

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.

"Determination of Known Respirator Leakage Using Controlled Negative Pressure and Ambient Aerosol QNFT Systems," by Clifton D. Crutchfield, Debbie L. Park, Jennifer L. Hensel, Marina K. Kvesic and Marty D. Flack, *American Industrial Hygiene Association Journal*, January 56(1):16-23, 1995.

During cooperative studies, controlled negative-pressure fit-test systems have consistently reported lower fit factors and more respirator leakage than aerosol-based systems. This study was designed to assess how well a controlled negative pressure and an ambient aerosol fit test system could measure known sources of leakage introduced into respirators worn by human subjects. The basic study design involved conducting a sequential pair of fit tests with the same system. A fixed source of leakage (leak needle) was uncapped after the first test, so that the difference between the pair of fit tests reflected the introduction of the known leak source into the respirator. A second pair of fit tests was then completed with the second fit-test system in the same manner. In repeated (N = 15) measurements of respirator fit for five subjects, the controlled negative pressure system's measurements of known leak sources averaged 105% of the known leakage rate, with a mean coefficient of variation of 10%. The ambient aerosol system detected an average of 21% of the known leakage introduced into subject respirators, with a mean coefficient of variation of 62%.

"Influence of Anxiety Level on Work Performance With and Without a Respirator Mask," by Arthur T. Johnson, Cathryn R. Dooly, Cassandra A. Blanchard and Elizabeth Y. Brown, *American Industrial Hygiene Association Journal*, September 56(3):858-865, 1995.

Work performance of mask wearers has been shown to be less than performance of the same individuals without masks. How much this performance decrement is attributable to psychological factors was the subject of this study. This experiment was designed to give quantitative information about the effect of anxiety level on relative work performance while wearing a respirator mask. Twenty subjects were tested for trait anxiety levels and performed on a treadmill at 80-85% of their maximum heart rates until they reached voluntary end-point. Physiological, metabolic and subjective measurements were taken every minute. While experiment variability precluded many of the results from achieving statistical significance, performance times with the mask averaged less than without the mask. Anxious subjects experience more discomfort, perform for shorter times, and accomplish less total work than their lower anxiety counterparts, even when rate of work can be adjusted.

"Evaluation of Carbon Tetrachloride Replacement Agents for Use in Testing Nonpowered Organic Vapor Cartridges," by Ernest S. Moyer, Jeffrey A. Peterson, and Cathy Calvert, *Appl. Occup. Environ. Hyg.*, September 10(9):761-768, 1995.

Carbon tetrachloride has been used for years as a standard material for evaluating charcoal's ability to adsorb organic materials. It has also been the standard organic compound for testing organic vapor break-through characteristics of respirator cartridges and canisters. However, due to the potential carcinogenic characteristic of carbon tetrachloride and the lack of commercial availability, a suitable substitute organic vapor cartridge test agent is needed. Four potential replacement agents were tested (ethyl acetate, pentane, *n*-hexane, and heptane). Initially, testing was performed using the stacked-cartridge test system. This screening method identified replacement agent challenge concentrations which gave breakthrough characteristics equivalent to 1000 parts per million (ppm) carbon tetrachloride. Break-through time was the critical criterion. Two test conditions (550 ppm pentane and 1000 ppm *n*-hexane) were selected for side-by-side testing with 1000 ppm carbon tetrachloride. The results show that for the most stringent test condition ("as received" cartridges tested at 64 L/min and 80% relative humidity) the breakthrough times for two different manufacturers' organic vapor cartridges were identical for these three test conditions (1000 ppm carbon tetrachloride, 550 ppm pentane, and 1000 ppm *n*-hexane). Pentane's lower toxicity makes it the replacement agent of choice.

