199 EVALUATION OF QUANTITATIVE FIT TEST RESULTS FOR FEMALE HEALTH CARE WORKERS IN KOREA

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Introduction Risk of infections due to communicable pathogens among health care workers is very high. Though many counter measures have been implemented, respiratory protective devices (RPD) are very common in use for prevention of the inhalation of pathogens. Nevertheless, proper education and training of RPDs are lacking for health care workers. This study is focused on the actual RPDs use and the fit tests so as to establishing effective training programs.
Methods A total of 393 female health care workers were recruited for quantitative fit testing (QNFT), with at least 2 RPDs out of 4 different types of RPDs provided. The U.S. OSHA Fit Test protocol was used to conduct the fit test exercises along with the pass criteria (FF >100). The QNFT results were analysed by division and occupation using STATA.
Results Among participants, all occupations showed relatively high pass percentages except doctors who showed about 40% of failure with the Folder shaped mask. For almost all divisions, the cup shaped and the cup shaped small size mask showed the highest fail rate, but the folder shaped mask showed lower failure rates. Within the hospital, different failure rates were observed between divisions; emergency room=13.5%, MICU=3.6%, SICU=8.8%, BMTICU=15.4%, isolation ward=6.7%, respiratory/infection control division=3.7%, PICU=0.0%, and CCU=4.3%, respectively. While no association between types of occupation and QNFT result were observed, QNFT results were statistically significantly different between divisions ($\chi 2=17.122$, $p=0.017$).
Discussion The results of this study showed that some RPDs perform better in terms of respiratory protection providedaccording to the subjects'facial shapes. And health care professionalsneed formal educationand training for the use of RPDs, regardless of their occupations. Properdonning experiences of RPDs arehighly recommended and annual QNFT are recommended for checking the effectiveness of RPDs.

239 PRODUCTION AND RELEASE OF CONVECTIVE AND EVAPORATIVE HEAT FLOWS WHEN WEARING RESPIRATORS AND EXERCISING UNDER SIGNIFICANT METABOLIC DEMAND

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Introduction When wearing a respirator the metabolic heat accumulated inside the mask affects the comfort of the wearer and thus the efficacy of respirator use. This study evaluated the change in respirator convective and evaporative heat flows occurring in response to the use of respirators of different facepiece design under activities of varying metabolic load.
Methods The study was performed in a climatic chamber with environmental temperature fixed at 25°C and relative humidity at 65%. In the experiment, each participant (13 males and 12 females) first exercised under specified activity for 30 min to thermally adapt and then with a respirator on continued the same activity for another 30 min. The specified activities included sitting in chair, walking on stairs, and jogging, representing exercises of low (70–130 W/m^2), moderate (130–200 W/m^2), and very high metabolic rate (>260 W/m^2). Three models of half-mask respirators (two cup-shaped filtering facepieces, including one with and one without exhalation valve, and one elastomeric facepiece with valve) were tested.
Results The increase in the temperature of the respired air when wearing a filtering facepiece was approximately 1.7 to 2.0 folds of when donning the elastomeric facepiece. The change in the convective or evaporative heat flows as a result of wearing either of the filtering facepieces was significantly different among metabolic rates ($p<0.001$). For both the filtering facepieces, the gradient between the convective and the evaporative heat flows increased with increasing metabolic rate.
Discussion The increase in heat strain resulting from respirator use and metabolic demand heightened the requirement of heat dissipation, particularly if the wearers worked strenuously in hot environment. The elastomeric facepiece with an exhalation valve relieved the hot-and-humid air inside the mask more effectively than the filtering facepieces did in this study, lowering thermal discomfort and potential heat stress.

1117 DUST CONTROL MEASURES IN THE REDUCTION OF SILICA EXPOSURE ON SURFACE MINES

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Introduction There are several types of surface mining, but the three most common are open pit, strip mining and quarrying. Open cast mining activities produce dust. In open cast mining the process of accessing the ore body involves the removal of the natural land surface, using mobile excavation equipment such as bull dozers, front end loaders, and haulage trucks.

Recent studies have found that silica dust confers an increased risk for Tuberculosis, and that the risk persists even after dust exposure ends. The interaction between inadequate silica dust control, a high burden of HIV/Aids and Tuberculosis, present major challenges to occupational hygiene control measures in silica dust suppression as well as medical surveillance monitoring programmes.
Methods Stratified random sampling from five homogenous exposure groups (n=30) in two settings was used in a descriptive correlational research design to compare the personal gravimetric sampling results of silica dust and the implementation of dust suppression methods on employees.
Results The results indicated a positive correlation between dust suppression and a reduction in employee 's personal exposure.
Discussion A primary prevention approach entails controlling the dust at source so as to reduce the employee exposure through the introduction of dust control measures, and appropriate technologies i.e. process enclosure, and wet techniques. It includes the enclosing/installation of air conditioning systems on mobile equipment, and closing of cab windows in driven equipment. Haul road dust control includes the constant

watering of roadways during the mining operation. Employee education on health effects of dust exposure, work practices, maintenance of equipment and PPE, medical surveillance, chest X-rays and TB awareness and monitoring are essential in the elimination of silicosis.

