

**Workplace Breathing Rates:
Defining Anticipated Values and Ranges for Respirator Certification Testing**

David M. Caretti, Karen M. Coyne, and Paul D. Gardner

U.S. Army Edgewood Chemical Biological Center
Aberdeen Proving Ground, MD 21010-5424
Tel: +1-410-436-6692 Fax: +1-410-436-3141
e-mail: paul.gardner2@us.army.mil

ABSTRACT

In the United States, the National Institute for Occupational Safety and Health (NIOSH) uses methods to certify that respirators meet a minimum level of efficacy when tested under standard laboratory protocols. A number of different test airflow rates are used to assess the performance of respirators depending on the respirator type and test being performed. For air-purifying respirators (APRs), the primary performance tests most affected by airflow rate are filter gas-life capacity, particulate filter efficiency, and respirator breathing resistances. Presently, NIOSH measures all three parameters using constant-rate airflow conditions. A review and analysis of workplace breathing rates contained in the literature was performed to quantify ventilation rates for occupational activities and to gauge the adequacy of current certification flow rates. The results of this effort indicated that measured and estimated workplace minute volumes ranged from about 8 to 162 L·min⁻¹ for unencumbered ventilation and work activities that spanned from mild to exhaustive workloads. The mean minute volume of the distribution was 38.5 ± 16.6 L·min⁻¹ and the median was 33.6 L·min⁻¹. Based on an empirical relationship between minute volume and peak inspiratory flow (PIF), peak flows between 72 L·min⁻¹ and 183 L·min⁻¹ would be expected for a minute volume of 38.5 L·min⁻¹. The anticipated range of PIF rates for the 95th percentile minute volume was between 182 L·min⁻¹ and 295 L·min⁻¹. The findings of this literature review suggest that current test flow rates may not adequately account for PIF occurring in the workplace and that cyclic flow rates should be considered for certification testing at levels that better represent workplace ventilation rates.