

with abrasive blasting helmet (Ex. 3–9–2). Based on the results of these studies, OSHA granted these respirators an interim APF of 1,000 (Exs. 3–7–4, 3–8–4, 3–9–3).

In the latest SWPF study, Johnson, Biermann, and Foote of LLNL and Cohen, Hecker, and Mattheis of ORC (Ex. 3–4) tested six models of continuous flow SARs with hoods or

helmets as part of the ORC–LLNL SWPF Study. Five of these respirators had fifth percentile SWPFs ranging from 86,000 to over 250,000. However, the fifth percentile SWPFs for the sixth respirator (the North Model 85302 T) ranged from 13 to 18. The authors attributed the poor performance of this respirator to the absence of a “tuck-in”

bib. When the manufacturer corrected this design problem by adding a tuck-in bib, the resulting model (designated the North Model 85302 TB) performed as well as most of the other respirators tested in the study.

The following tables summarize the WPF and SWPF studies for tight-fitting SARs with hoods or helmets.

WPF studies for SARS with hoods or helmets (by name of authors and model of respirator tested)	Sample size	Geometric mean	Geometric standard deviation	5th percentile WPF
Johnston <i>et al.</i> (Ex. 1–64–36) 3M W–8100 Whitecap II (abrasive blasting helmet with extended-length shroud) .....	15	4,076	2.3	1,038
Johnston <i>et al.</i> (Ex. 1–64–37): 3M W–8000 Whitecap II (helmet)				
Study 1 (using >750 x field blank with iron dust samples) .....	8	1,012	2.6	199
Study 2 (using >30 x field blank with silicon dust samples) .....	8	1,417	3.0	224
Colton <i>et al.</i> (Ex. 1–64–17), 3M Snapcap W–3256 (abrasive blasting hood)	14	10,344	2.5	2,290
Nelson <i>et al.</i> (Ex. 3–6), 3M H–422 (hood) .....	31	.....	.....	>1,000
Kiefer <i>et al.</i> (Ex. 2–1), Bullard 88 Type Type CE (abrasive blasting hood) ...	11	.....	.....	>1,000

SWPF studies for SARs with hoods or helmets (by name of authors and model of respirator tested)	Range of SWPFs	Geometric mean/median SWPF	5th percentile SWPF
Bullard–LLNL (Ex. 1–157) <sup>1</sup> , Bullard 77 and 88 Type CE (abrasive blasting helmet) .....	.....	>40,000 (mean)	.....
Clemco–LANL (Ex. 3–7–3) <sup>2</sup> , Apollo 20 and 60 Type CE (abrasive blasting hood) .....	.....	>100,000 (mean)	.....
3M–LANL (Ex. 3–9–2) <sup>3</sup> , 3M Whitecap Model W–8100 Type CE (abrasive blasting helmet) .....	.....	>100,000 (mean)	.....
ORC–LLNL SWPF Study (Ex. 3–4–2):			
3M Whitecap SAR (helmet with bib and chinstrap) .....	68,000–>250,000	>250,000 (median)	>250,000
3M Snapcap (Tyvek hood with bib and chinstrap) .....	13,000–>250,000	>250,000 (median)	170,000–250,000
MSA Versa-hood (Tyvek hood) .....	9,700–>250,000	>250,000 (median)	86,000–114,000
North Model 85302 TB (Tyvek hood with bib) .....	55,000–>250,000	>250,000 (median)	150,000–240,000
North Model 85302 T (Tyvek hood, no bib) .....	5–>250,000	1,217 (mean)	13–18
Bullard CC20TIC (Tyvek hood and bib and chinstrap) .....	160,000–>250,000	>250,000 (median)	>250,000

<sup>1</sup> Collected 288 samples (a panel of 4 respirator users × 12 exercises × 6 helmets).

<sup>2</sup> Collected 264 samples (a panel of 4 respirator users × 11 exercises × 6 helmets).

<sup>3</sup> Collected 132 samples (a panel of 4 respirator users × 11 exercises × 3 helmets).

The Agency is proposing an APF of 1,000 for continuous flow SARs with hoods or helmets based on their performance in the WPF and SWPF studies. In each of the WPF studies [except the second WPF study by Johnston, Colton, Stokes, Mullins and Rhoe (Ex. 1–64–37)], these respirators attained a fifth percentile protection factor over 1,000. In addition, the large geometric mean protection factors found for these respirators provide substantial evidence for this proposed APF.

The Agency qualified the proposed APF in footnote 4 of its proposed APF table. This footnote states that \* \* \* only helmet/hood respirators that ensure the maintenance of a positive pressure inside the facepiece during use, consistent with performance at a level of protection of 1000 or greater, receive an APF of 1000.” and that “[a]ll other helmet/hood respirators are treated as loose-fitting facepiece respirators and receive an APF of 25.”

Under this proposed requirement, an employer must select for employee use only continuous flow SARs with hoods or helmets that attained a protection factor of at least 1,000. While better performance has been associated with certain designs (e.g., double bibs, neck seals or dams, blouses, higher airflows), the presence of such design considerations are no guarantee of superior performance. In order to receive an APF of 1,000, it is contingent upon the respirator manufacturer to be able to demonstrate that their particular respirator meets the criteria specified in Table I of the proposed standard. This level of performance can best be demonstrated by performing a WPF or SWPF study. OSHA is proposing this requirement because previous WPF and SWPF testing conducted on these respirators shows that they do not always result in the requisite protection factor (Exs. 3–4, 3–5).

Accordingly, researchers have recommended that such testing be performed to ensure that employees use only respirators from this class that provide them with the specified level of protection during exposure to hazardous substances. In this regard, while the respirator manufacturer most likely would perform the required testing, it would be incumbent on the employer to ensure that the respirators they selected for employee use received this testing.

While the 1987 NIOSH RDL recommended an APF of 25 for continuous flow SARs with hoods or helmets, this recommendation is the result of combining these respirators into a single class with loose-fitting facepiece SARs, and giving the entire class the low APF (*i.e.*, 25) assigned originally to loose-fitting facepiece respirators. However, the 1992 ANSI standard established a separate class for continuous flow SARs with hoods or helmets based on analogous operating