

RESPIRATOR ARTICLE ABSTRACTS

We review the articles published in the American Industrial Hygiene Association Journal (AIHJ) and the Applied Occupational and Environmental Hygiene Journal for information that is applicable to the field of respiratory protection; we then publish abstracts of these articles. We appreciate the cooperation of the American Industrial Hygiene Association and the American Conference of Governmental Hygienists in allowing us to do this.—Ed.

"Validation of a Respirator Performance Model," by William C. Hinds, David Risi, and Ti-Lin Kuo, *Appl. Occup. Environ. Hyg.*, October 10(10): 827, 1995

This article presents results of an experimental validation of a model for predicting the performance of half-mask respirators. The model predicts respirator performance for protection against aerosols. It uses as input the measured fit factor, an estimated work rate, the exposure particle size distribution, and known performance characteristics for the type and brand of filter used. The validation tests involved the measurement of respirator performance, using human subjects, under simulated use conditions with known fit, work rate, particle size distribution, and filter performance. Comparison is made between measured and predicted performance for two conditions each of fit, particle size, and work rate. Fit factors ranged from 5 to 231, test aerosol mass median aerodynamic diameters from 0.6 to 1.3 μm , and work rates from 0 to 50 W. Based on tests conducted here, the predictive model does a reasonable job of predicting penetration under simulated use conditions where fit factor, size distribution, work rate, and filter efficiency are known. It is able to account for 58 percent of variability in measured penetration under the conditions of these tests. The model adequately accounts for the effect of fit (as determined by quantitative fit test), work rate (breathing pattern), and particle size distribution, and shows no bias with the magnitude of these parameters. Given the intrinsic variability of respirator performance measurements, the model is useful for predicting the effect of these variables on respirator performance.

"Effectiveness of Fit Check Methods on Half Mask Respirators," by Warren R. Myers, Majid Jaraiedi, and Lynnette Hendricks, *Appl. Occup. Environ. Hyg.*, November 10(11): 934, 1995

Studies were conducted to evaluate whether a positive/negative (+/-) fit check was an effective aid in helping users of respirator protective equipment (RPE) achieve a good fit when donning the RPE. Two types of half-facepiece RPE were used in the studies: the disposable, filtering facepiece and the elastomeric facepiece. Three models of disposable, filtering facepiece and one model of dual-cartridge, elastomeric facepiece were evaluated. A population of 64 inexperienced users of RPE was randomly divided into two equal groups. One group was trained to don the RPE using the +/- fit check as an aid, while the second group was trained to don the RPE without conducting a +/- fit check. The number of successful RPE donnings achieved in the group using the fit check was compared with the number of successful RPE donnings achieved in the group not using a fit check. The data obtained from this experiment suggested that, in general, fewer unsuccessful donnings and more consistent donnings were obtained by RPE users when fit checks were used as an aid in donning both general types of RPE used in the study. This implies that a +/- fit check has value in assisting the wearer of a disposable filtering facepiece or a half mask to properly don the RPE. On a second population of 64 inexperienced users of RPE, the pass/fail outcome of fit checks was used to measure the discriminatory power of fit checks. The subjects used the +/- fit check to discriminate whether the fit of RPE preadjusted by the experimenters was good or bad. Fit checks were found to be fairly useful, easy-to-learn tools for respirator wearers to discriminate between good and poor donnings.

"Development of New Qualitative Test for Fit Testing Respirators," by H.E. Mullins, S.G. Danisch, and A.R. Johnston, *AIHA Journal*, November 56: 1068–1073, 1995

A new qualitative fit test was developed using Bitrex™ (Mcfarland Smith Limited) as the test agent. It was validated by running a series of paired qualitative and quantitative fit tests. Quantitative tests were conducted with a small corn oil aerosol, using a condensation nucleus counter as a detector. Qualitative fit tests were run with Bitrex and saccharin, following the established protocol for the saccharin fit test. Four models of National Institute for Occupational Safety and Health-approved replaceable filter respirators were used in the study. All were half mask models equipped with high efficiency filters. In some cases, respirators expected to be the correct size for test subjects were tested. In other cases, respirators expected to be too small or too large for the subjects were tested. Test results were analyzed using fit test method validation criteria recommended in the American National Standards Institute draft standard on fit testing (ANSI Z88.10). The Bitrex and saccharin tests were found to have virtually identical performance. Both met proposed American National Standards Institute requirements for a valid qualitative fit test.

"Evaluation of Proposed Methods to Update Human Testing of Self-Contained Breathing Apparatus," by Nina Turner, David Beeckman, and Thomas Hodous, *AIHA Journal* December 56: 1195–1200, 1995

The current Man Test protocols used by the National Institute for Occupational Safety and Health for the certification testing of self-contained breathing apparatus (SCBA) do not provide continuous real-time information on the performance of these devices during actual use. In addition, current protocols do not test human subjects at the same absolute work rates but at rates that vary according to the subjects' body weights. This study was conducted to evaluate revised "Use Test" protocols proposed by the U.S. Bureau of Mines, which are normalized to subjects' body weights. No differences in duration were observed among the three body weight categories for the multiple work rate Use Test 2. It was concluded that the proposed Use Test protocols could form the basis for eventual recommendations to revise the current Man Tests for SCBA performance evaluation.

