

Investigation of Factors Affecting the Performance of N95 Respirator Filters

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A NIOSH approved N95 FFPR (filter face piece respirator) efficiency was studied on different situations that could be found in the field. A six-jet nebulizer was used to generate poly-disperse nanoparticles of NaCl of size ranging from 15 to 200 nm. A scanning Mobility Particle Sizer (SMPS) was used to scan the particle size distribution upstream and downstream of the FFPR. The respirator was fixed and sealed in manikin head to avoid particle infiltration during the test. The effects of air flow rate and time use were studied. The air flow rate affects significantly the filter efficiency. The maximum particle penetrations were 2.7%, 6.9%, 11.7% and 15% at air flow rates of 85, 135, 270 and 360 l/min respectively. The Most Penetrating Particle Size (MPPS) decreased from 46 nm to 36 nm when the testing air flow rate increased from 85 to 360 l/min. The effect of the time use up to five hours at 85 l/min demonstrated that the particle penetration decreased from 1.8% to 0.9% in the range of 15 to 100 nm and increased from 0.7% to 1.1% in the range of 100 to 200 nm. Also, tests were performed under cyclic air flow rates using a mechanical breathing machine with a peak flow of 185 l/min. Results confirm that the respirator filter efficiency of the N95 is sensitive to the air flow rates. NIOSH use 85 l/min for filter approvals which is not representative of real situations.