

Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services

2019



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NFPA® 1981

Standard on

Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services

2019 Edition

This edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 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 acted on by NFPA at its June Association Technical Meeting held June 11-14, 2018, in Las Vegas, NV. It was issued by the Standards Council on August 14, 2018, with an effective date of September 3, 2018, and supersedes all previous editions.

This edition of NFPA 1981 was approved as an American National Standard on September 3, 2018.

Origin and Development of NFPA 1981

The first NFPA document to address fire fighter respiratory protection was NFPA 19B, *Standard on Respiratory Protective Equipment for Fire Fighters*. NFPA 19B was adopted on May 17, 1971, at the Association's Annual Meeting in San Francisco, California. It was developed by the Sectional Committee on Protective Equipment for Fire Fighters of the Technical Committee on Fire Department Equipment. After 1975, the sectional committee was removed from the Technical Committee on Fire Department Equipment and made its own technical committee. The main thrust of NFPA 19B was to prohibit filter-type canister masks for fire fighters and permit only self-contained breathing apparatus (SCBA). NFPA 19B was officially withdrawn by the Association on May 19, 1981, at the Annual Meeting in Dallas, Texas.

NFPA 1981, Standard on Self-Contained Breathing Apparatus for Fire Fighters, was adopted at the same meeting to replace NFPA 19B. That first edition of NFPA 1981 essentially specified National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approved SCBA with a minimum rated service life of 30 minutes. Open-circuit SCBA was required to be positive pressure.

The Technical Committee on Protective Equipment for Fire Fighters undertook a complete revision of NFPA 1981 to state performance requirements and appropriate testing procedures designed to simulate various environmental conditions to which fire fighters' SCBA can be exposed during use and storage. These requirements are in addition to the basic NIOSH/MSHA certification requirements, and now NFPA 1981 applies to open-circuit SCBA.

The second edition of NFPA 1981 was completed in March 1986 and adopted by the Association at the 1987 Annual Meeting in Cincinnati, Ohio.

After the second edition, the name of the Technical Committee was changed to Fire Service Protective Clothing and Equipment, and a standing Subcommittee on Self-Contained Breathing Apparatus was established.

The third edition, in 1992, incorporated new requirements for third-party certification and quality control, as well as a new total heat and flame test for the entire apparatus. Other test methods covering facepiece lens abrasion and communications were revised.

The third edition was completed in December 1991 and presented to the Association at the 1992 Annual Meeting in New Orleans, Louisiana.

In January 1995, the Standards Council reorganized the entire project for fire service protective clothing and equipment. The new project was given a Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment and seven technical committees operating

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within the project. The former standing Subcommittee on Self-Contained Breathing Apparatus was changed to the new Technical Committee on Respiratory Protection and Personal Alarm Equipment.

The fourth edition, presented to the Association membership at the 1997 Annual Meeting in Los Angeles, California, incorporated new requirements for surrogate cylinders to replace the actual breathing gas cylinders during the vibration testing to ensure a higher level of safety during this rigorous test. A new requirement for redundant end-of-service-time indicators (EOSTI) was added to provide a better level of safety in case of failure of one EOSTI.

The fifth edition of NFPA 1981 was presented to the NFPA membership at the 2002 Annual Meeting in Minneapolis, Minnesota, on May 19, 2002. That edition incorporated new requirements for heads-up displays (HUD) that provide visual information and warnings to SCBA wearers of the status of the SCBA's air supply and, where the HUD is powered by a power source, the power source status. Those new requirements were in response to fire service requests for the provision of userfriendly information for SCBA wearers so they can better understand their environment and limitations.

Also in response to strong fire service input to the committee, new requirements were specified for a single universal air connection located in a specific position on all new SCBA certified as compliant with the 2002 edition of NFPA 1981, and existing SCBA that could be upgraded and certified as compliant with the 2002 edition of NFPA 1981. The RIC UAC [RIC stands for rapid intervention company or crew (sometimes called RIT for rapid intervention team, or FAST company or crew); UAC stands for universal air connection] permits the breathing air cylinder of an SCBA user to be replenished from an independent rescue breathing air supply source when the SCBA user is trapped or unable to be removed from a hazardous atmosphere. The RIC UAC does not take breathing air from an SCBA worn by a member of the rescue operation but replenishes the victim's breathing air cylinder from a source of rescue breathing air, such as a rescue breathing air cylinder or a high-pressure breathing air supply line. The RIC UAC is not a buddy breathing device—it does not permit the sharing of a single SCBA breathing air source between two persons. NIOSH does not permit or certify any buddy breathing system that allows two users to share a single breathing air source. Because NFPA 1981 requires NIOSH certification as a prerequisite to become certified as compliant with NFPA 1981, NFPA cannot permit buddy breathing systems, which would be in violation of NIOSH regulations.

The committee continued to review and revise text for improved clarity and specificity, improved accuracy in testing and test result reporting, and added criteria to better evaluate and test the EOSTI.

In 2002, NFPA revised the format for its codes and standards, resulting in chapter, section, and paragraph numbers not matching or corresponding to those of previous editions.

