection program to the health and welfare of personnel who work in hazardous atmospheres.

**1-2.2** Nothing herein is intended to restrict any authority having jurisdiction from exceeding these minimum requirements.

**1-3* Philosophy.** The use of self-contained breathing apparatus (SCBA) by fire fighters is always assumed to be in an atmosphere immediately dangerous to life or health (IDLH) because there is no way to predetermine those hazardous conditions, concentrations of toxic materials, or percentages of oxygen in air that exist in a fire environment, during overhaul (salvage) operations, or under other emergency conditions involving spills or releases of chemicals or other toxic materials. Thus, SCBA shall be required at all times during any firefighting or overhaul operations inside, and frequently outside, a structure.

**1-4 Definitions.** Unless expressly stated elsewhere, the following terms shall, for the purposes of this standard, be defined as follows:

**ANSI.** American National Standards Institute.

**Approved.*** Acceptable to the authority having jurisdiction.

**Authority Having Jurisdiction.*** The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

**Closed-Circuit SCBA.** A recirculation-type SCBA in which the exhaled gas is rebreathed by the wearer after the carbon dioxide has been removed from the exhalation and after the oxygen content within the system has been restored from sources such as compressed breathing gas, chemical oxygen, and liquid oxygen.

**Compressed Breathing Gas.** A mixture of oxygen or air stored in a compressed state and supplied to the user in gaseous form. Compressed breathing gas shall meet at least the requirements of the specification for Type I, Grade D breathing air, and liquid air shall meet at least the requirements for Type II, Grade B breathing air as described in CGA G7.1, *Commodity Specification for Air.*

**Confined Space.** A space that is large enough and so configured that a person can bodily enter and perform assigned work; has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits); and is not designed for continuous occupancy by humans.

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

**Controlled Breathing.** The ability to maintain a breathing rate that is near normal for the activities being performed while wearing a SCBA.

**Corrective Lens.** A lens designed to fit the specifications of the wearer's individual corrective prescription.

**Exhalation Valve.** A device that allows exhaled air to leave a facepiece and prevents outside air from entering through the valve.

**Eyepiece.** A gastight, transparent window(s) or lens(es) in a full facepiece through which the wearer can see.

**Facepiece.** The component of a respirator that covers the wearer's nose, mouth, and eyes. It is designed to make a gastight or particle-tight fit with the face and includes the headbands, exhalation valves, and other necessary components required to connect it to a respirable gas source.

**Fire Apparatus.** A fire department emergency vehicle used for fire suppression, rescue, or other specialized functions.

**Fire Department.** An organization providing rescue, fire suppression, and related services. For the purposes of this standard, the term "fire department" shall include any public, private, or military organization engaging in this type of activity.

**Fire Service.** Service groups (career or volunteer) that are organized and trained for the prevention and control of loss of life and property from any fire or disaster.

**Gas.** An aeriform fluid that is in the gaseous state at ordinary temperature and pressure.

**Hazardous Atmosphere.** Any atmosphere that is oxygen deficient or that contains a toxic or disease-producing contaminant. A hazardous atmosphere might or might not be immediately dangerous to life and health.

**Head Harness.** A device for holding the facepiece securely in place on the wearer's head.

**Immediately Dangerous to Life or Health (IDLH).** Posing an immediate hazard to life or producing immediate irreversible effects on health that can be debilitating.

**Inhalation Valve.** A device that allows respirable air or oxygen to enter the facepiece and prevents exhaled air or oxygen from leaving the facepiece through the intake opening.

**Irrespirable.** Unfit for breathing.

**Labeled.** Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Lens.** See Eyepiece.

**Listed.*** Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

**Maintenance.** Any work, program, or system for keeping the authority having jurisdiction's respiratory devices in a usable condition.

**Member.** A person involved in performing the duties and responsibilities of a fire department under the auspices of the organization. For the purposes of this standard, a fire department member can be a full-time or part-time employee, can be a paid or unpaid volunteer, can occupy any position or rank within the fire department, and might or might not engage in emergency operations.

**MSHA.** Mine Safety and Health Administration of the U.S. Department of Labor.

**Negative-Pressure Apparatus.** An open-circuit or closed-circuit apparatus in which the pressure inside the facepiece, in relation to the immediate environment, is positive during exhalation and negative during inhalation.

**NIOSH.** National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services.

**NIOSH/MSHA Approved.** Tested and certified jointly by the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services and the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor, in accordance with the requirements of Title 30, *Code of Federal Regulations*, Part 11, Subpart H. Approval by the Bureau of Mines of the U.S. Department of Interior shall not fall under the definition of Approved. For the approval to remain in effect, the SCBA shall be used and maintained in the approved condition.

**Open-Circuit SCBA.** A SCBA in which exhalation is vented to the atmosphere and not rebreathed. There are two types of open-circuit SCBA:

(a) *Demand Type (Negative Pressure).* A SCBA in which the pressure inside the facepiece, in relation to the immediate environment, is negative during any part of the inhalation or exhalation cycle when tested in accordance with Title 30, *Code of Federal Regulations*, Part 11, Subpart H, by NIOSH and using NIOSH test equipment.

(b) *Pressure Demand Type (Positive Pressure).* A SCBA in which the pressure inside the facepiece, in relation to the immediate environment, is positive during both inhalation and exhalation when tested in accordance with Title 30, *Code of Federal Regulations*, Part 11, Subpart H, by NIOSH and using NIOSH test equipment.

**OSHA.** Occupational Safety and Health Administration, U.S. Department of Labor.

**Overhaul.** The final stages of fire control, following suppression of the main body of fire, during which smoke conditions and visibility gradually improve and pockets of fire are sought out to complete extinguishment, the search for victims continues, and salvage operations can be carried out. In situations other than fire, this is the cleanup stage following the elimination of the emergency phase of the incident.

**Oxygen-Deficient Atmosphere.** Oxygen concentrations less than 19.5 percent.

**Point of No Return.** The point at which the remaining operation time of breathing apparatus equals the time necessary to return safely to a nonhazardous atmosphere.

**Positive-Pressure Apparatus.** An open-circuit or closed-circuit apparatus in which the pressure inside the facepiece, in relation to the immediate environment, is positive during both inhalation and exhalation.

**Pressure-Demand Apparatus.** See Positive-Pressure Apparatus.

**Qualitative SCBA Fitting Test.** A fit test during which a person wearing a SCBA is exposed to an irritant smoke, an odorous vapor, or other suitable test agent. If the SCBA wearer is unable to detect penetration of the test agent into the facepiece, the wearer has achieved a satisfactory fit.

**Quantitative SCBA Fitting Test.** A fit test during which a person wears a SCBA in a test atmosphere that contains a test agent in the form of an aerosol, a vapor, or a gas. Instrumentation that samples the test atmosphere and the air inside the facepiece of the SCBA is used to measure quantitatively the penetration of the test agent into the facepiece.

**Respiratory Hazard.** Any exposure to products of combustion, superheated atmospheres, toxic gases, vapors, or dust, or potentially explosive or oxygen-deficient atmospheres, or any condition that creates a hazard to the respiratory system.

**Respiratory Protection Equipment (RPE).** Devices that are designed to protect the respiratory system against exposure to gases, vapors, or particulates. Examples are filter respirators, chemical cartridge or canister respirators, air-line respirators, powered air-purifying respirators, and self-contained breathing apparatus.

**Respiratory Protection Program.** A systematic and comprehensive program of training in the use and maintenance of respiratory protection devices and related equipment.

**Sanitization.** The removal of dirt and the inhibiting of the action of agents that cause infection or disease.

**SCBA.** See Self-Contained Breathing Apparatus.

**Self-Contained Breathing Apparatus (SCBA).** A respirator worn by the user that supplies a respirable atmosphere, that is either carried in or generated by the apparatus, and that is independent of the ambient environment.

**Shall.** Indicates a mandatory requirement.

**Should.** Indicates a recommendation or that which is advised but not required.

**Smoke.** The products of incomplete combustion or organic substances in the form of solid and liquid particles and gaseous products in air.

**Speaking Diaphragm.** A device integral with the facepiece that is designed to improve direct voice communication.

**Standard Operating Procedures.** Written instructions that document and define the manner in which activities shall be conducted.

**1-5 Coordinated Administrative Policies.**

**1-5.1** The authority having jurisdiction shall adopt and maintain a respiratory protection program that meets the requirements of Section 5-3 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

**1-5.2*** The authority having jurisdiction shall establish and enforce written standard operating procedures for the use of respiratory protection equipment. Utilization policies shall include the following:

(a) When respiratory protection equipment is to be used;

(b) When to exit due to reduced air supply;

(c) Procedures for insuring proper facepiece fit;

(d) The cleaning of respiratory protection equipment components.

**1-5.3** The authority having jurisdiction shall provide respiratory protection equipment for each member at the scene of an incident who might be exposed to respiratory hazards.

**1-5.4** The authority having jurisdiction shall conduct an ongoing respiratory protection training program that meets the requirements of this standard.

**1-5.5** The respiratory protection training program shall be conducted according to written standard operating procedures.

**1-5.6*** The authority having jurisdiction shall establish written training policies for a respiratory protection program. Training policies shall include, but shall not be limited to:

(a) Identification of the various types of respiratory protection equipment.