964 PASSIVE MONITORING OF CHEMICAL EXPOSURES IN SOUTH FLORIDA FIREFIGHTERS USING SILICONE WRISTBANDS

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Introduction Firefighters are likely to be exposed to many toxic chemicals in the performance of their work duties such as polycyclic aromatic hydrocarbons (PAHs). Chemical exposures may occur through dermal, oral, or inhalation pathways. Passive sampling devices are used to sequester organic molecules through passive diffusion and provide time-weighted averages of chemical concentrations. This pilot study uses silicone-based wristbands as a personal passive sampler to detect known carcinogens during a 24 hour work shift.

Methods Twenty-four wristbands were deployed across various fire services throughout South Florida. Prior to deployment, bands were cleaned using a standardised cleaning protocol to remove contamination and optimise the surface for absorption. Wristbands were then packaged in air-tight bags to prevent contamination. Wristbands were worn on fire service personnel and collected at the end of a 24 hour work shift. Chemical contaminants were then extracted from the wristband and analysed for PAHs—identified using the EPA IRIS, California Proposition 65, and IRAC datasets—using gas chromatography-mass spectrometry.

Results The average number of chemicals found across all wristbands (n=24) was 23 with 4 categorised as carcinogenic to humans (i.e., Benzo[b]fluoranthene, Benzo[j]fluoranthene, Chrysene, and Naphthalene). All bands had at least one PAH present, specifically, 87.5% contained Benzo[b]fluoranthene (mean=5.23 ng/band), 50% contained Benzo[j]fluoranthene (mean=2.05 ng/band), 79.2% contained Chrysene (mean=9.55 ng/band), and 100% contained Napthalene (mean=176.53 ng/band). Actual types of exposure compounds is likely to be larger than the observed data as the group of PAHs detected was limited to three existing datasets.

Discussion Silicone-based wristbands are feasible to use within the fire service to detect and characterise ambient hazardous chemical compounds. These personal self-samplers used during a 24 hour collection period identified various PAHs in the firefighter work environment. Objective measures of harmful chemical exposures in the fire service should be monitored with a comprehensive surveillance system that includes personal sampler devices.

967 EVALUATING TEMPERATURE CHANGES AND VOLATILE ORGANIC COMPOUND OFF-GASSING IN TURNOUT PROTECTIVE GEAR ENSEMBLES AMONG FLORIDA FIREFIGHTERS

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Introduction Firefighter protective gear ensembles have been shown in controlled laboratory and staged live fire training experiments, to collect and harbour carcinogens such as polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). Protective gear is often time transported in the personal vehicle of firefighters, resulting in cross-contamination between the vehicle and the fire incident environment. In the Southern United States particularly, ambient warmer temperatures may influence the rate of VOC gear off-gassing. This pilot study characterises temperature and particle off-gassing of firefighter turnout gear immediately following a 24 hour work shift.

Methods Twelve sets of gear were obtained from South Florida career firefighters. Their protective gear, including helmet, gloves, hood, pants, boots and turnout coat, were placed in a large vacuum sealed Pelican case immediately after a 24 hour work shift. Turn-out gear was randomly selected at each fire station regardless of fire exposure. A photoionization gas detector (0.2 to 200 ppm), MetOne particle counter, Chromosorb diffusion patch, and a temperature logger were placed in each case with the ensemble for a 24 hour collection period.

Results In two extreme observation points, VOC off-gassing was moderately, but significantly, correlated with temperature changes within the exposed gear (case#1: $r=0.50$; $p<0.001$) while a low correlation was observed in case#2 ($r=0.06$; $p=0.01$). Fine particulate matter (1–10 µm) was documented at least up to 1 hour after the gear was placed in most cases. Smaller size (0.3–0.5 µm) particulate matter was present up to 5 hours after placement across several cases.

Discussion Firefighter turnout gear used during real-life fire incident response events was documented to release VOCs and particles immediately after a 24 hour work shift. These results suggest the importance of the development of robust decontamination procedures immediately following a fire incident response is needed to reduce exposure to potential carcinogens from firefighter protective gear.

176 MODIFICATION AND IMPROVEMENT OF FIT TEST METHOD USING AMBIENT AEROSOLS

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Introduction Fit testing should be performed before the use of tight-fitting respirators. However, it may not always be