

OSHA's proposed APFs for half-mask SARs. No WPF studies were available for half-mask SARs. Therefore, OSHA is proposing an APF of 10 for this respirator class when used in the demand mode based on their analogous operational performance with negative pressure half-mask air-purifying respirators tested during WPF and SWPF studies. In addition, the Agency proposes to give half-mask SARs that function in the continuous flow or pressure demand modes an APF of 50, consistent with the performance of half-mask PAPRs in WPF and SWPF studies (and operated at the same airflow rates). Additional support for the proposed APFs comes from the 1992 ANSI standard, which assigned an APF of 10 to half-mask airline SARs operated in the demand mode, and an APF of 50 when operated in the continuous flow or pressure demand mode. The 1987 NIOSH RDL also gave half-mask demand SARs an APF of 10, but recommended an APF of 1,000 for these respirators when functioning in the pressure demand or other positive pressure modes.

Regarding the recommended APF of 1,000, OSHA preliminarily finds that these respirators warrant the more conservative APF of 50 because of the possibility that negative pressure could develop inside the mask during tasks that stress the facepiece seal; moreover, in the absence of WPF and SWPF data for these respirators, the Agency believes that a conservative approach to setting this APF is appropriate.

OSHA's proposed APFs for full facepiece SARs. No WPF or SWPF studies were available involving tight-fitting full facepiece SARs operated in the demand mode. Therefore, in the absence any such data, the Agency is assigning this respirator class an APF of 50 based on the analogous operational characteristics between these respirators and negative pressure air-purifying respirators when operated in the demand mode under WPF conditions. The proposed APF is the same as the APF recommended for this respirator class by the 1987 NIOSH RDL, and similar to the APF (*i.e.*, 100) given to these respirators by the 1992 ANSI standard. In choosing an APF of 50 instead of 100 for this class of respirators, the Agency believes that the paucity of WPF and SWPF studies warrants taking a conservative approach in this determination.

While no WPF studies for full facepiece SARs operated in the pressure demand or other positive pressure modes were available, there was one SWPF study of this respirator class by Skaggs, Loibl, Carter, and Hyatt (Ex. 1–

38–3). The study, performed at LANL, evaluated the respirators under different temperature and humidity conditions; the results of the study showed that these respirators had geometric mean protection factors ranging from 8,500 to 20,000. Therefore, the Agency is proposing an APF of 1,000 for full facepiece SARs used in the pressure demand or other positive pressure modes based on their performance in this study (*i.e.*, that the likelihood is high that the geometric mean SWPFs would translate to fifth percentile WPF of 1,000. Further justification for the proposed APF comes from the similarity in operational characteristics (including the same minimum airflow rates) between these respirators and tight-fitting full facepiece continuous flow PAPRs, which are receiving a proposed APF of 1,000 in this rulemaking. (See the discussion of these PAPRs above).

The proposed APF of 1,000 for full facepiece SARs operated in the pressure demand or other positive pressure modes also is consistent with the APFs of 1,000 assigned by the 1992 ANSI standard to these respirators when used in the continuous flow or pressure demand modes, and the APF of 2,000 recommended by the 1987 NIOSH RDL for pressure demand respirators in this class. Although the RDL gave an APF of 50 to these respirators in a continuous flow mode, the Agency believes that the SWPF study, as well as the WPF studies performed on analogous tight-fitting full facepiece continuous flow PAPRs, justify the proposed APF.

OSHA's proposed APF for SARs with hoods or helmets. The Agency found a number of WPF studies on these respirators, including one by Johnston, Stokes, Mullins, and Rhoe (Ex. 1–64–36).

These authors performed a WPF study on the 3M Whitecap continuous flow abrasive blasting helmet (equipped with an extended length shroud) used by four shipyard employees while sandblasting a barge. After performing several data analyses, the authors concluded that outside-the-respirator samples with filter loadings at least 1,000 times greater than the mean blank value were most representative of the respirator's performance. Therefore, OSHA is using only statistics based on these samples for its APF determinations; these statistics indicate that the estimated fifth percentile protection factor is 1,038 for these samples.

Johnston, Stokes, Mullins, and Rhoe (Ex. 1–64–37) conducted a second WPF study on the 3M Whitecap II general purpose SAR with a helmet. In this study, the authors sampled six employees while they performed

grinding operations in a foundry. The authors stated that “because of the relatively low sample loadings, the WPF numbers obtained significantly underestimate the performance capability of the respirator.” Therefore, OSHA did not use the WPFs from this study in developing the proposed APF for this respirator class.

Colton, Mullins, and Bidwell (Ex. 1–64–17) published a WPF study on foundry employees who used the 3M Snapcap continuous flow SAR with an abrasive blasting hood while exposed to silica during tear-down operations. The authors reported a fifth percentile protection factor over 1,000, which they noted was consistent with the APF of 1,000 assigned to these respirators by the 1992 ANSI standard.

In another WPF study, Nelson, Wheeler, and Mustard (Ex. 3–6) sampled aircraft assembly employees involved in sanding and primer spraying operations while using the 3M H–422 continuous flow SAR hood with both an outer and inner shroud. The authors reported that 14 of the 31 samples taken during primer spraying operations showed measurable concentrations of strontium (Sr) outside the facepiece (C_o), but none of the samples showed any measurable concentration of Sr inside the facepiece (C_i). Based on these C_o data, and using the lowest detectable limit for C_i , the authors concluded that “the WPFs were greater than 1,200 for all samples with a mass of Sr on the C_o samples 1,000 times the detection limit for the C_i samples.” They stated further that their study supports the APF of 1,000 given to these respirators by the 1992 ANSI standard.

In a WPF study conducted at Avondale shipyard, Kiefer, Trout, and Wallace (Ex. 2–1) sampled the total particulate exposures (*i.e.*, small and large particle fractions combined) of employees involved in abrasive blasting operations while using the Bullard Type 88 CE (continuous flow) SAR abrasive blasting hood. The authors reported WPFs ranging from 2,817 to 10,000.

OSHA identified four SWPF studies of this respirator class, all performed by LLNL or LANL for manufacturers of continuous flow SARs with abrasive blasting hoods or helmets. The geometric mean protection factors found for these respirators were 40,000 for the Bullard Model 77 and 88 Type CE (continuous flow) SARs with an abrasive blasting hood (Ex. 1–157), and 100,000 for the Clemco Apollo 20 and 60 Type CE (continuous flow) SARs with an abrasive blasting hood (Ex. 3–7–3) and the 3M Whitecap Model W–8100 Type CE (continuous flow) SAR