(b) Responsibilities of members to obtain and maintain proper facepiece fit.

(c) Responsibilities of members for proper cleaning and maintenance.

(d) *Identification of the factors that affect the duration of the air supply.

(e) *Determination of the point of no return for each member.

(f) Responsibilities of members for using respiratory protection equipment in a hazardous atmosphere.

**1-5.7** The authority having jurisdiction shall establish written standard operating procedures for inspection, maintenance, repair, and testing of respiratory protection equipment in accordance with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and the manufacturer's recommendations.

**1-5.8** The SCBA shall be cleaned and sanitized after each use in accordance with the standard operating procedures of the authority having jurisdiction.

*Exception: Where impracticable under tactical conditions.*

**1-5.9** All SCBA shall be inspected, maintained, and tested in accordance with the standard operating procedures of the authority having jurisdiction.

## Chapter 2 Provisions of SCBA

**2-1 Inventory and Allocation of SCBA.**

**2-1.1*** Sufficient SCBA shall be available at the incident to provide one unit for each member who might be exposed to respiratory hazards.

**2-1.2*** Sufficient reserve SCBA shall be provided to maintain the required number in service when maintenance or repairs are being conducted.

**2-1.3** An adequate reserve air supply shall be provided by use of reserve cylinders or by an on-scene refill capability, or both.

**2-1.4** Where carried on apparatus, SCBA shall be secured in brackets or carrying cases and shall be stored in a manner that protects the regulator openings and facepiece from contamination by road dirt, dust, or weather conditions.

**2-1.5** All SCBA shall be stored in a ready-for-use condition and shall be protected from damage or exposure to rough handling, excessive heat or cold, moisture, or other elements.

**2-2 NIOSH/MSHA Certification.**

**2-2.1*** SCBA of the open-circuit design shall be positive-pressure apparatus and shall meet the requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters.* Closed-circuit-type SCBA shall be approved by NIOSH/MSHA with a minimum service duration of 30 minutes and shall operate in the positive-pressure mode only. The use of rescue or "buddy" breathing devices shall be prohibited.

**2-2.2** The authority having jurisdiction shall maintain a complete inventory record of all SCBA. Each SCBA and cylinder shall be identified individually by serial number or inventory number.

**2-2.3*** An individual record of each SCBA regulator and harness assembly shall be maintained. This record shall include the inventory or serial number, date of purchase, date of manufacture, date placed in service, location, maintenance and repairs, replacement parts, upgrading, and test performance.

**2-2.4*** A record shall be maintained for each SCBA cylinder. This record shall include the inventory or serial number, date of purchase, date of manufacture, date placed in service, location, hydrostatic test pressure and dates, and inspection and repairs. Hydrostatic test dates shall appear on each cylinder according to the manufacturer's instructions and applicable government agencies.

**2-2.5** A record shall be maintained for each SCBA facepiece. This record shall include the inventory or serial number, date of purchase, location, maintenance and repairs, replacement parts, upgrading, and test performance.

**2-3 Acceptance Testing Program.**

**2-3.1** Respiratory protection equipment shall be selected according to the hazards to which a member might be exposed and to the operations expected to be performed.

**2-3.2*** Prior to being placed in service, all SCBA that are acquired shall be inspected and tested by factory certified personnel. Documentation of testing shall be provided to the fire department and included with the records specified in 2-2.3. Testing shall include the following:

(a) All major components shall be inspected for compatibility, completeness of assembly, and signs of damage.

(b) All components shall be tested for proper function and performance. Testing shall include manipulation of all adjustable components such as slides, buckles, control valves, and levers. Furthermore, the facepiece, regulator mechanism, alarm, and cylinder valve shall be tested on the manufacturer's test equipment for compliance with specifications.

## Chapter 3 Emergency Scene Use

**3-1 Criteria for Use.**

**3-1.1** The authority having jurisdiction shall require the use of respiratory protection by all members who might be exposed to respiratory hazards in the performance of their duties.

**3-1.2*** Respiratory protection shall be used by all members who are exposed to respiratory hazards or who might be exposed to such hazards without warning. Members who are operating in areas that might be subject to these hazards where there is sufficient warning to don respiratory protection equipment shall have respiratory protection equipment readily available for use.

**3-1.3*** Respiratory protection equipment shall be used by all members operating in confined spaces, below ground level, or where the possibility of a contaminated or oxygen-deficient atmosphere exists until, or unless, it can be established by monitoring and continuous sampling that the atmosphere is not contaminated or oxygen deficient.

**3-1.4** Where used, respiratory protection equipment shall be worn according to the manufacturer's requirements.

**3-1.5*** Members shall be monitored for indications of fatigue or other factors that can result in unsafe conditions.

**3-1.6** Members using a SCBA shall operate in teams of two or more who shall be able to communicate with each other through visual, audible, physical, safety guide rope, electronic, or other means to coordinate their activities and who shall be in close proximity to each other to provide assistance in case of an emergency.

**3-1.7*** Where members are involved in operations that require the use of a SCBA or other respiratory protective equipment, at least one member shall be assigned to remain outside the area where respiratory protection is required. This member shall be responsible for maintaining a constant awareness of the number and identity of members using a SCBA, their location and function, and their time of entry. Members with a SCBA shall be available for rescue.

**3-1.8** Unapproved devices, or approved devices that have been modified in a manner that voids their approval, shall not be used.

## Chapter 4 SCBA Training

**4-1 Recruit Training Program.**

**4-1.1*** All training related to the use, maintenance, and care of respiratory protection equipment shall be provided by instructors meeting the objectives of Instructor I of NFPA 1041, *Standard for Fire Service Instructor Professional Qualifications,* or instructors that have been trained and certified by a SCBA manufacturer or authorized distributor.

**4-1.2*** Records of all respiratory protection training shall be maintained, including training of personnel involved in maintenance of such equipment.

**4-1.3*** Minimum performance standards shall be established by the authority having jurisdiction for donning respiratory protection equipment.

**4-2 Annual Member Certification.**

**4-2.1** Prior to initial training, members shall be examined and certified by a physician as being medically and physically fit in accordance with Chapter 2 of NFPA 1001, *Standard for Fire Fighter Professional Qualifications.*

**4-2.2*** If the physician certifying members for respiratory protection equipment use is other than the fire department physician, the examination report shall be subject to the approval of the fire department physician.

**4-2.3** All members who might be required to use respiratory protection equipment shall be medically certified by a physician on an annual basis in accordance with 8-1.3 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

**4-2.4*** The facepiece seal capability of SCBA for each member qualified to use a SCBA shall be verified by qualitative fit testing on an annual basis and any time that new types of SCBA are issued. Each new member shall be tested before being permitted to use a SCBA in a hazardous atmosphere. Only members with a properly fitting facepiece shall be permitted by the fire department to function in a hazardous atmosphere with a SCBA.

**4-2.4.1* Qualitative Tests.** Members shall not be assigned fire-fighting duties requiring the use of a SCBA unless it has been demonstrated through the fitting test methods of 4-2.4 that they can achieve a satisfactory facepiece-to-face seal with each type of facepiece they might be required to wear. These tests shall be made at least annually. Furthermore, each member shall pass the negative-pressure test each time a negative-pressure SCBA is donned for entry into a hazardous atmosphere.

**4-2.4.2* SCBA Facepiece Fitting Test Records.** Records of SCBA fitting tests shall include at least the following information:

(a) Name of the member tested;

(b) Type of fitting test performed;

(c) Specific make and model of facepieces tested;

(d) Results of the tests:

1. Satisfactory
2. Unsatisfactory.

For departments that perform quantitative fitting tests, the protection factor producedshall be at least 1000 for negative-pressure SCBA (facepiece leakage shall be 0.1 percent penetration or less).

**4-2.5** Beards or facial hair that interferes with the facepiece seal shall be prohibited for members required to use respiratory protection equipment. If eyeglasses are worn, the member shall use frames that do not pass through the seal area of the facepiece.

**4-2.6*** Members required to wear respiratory protection equipment in conjunction with specialized protection equipment (e.g., proximity suits or totally encapsulated suits) shall be evaluated for physical and emotional stresses associated with these specialized applications.

**4-2.7** The authority having jurisdiction shall be responsible for establishing a program that provides members with training in the proper and safe use and the limitations of respiratory protection equipment and related equipment; in the policies and procedures related to the authority having jurisdiction's respiratory protection program; and in those areas outlined by this standard.

The program also shall provide a means of evaluating member performance in the use of respiratory protection equipment and member knowledge of the respiratory equipment used. Respiratory protection training shall be conducted as an ongoing training program.

**4-2.8** All members who are permitted to use a SCBA shall, at least annually, successfully demonstrate their ability to meet the performance standards set by the authority having jurisdiction.

**4-2.9** All members shall meet the training and performance requirements of this standard prior to the actual emergency operations during which they might be expected to wear respiratory protection equipment.

**4-3 SCBA Safety.**

**4-3.1** The authority having jurisdiction shall provide members with the most current information available concerning the safe operation of their respiratory protection equipment.

**4-3.2** Standard operating procedures shall be written concerning the safe operation of respiratory protection equipment during training and while in use on the emergency scene.

