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COMPARISON OF THE ASSIGNED PROTECTION FACTORS (APF) OF SELECTED SINGLE-USE DUST MASKS WITH THE APFS OF HALF-FACEPIECE RESPIRATORS UNDER SIMULATED WORK CONDITIONS. B. Samimi, J. Muni, San Diego State University, San Diego, CA.

Single-use (disposable) dust respirators, known as "dust mask," have been used since late 1960s in a variety of working conditions. Historically, there are ample evidences of widespread use of these masks by workers with the anticipation of providing adequate protection against inhalation of harmful dusts such as silica in and around sandblasting and asbestos in insulation works, without being aware of the limitations of these masks.The consequences, in terms of incidence of associated occupational lung diseases among users have been overwhelming. Robotic systems have been used for quantitative evaluation of respirators including "dust masks". Using such system, we applied several testing modes, i.e., different breathing volumes and cycles, and head/body motions under high (50-60 mg/M3) dust concentrations. AFRD test dust and Wright Dust Generator were used to produce the desired dust concentrations within an inhalation chamber. Real-time dust concentrations and air pressure values inside and ouside repirators were continuously monitored. Data were displayed and stored using LabView Program. Four models of dust masks (MSA Affinity Plus; Wilson Dalloz Saf-T-Fit; AO:N9500C and AON9501C) and two models of elastomeric respirators (MSA Comfo and Wilson Dalloz both with P100 HEPA cartridge) were tested and compared in the study. Three test runs, each for 90 minutes, were conducted on three respirators from each model (N=9). The results were analyzed by ANOVA and Quantile Test as well as graphically. For single-use respirators, the mean PF for all testing modes were: 4.731, 2.800, 3.267 and 2.300 for brands and models stated above, respectively. MSA Comfo and Wilson Dalloz elastomeric respirators showed mean PF of 80.300 and 14.580, respectively. Significant differences in APFs were found between (1) dust mask and elastomeric respirators, (2) various models of dust masks and (3) testing modes/models of dust masks. While Quantile Tests confirmed the APF of 10 for both models of elastomeric respirators, they rejected the APF of 5 for all four models of dust masks.

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A COMPARISON OF SODIUM SACCHARIN VERSUS CONTROLLED NEGATIVE PRESSURE FOR DETECTING KNOWN LEAKS IN FULL FACE RESPIRATORS. M. Hodges, R. McKay, University of Cincinnati, Cincinnati, OH.

This study evaluated the ability of respirator wearers to detect a qualitative fit test agent (sodium saccharin) through known leak sites in full-face respirators. Before inducing leakage, 17 subjects were evaluated with a Dynatech Nevada Fit Tester 3000 Controlled Negative Pressure (CNP) system to verify acceptable fit. OSHA requires a minimum fit factor (FF) of 100 for full-face respirators used in the positive pressure mode or when used in areas where half-masks are permitted. After achieving the desired fit factor, known leakage was induced in one of two ways. The first method involved loosening the exhalation valve retainer until a fit factor between 60 and 90 was obtained — verified by CNP. The second leak was accomplished by replacing the exhalation valve with one that leaked. The leaky valve had a small amount of adhesive on the rubber flap, which prevented a good seal. Qualitative Fit Testing (QLFT) was conducted using the OSHA protocol with one modification (the subjects performed the head straight-ahead, normal breathing maneuver for the entire 7-minute test). This avoided unknown leakages that could occur with head movements. Results demonstrated only 35% of the wearers could detect saccharin using either of the leaky valves, far less than the 95% sensitivity generally recommended. The 65% that did not taste the saccharin during fit testing did taste it immediately after loosening one of the straps and inserting three fingers between the respirator and cheek. In conclusion, QLFT with sodium saccharin did not adequately detect leakage through the exhalation valves of full facepiece respirators having fit factors less than 100.

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A FIELD TEST FOR DETERMINING RESPIRATOR FILTER EFFICIENCY. E. Moyer, M. Sandy, J. Clegg, NIOSH, Morgantown, WV.

The National Institute for Occupational Safety and Health (NIOSH) certifies negative-pressure particulate respirator filters according to 42 CFR 84. Filters are categorized N, R and P, depending on their resistance to filter degradation. N-series filters are not resistant to oil, and R-series and P-series filters are recommended for use in all environments. Within each series of filters, there are three levels of filter efficiency, namely 95, 99, and 100 (99.97) percent. NIOSH studies have investigated filter media efficiency reduction resulting from constant and intermittent aerosol exposures. Thus, it would be advantageous to have a field method for testing filter performance. A method using the TSI Portacount® Plus is presented which allows filter performance to be determined. N-, R-, and P-series filter efficiency was reduced by chemical treatments and/or aerosol loadings followed by testing with the Portacount® Plus. Instantaneous filter efficiency testing was also conducted on these filters using the 42 CFR 84 certification test aerosols. Further, a set of 40 high efficiency filters used at a battery plant were tested using the Portacount® Plus and/or 42 CFR 84 certification test. Two filters showed elevated penetration by the 42 CFR 84 test and also the Portacount® Plus method. Data comparing the two methods show that the TSI Portacount® Plus could be used to monitor the degradation of respirator filters in the field.

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PERFORMANCE OF RESPIRATORS MADE FROM ELECTROSTATIC MEDIA AFTER EXPOSURE TO SOLVENT VAPORS. H. Mullins, 3M Company, St. Paul, MN.

