

# Development of Respirator Fit Test Panels for use in Respirator Testing Standards

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An anthropometric survey of 3,997 respirator users was conducted by the National Institute for Occupational Safety and Health (NIOSH) in 2003 and the data were used to develop new fit test panels. One fit test panel was developed using face length and face width (bivariate approach). Another panel was developed using the first two principal components obtained from a set of 10 facial dimensions. Both panels have been published as ISO technical specification standards (ISO+TS+16976-2-2010). The bivariate panel is simpler to use than the principal component analysis (PCA) panel. The inclusion of the 8 additional facial measurements allows the PCA panel to provide better criteria for excluding extreme face sizes from being used. This presentation will describe the advantage and disadvantages of the two panels, how NIOSH proposed to use them in the NIOSH certification standards, and how ISO proposed to use them in the ISO standards.

Determining the required sample size (number of test subjects populating the panel), and the corresponding cut-off for minimally sufficient results, represents a significant issue to determine whether a given respirator will fit the worker population. This presentation will also describe the use of binomial probabilities for specifying a fit test criterion across a range of sample sizes, evaluating statistical properties for a range of type I and type II error rates, and making subsequent recommendations about the minimum sample size and cut-off for minimally acceptable results. Results show that a sample size of at least 35 is needed to simultaneously achieve sufficiently high power and sufficiently low error rates. Optimal statistical properties can be achieved by requiring 26 of 35, 30 of 40, 33 of 45, or 37 of 50 subjects to pass, with larger sample sizes yielding overall better properties.