**4-3.3** The SCBA training program shall provide members with training in the safe operation of a SCBA, the uses and limitations of SCBA equipment, and the individual limitations of members who might be required to use a SCBA.

**4-3.4** Members shall demonstrate proper knowledge of safety procedures and practices through an evaluation process that is established by the authority having jurisdiction.

**4-3.5** Instruction on the common reasons for the breakdown of safety procedures or equipment that might cause injuries shall include the following subjects:

(a) Abuse and misuse of equipment;

(b) Physiological and psychological factors (*see Appendix E*);

(c) Unapproved equipment;

(d) Buddy breathing (*see Appendix F*);

(e) Information supplied to agencies that collect accident information, where available.

**4-4 Ability to Act Properly in Emergencies.**

**4-4.1*** The authority having jurisdiction shall provide a means for evaluating its members in the use and operation of a SCBA under simulated emergency incidents.

**4-4.2** Periodic evaluations shall be held to determine the proficiency level of members while using a SCBA under simulated emergency incident conditions. These simulated emergency incident conditions shall be as realistic as possible while maintaining a safe level of protection for the wearer.

**4-4.3** Members shall demonstrate proper ability to operate under simulated emergency incident conditions.

**4-5 Requirements for the Progression of Training.** Recruit training shall include the identification of SCBA components, terminology, and equipment specifications through the following:

(a) Operation of SCBA and related equipment;

(b) Inspection and maintenance of equipment;

(c) Donning methods employed by the authority having jurisdiction;

(d) Performance of related emergency scene activities, such as advancing hose lines, climbing ladders, crawling through windows and confined spaces, and performing rescues, while wearing a SCBA;

(e) Comprehension of organizational policies and procedures concerning safety, emergency operations, use, inspection, and maintenance;

(f) Performance of activities under simulated emergency conditions;

(g) Compliance with all performance standards of the authority having jurisdiction.

**4-6 Evaluation of SCBA Training.** All members who might be required to wear a SCBA shall be evaluated periodically on their knowledge of SCBA equipment operation, safety, organizational policies and procedures, and facepiece seal. This evaluation shall occur at least annually.

**4-7* Required Training.** This section sets forth, in a sequential format, a logical progression towards achieving training goals, first by requiring minimum policies to be established by the authority having jurisdiction; next by requiring a theoretical understanding of SCBA; and finally by developing practical skills.

**4-8 Recognizing Hazards that Could Be Encountered.**

**4-8.1** The authority having jurisdiction's training program shall evaluate the ability of personnel to:

(a) Identify hazardous environments that might require the use of respiratory protection.

(b) Identify the primary gases produced by combustion.

(c) Identify the primary characteristics of gases that might be present or generated by processes other than combustion.

(d) *Identify any toxic gases that might be unique to the particular authority having jurisdiction resulting from manufacturing or industrial processes.

(e) Identify the shipping labels of hazardous materials.

**4-8.2*** Fire department members shall be trained to handle problems related to the following that can be encountered during the use of a SCBA:

(a) Low temperatures;

(b) High temperatures;

(c) Rapid temperature changes;

(d) Communications;

(e) Confined spaces;

(f) Vision;

(g) Facepiece-to-face sealing problems;

(h) Absorption through or irritation of the skin;

(i) Effects of ionizing radiation on the skin and the entire body;

(j) Punctured or ruptured eardrums;

(k) Use near water;

(l) Overhaul.

**4-9 Understanding the Components of a SCBA.** The authority having jurisdiction's training program shall evaluate the ability of members to:

(a) Identify the components of facepieces, regulators, harnesses, and cylinders used by the authority having jurisdiction.

(b) Demonstrate the operation of the SCBA used by the authority having jurisdiction.

(c) Describe the operation of the SCBA used by the authority having jurisdiction.

(d) *Describe the potential incompatibility of different makes and models of SCBA.

**4-10 Understanding the Safety Features and Limitations of a SCBA.** The training program of the authority having jurisdiction shall evaluate the ability of members to:

(a) *Describe the operational principles of warning devices required on a SCBA.

(b) Identify the limitations of the SCBA used by the authority having jurisdiction.

(c) *Describe the limitations of the SCBA's ability to protect the body from absorption of toxins through the skin.

(d) Describe the procedures to be utilized if unintentionally submerged in water while wearing a SCBA.

(e) Demonstrate the possible means of communications when wearing a SCBA.

**4-11 Donning and Doffing SCBA.** The training program of the authority having jurisdiction shall evaluate the ability of members to:

(a) Demonstrate the proper techniques for donning and doffing all types of SCBA used by the authority having jurisdiction while wearing the full protective clothing used by the authority having jurisdiction.

(b) Demonstrate that a proper face-to-facepiece seal has been achieved.

**4-12 Practical Application in SCBA Training.**

**4-12.1** The authority having jurisdiction's training program shall evaluate the ability of members to:

(a) Demonstrate knowledge of the components of respiratory protection.

(b) *Demonstrate the use of all types of SCBA utilized by the authority having jurisdiction under conditions of obscured visibility.

(c) Demonstrate the emergency operations that are required when a SCBA fails.

(d) *Demonstrate emergency techniques using a SCBA to assist other members, conserve air, and show restrictions in use of bypass valves.

(e) Demonstrate the use of a SCBA in limited or confined spaces.

**4-12.2*** Training shall be conducted under simulated stressful circumstances to promote immediate response to emergency operations.

**4-12.3** Annual SCBA training shall be provided to each member required to use breathing apparatus. This training shall include reevaluation of the individual for the required facepiece seal.

**4-13 Training in the Maintenance and Testing of a SCBA.** The authority having jurisdiction's training program shall evaluate the ability of members to:

(a) Demonstrate the proper procedure for conducting routine and post-incident inspections of a SCBA.

(b) Demonstrate a thorough examination and test of the SCBA.

(c) *Demonstrate the proper procedure for reporting a defective SCBA.

**4-14* Training in the Storage of SCBA and Reserve SCBA Cylinders.** The authority having jurisdiction's training program shall evaluate the ability of members to demonstrate the proper storage of SCBA. This shall include, but shall not be limited to:

(a) SCBA mounted on apparatus.

(b) SCBA in carrying cases.

(c) *Individually issued facepieces.

(d) *Reserve air cylinders.

## Chapter 5 SCBA In-service Inspection

**5-1 Daily/Weekly Service Checks.**

**5-1.1** Inspection, maintenance, and repair records shall be maintained as required by Section 2-2.

**5-1.2*** Where fire apparatus is in daily use, routine inspections of all respiratory protection equipment and reserve cylinders on the apparatus shall be conducted at least daily. If fire apparatus is not in daily use, routine inspections shall be conducted at least weekly. All inspections shall be in accordance with the requirements of the manufacturer of the specific respiratory protection equipment.

**5-1.3*** Monthly inspection of respiratory protection equipment shall be conducted and shall include a check of the entire unit for deteriorated components, airtightness of cylinders and valves, gauge comparison, reducing valve and bypass valve operation, and a check of the regulator, exhalation valve, and low-air alarm. The SCBA shall be cleaned and returned to service.

**5-1.4*** Inspection of respiratory protection equipment shall be conducted by the user before and after each use.

## Chapter 6 SCBA Maintenance

### 6-1 User Maintenance.

**6-1.1*** All maintenance and repairs on a SCBA shall be conducted in accordance with manufacturer's instructions by qualified personnel.

**6-1.2*** Annual inspection and servicing of a SCBA shall be conducted by qualified personnel and whenever an operational problem is reported.

**6-1.3** Annual inspection and servicing shall include at least the following procedures and the manufacturer's recommendations:

(a) Disassembling of the SCBA into major components;

(b) Flow testing of the regulator;

(c) Disassembling and cleaning of the regulator;

(d) Replacement of worn parts, or those recommended by the manufacturer, in the regulator assemblies;

(e) Disassembling of the low-air alarm, and cleaning and replacement of components as necessary;

(f) Cleaning and replacement of components of the facepiece and harness assembly, and replacement of components as needed or scheduled;

(g) Reassembling of the entire SCBA and testing for proper operation of all components;

(h) Proper recording of all performed maintenance on the forms provided and return of the SCBA to service.

### 6-1.4* Cleaning and Sanitizing Requirements.

**6-1.4.1** The authority having jurisdiction shall adopt a cleaning and sanitizing procedure. Each member shall be trained in this procedure.

**6-1.4.2** Fire fighters, or other designated and trained personnel, shall clean and sanitize each SCBA after each use upon their return to the fire station. The entire device shall be cleaned, and the facepiece and breathing tube shall be sanitized.

### 6-2* Preventative Maintenance Program.

**6-2.1** A preventative maintenance program shall be established by the authority having jurisdiction for all SCBA used in the organization.

**6-2.2** The established SCBA preventative maintenance program shall be conducted in order to prevent SCBA malfunction and failures of equipment during use.

**6-2.3** The SCBA maintenance program shall be conducted by qualified fire department members or by another organization using qualified personnel. Qualified personnel shall be trained and certified by the manufacturer or by an authorized distributor.

**6-2.4** Organizations without an internal SCBA maintenance program shall be permitted to contract with an outside organization to provide SCBA preventative maintenance services.

