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Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: a Pilot Study

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In an effort to address questions regarding the Occupational Safety and Health Administration's annual fit testing requirement, a study was initiated to assess respirator fit and facial dimension changes as a function of time for a representative sample of 220 subjects wearing filtering-facepiece respirators and to investigate factors that affect such changes. The objective of this pilot study of 10 subjects was to investigate the variation in test data of a fit test protocol. Each subject was trained to don and doff a filtering-facepiece respirator model using standardized videos. Total inward leakage was measured with the TSI Portacount instrument during five exercises. Filter penetration for each respirator was also measured. Face seal leakage was then calculated. The study included only subjects who (a) passed the fit test and (b) demonstrated, through a series of nine donnings, that they achieved adequate protection. A subject was considered to have achieved adequate protection when, after nine trial donnings, the 90th percentile face seal leakage was 0.05 or less. Following the respirator fit tests, 13 traditional face measurements, height, weight, and a 3-D scan were collected. The same data were collected two and four weeks later. The mean face seal leakage of the 9 donnings for individual subjects ranged from 0.202% to 0.997% for the first test cycle, from 0.231% to 1.059% for the second test cycle, and from 0.248% to 2.234% for the third test cycle. The mean change in face seal leakage for the 10 subjects was 0.044% between cycles 1 and 2, and was 0.229% between cycles 1 and 3. Although variability was observed between donnings and cycles, adequate fit was maintained for all 10 subjects. Scan data showed subject faces remained the same over a period of four weeks.