NIOSH has encouraged research in the area of electrostatic filter media and has indicated that new particulate respirators utilizing this technology need to be characterized regarding variables that might affect filter performance. While particulate filter media are not intended to remove solvent vapors, it may be used in work areas containing solvent vapors (e.g., levels < PEL, and paint spray). A study was conducted to determine the effect of solvent vapor on electrostatic respirator filter media. Vapor exposures from four common solvents (isopropyl alcohol, toluene, cyclohexane, and methyl ethyl ketone) were utilized in the study. The respirator performance was measured by following the testing and certification protocol established by NIOSH regulations in 42 CFR Part 84. Respirators from N95 and P95 classes were tested at 10 times the PEL of the selected solvent over time periods up to 4 hours. Each respirator class was tested with the appropriate aerosol, that is NaCl was used with the N95 respirators and DOP was used with the P95 respirators. Control samples, respirators that remained free of solvent exposure throughout the testing, were used to establish performance baselines. Initial penetration levels were measured before and after vapor exposures. Loading curves out to 200 milligrams were also generated. No differences in the particulate loading curves characteristics were observed. In addition no filter efficiency degradation was observed after exposure to any of the solvent vapors, therefore the test results were combined. The mean penetration value for the N95 respirator was 0.46 % with the NaCl aerosol. The P95 respirators had a mean penetration value of 0.81% with the DOP aerosol. There was no significant difference in aerosol penetration between respirators exposed to solvent vapors and the corresponding control respirators. Two-sample t-test results for the N95 and P95 respirators had p-values of 0.519 and 0.389 respectfully.

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PREDICTION OF THE EFFECT OF HIGH RELATIVE HUMIDITY ON ORGANIC VAPOR CARTRIDGE PERFORMANCE. E. Johnson, L. Brey, 3M, St. Paul, MN.

OSHA regulations for use of chemical cartridges require the establishment of change-out schedules based on objective information. One of the most commonly used mathematical models for doing this has been developed by G.O. Wood. This model does not account for relative humidity effects. The severity of the effect of high relative humidity on the performance of chemical cartridges against organic vapors is often underestimated. The early work by G. Nelson established a breakthrough time multiplier (correction factor) of about 0.48 for cartridges preconditioned and tested at 90% RH relative to cartridges preconditioned and tested at 50% RH. However, these tests were conducted at a challenge concentration of 1000 ppm. Nelson's observation that humidity has a greater effect on cartridge performance at lower concentrations commonly seen in workplaces has been widely ignored. Correction factors were measured for several NIOSH approved organic vapor cartridges for a wide range of organic solvents including n-hexane, toluene, styrene, benzene, and perchloroethylene at concentrations from 5 ppm to 1000 ppm. Cartridges were tested "as received" (no preconditioning). Testing was done at a volumetric flow of 32 L/min per cartridge (equivalent to 64 L/min for a pair of cartridges) at several RH values up to 90%. Because of the long test times required, a multiplexed service apparatus with a flame ionization detector was used in which four cartridges were tested simultaneously. Correction factors ranged from about 1.0 for styrene at 1000 ppm to about 0.04 for n-hexane at 5 ppm. A good correlation was obtained when the measured humidity correction factors were plotted against the We/d parameter calculated from Wood's equation. These characteristic curves can be used to predict the humidity correction factor at high RH for any water immiscible solvent at any concentration given the We/d parameter from the Wood equation at 50% RH.

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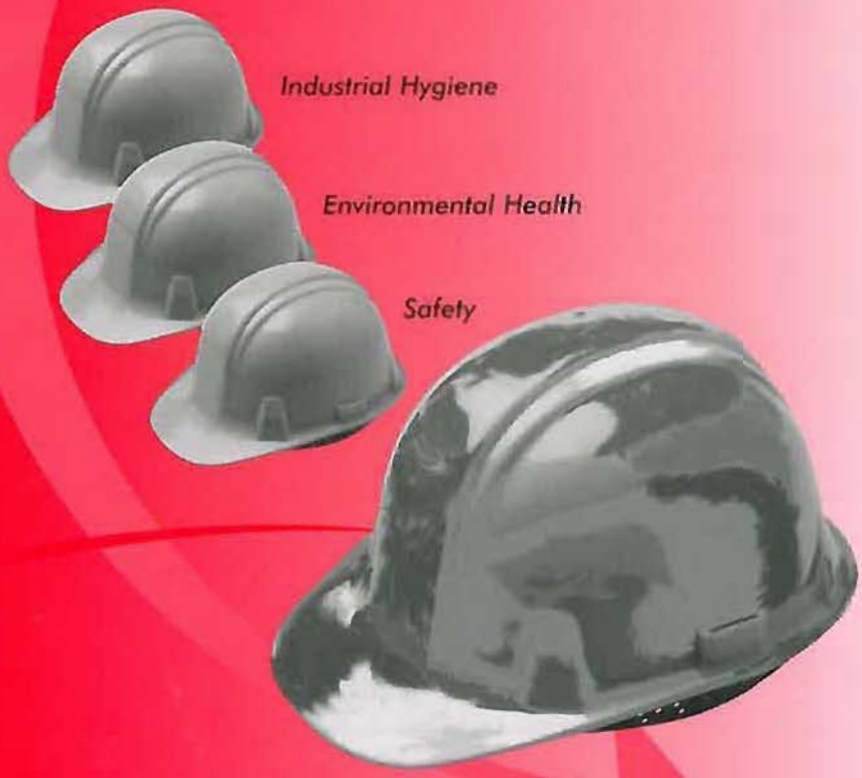

ABSTRACTS