

facepiece positive pressure SCBAs, Campbell, Noonan, Merinar, and Stobbe of NIOSH assessed the performance of two different models of full facepiece pressure demand SCBAs that met the NFPA 1981 airflow requirements for respirators used by firefighters (Ex. 1–64–7). While the authors could not determine WPFs for these respirators because contaminant levels measured inside the facepiece were too low, pressure measurements taken inside the facepiece proved more useful. These measurements showed that four of the 57 firefighters experienced one or more negative-pressure incursions inside the facepiece while performing firefighting

tasks. After analyzing the data for these firefighters using two different methods, the authors estimated that the overall protection factor exceeded 10,000.

In the first of two SWPF studies performed on full facepiece SCBAs used in the pressure demand mode, McGee and Oestenstad (Ex. 1–64–86) determined the protection afforded to members of a respirator test panel consisting of 23 men wearing the Biopack 60 closed circuit SCBA (Ex. 1–64–86). Three members of the panel had protection factors of 4,889, 7,038, and 18,900, with the remaining members having protection factors over 20,000. In the second study, Johnson, da Roza, and McCormack of LLNL (Ex. 1–64–98)

tested the Survivair Mark 2 SCBA that met NFPA 1981 airflow requirements; during testing, a panel of 27 respirator users exercised on a treadmill at 80% of their cardiac reserve capacity. Although the authors found negative-pressure incursions inside the facepiece at high work rates, they concluded that the respirator “provided [a minimum] average fit factor of 10,000 [for any single subject], with no single subject having a fit factor less than 5,000 at a high work rate.”

The tables below summarize the results of the WPF and SWPF studies performed on full facepiece pressure demand SCBAs.

WPF studies for tight-fitting full facepiece pressure demand SCBAs (by name of authors and model of respirator tested)	Sample size	Geometric mean	Geometric standard deviation	5th percentile WPF
Campbell et al. (Ex. 1–64–7), Unspecified model (with NFPA-compliant airflow)	57	10,000 (estimated)
SWPF studies for tight-fitting full facepiece pressure demand SCBAs (by name of authors and model of respirator tested)	Sample size	Geometric mean	Geometric standard deviation	5th percentile WPF
McGee and Oestenstad (Ex. 1–64–86), Biopack 60 (closed circuit)	23	20,000
Johnson et al. (Ex. 1–64–98), Survivair Mark 2 (with NFPA-compliant airflow)	27	29,000	1.63

OSHA is proposing APFs of 10 and 50, respectively, for tight-fitting half-mask SCBAs and tight-fitting full facepiece SCBAs operated in the demand mode. In the absence of any WPF and SWPF studies on these respirators, the Agency derived the proposed APFs based on analogous operational characteristics between these respirators and half-mask facepiece and full facepiece air-purifying respirators for which WPF and SWPF studies (described previously) are available. In addition, the proposed APFs are consistent with the APFs recommended by the 1987 NIOSH RDL for these respirators. (Note that the 192 ANSI standard did not assign APFs for these respirator classes.)

For tight-fitting full facepiece SCBAs used in the pressure demand or other positive pressure modes, OSHA is proposing an APF of 10,000, which is consistent with the 1987 NIOSH RDL and the 1992 ANSI standard. Empirical support for the proposed APF comes from the WPF study conducted by Campbell, Noonan, Merinar, and Stobbe (Ex. 1–64–7). This study showed that individual protection factors for these respirators, when operating at NFPA-compliant airflows, far exceed 10,000; however, four respirator users

experienced momentary negative-pressure spikes inside the facepiece, indicating possible leakage of ambient contamination into the facepiece, and the breathing zone of the user, under some workplace conditions.

The two SWPF studies also provide support for the proposed APF, although several individual protection factors fell below 10,000 in the two studies, and the Johnson, da Roza, and McCormack study (Ex. 1–64–98) found negative-pressure incursions inside the facepiece during high exercise rates. Since the WPF and SWPF studies indicate that these respirators fail to provide the designated level of protection under some conditions, OSHA states in footnote 5 of its proposed APF table that “[w]hen employers can estimate hazardous concentrations for emergency planning purposes, they must use a maximum assigned protection factor no higher than 10,000.” Therefore, this proposed provision limits use of tight-fitting full facepiece positive pressure SCBAs to conditions for which an emergency-response plan exists and the employer can estimate the concentration of the hazardous substance in those conditions; in addition, the employer must restrict respirator use to conditions in which the required level of employee

protection is at or below an APF of 10,000.

In proposing to limit use of tight-fitting full facepiece positive pressure SCBAs to planned emergency conditions only, OSHA acknowledges that while these respirators are among the most protective respirators available, the existing WPF and SWPF data demonstrate that they do not consistently provide employees with a protection level of 10,000 under some exposure conditions. Therefore, the Agency is proposing that employers not use these respirators routinely for protecting employees against workplace exposures requiring an APF above 1,000, but instead limit their use to non-routine (*i.e.*, emergency) conditions that require high levels of respirator protection. In this regard, the Agency believes that few, if any, routine exposure conditions in the workplace require protection above an APF of 1,000; consequently, the proposed restriction would have minimal effect on routine respirator use.¹¹

¹¹ In preparing the risk analysis for the final Respiratory Protection Standard, OSHA reviewed data in its Integrated Management Information System for the years 1992 to 1996 to determine overexposure rates to the hazardous substances listed in Table Z (“Limits for air contaminants”) of