

ISRP Forum

"Protection Factor": The Need to Agree on a Definition

R. M. Howie

The term "Protection Factor" (PF) is widely used as an expression to define the level of protection afforded by RPE. The term is used either directly, being defined as the ratio of contaminant concentration outside and inside the facepiece, or *indirectly*, being expressed as "maximum multiples of the OEL" (CEN Report 5529 and HSE Document HS(G)53) or "maximum use concentration" (HSE Documents EH41 or F2486). In terms of the CEN Standards which are used as the basis for approving products, the *direct* definition (often expressed as percentage inward leakage) is applied. This is often termed the Nominal Protection Factor (NPF).

During a recent discussion regarding the numerical value of PF which could be assigned to a device, it became apparent that not all persons in the discussion were adopting the same definition of PF. This led to considerable confusion and is the basis of my plea for the need for common agreement on definition.

Some parties at the discussion defined PF as a numerical index of the protection which could be achieved by a given proportion of wearers. This may be 75, 90, or 95%, and, in the context of the discussion, I took it as 95%. Other parties regarded PF as the figure which could be obtained by the "majority" of wearers (in the worst case this could mean 51%).

With respect to the device in question, where the NPF defined by the European Standard was 2000, the study under discussion gave rise to results in which one quarter were below 2000. Thus, the first definition concluded that the PF

was less than 50, whereas the second definition gave rise to the conclusion that the PF exceeded the NPF defined by the Standard — i.e., 2000.

In essence, the discussion revealed that the difference between the two definitions was the difference between the proportion of wearers which were assumed to achieve the NPF.

It is, therefore, essential that the proportion of wearers who can be expected to achieve at least the PF should be agreed, so that the performance data can be interpreted and to enable valid guidance for selecting RPE able to provide "adequate" protection for given use situations.

For information, there are three accepted proportions adopted in current documents:

1. EN140 and EN149 require in-laboratory leakage tests that the mean results for 8 wearers out of 10 shall not exceed the criterion. In essence, 8 out of 10 wearers meeting the requirement implies that approximately 75 percent of wearers will achieve at least that level of protection, i.e., one person in four could be expected to receive lower protection.
2. EN136, EN147 etc., require that all 10 out of 10 leakage test subjects shall meet the criterion. In essence, 10 out of 10 wearers meeting the requirement implies that approximately 95 percent of wearers will achieve at least that level of protection, i.e., one person in twenty could be expected to receive lower protection.

3. In the extensive Workplace Protection Factor literature, most authors derive a single figure index of performance based on the 95th percentile of the distribution of individual results. It is generally assumed that results are log-normally distributed.

In agreeing the percentile at which the PF shall be set demands *explicit* recognition that a defined percentage of wearers may/will receive lower protection than that PF.

To put the legal situation into perspective, UK employers' duties are covered by the Health and Safety at Work etc., Act, 1974, Section 2 of which specifies:

"It shall be the duty of the employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of *all* his employees." (my italics)

It is, in my view, essential that there is a clear understanding of how Protection Factor is to be interpreted by manufacturers, by users, by those who select RPE, and by those who interpret the Law.

My recent experience showed that there is not yet such an understanding and I believe ISRP is the ideal forum whereby this matter can be resolved.