## Chapter 7 Breathing Air Program

### 7-1 Air Quality Control.

**7-1.1*** Air for SCBA taken from the regular production of a compressor and storage system shall meet the testing and quality requirements of CGA G7.1 *Commodity Specification for Air*, with a minimum air quality of Grade D and a maximum dew point of –50°F(–45°C) or 10°F (5°C) lower than the coldest temperature expected in the area.

**7-1.2*** Where the fire department purchases compressed breathing air in a vendor supplied cylinder, the fire department shall require the vendor to provide certification and documentation that the breathing air has been tested and that it meets the requirements of 7-1.1. The vendor shall provide documentation to demonstrate that the laboratory is accredited by the American Industrial Hygiene Association, the American Association for Laboratory Accreditation, or the National Voluntary Laboratory Accreditation Program.

Where the fire department makes its own breathing air or transfers purchased breathing air from vendor cylinders into other storage cylinders, the air quality from compressors, cascade system cylinders, storage receivers, and other such breathing air manufacturing or storage equipment used for filling SCBA cylinders shall be tested at least every 3 months by a laboratory accredited by the American Industrial Hygiene Association, the American Association for Laboratory Accreditation, or the National Voluntary Laboratory Accreditation Program to certify that the breathing air meets the requirements of 7-1.1. Laboratories shall be required to notify the fire department immediately of air not meeting the requirements of 7-1.1.

**7-1.3** Records shall be maintained for each air quality test. If the required air quality is not being achieved, the use of the system shall be discontinued until repairs are made and the air quality is verified by testing.

**7-1.4*** Any air cylinders that contain air that is suspected of not meeting air quality standards shall be emptied and purged.

### 7-2 Recharging Air Cylinders.

**7-2.1** The air cylinders of all SCBA shall be maintained at not less than 90 percent of the rated pressure stamped on the cylinder. Cylinders filled to less than 90 percent of their rated pressure shall be segregated from full cylinders until they are refilled.

**7-2.2** SCBA cylinders shall be refilled only with approved breathing quality air, as specified in Section 7-1.

**7-2.3** Written policies shall be established to ensure that air is obtained only from a source that meets the requirements of Section 7-1. Refilling shall be conducted by qualified personnel using proper equipment and procedures.

**7-2.4** Air cylinders shall be filled only by personnel who have been trained on the proper procedures and equipment.

**7-2.5** The proper operating procedures and safety precautions shall be posted in a conspicuous location at the fill station.

**7-2.6*** Personnel assigned to operate fill station equipment shall visually inspect all cylinders before filling. Cylinders that do not meet the manufacturer's requirements due to defects or damage, or that have not met hydrostatic test requirements, shall be left unfilled and removed from service.

**7-2.7*** All air cylinders shall be refilled in accordance with the manufacturer's instructions.

**7-2.8** Where a breathing air compressor system, mobile or fixed, is used, it shall be located in an area where the air is free from contamination.

**7-2.9*** The authority having jurisdiction shall have the ability to support emergency scene operations of extended duration by providing a reserve supply of air for a SCBA.

**7-2.10** Mobile breathing air compressor systems shall be equipped with monitoring equipment to detect carbon monoxide contamination and an automatic shutdown device that activates when the level of carbon monoxide exceeds the limits of Grade D air (20 ppm).

**7-2.11** All breathing air compressors shall have the air quality tested as required by 7-1.2.

**7-2.12** Equipment used to produce compressed air for SCBA shall be inspected and maintained in accordance with the manufacturer's instructions.

**7-2.13*** All filters and other components of air purification systems shall be inspected and replaced in accordance with the manufacturer's instructions.

**7-2.14** A record shall be maintained for each air compressor, fill station, cascade cylinder, purification system, and related equipment used to produce and store air for SCBA. The record shall indicate the date of purchase, location, inspection, maintenance, and testing of the device.

## Chapter 8 Program Evaluation

**8-1 Annual Review.**

**8-1.1** The authority having jurisdiction shall review the organization's respiratory protection program annually for the purpose of determining the need to upgrade or change various aspects of the program.

**8-1.2** An annual review of the respiratory protection program policies and procedures shall be conducted to ensure they are being followed and to make necessary adjustments for the effective operation of the program.

**8-1.3** Problem areas involving members, equipment, inspection, maintenance, and repair schedules or resources shall be addressed on a timely basis.

**8-1.4** The levels of responsibility for the SCBA program shall be established and maintained to ensure that proper assignments are made and that all members of the program know exactly which duties they are to perform.

**8-1.5** Any failures encountered in the respiratory protection program dealing with members, training, or equipment shall be analyzed, and appropriate corrective action shall be taken to preclude the recurrence of an additional failure of a similar or related nature.

## Chapter 9 Referenced Publications

**9-1** The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

**9-1.1 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 1992 edition.

NFPA 1041, *Standard for Fire Service Instructor Professional Qualifications*, 1992 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1992 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1992 edition.

**9-1.2 Other Publications.**

**9-1.2.1 CGA Publication.** Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA G7.1, *Commodity Specification for Air*, 1989.

**9-1.2.2 U.S. Government Publication** U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Title 30, *Code of Federal Regulations*, Part 11, Subpart H.

## Appendix A Explanatory Material

*This Appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.*

**A-1-2** Organizations that train with or use respiratory protection equipment need to recognize their responsibility for the safety and welfare of personnel. A part of this responsibility is the development and implementation of a comprehensive respiratory protection program. This standard can also assist an organization with the development of a respiratory protection program that meets the requirements of OSHA Title 29, *Code of Federal Regulations*, 1910.134; Title 29, *Code of Federal Regulations*, 1910.156; and NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

**A-1-3** It also should be noted that, unlike industrial users of respiratory protective devices who consider respirators as a secondary defense against breathing hazards and engineering controls as the primary means, the fire service depends on SCBA as the first and only means of respiratory protection.

**A-1-4 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations that is in a position to determine compliance with appropriate standards for the current production of listed items.

**A-1-4 Authority Having Jurisdiction.** The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**A-1-4 Listed.** The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

**A-1-5.2** Paragraph 5-3.2 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, provides specific information on when a SCBA is to be used.

**A-1-5.6** One role of any training program is to generate acceptance of operational evolutions for coordination and skill. The use of proper procedures and the dispelling of false notions concerning the use and application of respiratory protection equipment are equally important. The state of the art in today's fire-fighting environment demands a commitment by each authority having jurisdiction to ensure maximum acceptance in the use of respiratory protection equipment.

**A-1-5.6(d)** Members should be instructed in the variables that affect the duration of available air supply. Such factors as physical conditioning, physical exertion, and emotional stability all influence the duration of the air supply.

**A-1-5.6(e)** Members should be thoroughly familiar with the "point of no return" theory to prevent entrance into hazardous areas that are located beyond safe margins. The time necessary for entry, work, and exit from a hostile environment should be considered for each member, since it varies among individuals. The factors that help determine the point of no return are:

(a) Entry point;

(b) Physical condition;

(c) Size of the individual;

(d) Work being performed;

(e) Environment where the work is being performed;

(f) Amount of air available when entering the environment;

(g) Other stresses (people trapped, difficult access, outside temperatures);

(h) Type of protective clothing used; and

(i) Training.

Even though these factors can change dramatically at the emergency scene, it is important that each member be provided an opportunity to help determine his or her individual point of no return.

To help determine their points of no return, members need to be subjected to a variety of activities where they are allowed to consume their entire air supply. Where determining point of no return, it is important that the process be cumulative, beginning with the basic skills and progressing to more difficult, stressful tasks utilizing SCBA.

Determining an individual's point of no return is important for members. Although the following activities can be used to measure air consumption, they can only approximate the point of no return. The following help determine the consumption demands of air for an individual:

(a) Maze work;

(b) An obstacle course that includes fire-fighting tasks;

(c) Smoke-building work; and

(d) Combined activities.

It is important to determine two points of air consumption relevant to the point of no return: the point from the start of the operation until the warning alarm operates, and the time it takes to consume the remainder of the air available. These two points can help determine the individual's point of no return.

**A-2-1.1** The additional SCBA can be provided on each apparatus or by providing a vehicle with extra SCBA.

**A-2-1.2** At least one additional reserve SCBA should be available at the scene of an incident for each 10 SCBA in use to provide for emergency replacement if a failure occurs.

**A-2-2.1** The use of long duration SCBA should be restricted to operations in tunnels and underground structures, on ships, and in other situations where the need for this capability is demonstrated.

Several manufacturers of SCBA currently market "buddy" or rescue breathing devices as a component of their SCBA. The use of such a device voids the NIOSH certification of the SCBA and cannot be recommended at this time.

The National Institute for Occupational Safety and Health (NIOSH) has issued three bulletins concerning emergency escape breathing support systems. They are reprinted here for informational purposes.

July 24, 1984

**Letter to Interested Persons**

Subject: Approval of Self-contained Breathing Apparatus Equipped with Emergency Escape Breathing Support System

In accordance with the requirements of Title 30, *Code of Federal Regulations*, Part 11, (30 CFR 11), the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) presently test and approve open-circuit self-contained breathing apparatus. These apparatus are used regularly by the fire service for respiratory protection during fire fighting and other associated rescue activities. Although the apparatus is designed principally for use by and protection of a single individual at one time, it has been recognized that the apparatus is being used to protect two persons simultaneously, either by sharing of the facepiece, or by adaptation of the apparatus to accept a second facepiece. The latter practice is permitted under the OSHA Fire Brigades Standard (29 CFR 1910.156).

