

NFPA[®]

1852

**Standard on
Selection, Care, and
Maintenance of
Open-Circuit Self-Contained
Breathing Apparatus (SCBA)**

2019



IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA STANDARDS

NFPA® codes, standards, recommended practices, and guides (“NFPA Standards”), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A **Δ** before a section number indicates that words within that section were deleted and a **Δ** to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the **Δ** symbol. Where one or more sections were deleted, a **•** is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an **N**.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that NFPA Standards may be amended from time to time through the issuance of a Tentative Interim Amendment (TIA) or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of Tentative Interim Amendments or corrected by Errata, go to www.nfpa.org/docinfo to choose from the list of NFPA Standards or use the search feature to select the NFPA Standard number (e.g., NFPA 13). The document information page provides up-to-date document-specific information as well as postings of all existing TIAs and Errata. It also includes the option to register for an “Alert” feature to receive an automatic email notification when new updates and other information are posted regarding the document.

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards (“the ANSI Patent Policy”), and hereby gives the following notice pursuant to that policy:

NOTICE: The user’s attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term “adoption by reference” means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

Copyright © 2018 National Fire Protection Association®. All Rights Reserved.

NFPA® 1852

Standard on

Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2019 Edition

This edition of NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)*, was prepared by the Technical Committee on Respiratory Protection Equipment and released by the Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. It was issued by the Standards Council on May 4, 2018, with an effective date of May 24, 2018, and supersedes all previous editions.

This edition of NFPA 1852 was approved as an American National Standard on May 24, 2018.

Origin and Development of NFPA 1852

The technical committee was assigned the responsibility of addressing selection, care, and maintenance issues for open-circuit self-contained breathing apparatus (SCBA). To address these issues, the committee developed NFPA 1852, which is oriented to the users of such SCBA and their respective organizations.

This document was developed for organizations that use SCBA for the respiratory protection of their personnel who engage in emergency operations with the goal of reducing the safety risks and potential health risks associated with poorly maintained, contaminated, or damaged SCBA.

This document was also developed to fulfill the SCBA selection, care, and maintenance portions of the overall respiratory protection program required by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and applies to all SCBA that are certified as compliant with the current and previous editions of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*.

During the development of this document, committee member Deputy Chief Robert Kolenda of the Pittsburgh, Pennsylvania, Bureau of Fire (PBF) worked tirelessly to develop meaningful requirements to assure the safety of fire and emergency services personnel who depend on SCBA for their respiratory protection and their lives. Chief Kolenda lost his son, Pittsburgh Fire Fighter Marc Kolenda, at a fire, due in part to inadequate protection provided by his SCBA.

The first edition, the 2002 edition of NFPA 1852, was acted on by the NFPA membership at its November Association Technical Meeting in Dallas, Texas, on November 13, 2001, and became effective on January 31, 2002.

In the 2008 edition, the committee processed a complete revision of the document including an overall revision of text for clarity and up-to-date terminology. Section 1.3 was revised and restructured to include later editions of NFPA 1981 and to clarify the documents to which this standard applies. Chapter 2 was revised to include the documents referenced within the mandatory sections of the standard and updated editions approved by the committee. Section 3.3 was reviewed and revised as necessary to update or add new definitions according to the project on Fire and Emergency Services Protective Clothing and Equipment glossary.

Chapter 4 was completely reviewed for upgrades and modifications to existing text as hazards involving SCBA. Section 4.4 (formerly Section 4.3), SCBA Compliance — Upgrades and Retirement, was revised and reformatted to add new requirements for SCBA purchased during the effective periods of the 2000 and 2007 editions of NFPA 1981. In Chapter 5, subsection 5.1.1 was expanded to include selected accessories that could be added to SCBA.

Overall, chapters 5, 6, 7, and 8 were completely reviewed for upgrades and modifications to existing text as necessary, and the annex material was updated and expanded to provide additional advisory information regarding selection, care, and maintenance issues.

The 2008 edition was issued by the NFPA Standards Council with an effective date of December 31, 2007.

The 2013 edition of NFPA 1852 was completely reviewed for updates and changes to the existing text. The committee processed several proposals and comments, most notably changing the term hazards in Section 4.2 to adverse conditions. Several annex items were updated to reflect changes in U.S. Department of Transportation terminology, including a replacement of the term exemptions with special permits. Also, in Annex C, the committee replaced the name of the Research and Special Programs Administration (RSPA) with its current name, Pipeline and Hazardous Material Safety Administration (PHMSA).

The 2019 edition of NFPA 1852 features editorial updates and changes to the 2013 text. Since NFPA 1852 is now the selection, care, and maintenance standard for NFPA 1986 as well as NFPA 1981, references to NFPA 1986 have been added to sections of the standard. New requirements for reporting adverse conditions involving SCBA have been added, including removal from service, securing SCBA and restricting access, and documenting the chain of custody. A chain of custody form has been added to an annex as an example for users of this standard. NFPA 1986 now requires organizations to provide to the SCBA manufacturer data logging and photo or video evidence of the specific adverse condition. The 2019 edition also clarifies when SCBAs must be upgraded or retired.

Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment

William E. Haskell, III, Chair

National Institute for Occupational Safety & Health, MA [E]
Rep. National Institute for Occupational Safety & Health

Jason L. Allen, Intertek Testing Services, NY [RT]
James B. Area, Chimera Enterprises International, MD [SE]
Joseph Arrington, San Antonio Fire Department, TX [U]
Roger L. Barker, North Carolina State University, NC [SE]
James E. Brinkley, International Association of Fire Fighters, DC [L]
Rep. International Association of Fire Fighters
Steven D. Corrado, UL LLC, NC [RT]
Cristine Z. Fargo, International Safety Equipment Association, VA [M]
Edmund Farley, Pittsburgh Bureau Of Fire, PA [E]
Robert A. Freese, Globe Manufacturing Company, NH [M]
Patricia A. Gleason, ASTM/Safety Equipment Institute (SEI), VA [RT]
David V. Haston, U.S. Department of Agriculture, ID [E]
Diane B. Hess, PBI Performance Products, Inc., NC [M]
Thomas M. Hosea, U.S. Department of the Navy, FL [RT]
James S. Johnson, Lawrence Livermore National Laboratory, CA [RT]
Beth C. Lancaster, U.S. Department of Defense, VA [E]
Jeff Legendre, Northborough Fire Department, MA [U]
Karen E. Lehtonen, Lion Group, Inc., OH [M]

David G. Matthews, Fire & Industrial (PPE) Ltd., United Kingdom [SE]
Rep. International Standards Organization
Benjamin Mauti, Globe Manufacturing/Mine Safety Appliances Company, PA [M]
Rep. Compressed Gas Association
Michael F. McKenna, Michael McKenna & Associates, LLC, CA [SE]
Douglas Menard, Boston Fire Department, MA [U]
John H. Morris, 3M/Scott Safety, GA [M]
Jack E. Reall, Columbus (OH) Division of Fire, OH [L]
Rep. Columbus Firefighters Union
Jeffrey O. Stull, International Personnel Protection, Inc., TX [M]
Tim W. Tomlinson, Addison Fire Department, TX [C]
Robert D. Tutterow, Jr., Fire Industry Equipment Research Organization (FIERO), NC [U]
Rep. NFPA Fire Service Section
William A. Van Lent, Veridian Ltd., Inc., IA [M]
Rep. Fire & Emergency Manufacturers & Services Association
Bruce H. Varner, BHVarner & Associates, AZ [M]
Rep. International Fire Service Training Association
Steven H. Weinstein, Honeywell Safety Products, CA [M]
Richard Weise, Los Angeles County Fire Department, CA [U]
Harry P. Winer, HIP Consulting LLC, MA [SE]

Alternates

Louis Carpentier, Innotex Inc., Canada [M]
(Alt. to William A. Van Lent)
Robin B. Childs, U.S. Department of Defense, VA [E]
(Alt. to Beth C. Lancaster)
Patricia A. Freeman, Globe Manufacturing Company, LLC/Mine Safety Appliances Company (MSA), NH [M]
(Alt. to Robert A. Freese)
Tim J. Gardner, 3M Company/Scott Safety, MN [M]
(Alt. to Cristine Z. Fargo)
Kenneth Hayes, Boston Fire Department, MA [U]
(Alt. to Douglas Menard)
Pamela A. Kavalesky, Intertek Testing Services, NY [RT]
(Alt. to Jason L. Allen)
Judge W. Morgan, 3M Company/Scott Safety, NC [M]
(Alt. to John H. Morris)
Gary L. Neilson, Sparks, NV [U]
(Alt. to Robert D. Tutterow, Jr.)
Amanda H. Newsom, UL LLC, NC [RT]
(Alt. to Steven D. Corrado)
Anthony Petrilli, U.S. Department of Agriculture, MT [E]
(Alt. to David V. Haston)
Kevin M. Roche, Facets Consulting, AZ [M]
(Alt. to Bruce H. Varner)

Stephen R. Sanders, ASTM/Safety Equipment Institute (SEI), VA [RT]
(Alt. to Patricia A. Gleason)
Russell Shephard, Australasian Fire & Emergency Service Authorities Council, Australia [SE]
(Alt. to David G. Matthews)
David P. Stoddard, Michael McKenna & Associates, LLC, CA [SE]
(Alt. to Michael F. McKenna)
Grace G. Stull, International Personnel Protection, Inc., TX [M]
(Alt. to Jeffrey O. Stull)
Rick L. Swan, IAFF Local 2881/CDF Fire Fighters, VA [L]
(Alt. to James E. Brinkley)
Jonathan V. Szalajda, National Institute for Occupational Safety & Health, PA [E]
(Alt. to William E. Haskell, III)
Donald B. Thompson, North Carolina State University, NC [SE]
(Alt. to Roger L. Barker)
W. Jason Traynor, MSA Safety, PA [M]
(Alt. to Benjamin Mauti)
Jian Xiang, The DuPont Company, Inc., VA [M]
(Alt. to Diane B. Hess)

Nonvoting

Robert J. Athanas, FDNY/SAFE-IR, Incorporated, NY [U]
Rep. TC on Electronic Safety Equipment
George Broyles, U.S. Forest Service, ID [I]
Rep. TC on Wildland Fire Fighting PC&E
Tricia L. Hock, ASTM/Safety Equipment Institute (SEI), VA [RT]
Rep. TC on Emergency Medical Services PC&E

Stephen J. King, Babylon, NY [SE]
Rep. TC on Structural and Proximity Fire Fighting PC&E
Jeremy Metz, West Metro Fire Rescue, CO [U]
Rep. TC on Special Operations PC&E

Brian Montgomery, U.S. Department of Justice, DC [E]
Rep. Tactical and Technical Operations Respiratory Protection
Equipment

Daniel N. Rossos, Oregon Department of Public Safety Standards &
Training, OR [E]
Rep. TC on Respiratory Protection Equipment

Chris Farrell, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the 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 the design, performance, testing, and certification of protective clothing and protective equipment manufactured for fire and emergency services organizations and personnel, to protect against exposures encountered during emergency incident operations. This Committee shall also have the primary responsibility for documents on the selection, care, and maintenance of such protective clothing and protective equipment by fire and emergency services organizations and personnel.

