(RPE), medical surveillance, training in respirator use, and the assurance of air quality.

7.9.1.1* the selection, care, and maintenance of open-circuit SCBA shall be as specified in NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA).*

7.9.1.2 Training in respirator use shall include knowledge of hazards, hazard assessment, selection of RPE based on hazard exposure levels, fit testing of respirators, and respirator inspection.

7.9.2 The fire department shall develop and maintain standard operating procedures that are compliant with this standard and that address the use of respiratory protection.

7.9.3 Members shall be qualified at least annually in the use of RPE that they are authorized to use.

7.9.4* Reserve SCBA shall be provided to maintain the re-quired number in service when maintenance or repairs are being conducted.

7.9.5 A reserve air supply shall be provided by use of reserve cylinders or by an on-scene refill capability, or both.

7.9.6 RPE shall be stored in a ready-for-use condition and shall be protected from damage or exposure to rough handling, excessive heat or cold, moisture, or other elements.

7.9.7* When engaged in any operation where they could encounter atmospheres that are IDLH or potentially IDLH, or where the atmosphere is unknown, the fire department shall provide and require all members to use SCBA that has been certified as being compliant with NFPA 1981, *Standard on Open- Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*

7.9.8* Members using SCBA shall not compromise the protective integrity of the SCBA for any reason when operating in IDLH, potentially IDLH, or unknown atmospheres by remov-ing the facepiece or disconnecting any portion of the SCBA that would allow the ambient atmosphere to be breathed.

7.10 Breathing Air. Breathing air used to fill SCBA cylinders shall meet the requirements specified in NFPA 1989, *Standard on Breathing Air Quality for Fire and Emergency Services Respiratory Protection.*

7.11 Respiratory Protection Equipment.

7.11.1 SCBA.

7.11.1.1 All open-circuit SCBA that is purchased new shall be certified as compliant with NFPA 1981 and shall also be certified by NIOSH as compliant with NIOSH *Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Open Circuit Self-Contained Breathing Apparatus (SCBA).*

7.11.1.2* Open-circuit SCBA that does not meet the 1992 or later editions of NFPA 1981 shall be removed from fire service use.

7.11.1.3* Closed-circuit SCBA shall be permitted when long-duration SCBA is required.

7.11.1.4 Closed-circuit SCBA shall be NIOSH certified with a minimum rated service life of at least 2 hours and shall operate in the positive-pressure mode only.

7.11.2 Supplied-Air Respirators.

7.11.2.1 Supplied-air respirator units used shall be of the type and manufacture employed by the AHJ.

7.11.2.2 Supplied-air respirators other than SCBA shall not be used in IDLH atmospheres unless equipped with a NIOSH-certified emergency escape air cylinder and a pressure-demand facepiece.

7.11.2.3 Supplied-air respirators, Type C Pressure-Demand Class, shall not be used in IDLH atmospheres unless they meet manufacturers' specifications for that purpose.

7.11.3 Full Facepiece Air-purifying Respirators.

7.11.3.1 Full facepiece air-purifying respirators (APRs) shall be used only in non-lDLH atmospheres for those contaminants that NIOSH certifies them against.

7.11.3.2 The AHJ shall provide NIOSH-certified respirators that protect the user and ensure compliance with all other OSHA requirements.

7.11.3.3* The AHJ shall establish a policy to ensure canisters and cartridges are changed before the end of their service life.

7.12 Fit Testing.

7.12.1* The facepiece seal capability of each member qualified to use RPE shall be verified by quantitative fit testing on an annual basis and whenever new types of RPE or facepieces are issued.

7.12.2 The fit of the RPE of each new member shall be tested before the members are permitted to use RPE in a hazardous atmosphere.

7.12.2.1 Only members with a properly fitting facepiece shall be permitted by the fire department to function in a hazardous atmosphere with RPE.

7.12.3 Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative fit testing in the negative-pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

7.12.4* Quantitative test protocols shall be conducted as required by the AHJ.

7.12.5 Records of facepiece fitting tests shall include at least the following information:

(1) Name of the member tested
(2) Type of fitting test performed
(3) Specific make and model of facepieces tested
(4) Pass/fail results of the tests

7.12.6* For departments that perform quantitative fitting tests, the protection factor produced shall be at least 500 for negative-pressure facepieces for the person to pass the fitting test with that make of full facepiece.

7.13 Using Respiratory Protection.

7.13.1 Respirators shall not be worn when a member has any conditions that prevent a good face seal.

7.13.2 Nothing shall be allowed to enter or pass through the area where the respiratory protection facepiece is designed to seal with the face, regardless of the specific fitting test measurement that can be obtained.

seal requirement with equipment currently used by the AHJ, individually fitted facepieces should be provided.