MSHA and NIOSH have been asked by several interested persons to develop new performance requirements which would be applied to combination self-contained breathing apparatus and emergency escape breathing support systems (EEBSS). These requirements would be in addition to the present requirements of Part 11. These new requirements would be distributed to respirator manufacturers as prescribed in Section 11.63(c) of Part 11. This procedure, which has been used before by MSHA and NIOSH, would permit such manufacturers to apply for approval of combination self-contained breathing apparatus and EEBSS which meet the new performance requirements pursuant to MSHA and NIOSH authority within 30 CFR 11.63(c) in addition to the present applicable requirements of Part 11. MSHA and NIOSH would issue approvals which indicated that the device had also passed special test requirements in addition to the requirements of 30 CFR 11, Subpart H, following successful conclusion of testing and quality control review.

MSHA and NIOSH are requesting that you consider the potential approval of combination self-contained breathing apparatus and EEBSS and that you provide NIOSH with your comments on the practicability, safety, and need for such a device, recommendations you may have for performance criteria for such devices, and suggestions which MSHA and NIOSH might apply to limitations on and conditions for safe use of such devices.

Signed:

John B. Moran, Director

Division of Safety Research

November 6, 1984

**Notice to All Respirator Manufacturers with MSHA/NIOSH-Approved Respirators**

Until NIOSH establishes a formal position based upon our review of the information submitted pursuant to the NIOSH memorandum to Concerned Individuals dated July 24, 1984, titled "Emergency Escape Breathing Support System," the following policy remains in effect:

The use of any component connected, interfaced, or assembled in combination with MSHA/NIOSH certified self-contained breathing apparatus (SCBA) for use as an emergency escape support breathing system or "buddy breather" to allow more than one individual access to the apparatus' life support system(s), either directly or indirectly, automatically voids the applicable certification during its use. Such invalidation continues in effect until the SCBA is returned to the certified status through required maintenance, test checkout, and reassembly as prescribed by the manufacturer's instruction manual and any other applicable user company policy/rules, legislative directives, or enforceable regulations applicable to user health and safety.

Respirator manufacturers must not state in advertising or instructional literature that use of such components is approved by MSHA/NIOSH.

Signed:

John B. Moran, Director

Division of Safety Research

July 23, 1985

**Letter to Interested Persons**

Subject: Self-contained Breathing Apparatus Equipped with Emergency Escape Breathing Support System

On July 24, 1984, the National Institute for Occupational Safety and Health sent a letter to interested persons, requesting that they consider the potential approval of combination self-contained breathing apparatus (SCBA) and emergency escape breathing support systems (EEBSS). Also, it was requested that they provide NIOSH with comments on the practicability, safety, and need for recommendations for performance criteria for, limitation on, and conditions for safe use of such devices.

NIOSH has received several written replies to and verbal comments on the subject. It appears, from our evaluation of those replies and comments, that there is, at present, insufficient information on which to base certification of safe and practicable combination SCBA and EEBSS. In addition, there is concern over the legal and moral considerations of use of such devices, which NIOSH is unable to address at this time.

NIOSH understands that Lawrence Livermore National Laboratory (LLNL) is proposing to study the design and use of combination SCBA and EEBSS. NIOSH proposed to work with LLNL and with fire service and other organizations in an effort to resolve the present concerns and needs.

At present, NIOSH will take no action on certification of combination SCBA and EEBSS.

Signed:

John B. Moran, Director

Division of Safety Research

**A-2-2.3** A record or label should be maintained with each SCBA regulator and harness assembly noting the date of the most recent maintenance and testing and identifying the individual performing these functions. It is desirable to indicate the next due date for maintenance of the assembly. As an alternative, this information can be kept in a data file that is readily accessible according to the identification number or label.

**A-2-2.4** A record or label should be maintained with each SCBA cylinder noting the most recent date of maintenance and testing. It might be desirable to maintain a separate record of the maintenance and testing of cylinder valves. The cylinder manufacturer should be consulted for the recommended method of marking the hydrostatic test date on the cylinder.

Plano Fire Department
SCBA Periodic Maintenance and Testing Record

Inventory No. _____ Date of Inspection _____

| | O.K. | Needs Servicing |
|---|---|---|
| Cylinder check | ☐ | ☐ |
| Regulator function | ☐ | ☐ |
| Diaphragm function | ☐ | ☐ |
| Harness assembly | ☐ | ☐ |
| Facepiece and tube | ☐ | ☐ |
| P.A.S.S. device | ☐ | ☐ |

Next inspection due date _____

Maintenance and testing completed by _____

**Figure A-2-2.3 Sample maintenance and test record form.**

**A-2-3.2** The inspection and testing of new SCBA are normally performed at the factory. Where used SCBA are acquired, it is necessary for the fire department to ensure that the equipment is inspected and tested prior to being placed in service.

**A-3-1.2** This paragraph requires respiratory protection equipment to be used by all personnel who are actually or potentially exposed to any respiratory hazards. These include overhaul situations, unless it can be determined that the area has been adequately ventilated to eliminate respiratory hazards.

**A-3-1.3** One of the contaminants that can be readily measured is carbon monoxide. Respiratory protection equipment should not be removed where tests reveal a concentration greater than 50 ppm of carbon monoxide or where other toxic contaminants are known or suspected to be present.

**A-3-1.5** The additional weight of the SCBA could reduce work performance, increasing fatigue factors and the susceptibility to injury. The SCBA also changes the center of gravity of the individual, making loss of balance a possibility. These factors are reduced through training and familiarization with the SCBA and where members participate in regular physical fitness programs. The application of the SCBA in evolutions involving complete encapsulation, such as with chemical suits, proximity suits, and other hazardous materials protective clothing, warrants special consideration, as these suits are designed specifically to create an artificially protected environment exclusive of outside contaminants. Operating in an environment that is immediately dangerous to life and health presents a significant danger if the SCBA malfunctions. Strict monitoring of members and the establishment of safety margins for operation and backup systems for rescue should be provided and reinforced during training.

**A-3-1.7** During the initial stages of emergency scene operations, the member(s) assigned to remain outside and to maintain an awareness of the members working inside with SCBA could also be responsible for functions such as operating pumps, preparing equipment, or commanding operations. The essential requirement, however, is to have at least one member outside to maintain accountability and to direct help, if needed. As operations progress, this responsibility should shift to individuals assigned to this specific function according to standard operating procedures. The members required to be available for rescue could also be assigned to other functions at the scene of the incident. These members are to be equipped with SCBA and suitable rescue equipment and are to be available for reassignment to assist members in trouble. The requirement for additional personnel who are to be available for rescue could be satisfied by additional companies or members who are responding to the scene and who will arrive within the safe operating time of initial entry teams.

**A-4-1.1** This paragraph does not prohibit the use of manufacturers' representatives to provide training related to their products.

**A-4-1.2** A method of maintaining the information deemed appropriate by the authority having jurisdiction concerning respiratory protection training should be developed. This might vary from entries in the station log to specialized individual, company, or departmental records. *(See NFPA 1401, Recommended Practice for Fire Service Training Reports and Records.)*

**A-4-1.3** The minimum level of performance recommended by this standard is for a member wearing full protective clothing to be capable of donning respiratory protection equipment and to be fully operational within 60 seconds. This timed performance should begin with the member standing in full protective clothing with the respiratory protection equipment placed on the ground and should stop when the member is properly attired in full protective clothing and is properly wearing fully operational respiratory protection equipment. The respiratory protection equipment cylinder valve should be in the closed position before starting the performance. It is understood that members normally do not don SCBA by first picking it up off the ground; however, this procedure is used in this document to set a performance standard. It is recommended that additional performance standards be established by each authority having jurisdiction based upon the manner in which it stores or carries its SCBA. For example, if SCBA are carried on apparatus in cases, a performance standard should be established for the removal and donning of the SCBA from the cases.

**A-4-2.2** The attending physician should consult NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, for guidance. Members also should be evaluated for claustrophobic tendencies prior to acceptance into a respiratory protection equipment training program. Members displaying claustrophobic tendencies should be evaluated to determine their ability to work under conditions requiring respiratory protection equipment. Members deemed unable to work in conditions requiring respiratory protection equipment should be prohibited from participating in such activities.

**A-4-2.4** In those instances where members cannot meet the facepiece seal requirement with equipment currently used by the authority having jurisdiction, individually fitted facepieces should be provided.

Because of the importance of a proper facepiece fit, facepiece fit testing for applicants should be conducted prior to accepting them as members of the organization.

The effectiveness of the facepiece seal of any negative-pressure SCBA is to be determined by a negative-pressure fitting test followed by a qualitative irritant fume or odor fitting test. These tests are to be performed at least annually and whenever a member's facial characteristics change. The negative-pressure test also is to be performed and passed each time the facepiece is donned for use in a hazardous atmosphere.