Technical Committee on Respiratory Protection Equipment

Daniel N. Rossos, *Chair*

Oregon Department of Public Safety Standards & Training, OR [E]

Steven H. Weinstein, *Secretary*

Honeywell Safety Products, CA [M]

Jason L. Allen, Intertek Testing Services, NY [RT]

Christopher Anaya, California State Fire Fighters Association, CA [C]

Rep. California State Firefighters Association

Steven K. Berning, Ocenco Inc., WI [M]

David T. Bernzweig, Columbus (OH) Division of Fire, OH [L]

Rep. Columbus Firefighters Union

Ryan Brubaker, Clovis Fire Department, CA [U]

Kevin Campbell, Fairfax County Fire & Rescue Department, VA [U]

Craig E. Colton, 3M Company, MN [M]

Rep. International Safety Equipment Association

William Dickson, Bauer Compressors, Inc., VA [M]

Joseph W. Domitrovich, U.S. Department of Agriculture, MT [RT]

Robin R. Gainey, Jacksonville Fire Rescue Department, FL [L]

Rep. International Association of Fire Fighters

Ed Golla, TRI/Air Testing, TX [RT]

A. Ira Harkness, U.S. Department of the Navy, FL [RT]

Kenneth Hayes, Boston Fire Department, MA [U]

James S. Johnson, Lawrence Livermore National Laboratory, CA [RT]

Kevin D. Lentz, Grace Industries, Inc., TX [M]

Clint Mayhue, Avon Protection Systems, MD [M]

Stephen T. Miles, National Institute for Occupational Safety & Health, WV [E]

Rep. National Institute for Occupational Safety & Health

Judge W. Morgan, Scott Safety, NC [M]

William T. Mundy, Fire Department City of New York, NY [U]

Rep. Fire Department City of New York

Ruby Ochoa, Trace Analytics LLC, TX [RT]

Jeffrey Peterson, National Institute for Occupational Safety & Health, PA [E]

Rep. National Institute for Occupational Safety & Health

Bryan Profit, Portland Fire & Rescue, OR [L]

Timothy M. Radtke, U.S. Department of the Interior, CO [E]

Stephen R. Sanders, ASTM/Safety Equipment Institute (SEI), VA [RT]

Robert Sell, Draeger, Inc., PA [M]

Trevor L. Steedman, Ocean City Fire Department, MD [U]

Michael E. Szymanski, Virginia Beach Fire Department, NC [U]

Marco Tekelenburg, Mine Safety Appliance Company, PA [M]

Mark Trudgeon, Luxfer Gas Cylinders, CA [M]

Kenton D. Warner, KDW Consulting, LLC, FL [SE]

Alternates

Hans O. Almqvist, Createc Consulting LLC, CT [SE]

(Alt. to Kenton D. Warner)

John P. Campman, Grace Industries, Inc., PA [M]

(Alt. to Kevin D. Lentz)

Brian H. Cox, Clovis Fire Department, CA [U]

(Alt. to Ryan Brubaker)

David V. Haston, U.S. Department of Agriculture, ID [RT]

(Alt. to Joseph W. Domitrovich)

David Hodson, DAH Consultant, United Kingdom [M]

(Alt. to Robert Sell)

George Hoppe, Jr., Bauer Compressors, Inc., VA [M]

(Alt. to William Dickson)

John F. Kuhn, Mine Safety Appliances Company, PA [M]

(Alt. to Marco Tekelenburg)

Craig Martin, Avon Protection Systems, GA [M]

(Alt. to Clint Mayhue)

Timothy R. Merinar, National Institute for Occupational Safety & Health, WV [E]

(Alt. to Stephen T. Miles)

Tom Mooney, Tualatin Valley Fire & Rescue, OR [L]

(Alt. to Robin R. Gainey)

David G. Trebisacci, NFPA Staff Liaison

Dean D. Moran, ASTM/Safety Equipment Institute (SEI), VA [RT]

(Alt. to Stephen R. Sanders)

Kenneth A. Pravetz, City of Virginia Beach Fire Department, VA [U]

(Alt. to Michael E. Szymanski)

Thomas Richardson, Fire Department City of New York, NY [U]

(Alt. to William T. Mundy)

Steve Saksa, Columbus (OH) Division of Fire, OH [L]

(Alt. to David T. Bernzweig)

Matthew Shannon, Johnson Controls/Tyco/Scott Safety, NC [M]

(Alt. to Judge W. Morgan)

Dick Smith, Trace Analytics LLC, TX [RT]

(Alt. to Ruby Ochoa)

Michael L. Swofford, Interspiro, Inc., WI [M]

(Alt. to Steven K. Berning)

Jay L. Tarley, National Institute for Occupational Safety & Health, WV [E]

(Alt. to Jeffrey Peterson)

Gregory R. Vrablik, Honeywell Safety Products, CA [M]

(Alt. to Steven H. Weinstein)

Albert Yanagisawa, Los Angeles County Fire Department, CA [U]

(Voting Alternate)

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the 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 respiratory equipment, including breathing air, for fire and emergency services personnel

during incidents involving hazardous or oxygen deficient atmospheres. This Committee shall also have primary responsibility for documents on the selection, care, and maintenance of respiratory protection equipment and systems by fire and emergency services organizations and personnel.

Contents

Chapter 1 Administration	1852- 8	4.9 Technical Authorization.	1852- 13
1.1 Scope.	1852- 8	Chapter 5 Selection	1852- 13
1.2 Purpose.	1852- 8	5.1 Selection for Purchase.	1852- 13
1.3 Application.	1852- 8	5.2 Acceptance.	1852- 14
Chapter 2 Referenced Publications	1852- 9	Chapter 6 Care	1852- 14
2.1 General.	1852- 9	6.1 Cleaning and Disinfecting.	1852- 14
2.2 NFPA Publications.	1852- 9	6.2 Contamination and Decontamination.	1852- 15
2.3 Other Publications.	1852- 9	6.3 Storage.	1852- 15
2.4 References for Extracts in Mandatory Sections. (Reserved)	1852- 9	Chapter 7 Maintenance	1852- 15
Chapter 3 Definitions	1852- 9	7.1 User Maintenance.	1852- 15
3.1 General.	1852- 9	7.2 Technician Maintenance.	1852- 17
3.2 NFPA Official Definitions.	1852- 9	7.3 Breathing Air Cylinder Filling.	1852- 18
3.3 General Definitions.	1852- 9	7.4 Breathing Air Cylinder Requalification.	1852- 18
Chapter 4 Program Component	1852- 10	7.5 Testing.	1852- 18
4.1 General.	1852- 10	Annex A Explanatory Material	1852- 24
4.2 Reporting Adverse Conditions Involving SCBA.	1852- 10	Annex B Instructions for External Examination of SCBA Breathing Air Cylinders	1852- 29
4.3 SCBA Selection, Care, and Maintenance Program Component.	1852- 10	Annex C Requalification of SCBA Breathing Air Cylinders	1852- 29
4.4 SCBA Compliance — Upgrades and Retirement.	1852- 11	Annex D Informational References	1852- 30
4.5 Records.	1852- 11	Index	1852- 32
4.6 Manufacturer's Instructions.	1852- 12		
4.7 Retirement and Disposal.	1852- 12		
4.8 Quality Assurance.	1852- 13		

NFPA 1852

Standard on

Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2019 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notices and Disclaimers Concerning NFPA Standards.” They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the “List of NFPA Codes & Standards” at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

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

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in advisory sections of this document are given in Chapter 2 and those for extracts in the informational sections are given in Annex D. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text should be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1 Scope.

- Δ 1.1.1* This standard shall specify minimum requirements for the selection, care, and maintenance of open-circuit self-contained breathing apparatus (SCBA) and combination SCBA/supplied air respirator (SAR) that are used for respiratory protection during emergency or tactical or technical operations, in environments where the atmosphere is immediately dangerous to life and health (IDLH) or could become oxygen deficient or IDLH.

1.1.2 This standard shall specify the requirements for SCBA models as detailed in Section 1.3 of this chapter.

- Δ 1.1.3 For fire departments, this standard shall specify the requirements for the SCBA selection, care, and maintenance component of the respiratory protection program required in Section 7.10 of NFPA 1500.

1.1.4 This standard shall not specify requirements for any closed-circuit SCBA.

1.1.5 This standard shall not specify requirements for other respiratory protection program components of the organization such as SCBA training, appropriate use of SCBA for operations, and breathing air quality as these program components are under the jurisdiction of other NFPA standards.

1.1.6 This standard shall not specify requirements for accessories attached to the SCBA unless specifically addressed herein.

1.1.7 Nothing herein shall restrict any jurisdiction from exceeding these minimum requirements.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to establish procedures as part of a program to provide care and maintenance for open-circuit SCBA and combination SCBA/SAR in order to reduce the safety risks and potential health risks associated with poorly maintained, contaminated, or damaged SCBA.

- Δ 1.2.2 This standard shall also establish basic criteria for the evaluation and selection process associated with purchasing open-circuit SCBA to assure only SCBA that meet the requirements of NFPA 1981 or NFPA 1986 are acquired for use by emergency services organizations.

1.3 Application.

1.3.1 New and Existing SCBA.

- Δ 1.3.1.1 For fire departments, this standard shall apply to the requirements for selection, care, and maintenance of the SCBA component of the fire department's respiratory protection program as required by Section 7.10 of NFPA 1500.

1.3.1.2 This standard shall apply to the acquisition of new open-circuit SCBA and to the preparation of new SCBA to go into the “in service” status.

- Δ 1.3.1.3 This standard shall apply to the organization's existing open-circuit SCBA that are covered in the care and maintenance part of the respiratory protection program for open-circuit SCBA, and the standard shall also apply to the selection process to acquire new open-circuit SCBA to augment or replace existing SCBA.

- Δ 1.3.1.4 This standard shall apply to open-circuit SCBA that were certified by an independent third-party certification organization as compliant with the 2002 or 2007 edition of NFPA 1981, with the 2013 or later edition of NFPA 1981, or with the 2017 edition of NFPA 1986.

1.3.2 Implementation.

1.3.2.1 When this standard is adopted by an organization or by a jurisdiction, the authority having jurisdiction shall set a date or dates for achieving compliance with the requirements of this standard.

1.3.2.2 The organization or the jurisdiction shall be permitted to establish a phase-in schedule for compliance with specific requirements of this standard.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, 1971 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2018 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2007 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, 2002 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, 2018 edition.

NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*, 2017 edition.

NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection*, 2019 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 29, Code of Federal Regulations, Part 1910.134, *Respiratory Protection*, 7 August 2012.

Title 29, Code of Federal Regulations, Part 1910.156, *Fire Brigades*, 12 December 2008.

2.3.2 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections. (Reserved)

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

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

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Atmosphere-Supplying Respirator. A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, which includes self-contained breathing apparatus (SCBA) and supplied air respirators (SAR). [See also 3.3.14, *Self-Contained Breathing Apparatus (SCBA)*, and 3.3.16, *Supplied Air Respirator (SAR)*.]

3.3.2 Care. Procedures for cleaning, decontamination, and storage of protective clothing and equipment.

3.3.3* Combination SCBA/SAR. An atmosphere-supplying respirator that supplies a respirable atmosphere to the user from a combination of two breathing air sources both of which are independent of the ambient environment. [See also 3.3.1, *Atmosphere-Supplying Respirator*; 3.3.14, *Self-Contained Breathing Apparatus (SCBA)*; and 3.3.16, *Supplied Air Respirator (SAR)*.]

3.3.4 Contamination/Contaminated. The process by which protective clothing or equipment has been exposed to hazardous materials or biological agents.

3.3.5 Cross Contamination. The transfer of contamination from one item to another or to the environment.

3.3.6 Fully Charged. An SCBA cylinder filled to greater than 90 percent of the NIOSH rated service pressure.

3.3.7 In-Service. Ready for immediate use.

3.3.8 Maintenance. Procedures for inspection, repair, and removal from service of protective clothing and equipment.

3.3.9* Organization. The entity that provides the direct management and supervision for emergency services response personnel.

