RESPIRATOR PERFORMANCE TERMINOLOGY

The following terms were developed by the American Industrial Hygiene Association Respiratory Protection Committee to represent respirator performance in various contexts. They should be used properly in research studies and all other discussions of respirator performance to ensure clarity of meaning. In each term, \( C_a \) represents the measured or estimated concentration of contaminant in the air outside the respirator; \( C_t \) represents the measured or estimated concentration of contaminant in the air inside the respirator.

**Assigned Protection Factor (APF)**

\[
\text{APF} = \left( \frac{C_a}{C_t} \right) \]

The level of respiratory protection that a properly functioning respirator or class of respirators would be expected to provide to properly fitted and trained users in the workplace. The APF takes into account all expected sources of facepiece penetration (e.g., face seal penetration, filter penetration, valve leakage). It is not intended to take into account factors that degrade performance such as poor maintenance, failure to follow manufacturer's instructions, and failure to wear the respirator during the entire exposure period. (See definitions for Effective Protection Factor and Program Protection Factor.)

**Quantitative Fit Factor (QNFF)**

\[
\text{QNFF} = \left( \frac{C_a}{C_t} \right) \]

A measure of the fit of a particular tight-fitting respirator facepiece to a specific individual. It represents only facepiece to face leakage. Leakage from other sources (e.g., air purifying elements) must be essentially zero. QNFF is measured with specialized instrumentation.

**Qualitative Fit Factor (QLFF)**

\[
\text{QLFF} = \left( \frac{C_a}{C_t} \right) \]

A qualitative estimate of the minimum fit of a particular tight-fitting respirator to a specific individual when a validated qualitative fit test is passed, i.e., the test agent is not detected by the subject's senses. A validated qualitative fit test is one that meets the sensitivity criteria of ANSI standard Z88.10 or is listed in 29 CFR 1910.134.

**Workplace Protection Factor (WPF)**

\[
\text{WPF} = \left( \frac{C_a}{C_t} \right) \]

A measure of the protection provided in the workplace, under the conditions of that workplace, by a properly selected, fit tested and functioning respirator while it is correctly worn and used. WPF is a direct measurement of respirator performance capabilities in a specific work environment. It represents the workplace contaminant concentration outside the respirator \( (C_a) \) divided by the contaminant concentration inside the respirator \( (C_t) \). \( C_a \) and \( C_t \) are measured simultaneously only while the respirator is properly worn and used during normal work activities. \( C_a \) measurements made using respirators that are poorly maintained, improperly used, or not worn during the entire exposure period are inappropriate for WPF determination. (See definitions for Effective Protection Factor and Program Protection Factor.)

**Effective Protection Factor (EPF)**

\[
\text{EPF} = \left( \frac{C_a}{C_t \text{expected}} \right) \]

A measure of the protection provided by a properly selected, fit tested and functioning respirator when it is worn for only some fraction of the total exposure period in the workplace. It is the ratio of the contaminant concentration outside the respirator to that in the air actually inhaled. It is determined by sampling outside the respirator and in the breathing zone during the total exposure period, regardless of whether the respirator is being worn. While the respirator is worn, breathing zone sampling is done from within the respirator. EPF is strongly influenced by non-wear time, regardless of the respirator's WPF.

EPF may also be estimated by correcting appropriately measured workplace protection factors (WPF) for the time that the respirator is not worn during the exposure period using the following formula. It can be validly applied only if the air contaminant concentration is relatively constant over the exposure period.

\[
\text{EPF} = \frac{T_s}{T_w + T_{nw}} \]

where

- \( T_s \) = shift or exposure duration (hours)
- \( T_w \) = number of hours respirator is worn
- \( T_{nw} \) = number of hours that respirator is not worn

**Simulated Workplace Protection Factor (SWPF)**

\[
\text{SWPF} = \left( \frac{C_a}{C_t} \right) \]

A measure of respirator performance that is done in a laboratory using test exercises designed to simulate work. SWPF is determined by measuring a test atmosphere concentration outside \( (C_a) \) and inside \( (C_t) \) a properly functioning respirator that is properly worn. The validity of SWPF as a surrogate for WPF depends on how well the test exercises represent the work to be done.

**Program Protection Factor (PPF)**

\[
\text{PPF} = \left( \frac{C_a}{C_t} \right) \]

An estimate of the respiratory protection provided to a worker in the context of a specific respirator program. It is defined as the contaminant concentration that the user would inhale if the respirator were not worn \( (C_a) \) divided by the contaminant concentration inside the respirator as it is actually used \( (C_t) \). \( C_a \) may be estimated from biological monitoring as the airborne concentration expected to produce the measured biological index. PPF is an estimate of the effectiveness of the complete respirator program rather than the performance capabilities of the respirator itself. It is affected by such factors as the following:

- wearers’ activities;
- user training and motivation;
- proper respirator selection, maintenance, and storage;
- user training and fit testing;
- facial hair or other conditions that interfere with proper fit; and
- supervision, administration, and monitoring of the program.

If any of these or other program elements are deficient, the program protection factor will be adversely affected.