An irritant fume or odor test is to be used to test the seal of positive-pressure SCBA. Positive-pressure SCBA are designed to produce an outward leakage of air if a facepiece-to-face leak is present, thus reducing the inward leakage of contaminated air from outside the facepiece. The larger the leak, the more air is lost, depleting the compressed air cylinder's supply in a shorter time. If a large leak exists, the wearer might actually overcome the positive pressure in the facepiece by breathing deeply and pulling in outside contaminated air.

**A-4-2.4.1** SCBA negative-pressure fitting tests are to be performed by closing off the inlet opening of the breathing tube with the palm of the hand, inhaling gently, and holding the breath for 10 seconds, so that the facepiece collapses slightly. If the facepiece remains slightly collapsed and no minor leakage of air is detected, the tightness of the facepiece is probably satisfactory.

One of the following materials is to be used in qualitative irritant fume or odor fitting tests:

(a) A stannic tetrachloride or titanium tetrachloride ventilation smoke tube;

(b) An isoamyl acetate (banana oil) vapor;

(c) Other innocuous agents easily detectable by irritation or odor.

The test is to be conducted using an operating SCBA and not just a facepiece and breathing hose disconnected from the rest of the system. A recommended procedure for performing qualitative fitting tests is provided in Appendix D.

During qualitative testing, the SCBA wearer is to carry out a series of exercises that simulate work movements. Each exercise is to last for at least 1 minute. The following series of exercises is to be performed when a SCBA facepiece is being tested:

(a) Normal breathing;

(b) Deep breathing;

(c) Turning head from side to side;

(d) Nodding head up and down;

(e) Talking; and

(f) Frowning.

**A-4-2.4.2** A protection factor of at least 10,000 is recommended for positive-pressure SCBA. The quantitative test can be used to determine which facepieces fit an individual well and thus aids in selecting the facepiece that best conserves the amount of air in the cylinder.

If a satisfactory fit cannot be achieved for an individual with one make of facepiece, another make of the device should be bought for that member, or a negative-pressure unit should be converted to a positive-pressure SCBA.

WARNING: If a facepiece from one manufacturer is used on a unit from another manufacturer, the NIOSH/MSHA approval will be voided.

**A-4-2.6** Significant increases in blood pressure and respiratory rates, unusual signs of fatigue, and claustrophobic tendencies are factors that might disqualify members from performing these activities.

**A-4-4.1** Although all aspects of the physical and emotional stresses an emergency scene creates cannot be fully duplicated during training exercises, many of these aspects can be simulated.

The more stresses that are duplicated, the more beneficial the training. Furthermore, the student's performance can be evaluated more accurately. These simulations should take into consideration varying situations during which the student might be required to wear a SCBA, such as where using a fully encapsulating suit.

**A-4-7** The first level of instruction normally takes place in a classroom setting, allowing the students to become thoroughly familiar with the SCBA by actual "hands-on" training. This allows the instructor to use various testing and evaluation methods to determine a student's level of comprehension. Manipulative skills are best learned and retained by using the actual SCBA as soon as possible after the classroom instruction.

The second level of SCBA training should allow the student to operate the equipment while performing various fireground tasks, so the student becomes familiar with the unit and becomes confident with its use. This training should take place in a setting that can be safely controlled by the instructor and should be pertinent to the tasks being performed. The use of a SCBA training maze is one alternative application for this level of training and builds confidence in the student.

The third level of training should allow the student to operate with the SCBA under simulated emergency conditions. Up to this point, the student should have demonstrated his or her ability to identify, operate, and use the SCBA in performing various manipulative fireground tasks. When the student has successfully demonstrated the ability to perform fireground tasks, he or she is ready to perform these same tasks under simulated emergency conditions. The student should be allowed to demonstrate his or her ability to perform under emergency conditions by operating under various simulated emergency conditions during this level of training. Such training can include conducting tasks while wearing hazardous material suits and other job-related tasks required by the authority having jurisdiction. The facility or area for conducting this type of training should allow the instructor to maintain student safety and provide for the proper evaluation of the student's performance.

**A-4-8.1(d)** Management representatives from various companies in the response district, as well as information from prefire planning visits, are helpful in identifying features unique to the jurisdiction.

**A-4-8.2 Special Problems.**

(a) **Low Temperatures.** The major problems in the use of full facepieces at low temperatures are poor visibility and freezing of exhalation valves. All full facepieces are designed so that the incoming fresh air sweeps over the inside of the lens to reduce fogging. Antifogging compounds may be permitted to be used to coat the inside of some lenses to prevent fogging in temperatures as low as 32°F (0°C). Below 32°F (0°C), a nosecup usually is needed to inhibit fogging of the lens. Full facepieces are available with nosecups that direct the

warm, moist, exhaled air through the exhalation valve without contacting the lens.

At very low temperatures, the exhalation valve can collect moisture and freeze in the open position, allowing the wearer to breathe contaminated air, or in the closed position, preventing normal exhalation. Where SCBA are used in low temperatures, they should be used according to the manufacturer's instructions and under the conditions for which they are approved by NIOSH/MSHA.

High-pressure connections on SCBA can leak because of metal contraction at low temperatures. These connections should be tightened enough to prevent leakage but not so tight that they break when the temperature returns to normal. In temperatures below 32°F (0°C), moisture contained in breathing air can condense in the breathing circuits and freeze, rendering the device inoperable. If water spraying from the discharging fire lines comes in contact with the regulator housing or valve assemblies, it can freeze, forming an ice coating that can render the device inoperable. This is especially true if the ice coating covers the atmospheric pressure ports on the regulator, thereby preventing its proper operation.

Other problems that could occur in SCBA exposed to below-freezing temperatures for any length of time (e.g., SCBA in storage), depending on the make and model, are as follows:

1. The emptying of the air cylinder due to leakage at cylinder and valve connections;
2. The shattering of the facepiece lens if bumped or dropped;
3. The rigidity and inflexibility of rubber parts (e.g., the breathing tube or facepiece), affecting facepiece fit and head movement;
4. Any leaks around all connections;
5. The difficulty in operating control valves (e.g., main, bypass, and cylinder);
6. The failure of the low-pressure alarm to operate.

All members should be trained to be aware of these problems and should know how to correct them.

(b) **High Temperatures.** A member in areas of high ambient or radiant temperature is under stress. Although the SCBA, together with a helmet and protective clothing, affords some protection against the heated atmosphere, members should know their own limitations as well as the limitations of the protective clothing and equipment. Members should be trained to recognize the warning signs of extremely high temperatures that might not be obvious while they are breathing somewhat cooler air from the SCBA. Additional information on the use of SCBA in high temperatures is found in NFPA FSP-29B, *Breathing Apparatus for the Fire Service, A Fire Officer's Guide*, and "Operation of Self-Contained Breathing Apparatus Exposed to High Air Temperatures" in *The Official Publication of the International Association of Fire Chiefs*.

(c) **Rapid Temperature Changes.** Problems arise where SCBA are subjected to rapid changes in temperatures on the fireground. This is particularly true where a single-lens facepiece is used. The large lens on some makes is subject to distortions caused by rapid temperature changes or by high air temperatures alone, causing leakage around the lens mounting or the facepiece-to-face seal, or both. Such a situation is more likely to occur in areas where extremely cold climatic conditions are encountered but can also occur even during warm weather when the devices are taken into the extremely high temperatures encountered on the fireground. All members should be trained to know these limitations and corrective procedures in the event such conditions occur.

(d) **Communications.** Voice communication while wearing a respirator is necessary to perform specific tasks in fire-fighting operations. Although a respirator facepiece distorts the voice to some extent, the respirator's exhalation valve usually provides a pathway for some speech transmission over short distances in relatively quiet areas. However, a mechanical speech transmission device called a "speaking diaphragm" is an integral part of the facepiece in some respirators. The speaking diaphragm usually consists of a resonant cavity and a diaphragm that transmits the sound. The diaphragm also acts as a barrier to the ambient atmosphere and thus should be handled carefully to prevent a puncture that would allow leakage of an air contaminant into the facepiece.

Various methods of electronically transmitting and amplifying speech through the respirator are available. These methods use a microphone connected to a speaker, telephone, or radio transmitter. Usually, the microphone is mounted inside the facepiece, while the amplifier, power pack, and speaker or transmitter are attached to the exterior of the facepiece, carried on the body, or remotely located. Where an electronic device for transmitting speech is used, connecting cables from microphones can pass through the facepiece. Such devices should be used only if the SCBA is MSHA/NIOSH approved, with the transmission equipment installed. If the cables are removed for any reason, they should be replaced and resealed, or the resultant hole in the facepiece should be sealed completely. Before the cables are removed, the manufacturer should be consulted to confirm that the equipment retains its MSHA/NIOSH approval with a resealed hole in the facepiece. The connecting cables, and the location at which they pass through the facepiece, should have gastight seals and should be installed according to the SCBA manufacturer's instructions. A microphone mounted against the SCBA wearer's throat or a microphone speaker worn in the SCBA wearer's ear or helmet does not necessitate penetration of the facepiece by a cable; therefore, its use does not void the MSHA/NIOSH approval status of the SCBA.