3.3.10 Rebuild. To clean and examine compliant product thoroughly and make needed repairs and replace components as specified by the manufacturer.

3.3.11 SAR. An abbreviation for supplied air respirator. [See also 3.3.16, *Supplied Air Respirator (SAR)*.]

3.3.12 SCBA. An abbreviation for self-contained breathing apparatus. [See also 3.3.14, *Self-Contained Breathing Apparatus (SCBA)*.]

3.3.13 Selection. The process of determining what protective clothing and equipment (PCE) are necessary for protection of emergency services response personnel from an anticipated

specific hazard or other activity, the procurement of the appropriate PCE, and the choice of the proper PCE for a specific hazard or activity at an emergency incident.

3.3.14* Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by the user. [See also 3.3.1, *Atmosphere-Supplying Respirator*; 3.3.3, *Combination SCBA/SAR*; and 3.3.16, *Supplied Air Respirator (SAR)*.]

3.3.15 Specified Service Life. Time, exposure event, or number of uses to which a compliant product or component is expected to remain functional.

3.3.16* Supplied Air Respirator (SAR). An atmosphere-supplying respirator, also known as an airline respirator, for which the source of breathing air is not designed to be carried by the user. [See also 3.3.1, *Atmosphere-Supplying Respirator*; 3.3.3, *Combination SCBA/SAR*; and 3.3.14, *Self-Contained Breathing Apparatus (SCBA)*.]

3.3.17 Technician. An individual qualified and authorized by the compliant product manufacturer to provide specified care and maintenance to the product and perform inspection, repair, and testing beyond the level classified as “user repair.”

Chapter 4 Program Component

4.1 General.

4.1.1 Emergency services organizations shall have a written respiratory protection program that addresses the respiratory protection for the members of that organization.

4.1.1.1 As part of the organization’s respiratory protection program, the organization shall develop, implement, and apply a program component for the selection, care, and maintenance of open-circuit SCBA used for respiratory protection by the members of the organization.

▲ **4.1.1.2** For fire departments’ respiratory protection programs specified in Section 7.10 of NFPA 1500 the organization shall develop, implement, and apply the program component for the selection, care, and maintenance of open-circuit SCBA used by the members of the organization in the performance of their assigned functions.

4.1.2 The program component shall have the following goals:

- (1) Provide SCBA that is suitable and appropriate for the intended use
- (2) Maintain SCBA in a safe, usable condition to provide the intended protection to the user
- (3) Remove from use any SCBA that could cause or contribute to user injury, illness, or death because of its condition
- (4) Recondition, repair, or retire such SCBA

4.1.3 The SCBA selection, care, and maintenance component of the organization’s respiratory protection program shall be in accordance with Section 4.3 of this chapter.

4.2 Reporting Adverse Conditions Involving SCBA.

4.2.1 As part of the respiratory protection program, the organization shall develop standard operating procedures (SOPs) for a condition or conditions involving SCBA or SCBA compo-

nents that lead(s) to failure, near-failure, or a significant degradation of performance as a result of normal use.

■ **4.2.2*** The SOP specified in 4.2.1 shall include, but not be limited to, the following:

- (1) Removal from service of the complete SCBA assembly, including the cylinder and facepiece
- (2) Securing of the SCBA and restricting access
- (3) Documentation of the chain of custody

▲ **4.2.3** Where a specific condition as specified in 4.2.1 is identified, the organization shall promptly notify the manufacturer in writing of the specific condition(s) or cause and the circumstances involved with the specific condition(s) or cause.

■ **4.2.3.1** The organization shall provide to the manufacturer data logging and photographic and/or video evidence of the specific condition as specified in 4.2.1.

■ **4.2.3.2** The procedure for notifying the manufacturer in writing shall be identified in the organization’s SOPs.

4.2.4 Copies of the notification to the SCBA manufacturer shall also be promptly supplied to the certification organization that certified the SCBA and to National Institute for Occupational Safety and Health National Personal Protective Technology Laboratory (NIOSH NPPTL).

4.3 SCBA Selection, Care, and Maintenance Program Component.

4.3.1 The organization shall develop written SOPs that shall identify and define the various parts of the organization’s respiratory protection program and the various roles and responsibilities of the organization and the members.

• **4.3.2** As part of the respiratory protection program, the organization shall develop SOPs for minimizing exposure to contaminated SCBA.

4.3.2.1 The organization shall define what criteria determine when an SCBA is contaminated beyond the ability to remedy by cleaning and disinfecting in accordance with Section 6.1 of this standard.

4.3.2.2 The SOPs shall detail methods for proper disposal of such contaminated SCBA in accordance with 4.7.2.

4.3.2.3 As a minimum, SCBA that are known to be contaminated or are suspected of being contaminated shall be tagged out-of-service and shall be segregated from other equipment, personnel, and civilians.

4.3.2.4 The organization shall develop procedures to minimize the public’s risk of exposure to soiled or contaminated SCBA.

4.3.3 The portion of the respiratory protection program for selection of SCBA shall include the requirements specified in Chapter 5 of this standard.

4.3.4 The portion of the respiratory protection program for care of SCBA shall include the requirements specified in Chapter 6 of this standard.

4.3.5 The portion of the respiratory protection program for maintenance of SCBA shall include the requirements specified in Chapter 7 of this standard.

4.3.5.1 As part of the respiratory protection program for maintenance, the organization shall have written SCBA testing

procedures utilizing a breathing machine that meets the requirements of 7.5.5 and 7.5.6.

4.3.5.2 As part of the respiratory protection program for maintenance, the SCBA testing procedures shall include but not be limited to the following:

- (1) Administration
- (2) Testing protocol
- (3) Training in use of the breathing machine
- (4) Calibration of the breathing machine
- (5) Test technician authorization
- (6) Record keeping
- (7) Test scheduling
- (8) Evaluation of the effectiveness of the program

4.3.5.3 As part of the respiratory protection program for maintenance, the organization shall develop SOPs for the frequency of technician inspection and testing of SCBA.

4.3.5.3.1 In all cases, the frequency of technician inspection shall not be less than specified in the SCBA manufacturer's instructions.

4.3.5.3.2 The organization shall also consider factors including but not limited to the following:

- (1) Specific manufacturer's instructions related to breathing machine testing
- (2) Severity of environment in which SCBA is used
- (3) Number of uses for each SCBA
- (4) User reports of visual damage of SCBA
- (5) User complaints of improperly functioning SCBA
- (6) Specific worksite issues
- (7)* Specific SCBA cylinder inspection

4.3.5.4 Where the part of the respiratory protection program that addresses the maintenance of SCBA includes SCBA technicians who are members of the organization, such technicians shall meet the requirements of Section 4.9 of this chapter.

4.3.6* The organization shall develop an SOP that requires that no member of the organization performs any alterations to the SCBA's form, fit, or function that causes the certification to the National Institute for Occupational Health and Safety (NIOSH) or to NFPA 1981 or NFPA 1986 to be invalid.

4.3.7 The organization shall require that all members who use SCBA or are responsible for any part of the organization's respiratory protection program are informed and trained not to make any alterations or changes to any SCBA's original condition that causes the NIOSH certification of the respirators or the certification of the SCBA in accordance with NFPA 1981 or NFPA 1986 to be invalid.

4.4 SCBA Compliance — Upgrades and Retirement.

Δ 4.4.1 SCBA that are currently in service shall be certified as compliant with at least one of the following standards:

- (1) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, 2002 edition
- (2) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2007 edition
- (3) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition
- (4) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2018 edition
- (5) NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*, 2017 edition.

Δ 4.4.2 SCBA certified to the 2007 and 2013 editions of NFPA 1981 shall be permitted to be upgraded to be compliant with the 2018 edition of NFPA 1981 in accordance with the SCBA manufacturer's and certification organization's instructions.

Δ 4.4.3 Where currently-in-service SCBAs do not meet the requirements of 4.4.1, such SCBAs shall be retired and disposed of as specified in 4.7.1.

4.5 Records.

4.5.1* The organization shall create a written procedure to manage the record-keeping system.

4.5.2 The record-keeping system shall accommodate the documents listed in 4.5.8 and all additional documents that are needed after considering the following factors:

- (1) Need for the record, report, or document
- (2) How the record, report, or document contributes to realizing the organization's goals within the selection, care, and maintenance program component
- (3) Number of copies needed
- (4) Person(s) responsible for producing the record, report, or document
- (5) Format and substance of the record, report, or document
- (6) Person(s) who receives, forwards, reviews, processes, and uses the record, report, or document
- (7)* Disposition of the record, report, or document after it has been completely developed

4.5.3* The organization shall consult with legal counsel concerning specific laws that determine the length of time records, reports, and documents shall be retained. Legal counsel shall advise the organization about the form, written or electronic, that is permitted and under what circumstances original or copied documents are needed for various purposes.

4.5.4 The organization shall determine how required records, reports, and documents are created, processed, maintained, and stored. Regardless of the method selected, the organization shall take measures to prevent loss and damage.

4.5.5 The record-keeping system shall be managed by a person who is trained and qualified to ensure that information is obtained, collected, communicated, retrieved, used, and stored according to the plan. The record-keeping manager shall also consider how to reduce waste, redundancy, and cost in the system.

4.5.6 The manager of the record-keeping system shall educate and train personnel within the organization in completing, filing, and using various components of the record-keeping system. The manager shall be assisted by sufficient staff to fulfill the manager's duties.

4.5.7 The manager of the record-keeping system shall conduct an annual inventory and audit of records, reports, and documents. Following the inventory and audit, the manager shall recommend changes in the record-keeping system as needed.

4.5.8 The organization shall create, maintain, and disseminate the following as required:

- (1) Written instructions for care, maintenance, and repair that correspond to those provided by the manufacturer
- (2) Written instructions for checks while donning SCBA
- (3) Written instructions for inspection, including procedures to be followed if defects are found

- (4) Forms to document the findings during inspection
- (5) Forms to record and to report defects found during inspections and to track the SCBA or cylinder as it is repaired
- (6) Forms to document inspections, tests, and repairs by SCBA users and technicians that shall include the following:
 - (a) SCBA make, model, and serial number and other information to identify components
 - (b) Documentation of the date, result of the inspection or test, and all actions taken as well as who acted
- (7) Written instructions for filling and for testing cylinders
- (8) Written policy and procedure concerning training and authorization of SCBA technicians as well as documentation of that training and authorization
- (9) Written procedures for the inspection of cylinders by technicians
- (10) Written procedures for recording information about the inspection and repair of cylinders
- (11) Stickers, tags, or other similarly effective means to alert users and technicians to defects, to document inspections, and to certify that tests, repairs, and other actions have been completed
- (12) Written procedures for periodic tests and comprehensive inspections that comply with the requirements of this standard
- (13) Documentation of the tests to verify SCBA performance
- (14) Schedule for retention, disposition, and disposal of each report, record, and document
- (15) Methods of identifying all SCBAs, cylinders, parts, and components so that these can be identified and tracked from initial receipt by the organization until removed from the possession and control of the organization
- (16) Documentation when a defective or obsolete SCBA or component part is removed from service in accordance with the following:
 - (a) Until retirement and disposal of a defective or obsolete SCBA or component as specified in 4.7.3, a tag shall be conspicuously placed on the SCBA or component.
 - (b) The tag shall indicate the date and time the SCBA or component was removed from service, by whom, and for what reason.
 - (c) SCBA and components that are removed from service shall be stored separately from other SCBA and components and secured, as necessary.
 - (d) Access to tagged SCBA and components shall be limited, and only authorized persons shall remove tags after repair or service.
- (17) Records for maintenance of each individual SCBA regulator, reducer, harness, cylinder including valve assembly, and facepiece including the following information:
 - (a) Manufacturer's serial number or other unique identifier
 - (b) Date of manufacture, receipt, service, inspection, test, maintenance, and repair
 - (c) Inspections, service, repairs, and tests
 - (d) Who performed the work
 - (e) Other comments
- (18) Records of training provided to each user showing date(s) and subject(s) covered
- (19) Such other reports, records, and documents including forms, tags, stickers, and other means necessary to effectuate the purposes of record keeping and the intent of this standard

4.6 **Manufacturer's Instructions.**

4.6.1 When issuing new SCBA, the organization shall provide users with the instructions provided by the manufacturer on the care, use, and maintenance of their SCBA, including any warnings provided by the manufacturer.

