Respiratory protective equipment

Respiratory protective equipment (RPE) is a part of risk management for many employers. Graveling et al. [1] identify the elements of an effective risk control programme involving RPE. The selection of technically appropriate RPE, and organizational/management issues are fundamental to a successful programme. Implementing an RPE programme is part of the bigger picture of risk management and control. Recommendations to complement efforts to ensure that the correct type of RPE protection is selected include:

- Managers must recognize the need for RPE and be aware of the hazards involved and possible consequences of exposure.
- Employees must participate in an effective programme and attitudes and behaviour can be a major positive (or negative) influence.
- A balance must be struck between the selection of appropriate RPE which is not intrusive and/or uncomfortable to wear.
- Interactions with workplace factors (e.g. space, temperature) can be important.
- Compatibility with other PPE. (EU Council Directives on manufacture (89/686/EEC) and use (89/656/EEC) of PPE.)
- A fit testing programme that takes account of factors such as face size and shape, and facial hair is advisable.
- Sufficient RPE must be provided and replacement disposable or reusable system replacement supplies must be easily obtainable.
- Information and training must inform employees of the hazard and consequent risks associated with the substances being protected against.
- Suitable provision is required for cleaning, maintenance, and storage (as appropriate) of RPE. Powered respirators have greater cleaning and maintenance requirements needing centralized provision.

There is increased interest in respirator performance against fine particles such as nanoparticles (natural and engineered) and bioaerosol particles (e.g. viruses and bacteria). Although the effect of particle size on the laboratory performance of respirators has been studied using manikins [2–7] few studied human subjects. A study investigated particle-size-selective protection factors (PFs) of four models of N95 filtering facepiece respirators (FFRs) undergoing fit testing [8]. Overall fit test pass rate was 67%. Of these, 29% had PFs<10 (the Occupational Safety and Health Administration Assigned Protection Factor for this respirator). Fit testing improved PFs with 9% having values <10. Overall PFs increased when subjects passed fit testing. The results support the value of fit testing but show that PFs are dependent on particle size regardless of fit testing status.

Workplace nanoparticle (<100 nm size) exposure is of major health concern. Approval of respirators for protection against nanoparticles is based on their filtration efficiency at sealed conditions. Concerns prevail about the lack of data on face seal leakage of nanoparticles. A recent study assessed filter penetration and total inward leakage (TIL) for National Institute of Occupational Safety and Health-approved N95 and P100 and European certified FFP2 and FFP3 filtering facepiece respirators [9]. The most penetrating particle size (MPPS) was ~50 nm and penetrations for 50 and 100 nm size particles were markedly higher than for 8 and 400 nm size particles but increased with increasing flow rates. The TIL values for all size particles increased with increasing leak sizes but, for smaller leaks, TIL for 50 nm size particles was ~2-fold higher than for 8 and 400 nm size particles indicating that the TIL for the most penetrating particles was higher than that for other size particles.

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References