NOTE: Where a walkie-talkie radio transmitter is used, speech transmission is often distorted when the walkie-talkie microphone is held near the exhalation valve. Holding the microphone firmly against the facepiece lens usually allows a clearer transmission without the voice distortion created by the operation of the exhalation valve. An even clearer transmission is possible for walkie-talkies in a leather case if the perforated leather over the microphone is cut out and a thin layer of foam rubber is cemented around the edge of the hole in the leather. The hole over the microphone then can be held securely against the facepiece lens for clearer voice transmission.

(e) **Confined Spaces.** All confined spaces should be considered to be immediately dangerous to life or health (IDLH) unless proven otherwise. No member should be permitted to enter a confined space for fire-fighting operations, including emergency rescue operations, without wearing a SCBA. Confined spaces include, but are not limited to, wells, cisterns, holds of ships, tunnels, subway tunnels, basements, subbasements, pits, windowless buildings, and other such spaces where oxygen deficiency or hazardous airborne materials, or both, can be present. Users of SCBA entering such spaces should work in teams of two or more and should maintain some form of contact with a person wearing a SCBA who is located in a safe atmosphere and who, in an emergency, is

capable of performing the necessary rescue operations. Such contact can be maintained by voice communication, visual communication, lifeline communication, radio communication, or other acceptable means of communication. The same requirement should apply to members entering and operating in any hazardous area at the scene of a fire, including smoke-filled rooms or areas of a building. (*See ANSI Z117.1, Safety Requirements for Confined Spaces, for additional information.*)

(f) **Vision.** Corrective lenses, if required, should be fitted in the facepiece in a way that provides proper vision and should be worn in a manner that does not interfere with the seal of the facepiece. Temple bars of corrective spectacles that pass between the sealing surface of the full facepiece and the wearer's face can prevent a proper seal of the facepiece to the face. Therefore, spectacles with these types of temple bars should not be used. If a member must wear corrective lenses while wearing SCBA, the lenses should be mounted in the mask with prescription lens mounting devices available from all SCBA manufacturers. The wearing of contact lenses by members who are required to wear a SCBA should not be permitted, because one or both lenses could pop out from the pressure of the facepiece at the side of the eye and dust could be blown upward by the incoming air and forced between the lens and the pupil of the eye.

(g) **Facepiece-to-Face Sealing Problems.** Facial hair that interferes with the facepiece-to-face seal or the operation of the exhalation valve on the full facepiece of the SCBA should not be permitted. Such facial hair can include beards, sideburns, mustaches, long hair, or bangs that pass between the sealing surface of the facepiece of the SCBA and the face of the wearer. Head coverings, spectacle temple bars, or any other protuberance that passes between the sealing surface of the facepiece and the face should not be permitted.

(h) **Absorption through or Irritation of the Skin.** Some airborne contaminants are extremely irritating to the skin (e.g., ammonia and hydrochloric acid), while others are capable of being absorbed through the skin and into the bloodstream with serious, possibly fatal, results. Hydrogen cyanide and many of the organic phosphate pesticides, such as thiophosphate insecticide and tetraethyl pyrophosphate (TEPP), can penetrate unbroken skin. The SCBA does not afford complete protection against these contaminants. If such materials are encountered or suspected, an effective full-body covering suit of impermeable materials should be worn with the SCBA, as specified in NFPA 49, *Hazardous Chemicals Data.*

(i) **Effects of Ionizing Radiation on the Skin and the Entire Body.** The SCBA does not protect the skin or the entire body against ionizing radiation from airborne concentrations of certain radioactive materials. All users of SCBA in such contaminated atmospheres should be made aware of the fact that special protection is necessary in addition to the SCBA.

(j) **Punctured or Ruptured Eardrums.** Since contaminated air can penetrate through a punctured eardrum into the respiratory tract, the examining physician should determine the restrictions for a member with this condition.

(k) **Use Near Water.** Although SCBA should never be used for underwater operations, occasionally a member might fall into water when operating near the water or on a fireboat. In departments where such a possibility exists, SCBA training should include an explanation of what happens to the equipment when submerged in water.

(l) **Overhaul.** This phase of fire-fighting operations has historically been responsible for many member injuries and deaths.

**A-4-9(d)** It should be noted that the components of SCBA made by different manufacturers are not interchangeable and, in addition, different models of SCBA from the same manufacturer might not be compatible with each other.

**A-4-10(a)** A personal alert safety system (PASS) device is required by Section 5-7 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.* Although the PASS device is not a component of the SCBA, it should be considered as an integral safety companion device and, therefore, included in any training session involving SCBA.

**A-4-10(c)** A sealed facepiece does not prevent infiltration of toxins through exposed skin.

**A-4-12.1(b)** Smoke produced from "live fire" is prohibited in SCBA training sessions. The authority having jurisdiction might decide to use a substitute for smoke that has the same effect in demonstrating the value of SCBA. Several accidents have occurred when smoke bombs, or other smoke generating devices that produce a toxic atmosphere, have been used for training exercises. Where training exercises are intended to simulate emergency conditions, smoke generating devices that do not create a hazard are required.

**A-4-12.1(d)** The intent of this objective, required by NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, is to ensure that members are familiar with procedures for assisting other members as well as those for their own personal protection in emergency situations. The committee is opposed to any procedure that breaks the facepiece seal of any operable SCBA while in use.

**A-4-12.2** The intent is to simulate stressful conditions without endangering the physical well-being of the individual.

**A-4-13(c)** This should include procedures for placing defective SCBA out of service, removal from apparatus, and documentation of defective equipment. Repairs should be accomplished only by trained personnel equipped with specified tools and test instruments needed to adjust and repair SCBA. These repair personnel should be factory certified by the manufacturer of the equipment utilized where such training is made available.

**A-4-14** Members should describe the procedure for returning an unused and exhausted SCBA to its proper location immediately upon removal from service. SCBA should not be placed in locations such as on the ground or in areas of debris that can cause damage to the unit.

**A-4-14(c)** Extreme caution should be employed, especially in high pressure systems, to avoid eye injury from trapped particles of debris that can be loosened during the activation of SCBA.

**A-4-14(d)** Members should be instructed in the inherent dangers associated with the improper storage, handling, and transportation of reserve air cylinders. This instruction should emphasize the use of properly designed storage for reserve cylinders, both at the station and on the apparatus. Protection of stem valves from damage or breaking is especially important. Cylinders should never be transported in an unrestrained condition.

**A-5-1.2** Routine inspections for open-circuit SCBA should include at least the following operational checks:

(a) The cylinder pressure gauge reading should be checked. The reading should meet or exceed the authority having jurisdiction's policy for change of cylinder (90 percent or greater of fully charged cylinder pressure).

(b) The cylinder valve should be turned on and checked for leaks; the low-air alarm operation should be verified audibly.

(c) The high-pressure line should be checked for leaks or damage.

(d) The harness and facepiece should be checked for wear, and all straps should be checked for proper adjustment and damage.

(e) The SCBA should be donned.

(f) The facepiece should be donned and the facepiece-to-face seal should be checked for leakage.

(g) The exhalation valve should be checked for proper operation.

(h) The SCBA should be placed in service and checked for normal SCBA operation.

(i) The bypass valve should be opened slightly to ensure operation and then closed.

(j) The cylinder valve should be shut, and breathing should take place until the low-air alarm initiates and operates correctly.

(k) The SCBA valves should be returned to normal positions.

(l) The SCBA should be doffed.

(m) The harness straps and facepiece webbing should be returned to their don positions.

(n) The facepiece and other associated equipment should be cleaned and sanitized, as needed.

(o) The SCBA should be returned to the appropriate case or rack, ready for use.

Routine inspections for closed-circuit SCBA should include at least the following operational checks:

(a) The cylinder pressure of the oxygen should be checked.

(b) A check for damage to the SCBA due to mechanical damage, heat, or abuse should be made.

(c) The cylinder should be opened, leaks listened for, and function of the low-air alarm verified.

(d) The SCBA should be donned.

(e) The facepiece should be donned and the facepiece-to-face seal checked to verify that hoses are connected.

(f) The operation of the bypass valve should be checked.

(g) The oxygen cylinder valve should be shut off, and breathing should take place until the low-air alarm initiates and operates correctly.

**A-5-1.3** See *A Fire Service Guide to the Selection, Use, Care, and Maintenance of Self-Contained Breathing Apparatus*, published by NFPA, for further details of the monthly check.

**A-5-1.4** Before-use inspections for open-circuit SCBA should include the following checks:

(a) The cylinder pressure should be checked to verify that it is at 90 percent or greater of full cylinder pressure.

(b) The low-air alarm should be checked to verify that it sounds when the cylinder valve is opened.

(c) A correct facepiece-to-face seal should be verified.

(d) The exhalation valve function should be checked.

(e) The bypass valve function should be checked.

(f) The normal operation of the SCBA should be checked.

After-use inspections for open-circuit SCBA should include the following:

(a) Replacing the air cylinder with a fully charged cylinder;

(b) Checking for defective or damaged components;

(c) Thorough cleaning of all SCBA components and sanitizing of the facepiece;

(d) Checking the SCBA for functional operation.

Closed-circuit SCBA should be checked before and after use in accordance with the manufacturer's recommendations.

**A-6-1.1** Daily and weekly checks and inspections can be conducted by any members who have completed the performance objectives of Chapter 4.