4.6.2 Where the SCBA **manufacturer's** instructions regarding the SCBA's care, use, and maintenance differ from the requirements in this standard other than the requirements specified in 7.2.1.3 and 7.5.1, the manufacturer's instructions shall be followed.

4.7 **Retirement and Disposal.**

4.7.1 Retired SCBA shall be destroyed or altered in a manner assuring that they are not used for respiratory protection and shall be rendered unable to hold pressure, or the ownership of the SCBA shall be transferred to the manufacturer or the manufacturer's agent.

4.7.2 Where SCBA or SCBA components are contaminated beyond the ability to be decontaminated so the SCBA or components can be returned to service, such SCBA or component shall be disposed of.

4.7.2.1 Contaminated SCBA or components as identified according to 4.7.2 shall be segregated from other equipment and personnel and disposed of in a manner consistent with the type of contamination and any governmental regulations governing contaminated items.

4.7.2.2 Prior to disposal, contaminated SCBA or components shall be altered in a manner assuring that they cannot be used for any purpose.

4.7.3 Defective or obsolete SCBA components or defective or obsolete SCBA that have been removed from service and cannot be repaired or upgraded shall be destroyed or altered in a manner assuring that they cannot be used in any emergency, **tactical or technical operations**, or other activities, including training; or the ownership of such SCBA shall be transferred to the manufacturer or the **manufacturer's** agent.

4.7.4 SCBA elastomeric components, including but not limited to facepieces, O-rings, and hose, shall be destroyed or altered in a manner assuring that they cannot be used for any purpose when the component reaches the SCBA manufacturer's specified component service life.

4.7.5* SCBA composite cylinders shall be removed from service and retired when they reach the end of the service life specified by the SCBA manufacturer. Such composite cylinders shall be destroyed or altered in a manner assuring that they cannot be used for respiratory protection and shall be rendered unable to hold pressure, or the ownership of the composite cylinder shall be transferred to the manufacturer or the **manufacturer's** agent.

4.7.6 Any SCBA cylinders that are beyond repair or not allowed to be repaired shall be destroyed or altered in a manner assuring that they are marked and identified as “Condemned” and shall be rendered unable to hold pressure. Before destroying or rendering them unable to hold pressure, permission from the owner of the cylinder shall be obtained.

4.8 Quality Assurance.

4.8.1 The organization shall establish and maintain a quality assurance plan for selection, care, and maintenance of SCBA.

4.8.2 The quality assurance plan shall be designed to realize all of the following goals:

- (1) Assure effective and safe performance of SCBA provided to users
- (2) Substantiate compliance with this standard
- (3) Confirm the organization's policies and procedures are being followed
- (4) Determine the effectiveness of those policies and procedures
- (5) Improve the organization's respiratory protection program component for selection, care, and maintenance of SCBA

4.9 Technical Authorization.

4.9.1 Where the portion of the respiratory protection program component that addresses the maintenance of SCBA, as specified in 4.3.5, includes SCBA technicians that are members of the organization, such technicians shall be qualified and authorized by the SCBA manufacturer to perform specified allowable maintenance.

4.9.1.1 Allowable maintenance shall include periodic inspection, repair, and overhaul of all SCBA components and assemblies.

4.9.1.2 Technicians shall also be qualified and authorized in the use of all special tools and equipment required to test and maintain the SCBA.

4.9.2 The program component shall establish policies and procedures for qualification and selection of personnel for SCBA technician training and authorization.

4.9.3 The organization shall maintain evidence that all SCBA technicians that are used by the organization have current authorization by the SCBA manufacturer and have maintained their level of competency.

Chapter 5 Selection

5.1 Selection for Purchase.

5.1.1 Risk Assessment.

5.1.1.1 Prior to starting the procurement process of SCBA, a risk assessment shall be performed.

5.1.1.2 The risk assessment shall include, but not be limited to, the expected hazards that can be encountered by users of SCBA based on the type of duties performed, frequency of use, the organization's experiences, and the organization's geographic location and climatic conditions.

5.1.2 The organization shall review the following standards as a minimum:

- (1) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*
- (2) NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, where SCBA-integrated PASS are being considered as an accessory for the SCBA
- (3) NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*

5.1.2.1 Fire department organizations shall also review NFPA 1500 and 29 CFR 1910.156.

5.1.2.2 Organizations in the United States shall also review 29 CFR 1910.134.

5.1.2.3 Organizations outside the United States shall also review all applicable national, state/provincial, and local regulations.

5.1.3 The organization shall compile and evaluate information on comparative product strengths and weaknesses.

5.1.4 The organization shall ensure that the SCBA interfaces properly with other personal protective items already being used by the organization.

Δ 5.1.5 The organization shall consider at least the following items during the selection process:

- (1) Cross contamination between users and ease of cleaning/decontamination
- (2) Legibility of remote pressure indicators in reduced visibility
- (3) Size
- (4) Weight
- (5) Rated service time
- (6) Breathing resistance
- (7) Environment
- (8) Ease of donning and doffing
- (9) Comfort
- (10) Fit range and available number of facepiece sizes
- (11) Number and complexity of steps involved in operation and maintenance of the SCBA
- (12) Design features that provide positive feedback to the user that required steps have been completed properly
- (13) Design features that prevent steps from being performed improperly
- (14) Operability by user wearing the protective clothing and gloves worn when using SCBA
- (15) Facepiece vision area
- (16) Cylinder fill station requirements
- (17)* Method for uniquely identifying the components of the SCBA
- (18)* Facepiece nose cup
- (19) Vision correction needs of their personnel
- (20) Characteristics of the end-of-service time indicators (EOSTIs)
- (21) Communication capability including, but not limited to, speech diaphragms, voice amplifiers, and radio interface
- (22) Supplied air compatibility
- (23) Number of spare SCBA and cylinders
- (24) Rapid cylinder filling options

- (25) Cylinder types
- (26) Chemical, biological, radiological, and nuclear (CBRN) respiratory protection
- (27) SCBA accessories as follows:
 - (a) Telemetry and monitoring systems
 - (b) Personnel location systems
 - (c) SCBA-integrated PASS
 - (d) Emergency egress escape systems for bailout
 - (e) Emergency breathing safety system (EBSS)
- (28) Data log information and ease of retrieval
- (29) Battery life
- (30) Integration with command, accountability, and air management systems
- (31) Interface with certified CBRN ensembles
- (32) Interface with transportation seating
- (33) Interface with storage mechanisms
- (34) Interface or certification with fall protection harness
- (35) Interface or certification with escape or rappelling devices
- (36) Profile passing through openings
- (37) Interface with structural fire-fighting protective hood interface component providing particulate protection

N 5.1.5.1 For SCBA certified to NFPA 1986, the organization shall consider the following items:

- (1) Interface and mobility with weapons
- (2) Interface with body armor and non-fire-fighting helmets
- (3) Interface with other tools and equipment not used in fire-fighting operations
- (4) Interface with cooling systems

5.1.6 Where a field or laboratory evaluation is conducted, at least the following criteria shall be used for designing a systematic evaluation procedure:

- (1) The organization shall develop an evaluation plan including, but not limited to, testing according to 7.5.2 prior to and after field evaluations.
- (2) Participants for field evaluations shall be selected based on a cross-section of personnel, willingness to participate, objectivity, and level of operational activity.
- (3) Participants shall perform a field evaluation on each different product model being considered from each manufacturer for a particular SCBA. Participants shall be fitted for and instructed in the use of each product model being evaluated from each manufacturer.
- (4) A product evaluation form shall be developed for each model.
- (5) The organization shall solicit periodic reports from participants in the field evaluation.
- (6) The organization shall conclude the evaluation process and analyze the results.

5.1.7 Purchase specifications shall require evidence that the SCBA to be purchased are certified as compliant with NFPA 1981 or NFPA 1986, as appropriate.

Δ 5.1.7.1 Where SCBA-integrated PASS are installed as an accessory to the SCBA, the SCBA-integrated PASS shall be certified as compliant with NFPA 1982.

Δ 5.1.7.2 For each standard, NFPA 1981, NFPA 1982, or NFPA 1986, the edition of the respective standard(s) that is the current edition at the time of purchase shall be the edition specified.

5.1.8 Where the organization develops purchase specifications, at least the following criteria shall be considered:

- (1) All requirements developed by the organization in its evaluations conducted as specified in 5.1.3 through 5.1.7
- (2)* Quantitative fit testing
- (3) User training
- (4) Maintenance training
- (5) Manufacturer assistance to develop SOPs for maintenance
- (6) SCBA testing on site prior to acceptance
- (7) Maintenance schedule
- (8) Complete parts list
- (9) SCBA user and service manuals
- (10) List of any specialized equipment or special tools needed for SCBA maintenance
- (11) List of authorized service centers
- (12) Warranty statement
- (13) Need for an optional EBSS
- (14) Need for an optional supplementary voice communications system
- (15) Procedures for returning items found defective upon initial receipt

N 5.1.8.1 Where the organization develops purchase specifications for SCBA certified to NFPA 1986, at least the following criteria shall be considered:

- (1) Need for an optional HUD
- (2) Need for an optional RIC UAC

5.2 Acceptance.

5.2.1 Upon receipt, organizations shall inspect and test purchased SCBA in accordance with 7.1.2, and 7.5.2 through 7.5.6, respectively.

5.2.2 Organizations shall verify that the equipment received is as specified.

5.2.3 Procedures shall be established for returning unsatisfactory products if the organization's specifications are not met.

5.2.4 Organizations shall review information supplied with the products such as instructions, warranties, and technical data.

Chapter 6 Care

6.1 Cleaning and Disinfecting.

6.1.1 The external surfaces of the SCBA shall be cleaned and disinfected according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.2 The facepiece shall be thoroughly cleaned after each use and disinfected as needed. Facepiece cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.2.1 The exhalation valve shall be cleaned and flushed.

6.1.2.2 The facepiece shall be dried, and drying shall not be done in direct sunlight or in high heat.

6.1.2.3 The exhalation valve shall be cycled to assure proper operation.

6.1.3 Where the internal components have been exposed to bodily fluids, exhaled breath, dirt, or debris, the second stage regulator shall be thoroughly cleaned and disinfected. The cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.4 SCBA straps and harness assemblies shall be cleaned and disinfected when required according to manufacturer's instructions. Straps and harness assembly cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.4.1* Under no circumstances shall a chlorine bleach ever be used to clean straps and harness assemblies.

6.1.4.2 The straps and harness assemblies shall be dried, and drying shall not be done in direct sunlight or in high heat.

6.1.5 SCBA cylinder valve assemblies shall be cleaned and disinfected according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.5.1 The valve shall be free of debris.

6.1.5.2 The burst disc outlet shall be inspected and, if debris is present, the cylinder shall be removed from service.

6.1.6* Water or cleaning materials shall be prevented from entering the connection between the cylinder valve and the mating SCBA inlet connector.

