Temporal Changes in Filtering-Facepiece Respirator Fit

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ABSTRACT

Objective: A three-year study was performed to validate the scientific basis for the periodicity of fit testing by investigating changes in N95 filtering-facepiece respirator (FFR) fit and facial dimensions as a function of time.

Methods: A sample of 229 subjects was initially enrolled and tested every six months. During each visit, subjects performed a total of nine fit tests using three samples of the same FFR model. Anthropometric data were obtained on each visit. Inward leakage and filter penetration were measured for each donned respirator to determine face seal leakage (FSL). A total of 195 subjects completed the second visit and only 134 subjects completed all seven visits of the study. Acceptable fit was defined as 90th percentile FSL $\leq 5\%$ and at least one fit factor ≥ 100.

Results: The mean FSL for Visit 1 (baseline) was 0.64% (SD = 0.30%). The mean changes in FSL between Visit 1 and any subsequent visit were 0.13% or less for subjects whose fit remained acceptable. The changes in FSL were about 2% for those subjects whose fit became unacceptable. An unacceptable fit was observed for 13.8%, 10.4%, 6.9%, 12.3%, 14.9%, and 15.7% of subjects for Visits 2 to 7, respectively. On average 5.8% of subjects experienced unacceptable fit for more than six months. For subjects with a weight loss or gain of ≥ 20 lbs., about one third of them experienced unacceptable fit.

Conclusions: This study found that on the average about 12% of subjects did not maintain acceptable fit over the course of the study. This study results support the OSHA requirement for annual fit testing and additional fit testing guidance based on weight gain or loss. Further data analyses will be performed to understand why subjects had unacceptable fit.