

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.

"Field Performance Measurements Half-Facepiece Respirators—Paint Spraying Operations," by Z. Zhuang and W.R. Myers, *AIHA Journal* January 57: 50–57, 1996

This article presents the results of a workplace protection factor (WPF) study for half-facepiece respirators conducted in a aircraft paint-spraying operation. The major elements of the paint overspray collected with ambient samples were titanium, strontium, chromium, and silicon. The major elements collected on the in-facepiece samples were chlorine and silicon. The geometric mean (GM) ambient concentrations of chromium and titanium varied significantly among painting locations and paint types. There was a significant difference in GM in-facepiece concentrations of titanium among painting locations. However, no significant difference in GM in-facepiece concentrations of chromium by location was found. In both ambient and in-facepiece samples the amounts of chromium and strontium were highly correlated as expected. In ambient samples total airborne mass was highly correlated with levels of chromium and titanium when primer and top coat were applied, respectively. No difference in respirator performance, measured by in-facepiece concentration and WPF, was observed during the application of the top coat. During the application of primer, Respirator 1 had a significantly higher GM in-facepiece concentration level of chromium and a correspondingly lower GM WPF value than Respirators 2 and 3. The 5th percentile estimates for all WPF data or different subsets of WPF data partitioned by paint type and respirator were much greater than 10. Measured WPF values and in-facepiece exposure levels were significantly correlated with an R^2 of 0.55. When the half-facepiece respirators, equipped with high-efficiency/organic vapor combination air purifying elements, were conscientiously worn, used in conjunction with existing controls, and were properly maintained, they provided effective worker protection.

"Field Performance Measurements Half-Facepiece Respirators—Foundry Operations," by W.R. Myers, Z. Zhuang, and T. Nelson, *AIHA Journal* February 57: 166–174, 1996

A series of field studies was conducted to measure workplace protection factors (WPF) provided by elastomeric and disposable half-facepiece respirators against different particulate contaminants. The research protocol developed for the study has been described in a previous article. This article presents results from dust and fume exposures at three foundries. The major components of the airborne exposures in these foundries were zinc, lead, and silicon. The major components of the in-facepiece samples were zinc, chlorine, and lead. Significant differences were observed in ambient zinc and lead concentration levels among foundries; however, no significant difference was observed in the in-facepiece concentration of these elements among foundries. Respirator performance varied within each foundry, but there was no difference in performance when pooling all foundry data. The 5th, 10th, and 50th percentile estimates for the pooled foundry and respirator WPF data were about 9, 16, and 114, respectively. The in-facepiece concentration data clearly indicate that dust-fume-mist (DFM) class half-facepiece respirators, when conscientiously used, worn, and maintained, in conjunction with other existing controls in these foundries, provided effective worker protection.

"Penetration of Airborne Microorganisms Through a Surgical Mask and a Dust/Mist Respirator," by K. Willeke, Y. Qian, J. Donnelly, S. Grinshpun, and V. Ulevicius, *AIHA Journal*, April 57: 348–355, 1996

This study investigated bacterial penetration of different bacterial shapes, aerodynamic sizes, and flow rates through a surgical mask and a dust/mist respirator. The bacterial penetrations were compared with those of spherical corn oil particles of the same aerodynamic diameter tested under the same conditions. The tests were performed at different levels of aerosol penetration. Bacteria, ranging from spherical or rod-shaped with a high aspect (length to width) ratio, were selected as test agents. Among these, *Pseudomonas fluorescens* physically simulates *Mycobacterium tuberculosis* by shape and size. The concentrations of bacteria upstream and downstream of the test devices were measured with an aerodynamic size spectrometer. This instrument was found to measure the total viable and nonviable bacterial concentration effectively and dynamically over the entire bacterial size range down to 0.5 μm in aerodynamic size. The results indicate that the spherical corn oil particles and the spherical *Streptococcus salivarius* bacteria have the same penetration in the size range from 0.9 to 1.7 μm . It has been found that rod-shaped bacteria penetrate less. The penetration difference between the spherical and rod-shaped bacteria depends on the aspect ratio of the bacteria. For an aspect ratio of 4, the penetration of rod-shaped bacteria is about half that of spherical ones. Thus, it is projected that a respirator with 90% efficiency against spherical microorganisms or test particles (10% penetration) will be 95% efficient against rod-shaped microorganisms of the same aerodynamic equivalent diameter with an aspect ratio of 3 to 4, such as *Mycobacterium tuberculosis* (5% penetration).