6.1.7 Pneumatic component cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.7.1 All pneumatic components shall be thoroughly dried after cleaning.

6.1.7.2 Drying of pneumatic components shall not be done in direct sunlight or in high heat.

6.1.8 All other SCBA components shall be thoroughly air-dried prior to storage in a compartment that does not allow for air circulation.

6.1.9 Appropriate inspections according to 7.1.2 shall be performed after cleaning.

6.2 Contamination and Decontamination.

6.2.1 Where SCBA is suspected of being contaminated, it shall be tagged out-of-service and segregated from other equipment and personnel.

6.2.2 Tags shall include details of the incident including known and suspected contaminants.

6.2.3 The SCBA manufacturer shall be contacted to determine if any additional special procedures can be used to decontaminate the SCBA.

6.2.4 In all cases, decontamination shall be conducted in accordance with the SCBA manufacturer's instructions.

6.2.5 Where it is determined, in accordance with 4.3.2.1, that the SCBA is contaminated beyond the ability to decontaminate it and return it to service, the SCBA shall be disposed of in accordance with 4.7.2.

6.3 Storage.

6.3.1 SCBA shall be stored in their original carrying or storage cases or in a wall or apparatus bracket/rack designed for quick removal and for protection of the SCBA. Brackets/racks shall protect the SCBA and shall be adjusted so they do not cause physical damage to cylinders, hoses, regulators, or straps.

Δ 6.3.2 Brackets for securing SCBA in vehicles used for transportation of emergency services personnel shall meet the requirements of 14.1.10 of NFPA 1901.

6.3.3 SCBA shall be stored with the cylinder valves closed. Other valves or controls shall be positioned according to manufacturer's specifications.

6.3.4 The facepieces of all SCBA shall be positioned to avoid distortion of parts during storage.

6.3.5 All harness straps shall be adjusted to their maximum length during storage.

6.3.6 In all instances, the SCBA shall be stored in a manner to control and minimize exposure to shock, vibration, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and environmental elements.

6.3.7* All in-service SCBA cylinders shall be stored fully charged.

6.3.7.1 Cylinders shall be filled when the pressure falls to 90 percent of the manufacturer's specified pressure level.

6.3.7.2 A positive pressure shall be maintained in depleted SCBA cylinders by keeping the valve closed until they are filled to keep external contamination and condensation out of the cylinder.

6.3.7.3* Compressed breathing air stored in SCBA breathing air cylinders shall be replaced at least annually.

6.3.8 SCBA cylinders shall be stored in a manner that prevents damage to the valve and cylinder.

Chapter 7 Maintenance

7.1 User Maintenance.

7.1.1 Inspection Frequency.

7.1.1.1* Where SCBA is assigned to an individual user for a duty period, the inspection specified in 7.1.2 shall be performed by the individual user at the beginning of each duty period.

7.1.1.2 Where additional SCBA are available for use on response vehicles but not assigned to individual users, the inspection specified in 7.1.2 shall be performed on such additional SCBA at least once each duty period.

7.1.1.3 Where SCBA are not assigned to an individual user for a duty period, the inspection specified in 7.1.2 shall be performed at least once a week on all SCBA that are available for use.

7.1.1.4 In all cases, the interval between the inspections specified in 7.1.2 shall not exceed 1 week.

7.1.2 Inspection.

7.1.2.1 All of the following SCBA components shall be present:

- (1) Facepiece
- (2) Backframe and harness assembly
- (3) Cylinder
- (4) Hose
- (5) End-of-service-time indicator(s) (EOSTI)
- (6) Regulators
- (7) Accessories

7.1.2.2 Facepiece inspection shall include the following:

- (1) Material checked for deterioration, dirt, cracks, tears, holes, pliability, and tackiness
- (2) Head-harness buckles, strap, and webbing checked for breaks, loss of elasticity, or wear
- (3) Lens checked for holes, cracks, scratches, heat-damaged areas, and a proper seal with the facepiece material
- (4) Exhalation valve, where present, checked for valve seat
- (5) Springs and covers checked for proper operation and cleanliness
- (6) Regulator connection(s) checked for proper operation and damage
- (7) Speaking diaphragm, where present, checked for damage

7.1.2.3 Backframe and harness assembly inspection shall include the following:

- (1) Harness straps and backframe checked for cuts, tears, abrasion, indications of heat damage, and indications of chemical-related damage
- (2) All buckles, fasteners, and adjustments checked for proper operation
- (3) Cylinder retention system checked for damage and proper operation
- (4) Cylinder checked for secure attachment to the backframe
- (5) Harness straps checked for full extension

7.1.2.4 Breathing air cylinder assembly inspection shall include the following:

- (1) Hydrostatic test date on the cylinder checked to be current
- (2) Gauge checked for damage
- (3) Cylinder body checked for cracks, dents, weakened areas, indications of heat damage, and indications of chemical damage (*See Annex B*)
- (4) Composite portion of the cylinder checked for cuts, gouges, loose composite materials, and the absence of resin (*See Annex B*)
- (5) Cylinder valve outlet sealing surface and threads checked for damage
- (6) Valve hand wheel checked for damage, proper alignment, serviceability, and secure attachment
- (7) Burst disc outlet area checked for debris
- (8) Cylinder checked for full charge

7.1.2.5 Hose inspection shall include the following:

- (1) Hose checked for cuts, abrasions, bubbling, cracks, heat damage, and chemical damage
- (2) External fittings checked for visual signs of damage
- (3) Hose checked for tight connections

7.1.2.6 EOSTI inspection shall include the following:

- (1) EOSTI alarm and mounting hardware checked for damage, secure attachment, dirt, and debris

- (2) EOSTI checked for proper activation in accordance with the manufacturer's instructions

7.1.2.7 Regulator inspection shall include the following:

- (1) Regulator controls, where present, checked for damage and proper function
- (2) Pressure relief devices checked visually for damage
- (3) Housing and components checked for damage
- (4) Regulator checked for any unusual sounds such as whistling, chattering, clicking, or rattling during operation
- (5) Regulator and bypass checked for proper function when each is operated (Where this is accomplished by donning the facepiece and contamination between users is a possibility, the regulator, facepiece, or both shall be cleaned and disinfected.)

7.1.2.8 Pressure indicator inspection shall include the following:

- (1) Pressure indicator checked for damage
- (2) Cylinder pressure gauge and the remote gauge checked to read within 10 percent of each other

7.1.2.9 Where SCBA has an integrated PASS, the SCBA-integrated PASS inspection shall include the following:

- (1) Wear and damage assessment
- (2) Covers/compartments checked for secure attachment
- (3) All operating modes checked for proper function
- (4) Low battery warning signal

7.1.2.10 Where SCBA has other required or optional components, such components shall be inspected in accordance with the manufacturers' instructions and shall include at least inspection for signs of complete assembly of the component, wear, damage, secure attachment, adequate power source, and proper operation and functioning in accordance with the manufacturers' operational instructions.

7.1.2.11 As the final inspection item, the entire SCBA shall be checked for pressure retention by closing all regulator valves, opening the cylinder valve thereby pressurizing the SCBA system, and then closing the cylinder valve.

7.1.2.11.1 The SCBA shall hold system pressure in accordance with the manufacturer's specifications after the cylinder valve is closed.

7.1.2.11.2 Following the pressure check, the system pressure shall be released.

7.1.3 Repair.

7.1.3.1 Where user repair can be accomplished promptly and replacement items or remedial action are immediately available, the SCBA shall be permitted to be restored to proper condition and returned to in-service status.

7.1.3.2 Where user repair cannot be accomplished promptly or where replacement items or remedial action are not immediately available, the SCBA shall be tagged out-of-service and removed from the response vehicle or standby location until the user repair can be completed.

7.1.3.3 The organization's personnel shall follow the organization's SOPs and the manufacturer's written instructions for allowable user repairs and shall be trained on the specific repair procedures before performing them.

7.1.3.4 Users shall not perform work beyond the limits of the organization's SOPs and their training and shall not exceed what is allowed by the manufacturer's written instructions.

7.1.3.5 All repairs shall be done with the proper tools, parts, and equipment as specified by the manufacturer.

7.1.3.6 After repairs are made, the user shall conduct the appropriate inspection as specified in 7.1.2 to verify proper function of the SCBA.

7.1.4 Removal from Service.

7.1.4.1* Where a condition exists that is beyond user repair in accordance with 7.1.3, or the SCBA is suspected to be in an unsafe condition, the SCBA shall be removed from service, tagged, and referred to personnel responsible for technical maintenance.

7.1.4.2 Where any breathing air cylinder condition specified in 7.1.2.4 is identified, the cylinder shall be immediately depressurized to a slight positive pressure, tagged, and taken out of service. The valve shall be closed to keep external contamination and condensation out of the cylinder.

7.1.4.3 Any SCBA or SCBA components that have been exposed or are suspected of having been exposed to a CBRN agent(s) shall be removed from service, tagged, segregated from other equipment and personnel, and referred to person(s) designated in the organization's SOPs for appropriate disposition as specified in Section 4.7.

▲ **7.1.4.4** Any SCBA or SCBA components being taken out of service shall be tagged as specified in 4.5.8(16).

7.1.4.5 Where an SCBA breathing air cylinder is identified as having been filled with air that did not comply with 7.3.2, the cylinder shall be removed from service, tagged, and referred to personnel responsible for technical maintenance.

7.2 Technician Maintenance.

7.2.1 Inspection Frequency.

7.2.1.1 The technician shall perform the inspection specified in 7.1.2 upon receipt of any SCBA removed from service.

7.2.1.2 The technician shall perform the inspection specified in 7.1.2 and the testing specified in Section 7.5 prior to returning any SCBA to service.

7.2.1.3 The SCBA shall be tested on a breathing machine specified in 7.5.6 in accordance with the organization's SOPs or in accordance with the SCBA manufacturer's instructions, whichever is more frequent, but in all cases at least annually.

7.2.1.4 The frequency of technician inspection and testing of SCBA shall be conducted in accordance with the organization's SOPs developed as specified in 4.3.5.3.

7.2.1.5 The organization shall test all newly purchased SCBA as specified in Section 7.5 prior to putting the SCBA in service.

7.2.2 Inspection.

7.2.2.1 Technicians shall perform the level of inspection for which they have been trained and have been qualified to conduct by the SCBA manufacturer.

7.2.2.2 Where an SCBA is removed from service in accordance with 7.1.4, the technician shall verify the user-reported condition.

7.2.2.3 Where the user-reported condition is verified by the technician, the technician then shall determine the appropriate action to be taken to repair, return to service, or retire the SCBA or SCBA component(s).

7.2.2.4 Where the user-reported condition cannot be substantiated, the technician shall perform a complete SCBA inspection in accordance with the manufacturer's instructions.

7.2.3 Repairing and Rebuilding.

7.2.3.1 Technicians shall perform the level of repair or rebuild for which they have been qualified and are authorized to conduct by the SCBA manufacturer.

7.2.3.2 The technician shall verify that all parts and tools used in the maintenance, repair, and rebuild of SCBA are specified by the SCBA manufacturer for the specific SCBA model being repaired.

7.2.3.3* Parts and tools not specified by the manufacturer shall not be used.

7.2.3.4 The technician shall ensure that all components and tools are kept clean and free from contamination during repair and rebuild.

7.2.3.5 The technician shall ensure components are not damaged during repair and rebuild.

7.2.3.6 Product labels shall not be removed or obscured during repair or rebuild. Damaged or missing labels shall be replaced during repair or rebuild.

7.2.3.7 After repair or rebuild, the SCBA or SCBA component shall be inspected and tested in accordance with manufacturer's instructions.

