
Letter to the Editor

Dear Editor,

The abstract of the paper by Jung et al in volume 31(2) of the journal about total inward leakage begins by saying, "Respiratory protection is dependent on the filtration efficiency and face seal leakage of the respirator." This sentence includes two thirds of the three elements required for respiratory protection of the wearer.

The third element is the path taken by the leakage from whatever source location to the mouth or nose of the wearer. If the leakage contaminants never reach the mouth or nose, then they cannot be inhaled, so the total distance from the leakage source to the mouth is an important contributor to respiratory protection.

We have shown that the twists and turns in the flow pathway from the leakage source to the mouth or nose can lengthen the leakage pathway sufficiently that the leakage contaminants are not inhaled. We called this "protective dead volume". Contaminated air in the protective dead volume is swept clean during each exhalation, with, presumably, a different, and shorter, flow pathway than that which exists during inhalation.

On the other hand, leakage contaminants can reach the mouth and be inhaled during peak flows if the flow pathway is not long enough. These contaminants can then be scrubbed from the facepiece during exhalation, and a measurement of contaminant leakage inside the facepiece that averages contaminant concentration over the entire inhalation-exhalation cycle will give a value too low to be correct. It's only inhaled contaminants that pose a threat; any leakage while the wearer is exhaling (and that can happen) is not a respiratory threat.

This all points to two elements of aerosol leakage detection procedures that are very important: placement of the measurement probe inside the facepiece (at the location of the mouth is best because, at high flow rates during which contaminant inhalation would be greatest, the wearer is likely breathing through the mouth).

Speed of the measurement (the detector should be fast enough to be able to pick up peak contaminant concentrations, and tubing from the probe to the detector should be kept very short, 6 inches or less if possible. Dispersion in a long tube distorts the signal.)
These types of measurements would truly give total respiratory protection.

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