

TABLE 4.—SUMMARY OF SIMULATED WORKPLACE PROTECTION FACTOR RESULTS—Continued

Device	Range of SWPFs	Median SWPF	5th percentile SWPF
SAR 6 .....	160,000—>250,000	>250,000	>250,000

*List of Respirators**Powered Air-Purifying Respirators With Hoods/Helmets*

(PAPR1) 3M Whitecap helmet with chinstrap with GVP blower (hard plastic helmet with bib).

(PAPR 2) 3M Snapcap hood with chinstrap with GVP-100 blower (Tyvek hood with bib).

(PAPR 3) Racal BE-5 (clear PVC hood with bib).

(PAPR 4) Racal BE-10 (Polycoated Tyvek hood with bib and head suspension).

*Loose-Fitting Powered Air-Purifying Respirator*

(PAPR 5) Racal BE-12 (Polycoated Tyvek loose-fitting facepiece).

*Supplied-Air Respirators*

(SAR 1) 3M Whitecap helmet with chinstrap (hard plastic helmet with bib).

(SAR 2) 3M Snapcap hood with chinstrap (Tyvek hood with bib).

(SAR 3) MSA VERSA-Hood with #5-613-1 direct hose connection for 3/8" hose system (Tyvek hood).

(SAR 4) North Model 85302 TB (Tyvek hood with ratchet head suspension and bib).

(SAR 5) North Model 85302 T (Tyvek hood with ratchet head suspension).

(SAR 6) Bullard CC2OTIC with 2ORT suspension and 2ONC chinstrap (Tyvek hood with bib).

**Note:** All PAPRs tested with high-efficiency filters.

The study report was finalized in 1999, and ORC requested that OSHA consider assigning an interim final APF of 1,000 to the study's high-performing respirator models, with provisions for an APF as high as 5,000 based on programmatic and environmental factors (Ex. 3-4-3, 1999 communication with OSHA). ORC also recommended that, because the current NIOSH respirator certification procedures are not capable of distinguishing between high-performing PAPRs and SARs (and that some respirators may not provide adequate protection), the study methodology should be the basis for determining APFs for all respiratory protective equipment regulated by OSHA.

In 2000, ORC renewed its requests. They pointed out that the study demonstrated that the PAPRs tested, including the loose-fitting facepiece PAPRs, were capable of achieving protection factors of 6,000 to 10,000 (rather than the APF of 25 assigned by NIOSH and adopted by OSHA), and that the tested SARs achieved protection factors of 3,000 to 10,000. However, one tested SAR model did not provide a protection factor of 25, demonstrating to the Agency the importance of testing specific equipment being considered for an increased APF to assure the expected protection.

ORC asserted that new APFs for the models tested in the study were warranted. They believed that the study results justified a re-evaluation of the methods for assessing the ability of PAPRs and SARs to provide protection

against airborne particulates, and asked OSHA to issue a directive or similar document assigning an interim APF of 1,000 for the SARs and PAPRs that tested successfully in the study. ORC believed that SWPF testing of PAPRs and SARs was beneficial, and strongly supported use of a collaborative approach as was pursued in developing the study.

OSHA permitted use of an interim APF of 1,000 for 9 of the 11 respirators tested and developed an enforcement policy similar to that followed for the Bullard, Clemco, and 3M respirators (Ex. 3-4-4; 2002 memo to RAs). Again, the interim APFs are subject to a final APF determination resulting from this rulemaking. OSHA requests comments on all aspects of this study.

*LLNL/OSHA PAPR Study.* OSHA requested that LLNL conduct two additional PAPR studies using the protocol of the 1995-96 ORC study. The raw data from the two evaluations were then compared with the ORC SWPF study data.

A modified SWPF protocol was used to test two additional PAPRs, an MSA OptimAir and a Neoterik, selected by OSHA. The testing employed the same exercise protocol as the ORC study; however, only three test subjects participated in the evaluation. The three test subjects each performed four separate donnings of each respirator model. The 50th and 95th percentiles of the penetration and protection factors for the two respirators are shown in Table 5.

TABLE 5

Respirator model	Penetration		Protection factor	
	50th percentile	95th percentile	50th percentile	95th percentile
MSA OptimAir .....	$1.67 \times 10^{-6}$ (a) .....	$4.08 \times 10^{-5}$ .....	250,000(a) .....	24,510
Neoterik .....	$2.74 \times 10^{-5}$ .....	$1.43 \times 10^{-3}$ .....	36,563 .....	698

For the Neoterik, SWPFs of 100 and somewhat less were observed for the running in place and the moving bricks (building a concrete block wall) exercises. The Neoterik demonstrated SWPFs near 1,000 and somewhat less for the twisting head side to side, moving the head up and down, and touching toes exercises. For the MSA OptimAir, SWPFs approaching 100 for

the running in place exercise were observed, while all of the other exercises resulted in SWPFs of 10,000 or greater. Penetration levels by type of exercise were compared between the OSHA PAPR analyses and the ORC results. In general, the comparison indicated that the same exercises triggered increased penetration values. That is, sources of penetration were

“running-in-place” (for both respirators) and “moving bricks” (for the Neoterik PAPR).

**V. Health Effects**

In a number of previous rulemakings, OSHA discussed the serious health effects caused by exposure to airborne chemical hazards (*see, e.g.*, Appendix A of the Hazard Communication Standard