7.2.3.8 Cylinder repairs shall be limited to only those conditions specified by the SCBA manufacturer.

▲ **7.2.3.9*** SCBA shall be periodically rebuilt to replace all components that are subject to wear and aging at a frequency specified by the manufacturer or by the organization, whichever is more frequent. Such frequency shall be based on the conditions of use of the SCBA as indicated in 4.5.8(17)(a) through (e).

7.2.4 Removal from Service and Disposition.

7.2.4.1* An SCBA breathing air cylinder identified as having been filled with air that is found to not comply with the breathing air requirements of 7.3.2 shall be removed from service.

7.2.4.1.1 Action shall be taken based on consideration of the reason for the air sample failure.

7.2.4.1.2 Further action shall be taken to ensure that if the breathing air cylinder is placed back in service, that breathing air cylinder does not pass contaminants back to the breathing air in future fillings.

7.2.4.2* Any SCBA or SCBA component that is damaged and cannot be repaired shall be removed from service and retired as specified in Section 4.7.

7.2.4.3* Any SCBA or SCBA components that have been exposed to or are suspected of having been exposed to a CBRN agent(s), and where such exposure cannot be remedied by a decontamination process authorized by the SCBA manufacturer, shall be retired as specified in Section 4.7.

7.2.4.4 Any SCBA breathing air cylinder that is beyond repair shall be removed from service and retired as specified in Section 4.7.

7.2.4.5 Composite breathing air cylinders shall be removed from service and retired as specified in Section 4.7 when they reach the end of the SCBA **manufacturer's** specified service life.

7.2.4.6* Any elastomeric component, including but not limited to facepieces, O-rings, and hose, shall be removed from service and retired as specified in Section 4.7, when they reach the end of the SCBA **manufacturer's** specified service life.

7.3 Breathing Air Cylinder Filling.

Δ 7.3.1 Prior to filling SCBA breathing air cylinders, the cylinder inspection specified in 7.1.2.4(1) through (8) shall be performed.

Δ 7.3.2 Breathing air shall meet the requirements specified in NFPA 1989.

7.3.3 The SCBA **manufacturer's** specified fill rate shall not be exceeded.

7.3.4 SCBA breathing air cylinders shall be filled as soon as possible after use.

Δ 7.3.5* Where filling breathing air cylinders during routine maintenance, all operators and personnel shall be protected from catastrophic failure of the cylinder by the use of an SCBA fill station that meets the requirements specified in Section 24.9 of NFPA 1901.

7.3.6 SCBA breathing air cylinders shall be requalified as specified by the SCBA manufacturer.

7.4 Breathing Air Cylinder Requalification.

7.4.1 SCBA breathing air cylinders shall be periodically requalified for service as required by the U.S. Department of Transportation (DOT). (*See Annex C.*)

7.4.2 Where an SCBA breathing air cylinder is found to not be currently qualified for service, it shall be removed from service, tagged, and submitted for requalification testing.

7.4.3 An SCBA breathing air cylinder that fails requalification shall be dealt with in accordance with 4.7.6.

7.5 Testing.

7.5.1 The organization responsible for the maintenance of the SCBA shall perform periodic testing in accordance with the part of the SCBA program component for maintenance as specified in 4.3.5. In all cases, SCBA shall be tested at least annually on a breathing machine that meets the requirements specified in 7.5.5 and 7.5.6.

Δ 7.5.2 SCBA shall be tested for the performance specified in Table 7.5.2 after being inspected as specified in 7.1.2.

7.5.2.1 The sound level of all audible EOSTI shall be measured using a calibrated instrument following the SCBA manufacturer's instructions and specifications.

7.5.2.2 All other EOSTI shall be measured in accordance with the manufacturer's instructions and specifications at least annually.

7.5.2.3 SCBA EOSTI signaling device(s) activation and operation shall conform to the SCBA manufacturer's specifications.

7.5.3 SCBA that fail to meet any of the acceptance criteria provided in Table 7.5.2 shall be tagged out-of-service until that SCBA has been adjusted or repaired, retested, and shown to meet all the requirements of Table 7.5.2.

7.5.4 All equipment used to test SCBA shall be calibrated in accordance with the test equipment manufacturer's instructions for calibration.

7.5.4.1 Calibration shall be performed periodically in accordance with the test equipment manufacturer's instructions but shall be calibrated at least annually.

7.5.4.2 A label shall be affixed to each piece of test equipment stating the date of the latest calibration and the date of the next scheduled calibration.

7.5.4.3 Records of calibration results shall be kept on file at the maintenance facility.

7.5.5 The breathing machine shall be capable of performing the tests listed in Table 7.5.2.

7.5.6 The breathing machine and any associated equipment shall be capable of meeting the specifications in Table 7.5.6(a) and Table 7.5.6(b).

Table 7.5.2 Performance Test Requirements

Performance Element	Acceptance Criteria
Facepiece leakage	In order to proceed with the tests specified in this table, a pressure of at least 0.20 mb (0.1 in.) H ₂ O gauge below atmospheric shall remain in the facepiece at the end of a testing interval equal to 10 seconds $\pm$ 0.5 seconds.
Facepiece exhalation valve opening pressure	Facepiece exhalation valve opening pressure shall be within manufacturer's specifications.
Facepiece static pressure	Pressure shall be between 0 mb (0 in.) H ₂ O gauge and 3.7 mb (1½ in.) H ₂ O gauge above atmospheric or shall meet manufacturer's specifications, whichever are more stringent.
First stage regulator (pressure reducer) static pressure	First stage regulator (pressure reducer) static pressure shall be within manufacturer's specifications.
Minimum facepiece pressure during breathing resistance test (at 40 L/min $\pm$ 1 L/min)	Minimum facepiece pressure shall meet manufacturer's specifications.
Maximum facepiece pressure during breathing resistance test (at 85 L/min $\pm$ 1 L/min)	Maximum facepiece pressure shall be less than or equal to the manufacturer's specifications, but not more than 5.0 mb (2 in.) H ₂ O gauge above maximum static pressure.
Facepiece pressure during breathing resistance test (at 103 L/min $\pm$ 3 L/min)	Pressure shall be between 0 mb (0 in.) H ₂ O gauge and 8.7 mb (3½ in.) H ₂ O gauge above atmospheric or shall meet manufacturer's specifications, whichever are more stringent.
First stage pressure during breathing resistance test (at 103 L/min $\pm$ 3 L/min)	First stage pressure (pressure reducer) shall be within manufacturer's specifications.
First stage pressure during breathing resistance test (at 40 L/min $\pm$ 1.0 L/min)	First stage pressure (pressure reducer) shall be within manufacturer's specifications.
Remote pressure gauge accuracy at ¾, ½, ¼-rated cylinder pressure	Remote pressure gauge accuracy shall be within $\pm$ 5 percent of full scale.
End-of-service time indicator (EOSTI): Activation	The EOSTI shall activate within manufacturer's specifications. Where the SCBA includes a second EOSTI, the activation pressure of the second EOSTI shall meet manufacturer's specifications.
Bypass flow rate	Where bypass valves are provided on SCBA, the flow rate through the bypass system shall be within manufacturer's specifications.

Table 7.5.6(a) Lung Breathing Waveforms for 103 L/min Volume Work Rate

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) $\pm$ 0.1 L	Volume Change (L) $\pm$ 5%
0	0.00	—	-1.700	-0.012
1	0.02	Inspire	-1.688	0.012
2	0.04	Inspire	-1.662	0.025
3	0.06	Inspire	-1.626	0.036
4	0.08	Inspire	-1.581	0.045
5	0.10	Inspire	-1.529	0.052
6	0.12	Inspire	-1.471	0.058
7	0.14	Inspire	-1.409	0.062
8	0.16	Inspire	-1.345	0.064
9	0.18	Inspire	-1.277	0.068
10	0.20	Inspire	-1.207	0.070
11	0.22	Inspire	-1.134	0.073
12	0.24	Inspire	-1.059	0.075
13	0.26	Inspire	-0.984	0.076
14	0.28	Inspire	-0.906	0.077
15	0.30	Inspire	-0.828	0.079
16	0.32	Inspire	-0.748	0.080
17	0.34	Inspire	-0.667	0.081
18	0.36	Inspire	-0.586	0.081
19	0.38	Inspire	-0.504	0.082
20	0.40	Inspire	-0.421	0.083
21	0.42	Inspire	-0.337	0.084
22	0.44	Inspire	-0.254	0.084
23	0.46	Inspire	-0.169	0.085
24	0.48	Inspire	-0.085	0.085
25	0.50	Inspire	0	0.085
26	0.52	Inspire	0.085	0.085
27	0.54	Inspire	0.169	0.085
28	0.56	Inspire	0.254	0.085
29	0.58	Inspire	0.337	0.084
30	0.60	Inspire	0.421	0.084
31	0.62	Inspire	0.504	0.083
32	0.64	Inspire	0.586	0.082
33	0.66	Inspire	0.667	0.081
34	0.68	Inspire	0.748	0.081
35	0.70	Inspire	0.828	0.080
36	0.72	Inspire	0.906	0.079
37	0.74	Inspire	0.984	0.077
38	0.76	Inspire	1.059	0.076
39	0.78	Inspire	1.134	0.075
40	0.80	Inspire	1.207	0.073
41	0.82	Inspire	1.277	0.070
42	0.84	Inspire	1.345	0.068
43	0.86	Inspire	1.409	0.064
44	0.88	Inspire	1.471	0.062
45	0.90	Inspire	1.529	0.058
46	0.92	Inspire	1.581	0.052
47	0.94	Inspire	1.626	0.045
48	0.96	Inspire	1.662	0.036
49	0.98	Inspire	1.688	0.025
50	1.00	—	1.700	0.012
51	1.02	Expire	1.688	-0.012
52	1.04	Expire	1.662	-0.025
53	1.06	Expire	1.626	-0.036
54	1.08	Expire	1.581	-0.045
55	1.10	Expire	1.529	-0.052
56	1.12	Expire	1.471	-0.058

(continues)

Table 7.5.6(a) *Continued*

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) $\pm$ 0.1 L	Volume Change (L) $\pm$ 5%
57	1.14	Expire	1.409	-0.062
58	1.16	Expire	1.345	-0.064
59	1.18	Expire	1.277	-0.068
60	1.20	Expire	1.207	-0.070
61	1.22	Expire	1.134	-0.073
62	1.24	Expire	1.059	-0.075
63	1.26	Expire	0.984	-0.076
64	1.28	Expire	0.906	-0.077
65	1.30	Expire	0.828	-0.079
66	1.32	Expire	0.748	-0.080
67	1.34	Expire	0.667	-0.081
68	1.36	Expire	0.586	-0.081
69	1.38	Expire	0.504	-0.082
70	1.40	Expire	0.421	-0.083
71	1.42	Expire	0.337	-0.084
72	1.44	Expire	0.254	-0.084
73	1.46	Expire	0.169	-0.085
74	1.48	Expire	0.085	-0.085
75	1.50	Expire	0	-0.085
76	1.52	Expire	-0.085	-0.085
77	1.54	Expire	-0.169	-0.085
78	1.56	Expire	-0.254	-0.085
79	1.58	Expire	-0.337	-0.084
80	1.60	Expire	-0.421	-0.084
81	1.62	Expire	-0.504	-0.083
82	1.64	Expire	-0.586	-0.082
83	1.66	Expire	-0.667	-0.081
84	1.68	Expire	-0.748	-0.081
85	1.70	Expire	-0.828	-0.080
86	1.72	Expire	-0.906	-0.079
87	1.74	Expire	-0.984	-0.077
88	1.76	Expire	-1.059	-0.076
89	1.78	Expire	-1.134	-0.075
90	1.80	Expire	-1.207	-0.073
91	1.82	Expire	-1.277	-0.070
92	1.84	Expire	-1.345	-0.068
93	1.86	Expire	-1.409	-0.064
94	1.88	Expire	-1.471	-0.062
95	1.90	Expire	-1.529	-0.058
96	1.92	Expire	-1.581	-0.052
97	1.94	Expire	-1.626	-0.045
98	1.96	Expire	-1.662	-0.036
99	1.98	Expire	-1.688	-0.025

