

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.

"Measurement of the Leakage and Fit Factor of a Filtering Facepiece by Continuous Monitoring of Pressure Pulsations," by R. C. Brown and N. P. Vaughn, *American Industrial Hygiene Association Journal*, August 54(8):409–416, 1993.

A novel method for measuring the fit factor of filtering facepiece respirators is described. Measurement is made by the continual monitoring of the pressure produced by a volume of air injected into the respirator cavity, and withdrawn so that the added volume varies sinusoidally with time. Sets of measurement, each corresponding to a single breath, can be made. Data analysis, in which these pressure measurements are compared with a reference wave from the device producing the volume change, enables a measurement of pressure wave amplitude to be made for individual breaths. Comparison between measurements made when leaks occur and measurements made without leakage enables a fit factor to be calculated for each breath. Results obtained by the use of this method on a filtering facepiece worn by a manikin are compared with bubble flowmeter measurements and shown to agree (correlation coefficients >0.98), though systematic differences exist. The method is most accurate when leakage is large, and is potentially useful for fit factors up to about 50, and leakages down to about 2%.

"Preliminary Evaluation of an Active End-of-Service-Life Indicator for Organic Vapor Cartridge Respirators," by E. S. Moyer, M. W. Findlay, G. J. Maclay, and J. R. Stetter, *American Industrial Hygiene Association Journal*, August 54(8):417–425, 1993.

Data are presented on a microwatt chemiresistor microsensor for use with negative-pressure organic vapor respirators. This sensor would operate at or within a sorbent bed and detect parts-per-million levels of chemical vapors and/or gases as a function of sensor resistance. Sensors were evaluated against four challenge concentrations of ethyl acetate (750, 1000, 1500, and 2000 ppm). Direct comparison of breakthrough times and curves for the chemiresistor microsensor and standard infrared (IR) detector system were made. The chemiresistor sensor responses were found to correlate well with the IR system. The evaluation showed that although the chemiresistor sensors were not as sensitive as the IR detectors, they could be used if located inside the charcoal bed. Thus, these sensors could function as organic-vapor detectors and could be used in cartridge application. However, further improvements in stability and sensitivity of these chemiresistor sensors is necessary.

"Determining the Service Lives of Organic-Vapor Respirator Cartridges for Nitroglycerin Under Workplace conditions," by H. J. Cohen, *American Industrial Hygiene Association Journal*, August 54(8):432-439, 1993.

Results of a field study that estimated the service lives of several different brands of organic-vapor respirator cartridges for **nitroglycerin** are presented. Respirator carbon tubes (RCTs) were used to sample in a workplace where gun powder was manufactured and where nitroglycerin levels varied from approximately **0.1–0.7 mg/m³**. Tenax adsorbent tubes were used to monitor for nitroglycerin upstream and downstream of RCTs and were subsequently analyzed by a **gas-chromatography** method. A series of 10 trials failed to find evidence of **nitroglycerin** breakthrough. Estimates of the minimum service lives of respirator cartridges varied from **7–81** hours for nitroglycerin levels of **1.0 mg/m³**, ten times the current Occupational Safety and Health Administration Permissible Exposure Level. One trial specifically examined the potential of nitroglycerin to prematurely break through a cartridge due to bed migration, and results failed to indicate this as a potential problem. A field validation of the Tenax adsorbent tube method for nitroglycerin monitoring resulted in an accuracy of $\pm 77\text{--}88\%$ at the 95% confidence level. An unexpected finding was that up to 10% of the ambient nitroglycerin collected was adsorbed to an aerosol. This finding led to the recommendation that the addition of a **prefilter** to an organic vapor cartridge may be required when using air purifying respirators to protect workers from some nitroglycerin exposures.

"Organic Vapor (OV) Respirator Cartridge and Canister Testing Against Methylene Chloride" by E. S. Moyer and J. A. Peterson, *Applied Occupational and Environmental Hygiene*, June 8(6): 553-563, 1993.

The Occupational Safety and Health Administration (OSHA) has proposed amending its existing exposure regulations for methylene chloride. The National Institute for Occupational Safety and Health (NIOSH) tested organic vapor cartridges and canisters for their breakthrough characteristics against methylene chloride. These tests were conducted to determine breakthrough times for methylene chloride with commercially available, negative-pressure organic vapor cartridge and canister respirators. Various methylene chloride challenge concentrations, from a low of 50 ppm to a high of 1000 ppm, were employed. Cartridges and canisters were tested "as **received**" from the manufacturer at a flow rate of 64 L/min through the respirator; 50 and 80% relative humidities (RH) were used. Breakthrough times (tb) were determined for individual cartridges and canisters, as well as for stacked cartridges. The results indicate that cartridge breakthrough times were extremely short when tested at 80% RH for all the challenge concentrations. The chin-style canisters, which contained **2.5–3.0** times more sorbent than the cartridges, gave a tb of only 100 minutes when tested at 125 ppm and 80 percent RH. The **front-mounted/back-mounted** canisters (**10.5–11** times more sorbent than cartridges) gave a tb of more than 10 hours at 125 ppm and 80% RH, but the tb was reduced to only five hours when the challenge concentration was increased to 1000 ppm.