

# **VOLUME, FLOW AND SPEED: THREE COMBINED FACTORS THAT GOVERN FILTER PERFORMANCE**

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When it comes to examining the performance of respirator filters and cartridges, there are three factors that must be part of the equation. Ignoring just one of them will result in a skewed and incomplete picture of how well the device works, as well as the level of protection the user can hope to achieve. Standards testing focuses only on volume (usually 85 l/min constant flow) which is considered to be a realistic human demand for air. However, the standards testing does not consider the fact that humans do not breathe at a constant flow, and that a breath comprises two parts: inhalation and exhalation. Even if a human breath was 50/50 inhalation/exhalation, the flow through the filter would necessarily be  $85 \times 2 = 170$  l/min. How does the filter cope with this flow? The standards test does not examine this. Moreover, a human breath is very rarely 50/50 inhalation/exhalation. Because of human physiology the inhalation phase is usually much shorter than the exhalation at about 1/3 of a breath at rest.. This means that the required air has to flow through the filter in 20 seconds — not 1 minute. Furthermore, significantly higher flows are often found. During speech, for example, the inhalation phase commonly comprises only 10% of a breath. This leads to the third factor - air speed through the filter. Even at complete rest, a person speaking will draw air at hurricane speeds, above 100 km/h or 60 mph. In this respect, the diameter of the filter is of crucial importance, as the speed of air will increase dramatically with decreasing diameter of the filter or filters. Will the adsorption media cope? This paper graphically shows the influence of all three factors: volume, flow and speed. A program has been written that will help visualize the impact of one volume with many flows and speeds.