Table 7.5.6(b) Lung Breathing Waveforms for 40 L/min Volume Work Rate

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) $\pm$ 0.1 L	Volume Change (L) $\pm$ 5%
0	0.000	—	-0.833	0.001
1	0.025	Inspire	-0.831	0.002
2	0.050	Inspire	-0.825	0.005
3	0.075	Inspire	-0.816	0.009
4	0.100	Inspire	-0.803	0.013
5	0.125	Inspire	-0.787	0.016
6	0.150	Inspire	-0.768	0.019
7	0.175	Inspire	-0.745	0.022
8	0.200	Inspire	-0.720	0.025
9	0.225	Inspire	-0.692	0.028
10	0.250	Inspire	-0.661	0.031
11	0.275	Inspire	-0.628	0.033
12	0.300	Inspire	-0.592	0.035
13	0.325	Inspire	-0.555	0.038
14	0.350	Inspire	-0.515	0.039
15	0.375	Inspire	-0.474	0.041
16	0.400	Inspire	-0.431	0.043
17	0.425	Inspire	-0.387	0.044
18	0.450	Inspire	-0.341	0.046
19	0.475	Inspire	-0.295	0.047
20	0.500	Inspire	-0.247	0.048
21	0.525	Inspire	-0.198	0.049
22	0.550	Inspire	-0.149	0.049
23	0.575	Inspire	-0.100	0.050
24	0.600	Inspire	-0.050	0.050
25	0.625	Inspire	0	0.050
26	0.650	Inspire	0.051	0.050
27	0.675	Inspire	0.100	0.050
28	0.700	Inspire	0.150	0.050
29	0.725	Inspire	0.199	0.049
30	0.750	Inspire	0.248	0.048
31	0.775	Inspire	0.295	0.048
32	0.800	Inspire	0.342	0.047
33	0.825	Inspire	0.388	0.046
34	0.850	Inspire	0.432	0.044
35	0.875	Inspire	0.475	0.043
36	0.900	Inspire	0.516	0.041
37	0.925	Inspire	0.555	0.039
38	0.950	Inspire	0.592	0.037
39	0.975	Inspire	0.628	0.035
40	1.000	Inspire	0.661	0.033
41	1.025	Inspire	0.691	0.031
42	1.050	Inspire	0.719	0.028
43	1.075	Inspire	0.744	0.025
44	1.100	Inspire	0.767	0.022
45	1.125	Inspire	0.786	0.019
46	1.150	Inspire	0.802	0.016
47	1.175	Inspire	0.814	0.013
48	1.200	Inspire	0.823	0.009
49	1.225	Inspire	0.829	0.005
50	1.250	—	0.833	0.004
51	1.275	Expire	0.831	-0.002
52	1.300	Expire	0.825	-0.005
53	1.325	Expire	0.816	-0.009
54	1.350	Expire	0.803	-0.013
55	1.375	Expire	0.787	-0.016
56	1.400	Expire	0.768	-0.019

(continues)

Table 7.5.6(b) *Continued*

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) $\pm$ 0.1 L	Volume Change (L) $\pm$ 5%
57	1.425	Expire	0.745	-0.022
58	1.450	Expire	0.720	-0.025
59	1.475	Expire	0.692	-0.028
60	1.500	Expire	0.661	-0.031
61	1.525	Expire	0.628	-0.033
62	1.550	Expire	0.592	-0.035
63	1.575	Expire	0.555	-0.038
64	1.600	Expire	0.515	-0.039
65	1.625	Expire	0.474	-0.041
66	1.650	Expire	0.431	-0.043
67	1.675	Expire	0.387	-0.044
68	1.700	Expire	0.341	-0.046
69	1.725	Expire	0.295	-0.047
70	1.750	Expire	0.247	-0.048
71	1.775	Expire	0.198	-0.049
72	1.800	Expire	0.149	-0.049
73	1.825	Expire	0.100	-0.050
74	1.850	Expire	0.050	-0.050
75	1.875	Expire	0.000	-0.050
76	1.900	Expire	-0.051	-0.050
77	1.925	Expire	-0.100	-0.050
78	1.950	Expire	-0.150	-0.050
79	1.975	Expire	-0.199	-0.049
80	2.000	Expire	-0.248	-0.048
81	2.025	Expire	-0.295	-0.048
82	2.050	Expire	-0.342	-0.047
83	2.075	Expire	-0.388	-0.046
84	2.100	Expire	-0.432	-0.044
85	2.125	Expire	-0.475	-0.043
86	2.150	Expire	-0.516	-0.041
87	2.175	Expire	-0.555	-0.039
88	2.200	Expire	-0.592	-0.037
89	2.225	Expire	-0.628	-0.035
90	2.250	Expire	-0.661	-0.033
91	2.275	Expire	-0.691	-0.031
92	2.300	Expire	-0.719	-0.028
93	2.325	Expire	-0.744	-0.025
94	2.350	Expire	-0.767	-0.022
95	2.375	Expire	-0.786	-0.019
96	2.400	Expire	-0.802	-0.016
97	2.425	Expire	-0.814	-0.013
98	2.450	Expire	-0.823	-0.009
99	2.475	Expire	-0.829	-0.005

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.1 Emergency operations where respiratory protection is needed from IDLH atmospheres includes, but is not limited to, confined spaces, hazardous materials releases, chemical, biological, radiological, nuclear (CBRN) incidents, fire fighting, tactical or technical operations, medical treatment, technical rescue, any operations where the atmosphere is not stable or improving and could become IDLH, and any operations where it is difficult or not possible to accurately monitor the atmosphere.

A.3.2.1 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 that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, 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.3.3.3 Combination SCBA/SAR. Combination SCBA/SAR consist of the following:

- (1) An SCBA certified as compliant with NFPA 1981 or NFPA 1986
- (2) A connection for the attachment of an air line that provides a continuous supply of breathing air that is independent of the SCBA breathing air supply

The definition does not include SAR that are used in conjunction with escape self-contained breathing apparatus (ESCBAs) where ESCBA provide less than a minimum rated service life of 30 minutes. For the purposes of this standard, combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.3.3.9 Organization. Examples of such organizations include, but are not limited to, fire departments, police and other law enforcement agencies, rescue squads, EMS providers,

military and defense agencies, and hazardous materials response teams.

A.3.3.14 Self-Contained Breathing Apparatus (SCBA). For the purposes of this standard, the terms *self-contained breathing apparatus* and *SCBA* indicate only open-circuit SCBA. Where the term *SCBA* is used without any qualifier in this standard, it indicates only SCBA and combination SCBA/SAR. Combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.3.3.16 Supplied Air Respirator (SAR). For the purposes of this standard, combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

N A.4.2.2 In the event of an emergency services personnel death, or if they become unconscious or suffer a heart attack within 24 hours of using compressed breathing air, chain of custody procedures should be instituted, the respirator selected, the valve closed, and the respirator tagged and submitted to an accredited testing laboratory for analysis. (See Figure A.4.2.2.)

A.4.3.5.3.2(7) A responsible member of the organization should estimate the frequency of SCBA cylinder use. It is not necessary to record or maintain records on the frequency of each SCBA cylinder use. For the purposes of determining the needed frequency of technical inspections of the SCBA cylinder, an estimate of cylinder use is acceptable.

It is also recommended that a responsible member of the organization determine the severity of the environment that the SCBA cylinders are usually exposed to. Where a more severe environment (with regards to hazards such as chemical exposure or physical damage) exists, the organization should contact the SCBA manufacturer for cylinder technical inspection frequency advice.

Where the SCBA manufacturer does not have any technical inspection frequency instructions for SCBA cylinders used with their model, the following guidelines are recommended:

- (1) A routine technical inspection of SCBA cylinders should be performed every 2 or 2½ years when the cylinders are in normal service and are filled or used 5 times a week or less.
- (2) A routine technical inspection of SCBA cylinders should be performed every year (annually) when the SCBA cylinders are in hazardous service, or when they are estimated to be used or filled more than 5 times a week.

The frequency guidelines are not meant to prevent a nonroutine or specially required technical inspection. Where the user has determined that a cylinder condition exists that warrants a technical inspection (see 7.1.2.4), an immediate technical inspection of the cylinder is required.

A.4.3.6 The SCBA manufacturer should be contacted prior to any after-purchase modifications of any sort to an SCBA. Unapproved modifications could affect the NIOSH certification or certification to NFPA 1981 or NFPA 1986 and void the certifications.

A.4.5.1 The purposes of record keeping are to document what the organization has done, to create a record that can be used for compliance with laws or standards, and to provide information for analysis, evaluation, quality control, and planning. The organization should create and maintain a system of record keeping that achieves these purposes.

RESTRICTED ACCESS BAGS FOR GEAR/EQUIPMENT

PURPOSE

To provide the mechanism for the chain of custody, sealed access, and prevention from contamination of evidence, which may assist in determining the cause of malfunction, failure, accident, or injury/casualty.

SCOPE

This applies to all fire department personnel, equipment, and personal protective equipment (PPE).

CONTENT

The intent of these guidelines is to isolate equipment/PPE which, for the purpose of investigation, must be sequestered in as close to the same condition as at the time of the event. Information gathered from this process will assist the investigating officer(s) or agency(s) in cause determination.

PROCEDURE

Any equipment/PPE (non-vehicular) that fails to operate in its designed and prescribed fashion, whether in training or on an emergency incident, shall be sequestered. Employees shall immediately notify either the shift safety officer or a battalion officer to secure the item. The item(s) shall be maintained, as close as possible, in the same condition in which it malfunctioned or failed in order to preserve any evidence for investigation purposes.

When securing SCBA units the air will be turned off, the system bled down, and the “PASS” device turned off. Additionally, when sequestering an SCBA unit, the following shall be noted on the receipt: remaining air in tank; position of air cylinder valve (open/closed/½ open); PASS device status; and was the emergency bypass on or off. If the malfunction was due to free-flowing air, sequester the user's mask also.

All equipment sequestered will be placed into the Restricted Access Bag, zippered shut, and sealed with a “zip” tie around the zipper tabs. To prevent cross contamination, separate items should be placed in separate bags. The sequestering officer will issue a receipt with a detailed inventory (to include all identifying inventory numbers) to the supervisor responsible for the equipment/PPE. Use the enclosed sharpie and ID any opening of the bag and noteseal number on the chain of evidence form.

Once an item has been sequestered, the Shift Safety Officer will take control of the bag. Any time the restricted access bag changes hands, a new receipt, as outlined above, will be issued. The battalion chief of safety will maintain all original receipts at Fire Administration. Entry into the bag will be limited to only those parties authorized by the Battalion Chief of Safety, the Shift Safety Officer, or the Battalion Chief of Resource Management. An inventory of the Restricted Access Bag will be conducted any time the seal is broken and recorded on the inventory form. Any discrepancies in inventory will be immediately reported to the Battalion Chief of Safety. Once the equipment/PPE has reached its final destination and is removed from the Restricted Access Bag, the bag will be properly cleaned, decontaminated, and returned to its original assigned unit.