Maintenance and repair of a SCBA is more technical and should be performed only by persons who have been specially trained for this work.

**A-6-1.2** Preventative maintenance at this first level is a function of recognizing potential maintenance problems such as airflow restrictions, loose or broken components, or strange noises emanating from regulators. Administratively, the authority having jurisdiction should reinforce the attitude that the recognition of maintenance problems is to result in corrective action that returns a properly operating SCBA to the user in a reasonable amount of time. The second level of maintenance may be permitted to be accomplished in a variety of ways. This level involves the removal and replacement of defective or damaged parts of the facepiece, harness, and regulator. The second or intermediate level of maintenance requires completion of training provided by the SCBA manufacturer, simple tools, and a complement of spare parts. It is important to note that the type and degree of maintenance that can or should be accomplished by an individual organization varies widely depending on the specific manufacturer. The manufacturer should be contacted directly to ascertain individual maintenance policies. Advanced-level training allows personnel to disassemble, rebuild, assemble, and accurately test all portions of the SCBA. This level requires more training and test equipment, making it impractical for every authority having jurisdiction to provide this level of service using only its own personnel. Where large numbers of SCBA are in use, it might be reasonable to provide this level of service. Most authorities having jurisdiction make use of regional service centers provided by, or certified by, manufacturers for advanced-level maintenance.

**A-6-1.4** The manufacturer's instructions for procedures and the cleaner or sanitizer to be used should be followed. Where no manufacturer's instructions are provided, the following procedure is recommended:

(a) The facepiece and breathing tube should be separated from the rest of the device.

(b) The facepiece and breathing tube should be washed in the cleaner/sanitizer solution. A hand brush (not wire), lint-free cloth, or sponge should be used to facilitate the removal of dirt.

(c) The facepiece and breathing tube should be rinsed completely in clean, warm water.

(d) The facepiece and breathing tube should be air-dried thoroughly in a clean area. The breathing hose should be stretched sufficiently to drain water trapped in corrugations.

(e) Other parts should be cleaned as recommended by the manufacturer.

(f) All parts should be inspected as prescribed.

(g) The device should be reassembled, tested, and stowed on a fire apparatus, on a storage rack, or in a container in the ready position.

Cleaner and sanitizer solutions are available that clean effectively and also contain an antibacterial agent. Alternatively, rubber parts can be washed in a liquid detergent solution and then immersed in one of the following:

(a) A hypochloride solution (50 ppm of chlorine) for 2 minutes;

(b) An aqueous iodine solution (50 ppm of iodine) for 2 minutes;

(c) A quaternary ammonium solution (200 ppm of quaternary ammonium compounds in water of less than 500 ppm total hardness) for 2 minutes.

To prevent dermatitis and damage to parts, immersion times should be followed and all parts of the SCBA should be rinsed thoroughly of all sanitizers.

Strong cleaning and sanitizing agents that can damage parts should not be used. Vigorous mechanical agitation should not be used.

Alcohol should not be used as a germicide on the rubber parts of a SCBA.

NOTE: Rubber for facepieces has largely been replaced by silicon-based compounds. Alcohol can be used on these materials.

To avoid damaging rubber and plastic parts, the temperature of the cleaner, the sanitizer, and the rinsing solution should not exceed the manufacturer's specifications. Where no specifications are provided, the temperature of each should be at least 49°C (120°F) but should not exceed 61°C (142°F).

Spare facepieces and breathing tubes should be available for use in the event a second alarm sounds while the original facepieces and tubes are being cleaned or are drying.

If a SCBA has been used by a member who has been exposed to toxic chemicals or radioactive materials, additional special decontamination steps are necessary in order to clean it. In these cases, contaminated SCBA should be segregated from all other equipment. Special instructions for proper handling and decontamination should be obtained from knowledgeable personnel and followed.

**A-6-2** Replacement or repairs should be carried out in accordance with the manufacturer's instructions. Repairs should be made only by trained personnel equipped with the tools and test instruments needed to adjust and repair SCBA, as specified by the manufacturer. Exact replacement parts purchased from the manufacturer of the specific breathing apparatus should be used, and an inventory of expendable spare parts should be kept on hand. Personnel performing the repair should be certified by the SCBA manufacturer. Instrumentation for valve, regulator, and alarm adjustment and repair should be approved by the SCBA manufacturer, or the valves, regulators, and alarms should be returned to the manufacturer's service facility. Flow tests should be performed in accordance with the manufacturer's instructions.

When necessary, a SCBA should be rebuilt by its manufacturer or by a person trained and certified by the manufacturer. Frequency of rebuilding should be in accordance with the manufacturer's recommendations. If no manufacturer's recommendations are provided, rebuilding should be conducted at least every 5 years. Rebuilding should include the complete dismantling of the SCBA and replacement of all regulator parts that could wear. Breathing-gas cylinders should be tested as prescribed in the applicable "Shipping Container Specification Regulations" of the U.S. Department of Transportation contained in Title 49, *Code of Federal Regulations*, Part 178.

**A-7-1.1** Organizations should consider requiring an air quality higher than Grade D for SCBA, since, over time, even with quarterly testing, the effectiveness of the filtering system deteriorates.

**A-7-1.2** Addresses and phone numbers for the specified accreditation organizations are provided below. They can be contacted for a list of laboratories that have been accredited by their organizations.

American Industrial Hygiene Association
345 White Pond Drive
P.O. Box 8390
Akron, OH 44320
(216) 873-2442

American Association for Laboratory Accreditation
656 Quince Orchard Road, #304
Gaithersburg, MD 20878
(301) 670-1377

National Voluntary Laboratory Accreditation Program
Building 4311, Room A124
Gaithersburg, MD 20899
(301) 975-4016

**A-7-1.4** Instructions for purging should be obtained from the cylinder manufacturer.

**A-7-2.6** See Tables A-7-2.6(a) and A-7-2.6(b).

**A-7-2.7** During refilling operations, protection should be provided from fragmentation of SCBA cylinders.

**A-7-2.9** Where individual organizations are unable to provide their own mobile air supply, such a supply may be permitted to be provided by a mutual aid association, mobile cascade compressor vehicle, or a vehicle that carries a large number of spare cylinders.

**A-7-2.13** Filtration monitoring devices can be installed to warn of dirty or clogged filters.

**Table A-7-2.6(a) Luxfer FRP Cylinders—Allowable Defect with Field Repair[1]**

| Cylinder Identification | Service Pressure | Test Pressure | Maximum Allowable Defect Dimensions (in.) | | | Use |
|---|---|---|---|---|---|---|
| | (psi) | (psi) | (Length) | (Depth) | (Width) | |
| DOT 7235-4500 L45W-45 5.4 OD × 19 | 4500 | 7500 | 1 | 0.015 | 0.125 | Breathing apparatus |
| DOT 7235-2216 L45S-22 6.8 OD × 20 | 2216 | 3700 | 1 | 0.010 | 0.125 | Breathing apparatus |
| DOT 7235-3000 L21W-30 5.4 OD × 11 | 3000 | 5000 | 1 | 0.010 | 0.125 | Breathing apparatus |
| DOT 7235-4000 L70W-40 7.10 OD × 20 | 4000 | 6670 | 1 | 0.020 | 0.125 | Breathing apparatus |
| DOT 8258-4000 S70W-40 | 4000 | 6670 | 1 | 0.020 | 0.125 | Scuba |

[1]Fill defect with epoxy glue and resin and hydrotest.

**Table A-7-2.6(b) Structural Composites Industries FRP Cylinders—Allowable Defect with Field Repair**

| Cylinder Identification | Service Pressure | Test Pressure | Maximum Allowable Defect Dimensions (in.) | | | Use |
|---|---|---|---|---|---|---|
| | (psi) | (psi) | (Length) | (Depth) | (Width) | |
| DOT-E-7277-2216 ALT-59 6.8 OD x 20.4 | 2216 | 3700 | 1 | 0.090[1] 0.060[2] | 0.125 | Breathing apparatus |

[1]Applies to cylindrical section only.
[2]Applies to dome sections.


**Figure A-7-2.9 Spare cylinder trailer.**

## Appendix B Respirator Types and Limitations

*This Appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.*

**B-1 Limitations of Respirators.**

**B-1.1 Self-Contained Breathing Apparatus.** Provides respiratory protection under conditions of oxygen deficiency or in concentrations of toxic gases immediately dangerous to life or health. The period over which the device provides protection is limited by the amount of air in the apparatus. This type of respirator offers no protection against skin irritation or against skin absorption of materials.

**B-1.2 Air-Line Respirator.** Provides respiratory protection in atmospheres not immediately dangerous to life or health from which the wearer can escape unharmed without the aid of the respirator. It is necessary that sufficient oxygen be present at all times to support life. Half-mask respirators of this type provide no protection to the eyes.

**B-1.3 Combination Self-contained and Air-line Respirator.** Provides respiratory protection under conditions of oxygen deficiency or concentrations of toxic gases immediately dangerous to life or health. By means of a small air cylinder, the wearer is able to escape the dangerous atmosphere in case the primary air supply is interrupted. If used for entry into atmospheres dangerous to life or health, the air line needs to be connected on entry. This type of respirator offers no protection against skin irritation or against skin absorption of materials.