

NIOSH stated that it may revise the 1987 RDL if warranted by subsequent WPF studies.

In August 1992, ANSI again revised its Z88.2 Respiratory Protection Standard (Ex. 1-50). The ANSI Z88.2-1992 standard contained a revised APF table, based on the Z88.2 Subcommittee's review of the available protection factor studies. In a report describing the revised standard (Ex. 1-64-423), Nelson, Wilmes, and daRoza described the rationale used by the ANSI Subcommittee in setting APFs:

If WPF studies were available, they formed the basis for the [APF] number assigned. If no such studies were available, then laboratory studies, design analogies, and other information was used to decide what value to place in the table. In all cases where the assigned protection factor changed when compared to the 1980 standard, the assigned number is lower in the 1992 standard.

In addition, the 1992 ANSI Z88.2 standard abandoned the 1980 standard's practice of giving increased protection factors to some respirators if quantitative fit testing was performed.

Tom Nelson, the co-chair of the ANSI Z88.2-1992 Subcommittee, published a second report, entitled "The Assigned Protection Factor According to ANSI" (Ex. 135), four years after the Z88.2 Subcommittee completed the revised 1992 standard. In the report, he reviewed the reasoning used by the ANSI Subcommittee in setting the 1992 ANSI APFs. He noted that the Z88.2 Subcommittee gave an APF of 10 to all half-mask air-purifying respirators, including quarter-mask, elastomeric, and disposable respirators. The Subcommittee also recommended that full facepiece air-purifying respirators retain an APF of 100 (from the 1980 ANSI standard) because no new data were available to justify another value. The Z88.2 Subcommittee also reviewed the 1987 NIOSH RDL values, particularly the RDL's reduction of loose-fitting facepiece and PAPRs with helmets or hoods to an APF of 25 based on their performance in WPF studies. For half-mask PAPRs, the ANSI Subcommittee set an APF of 50 based on a WPF study by Lenhart (Ex. 1-64-42). The ANSI Subcommittee had no WPF data available for full facepiece PAPRs, so it decided to select an APF of 1,000 to be consistent with the APF for PAPRs with helmets or hoods. The Subcommittee, in turn, based its APF of 1,000 for PAPRs with helmets or hoods on design analogies (*i.e.*, same facepiece designs, operation at the same airflow rates) between these respirators and airline respirators. Nelson noted that a subsequent WPF report by Keys (Ex. 1-64-40) on PAPRs with helmets or hoods

was consistent with an APF of 1,000. According to Nelson, the Subcommittee used WPF studies by Myers (Ex. 1-64-48), Gosselink (Ex. 1-64-23), Myers (Ex. 1-64-47), and Que Hee and Lawrence (Ex. 1-64-60) to set an APF of 25 for PAPRs with loose-fitting facepieces. Nelson stated that two WPF studies, conducted by Gaboury and Burd (Ex. 1-64-24) and Stokes (Ex. 1-64-66) subsequent to publication of ANSI Z88.2-1992, supported the APF of 25 selected by the Subcommittee for PAPRs with loose-fitting facepieces.

Tom Nelson stated in his report that the ANSI Subcommittee had no new information on atmosphere-supplying respirators. Therefore, the APFs for these respirators were based on analogies with other similarly designed respirators (Ex. 135). The ANSI Subcommittee based the APF of 50 for half-mask continuous flow atmosphere-supplying respirators, and the APF of 25 for loose-fitting facepiece continuous flow atmosphere-supplying respirators, on the similarities between these respirators and PAPRs with the same airflow rates. Nelson noted that the ANSI Subcommittee set the APF of 1,000 for full facepiece continuous flow atmosphere-supplying respirators to be consistent with the APF for SARs with helmets or hoods found in two earlier studies—a WPF study by Johnson (Ex. 1-64-36) and a SWPF study by Skaggs (Ex. 1-3803). The Subcommittee used the analogy between PAPRs and continuous flow supplied-air respirators to select the APF of 50 for half-mask pressure demand SARs and 1,000 for full facepiece pressure demand SARs. Nelson stated: "The committee believed that setting a higher APF because of the pressure demand feature was not warranted, but rather that the total airflow was critical."

Nelson noted in the report that the Subcommittee selected no APF for SCBAs. In explaining the committee's decision, he stated that "the performance of this type of respirator may not be as good as previously measured in quantitative fit test chambers." Nelson also observed that the ANSI 88.2-1992 standard justified this approach in a footnote to the APF table. The footnote states:

A limited number of recent simulated workplace studies concluded that all users may not achieve protection factors of 10,000. Based on [these] limited data, a definitive assigned protection factor could not be listed for positive pressure SCBAs. For emergency planning purposes where hazardous concentrations can be estimated, an assigned protection factor of no higher than 10,000 should be used.

A new ANSI Z88.2 Subcommittee currently is reviewing the ANSI Z88.2-1992 standard, in accordance with ANSI policy specifying that each standard receive a periodic review. This review likely will result in revisions to the Z88.2 APF table based on WPF and SWPF respirator performance studies conducted since publication of the current standard in 1992.

B. Need for APFs

The proposed APF definition and regulatory text are important additions to, and an integral part of, OSHA's Respiratory Protection Standard because employers need this information to select appropriate respirators for employee use when engineering and work-practice controls are insufficient to maintain hazardous substances at safe levels in the workplace. Employers need the consistent and valid information contained in the proposed APF provisions to select respirators for employee protection, based on the type of hazardous substance and the level of employee exposure to that substance.

As noted in Table I of the proposed regulatory text, the proposed APFs differ for each class of respirator. In this regard, the proposed APF for a class of respirators specifies the workplace level of protection that class of respirator should provide under an effective respiratory protection program. Therefore, when the concentration of a hazardous substance in the workplace is less than 10 times the PEL, the employer must select a respirator from a respirator class with an APF of at least 10 for use by employees exposed to that substance. However, when the concentration of the hazardous substance is greater than 10 times the PEL, the employer must select a respirator that has an APF greater than 10 for this purpose. In addition, employers would derive MUCs from the APFs proposed for the different respirator classes. These MUCs determine the maximum atmospheric concentration of toxic gasses and vapors at which respirators equipped with cartridges and canisters can be used to protect employees.

In summary, when used in conjunction with the existing provisions of the Respiratory Protection Standard, especially the respirator selection requirements specified in paragraph (d), the proposed APF definition and regulatory text would provide employers with the information they need to select the appropriate respirators for reducing employee exposures to hazardous substances to safe levels. Accordingly, integrating the proposed APF provisions into the Respiratory Protection Standard will