The 2007 edition of NFPA 1981, the sixth edition, represented a complete revision and retitling of the standard as NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*.

While the committee made several significant changes to the standard, a major change in the 2007 edition was the mandatory requirement for all emergency services SCBA to also be NIOSH certified as CBRN SCBA in accordance with the NIOSH *Statement of Standard for NIOSH CBRN SCBA Testing*. This requirement provided respiratory protection from CBRN terrorism agents (specified chemicals, biological agents, and radiological particulates) that could be released as a result of a terrorism attack.

Although major metropolitan areas are more likely targets of a terrorist event, emergency responders from small communities could be called on to respond to urban areas where the emergency services have become overwhelmed by a terrorist incident. Terrorists themselves might reside in small communities while they await the opportunity to strike, and if they have chemical, biological, or nuclear material in their possession, the possibility of exposure is even greater for those small, rural areas. Terrorist attacks aside, CBRN-certified SCBA offer greater protection for emergency services personnel at minimal cost.

CBRN certification offers verification of enhanced protection for emergency responders that is not otherwise available. Without CBRN protection evaluation, SCBA components are not tested for permeation, penetration, corrosion resistance, or other detrimental effects from exposure to toxic industrial chemicals during hazardous materials incidents and hazardous chemical warfare atmospheres. NIOSH benchmark testing of non-CBRN-hardened SCBA against CBRN agents demonstrated that chemical warfare agents (CWA) could cause catastrophic failures within minutes of exposure.

NIOSH's selection of the test challenge agents for CBRN protection was based on a comprehensive review of available technical data and consultations with other government agencies (e.g., Department of Defense, Department of Justice, and Department of Energy). Various chemical data lists were analyzed, including lists from the Environmental Protection Agency; the Agency for Toxic Substances and Disease Registry; NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*; the U.S. Army Center for Health Promotion and Preventative Medicine Technical Guide 244; and other, classified sources. That analysis identified a total of 151 toxic industrial chemicals (TICs) and CWA as potential candidates for challenge agents. The candidate agents were evaluated for permeation (molecularly diffusing through material) and penetration (seeping through interfacing components) characteristics as part of a review of their physical properties.

This evaluation concluded that sarin and sulfur mustard could be selected as the two representative agents for the penetration/permeation test for the complete listing of 151 CWA and TICs due to their physical properties and molecular

structure. NIOSH is unaware of any data that indicate that CBRN-certified SCBA provide less protection against TICs than their industrial counterparts.

The evaluation for CBRN protection provides verification and assurance that the component and material combinations in the approved SCBA configurations provided high resistance to permeation and penetration of hazardous atmospheres of TICs and materials into the breathing air. This is of importance to all responders subject to extreme exposures to any hazardous industrial chemicals and materials.

In addition to the new CBRN requirement, the following significant requirements were added to increase the safety to the users of emergency services SCBA and to better assure the proper functioning of the SCBA:

- (1) New breathing air cylinder retention requirement within the mounted position
- (2) Mechanical voice diaphragm performance requirement increased to 80 percent minimum score at 1.5 m (4.9 ft) distance
- (3) New voice communications system with at least an 85 percent score at 3 m (10 ft) distance
- (4) New independent pressure gauge that would not be affected by failure of the head's-up display
- (5) New water immersion requirements for electronic devices that are part of the SCBA that must function properly and remain watertight after six exposures to 177°C (350°F) for 15 minutes and water submersion to 1.5 m (4.9 ft)
- (6) New low power capacity requirements for electronic devices to assure that such devices will continue to function properly for at least 2 hours following activation of the low power source signal

The 2013 edition of NFPA 1981, the seventh edition, represented a complete revision of the standard. Among the many changes included in this edition is a new section on emergency breathing safety systems (EBSS) in response to correspondence that the Technical Committee on Respiratory Protection Equipment received from NIOSH that indicated NIOSH's intention to modify its existing policy on buddy breathers. For the complete text of this letter, please see the NFPA 1981 F12 *Report on Comments* (ROC), 1981–1, LOG #21.

Also in this edition were new definitions for terms related to speech intelligibility, including speech transmission index, sound pressure level, mouth reference point, and microphone measurement point.

The technical committee also modified the performance requirements for the nonelectronic communications performance test and the supplementary voice communications system performance test. Several new tests were added, including an emergency breathing safety system cold temperature performance test, a lens radiant heat test, and a lens convective heat and flame resistance test.

The 2019 edition of NFPA 1981, the eighth, includes editorial corrections, paragraph numbering changes, and reference document updates. A definition of universal emergency breathing safety systems (UEBSS) is added, and Table 4.3.9, Test Series, is updated to include UEBSS. Also, the standard now requires pressure demand certification by NIOSH and a nonelectronic transmission system at a minimum for voice communications.

Breathing rate can now be reported by the data logging software. Updated figures for the EBSS male and female fittings are provided, and requirements for EBSS location marking specify that it be readily visible and contrasting. A new strength of connection between the facepiece and second stage regulator performance requirement and associated test has been added.

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