

RESPIRATOR ARTICLE ABSTRACTS

We review the articles published in the American Industrial Hygiene Association Journal 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.

"The Effect of Inhalation Resistance on Facepiece Leakage," by Thomas J. Nelson and Craig E. Colton, *AIHA Journal* 61:102-105 (2000)

Air purifying respirators use filters to remove particulate air contaminants. Resistance to airflow generally increases as the filter loads and a "filter cake" is formed. It has been recommended by ANSI and the Occupational Safety and Health Administration that filters should be replaced when the wearer notices they are hard to breathe through. Repeated face seal leak rate measurements were made during respirator wear over a range of simulated breathing resistances from 5.6 to 19.6 mm (0.22 to 0.77 inches) of water. The measured face seal leak rates increased as the breathing resistance increased and varied depending on the initial leak rate at the 5.6 mm pressure. The increase in face seal leak rate from 5.6 to 19.6 mm breathing resistance was as high as a factor of 4. Theoretically, a person with an initial respirator penetration of 2.5% could have that value increase to 10% as filter loading increased breathing resistance by 14 mm. Some research has shown that breathing resistances between 60 and 140 mm of water would be "noticeable but well tolerated." It is not known if workers would be able to detect an increase in breathing resistance that would lead to a significant increase in face seal leakage. These data suggest a need to establish a replacement schedule for all filters used in the workplace. How often a filter should be replaced is difficult to determine. Breathing resistance would vary depending on the individual filter and aerosol loading characteristics, the concentration of the aerosol in the workplace, and breathing rates.

"Communication Using a Telephone While Wearing a Respirator," by Arthur T. Johnson, William H. Scott, Christopher G. Lausted, Karen M. Coyne, Manjit S. Sahota, Monique M. Johnson, Grace Yeni-Komshian, and David M. Caretti, *AIHA Journal* 61:264-267 (2000)

Respirators have been found to degrade communication effectiveness when wearers speak face-to-face. However, little is known about communication effectiveness when using the telephone and wearing a respirator. Eleven pairs of subjects were asked to pronounce and identify words chosen from Modified Rhyme Test lists. Each word appeared on a computer screen in one room and the speaker said the word into the telephone. The listener in another room identified the word and typed it into a computer linked with the first. Subjects wore US Army M40 full-facepiece air-purifying respirators with hoods. Three different speech diaphragm arrangements and two hood materials were tested. Results show that accuracy suffered by about 10% when respirators and hoods were worn compared with the control condition. Word identification speed was one-third to one-half of the control (no respirator or hood) condition depending on specific equipment worn.

"An Effective Protection Factor Study of Respirators Used by Primary Lead Smelter Workers," by Terry M. Spear, James DuMond, Carrie Lloyd, and James H. Vincent, *AOEH* 15(2):235-244(2000)

An industrial hygiene study was conducted at a primary lead smelter to determine the effective protection factors for negative pressure and powered air purifying half-mask respirators. The study involved 99 paired personal samples taken in six different work areas, in which randomly chosen subjects from the workforce wore dual sampling pumps connected to closed-face 37-mm cassettes. The cassettes were attached either to the workers' lapels for exposure measurements outside the respirator or to a ported respirator for exposure measurements inside the respirator. Samples were collected throughout the work shift and analyzed for lead according to National Institute of Occupational Safety and Health (NIOSH) Method 7082. Using particle size distribution data obtained for the same workplaces, the within-mask samples were corrected for sampling bias. The negative pressure half-mask respirators showed a mean effective protection factor of 6.5 and a mean corrected effective protection factor of 4.56, with a 5th percentile less than 0.5. Approximately 80 percent and 90 percent of the effective protection factors and the corrected effective protection factors, respectively, were equal to or less than the assigned protection factor of 10. For the powered air purifying half-mask respirators, the means for effective protection factor and corrected effective protection factor were 18.20 and 11.92, respectively, with a 5th percentile of 1.0 or less. Approximately 90 percent and 95 percent of the effective protection factors and the corrected effective protection factors, respectively, were equal to or less than the assigned protection factor of 50. The uncorrected and corrected within-mask lead concentrations for both types of respirators exceeded the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for lead by 19 percent to 58 percent. These results indicate that the straight application of assigned protection factors to actual workplace situations may not always be appropriate.