Page 1 of 2

FIGURE A.4.2.2 Restricted Access Bags for Gear/Equipment. (Source: Virginia Beach Fire Department)

**VIRGINIA BEACH FIRE DEPARTMENT
RESTRICTED ACCESS BAG RECEIPT**

Date: _____ Time: _____ Incident #: _____

Location item/equipment received: _____

Item/equipment sequestered: _____

City ID#: _____

SCBA information: remaining air in tank; _____ psi. PASS ON/OFF _____

Position of air cylinder valve (open/closed/1/2 open); _____

Emergency bypass on or off _____

Item/equipment assigned to:

Reason for sequestering:

(Be as specific as possible) _____

Item/equipment received from: _____

Date: _____ Time: _____

Item/equipment delivered to: _____

Date: _____ Time: _____

Seal #: _____ Date: _____ Time sealed: _____

Comments: _____

Original: Battalion Chief of Safety Canary: Sequestering Officer Pink: Member Releasing Inventory

Page 2 of 2

FIGURE A.4.2.2 *Continued*

Record keeping should be comprehensive and structured to meet the requirements of this standard and needs of the organization. Record keeping should create, process, maintain, and store information with a minimum of effort, time, and cost. Record keeping should provide sufficient data and findings to allow the organization to analyze and to evaluate the selection, care, and maintenance performed under this standard.

All records, reports, and documents should be accurate and clear. If the reader detects inaccuracy, then the veracity of the writer, as well as the value of the record, could be suspect. Details, without the inclusion of unnecessary information, are necessary. Duplication of information in other forms or reports should be avoided.

A.4.5.2(7) Items to be considered should include the part the record, report, or document plays in the record-keeping system and whether it will be used for checking compliance, tracking, measuring effectiveness, spotting trends, or planning.

A.4.5.3 Some records and reports can be created and stored electronically although other items that are completed by users, such as forms, notices, stickers, and tags, are only practical and effective if tangible.

Δ A.4.7.5 No specific requalification procedures are outlined in 49 CFR for composite cylinders. Therefore, the Department of Transportation (DOT) developed certifications known as *special permits* (previously known as exemptions). DOT-authorized composite cylinders have a maximum service life indicated in the *special permits*. Most *special permits* specify that composite cylinders have a maximum life of 15 years, although some 30-year *special permits* are available. The composite cylinder is prohibited from being refilled after the maximum life specified in the *special permit*. All U.S. retest facilities performing requalifications on composite cylinders are required by the DOT to have a current copy of the cylinder's *special permit* available, and to follow its instructions and conditions. The DOT, which is the regulatory authority in the United States, specifies the cylinder requalification frequency of every 3 years for *fiberglass or Kevlar composite cylinders* and every 5 years for *all-metal cylinders and carbon fiber composite cylinders*. The organization/cylinder owner and retest facility are required by the DOT to know how often to have the requalification performed. (See also Annex C.)

A.5.1.5(17) SCBA maintenance and repair record keeping should include labeling and tracking SCBA major component assemblies by a unique identification method. Such identification can help to identify and document problems that are specific to a particular component assembly as well as simplify efforts to take corrective action and implement upgrades.

A.5.1.5(18) SCBA that are certified by NIOSH include a rated service time based on laboratory tests required by NIOSH. The SCBA is tested using a specified breathing machine with a breathing rate of 40 L/min. NIOSH uses this 40 L/min rate because it represents a moderate work rate that an average user can sustain for a period of time. To attain a rated service time of 30 minutes during this 40 L/min test, the typical SCBA cylinder has to contain 1200 L or more of compressed breathable air. A 45 ft³ cylinder has a capacity of 1273.5 L, based on 28.3 L/ft³. Because actual work performed by emergency services personnel often results in a ventilation rate that exceeds 40 L/min, these personnel frequently do not attain the rated service time of 30 minutes. During extreme exertion, for example, actual service time can be reduced by 50 percent or more.

To ensure proper utilization of equipment in actual situations, after training and instruction, it is recommended that users gain confidence by actually using the SCBA in a series of tasks representing or approximating the physical demands likely to be encountered.

In addition to the degree of user exertion, other factors that can affect the service time of the SCBA include the following:

- (1) Physical condition of the user (*see also ANSI/AIHA/ASSE Z88.6, Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*)
- (2) Emotional conditions, such as fear or excitement, which can increase the user's breathing rate
- (3) Degree of training or experience the user has had with such equipment
- (4) Whether or not the cylinder is fully charged at the beginning of use
- (5) Facepiece fit
- (6) Use in a pressurized tunnel or caisson [At 2 atmospheres of gauge pressure (29.4 psi), the duration is one-half the duration obtained at one atmosphere of gauge pressure (14.7 psi); at 3 atmospheres of gauge pressure (44.1 psi), the duration is one-third the duration obtained at 1 atmosphere of pressure.]
- (7) Condition of the SCBA
- (8) The SCBA effective dead air space. [Dead air space is a volume proportional to the carbon dioxide (CO₂) concentration in the inhaled breathing gas.]

During normal breathing without a facepiece, CO₂, which is produced by the body's metabolism, is released to the environment with each breath. The facepiece of an SCBA reduces this environment to a small space around the face. On exhalation, a portion of the carbon dioxide-rich exhaled breath is trapped in this space. On inhalation, fresh air from the SCBA cylinder mixes with this carbon dioxide-rich air and then enters the lungs. The concentration of carbon dioxide is dependent on facepiece configuration, flow characteristics, and ventilation rate.

The full effect of increased dead air space has not been demonstrated. However, the scientific work done in this area shows that an increase of CO₂ in the inhalation air leads to increased ventilation and, consequently, shorter service time for a given air supply. Means to reduce CO₂ in the inhalation air by using, for example, a well-fitting nose cup have been demonstrated to give longer service time. Each manufacturer should be contacted for specific data.

A.5.1.8(2) *Quantitative facepiece fit testing* measures the amount (quantity) of leakage around the facepiece-to-face seal. This is normally done, using specifically designed equipment, by measuring the concentration of a detector (challenge) gas or aerosol in the area surrounding a user who is wearing a facepiece and comparing this with the concentration of the challenge gas or aerosol inside the facepiece. Comparing these two concentrations results in a *protection factor* expressed as the following relationship:

Protection factor = $1 \div (\text{concentration in facepiece} / \text{concentration outside facepiece})$

A high protection factor indicates that a very small amount of the challenge gas or aerosol has passed to inside the facepiece, thus the facepiece provides a high degree of protection to the user being tested.

An alternative facepiece fit test method is the *qualitative fit test*. Qualitative fit testing is based on whether the wearer of a facepiece can detect the presence of the challenge gas or aerosol by sensing the odor of it. This is a highly subjective test where a particular wearer determines whether the quality of air in the facepiece is acceptable. Results of qualitative fit testing are not precise and can vary based on the wearer's senses and the concentration of the challenge gas or aerosol.

A.6.1.4.1 Exposure to chlorine bleach will damage straps and harnesses and cause holes, fraying, fiber fibrillation, and breakage of the strap or harness.

A.6.1.6 Cleaning materials or water in the connection between the cylinder valve and the SCBA inlet connector are forced into the regulator and other pneumatic assemblies and can adversely affect the SCBA's performance over time.

A.6.3.7 SCBA cylinder pressure relief devices, such as frangible discs, are designed to safely relieve the contents of a cylinder when the cylinder internal pressure exceeds $\frac{5}{3}$ of the rated service pressure. One way a cylinder can become overpressurized is when a cylinder is exposed to high heat or fire. The frangible disc pressure relief device is designed to protect a fully charged cylinder. If the cylinder is only partially charged, the cylinder structure can catastrophically fail before the cylinder's internal pressure reaches the pressure at which the pressure relief device functions. The conclusion is that SCBA cylinders in storage should be fully charged rather than partially charged.

A.6.3.7.3 Moisture accelerates the formation of rust, and oxygen could be depleted to dangerous levels over time as oxygen combines with the iron in the steel to form iron oxide.

A.7.1.1.1 For fire departments, a duty period should include, but not be limited to, a single shift in a career department, a substitute person taking over a position for part or all of a shift, personnel assigned to station duty in a department where the station is not staffed on a 24-hour daily basis, and other similar situations.

A.7.1.4.1 Defects that should cause an SCBA cylinder to be removed from service include, but are not limited to, cylinders under the following conditions:

- (1) Not well cared for and maintained
- (2) Dropped, fallen, struck, or crushed
- (3) Stored improperly
- (4) Degraded, deteriorated, or corroded
- (5) In contact with damaging chemicals or an extremely corrosive atmosphere or environment
- (6) Damaged, as evidenced by a dent, gouge, crack, scrape, cut, dig, tear, or abrasion
- (7) Distorted, discolored, or showing the effects of heat exposure including one or more of the following:
 - (a) Charring
 - (b) Blistering
 - (c) Peeling paint or coating
 - (d) Melting
 - (e) Loss of resin or loose fibers on composite cylinders
- (8) Partially or fully repainted or treated to hide suspected damage, or heat or fire damage
- (9) Leaking
- (10) Found depleted when it should have been full with no known reason for it to be in this condition

A.7.2.3.3 Many components in an SCBA, while appearing the same as those commonly available at stores and through catalogue sales, are made of special materials or under specific controls that are necessary to meet the stringent performance requirements of NFPA and NIOSH standards. One of the best examples of this is the manufacturer's use of a particular O-ring material and hardness in conjunction with a certain lubricant. Using a different O-ring or lubricant commonly obtainable from a hardware or plumbing store instead of that supplied by the manufacturer could result in a critical failure of the apparatus under certain conditions, even though the apparatus could appear to perform perfectly well immediately after repair.

A.7.2.3.9 It is recommended that organizations request substantiation from the SCBA manufacturer for any SCBA with no prescribed overhaul period.

A.7.2.4.1 The following is a suggested procedure for handling a breathing air cylinder that has been filled with breathing air that does not meet the requirements specified in 7.3.2 or has been filled with a nonbreathing air gas:

- (1) Determine what gas was put into the cylinder.
- (2) Determine the hazard(s) the gas poses to humans and the environment.
- (3) Where the technician is not or cannot be properly protected or cannot be trained to handle the hazard(s) of the gas, or if the facility is not equipped to properly handle the gas, then the cylinder should be retired to an authorized waste disposal facility that is able to properly discard the gas and cylinder.
- (4) Where the technician is properly protected and trained to handle the identified gas and its hazard(s), and the facility is equipped to properly release and dispose of the gas, then the gas is released to the atmosphere or scrubber, or disposal container, according to local, state/provincial, or federal environmental regulations.
- (5) Purge the cylinder with an inert gas appropriate for the hazard(s) of the incorrect gas to remove any residual gas if the incorrect gas was a hazardous gas.
- (6) Inspect the interior of the cylinder for contamination.
- (7) Where cylinder contamination is found, clean the interior of the cylinder in accordance with the instructions from the SCBA manufacturer.
- (8) Inspect the interior of the cylinder again to verify the cleaning process was successful in removing the contaminant(s).
- (9) Once the empty cylinder passes the visual interior inspection and meets other inspections and performance requirements, the cylinder can be considered for return to service.
- (10) Where the cylinder cannot be properly cleaned, or any condition prevents the cylinder from being returned to service, the cylinder should be retired.

Where the contents of a filled cylinder are unknown, then the gas should not be released and the cylinder should not be purged until the gas is identified by sampling of the cylinder contents before the cylinder is retired and sent to a waste disposal facility in accordance with local, state/provincial, or federal environmental regulations.

A.7.2.4.2 See A.7.1.4.1.

A.7.2.4.3 Many potential highly toxic or lethal agents exist for which the only known remedy is destruction and disposal. The