Fit testing is a procedure used to evaluate how well a given respirator fits a given person by assessing leakage around the face seal. Without fit testing, persons unknowingly can have poor face seals, allowing contaminants to leak around the mask and be inhaled. Poor face seals are due to certain facial characteristics (facial size, beards, large sideburns, scars, or other facial uniqueness) that prevent direct contact between the skin and the sealing surface of the respirator and result in leakage or inadequate respiratory protection.

Improper use of a respirator or improper fit testing of any respirator can lead to a false sense of security and possibly result in injury or death to the user.

A.7.12.4 In quantitative fit testing, the testing machine provides a numerical value of each test exercise and then a computed fit factor that can be used as a benchmark for future fit testing the following year. The test subject must obtain at least a fit factor of 500 for the person to pass the fit test with the full facepiece. The strip chart that the test machine provides becomes the written record, and a computer-generated record can be done at the same time. There is little judgment required by the operator of the fit test other than to make sure the test subject and the procedures are followed to the letter.

A.7.12.6 A protection factor of at least 10,000 in the positive-pressure mode is recommended for positive-pressure SCBA. The quantitative test can be used to determine which facepieces fit an individual well and thus aids in selecting the facepiece that best conserves the amount of air in the cylinder.

If a satisfactory fit cannot be achieved for an individual with one make of facepiece, another make of the device should be bought for that member.

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

A.7.13.3 The following is an except from 29 CFR 1910.134(g):

"(g) *Use of respirators.* This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

(1) *Facepiece seal protection.* (i) The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

(A) Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

(B) Any condition that interferes with the face-to-facepiece seal or valve function."

This prohibition applies to any negative- or positive-pressure personal respiratory protection device of a design relying on the principle of forming a face seal to perform at maximum effectiveness. A beard growing on the face at points where the seal with the respirator is to occur is a condition that has been shown to prevent a good face seal. This is so regardless of what fit test measurement can be obtained. However, if the beard is styled so no hair underlies the points where the SCBA facepiece is designed to seal with the face, then the employer may use the SCBA to protect the employee.

A.7.13.6 The user should be able to demonstrate the successful use of an SCBA with contact lenses in a nonhazardous training environment before being allowed to use them in an incident. Successful long-term soft contact lens use should be measured by the ability to wear soft contact lenses for at least 6 months without any problems.

A.7.14.1 Given the considerable amount of stored energy in- side an SCBA cylinder, cylinders should always be filled using manufacturers' recommendations and following any existing NIOSH, CGA, or other regulatory agency guidelines.

Because of the failure during refilling of 11 cylinders using aluminum alloy 6351-T6, SCBA cylinders made of this alloy should be diligently inspected, both externally and internally, by properly trained inspectors at least annually.

Most of these failed cylinders had not been maintained properly. Some were being used beyond their DOT-defined hydrostatic test period. Some had not been retrofitted with a special neck-ring that the manufacturer had recommended to reduce the possibility of failure.

For additional information, refer to the United States Department of Transportation (DOT) Research and Special Programs Administration (RSPA) Safety Advisory Notice of 1994 (Federal Register Vol.59, Ju1y 26, 1994), DOT Safety Advisory Notice of 1999 (Federal Register Vol. 64, October 18, 1999), and the NIOSH Respirator User Notice of December 7, 1999.

Several of the ruptured cylinders were made using aluminum alloy 6351-T6 This alloy has been identified as being susceptible to sustained load cracking (SLC) in the neck and shoulder area of the cylinder. The NIOSH Respirator User Notice of December 7, 1999, states: "It is important to note that only a small percent- age of cylinders made from aluminum alloy 6351-T6 have actu-ally been found to exhibit sustained load cracking. Moreover, out of several million cylinders manufactured from this alloy by sev-eral companies, NIOSH and the U.S. Department of Transporta-tion (DOT) are aware of only 12 ruptures within the United States. Eleven of the 12 ruptures occurred during refilling, six of these 12 ruptures involved SCBA cylinders. Forensic analysis has determined that most of these cylinders failed due to SLC failure. However, in some cases, evidence of other factors such as exter-nal mechanical damage was also present."

Changes have now been made in materials specification and design of cylinders. Since 1988, manufacturers have been using aluminum alloy 6061-T6 in the manufacture of all of their cylinders and cylinder liners. Alloy 6061-T6 has become the "standard of the industry" because it is not susceptible to sustained load cracking.

The failed cylinders belong to relatively small population of a particular type of cylinder, and there has been no occur-rence of cylinder failure during filling of any other type of SCBA cylinders. Full-wrapped composite cylinders, which are predominantly being purchased by the fire service at this time, have been used since 1988 without failure during refilling. There is, therefore, reason to believe that these other types of SCBA cylinders can continue to be used in the fire service without risk of failure during filling.

A.7.14.5 To facilitate this, it is recommended that industry develop an inexpensive, lightweight chamber, or other means, to provide protection at the fire scene during routine cylinder filling. There is no current commonly accepted standard or