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WHAT'S THE DIFFERENCE? COMPARING SURVEYS OF INDUSTRIAL RESPIRATOR USE. D. Groce, K. Bang, B. Doney, NIOSH, Morgantown, WV; R. Young, NIOSH, Cincinnati, OH.

This report compares the findings of several nationwide surveys of respirator use, and explores the possible reasons for differences in the findings of those surveys. The comparison was carried out in preparation for a new nationwide survey of respirator use. The primary types of survey data sought for comparison were those relating to the percentage of workers using respirators and industries where respirators are used. Four surveys of respirator use were identified for comparison. In selecting the four surveys, it was necessary to eliminate some reports and surveys due to limited scope of coverage — e.g., one industry, one state. The four surveys selected were: National Health and Nutrition Examination Survey (NHANES) III; National Occupational Exposure Survey (NOES); the Occupational Safety and Health Administration's (OSHA's) "PPE Survey" and "PPE Cost Survey." NHANES III estimated that 20.7% of all workers use respirators. The comparable estimates from the other surveys were: NOES, 2.9%; OSHA's PPE Survey, 5.1%; OSHA's PPE Cost Survey, 5.9%. Wider differences are evident when one compares the different survey data within specific industries. For example, NHANES III estimated that 40.4% of all construction workers use respirators. The comparable estimates from the other surveys were: NOES, 3.8%; OSHA's PPE Survey, 17.6%; OSHA's PPE Cost Survey, 20.2%. The differences can be attributed to a combination of the following factors: differences in date of survey; differences in strategy for respondent selection; differences in method of collecting data; differences in wording of questions. This finding is a reminder that public health investigators must be cognizant of the nature of data sources and their inherent biases and weaknesses, as well as the strengths of the data sources.

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PERFORMANCE OF N-SERIES FILTERING FACEPIECE RESPIRATORS EXPOSED TO INTERMITTENT LOADING CONDITIONS. A. Viner, 3M United Kingdom PLC, County Durham, United Kingdom; M. Jones, J. Huberty, M. Cadalbert, 3M, St. Paul, MN.

Respirator usage patterns vary widely between industries and tasks being performed. Some respirators are disposed of after a single shift or less, but others may be worn only briefly and then reused over the course of many shifts. A study was conducted to evaluate the performance of filtering facepiece respirators (made with electrostatic filter media) used in this fashion. Penetration and pressure drop of NIOSH-certified N95 respirators were recorded while adding 8 mg of sodium chloride aerosol (0.3 um MMAD) once a day over the course of three weeks. Samples were stored in a conditioning oven at 85% RH and 37°C between exposures. Penetrations increased during the loading and there was often a step-increase in penetration from one day to the next. Penetration reached a maximum of 4.5% at a loading of 80 mg. Pressure drop did not increase significantly during the test, even after loading with 100 mg of salt. This performance is significantly different from that observed during a standard 42 CFR 84 certification test, in which pressure drop increases continuously and penetration typically decreases with loading. Storage conditions of partially loaded respirators played a significant role in subsequent performance of a respirator; sample weights recorded before and after storage in the conditioning oven revealed they had absorbed water. Respirators loaded in a similar fashion with other, non-hygroscopic aerosols (e.g., silica dust) and probed with NaCl aerosol did not exhibit increasing penetration. Although intermittent exposure was found to be more damaging than continuous loading, the respirators still met the performance requirements of an N95 respirator.

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PERFORMANCE OF N-, R- AND P-SERIES RESPIRATOR FILTERS AGAINST DIESEL EXHAUST. S. Berardinelli, M. Sandy, S. Martin, Jr., E. Moyer, NIOSH/DRDS/LRB, Morgantown, WV.

The National Institute for Occupational Safety and Health (NIOSH) certifies nonpowered air-purifying particulate respirator filters according to 42 CFR 84. Air-purifying respirator filters are categorized as N-, R- or P- depending on their resistance to degradation. N-series filters are not resistant to oil, and R- and P-series filters are recommended for use in all work environments. There are three levels of efficiency within each filter series, 95, 99, and 100 (99.97) percent. Previous NIOSH studies have demonstrated filter media efficiency reduction resulting from constant and intermittent aerosol exposures in the laboratory. This study is part of a larger study to test for the degradation of respirator filters in the field. N-, R- and P-series filters were exposed to varying concentrations of diesel exhaust in an underground mine. Testing was conducted at the NIOSH Lake Lynn Laboratory experimental mine facility near Fairchance, PA. The ventilation characteristics of the mine were altered to provide suitable exposure. The source was a diesel-powered portable welder, which would have applications in both the mining and construction industries. Filters were tested in quadruplicate at a flowrate of approximately 50 L/min. Filter load was determined gravimetrically with parallel sampling conducted during diesel exposures. All filters were loaded at varying concentrations up to about 50 mg of diesel particulate matter and then tested for penetration using 42 CFR 84 certification test aerosols. In all of the filters tested, penetration values increased from that of the controls, but especially the N-series filters with electrostatic media which would not met the penetration criteria of 42 CFR 84. These data demonstrate that a diesel-powered welder can significantly affect the filter efficiency of N-series respirators.

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BIOMONITORING OF THE INFLAMMATION MEDIATOR, LEUKOTRIENE E4, IN DIESEL EXPOSED WORKERS. J. Burch, Dept. Environmental Health, Colorado State University, Fort Collins, CO; P. Bigelow, K. Bakjaji, Colorado State University, Fort Collins, CO.

Concern over adverse health outcomes in workers exposed to diesel exhaust has led to an intensified effort to develop suitable surveillance methods. Paramount in this effort is the development of biomonitoring approaches to identify acute reactions and possibly early indicators of chronic lung dysfunction, including cancer. Pulmonary inflammation is likely to play a key role in the generation of lung disease in diesel exposed workers. This study tested the hypothesis that urinary excretion of the inflammation mediator, leukotriene E4, was increased among transportation workers with elevated exposure to diesel exhaust. Study participants were employed as bus mechanics, conductors, drivers and administrative (comparison) workers in Damascus, Syria and Fort Collins, Colorado. Personal full-shift monitoring for diesel particulate exposure was conducted among each of the 41 participants using NIOSH method 5040. Subjects also provided concurrent post-shift and overnight (nocturnal) urine samples for analysis of LTE4 via an enzyme linked immunosorbent assay. Overall, exposures were highest among workers who spent their day in the Damascus bus depot. Several subjects had diesel particulate exposures exceeding the proposed TLV of 0.05 mg/m3. Personal elemental carbon exposures were associated with increased overnight LTE4 excretion and nocturnal creatinine-adjusted LTE4 concentrations, but not with post-work shift LTE4 levels. The results suggest that diesel exposures induce a pulmonary inflammation response that can be assessed by determining urinary LTE4 concentrations. This work was supported by a grant from the Colorado State University, College of Veterinary Medicine and Biomedical Sciences.

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QUANTITATIVE DETERMINATION OF TOTAL ALIPHATIC ISOCYANATES ON SKIN AND SURFACES USING THE MAP REAGENT. F. Youngs, D. Bello, S. Woskie, University of Massachusetts — Lowell, Lowell, MA; R. Streicher, NIOSH, Cincinnati, OH; Y. Liu, Yale University, New Haven, CT.

There is increasing interest in the effects of dermal exposure to isocyanates. One of the limitations with determining dermal exposures has been the lack of a suitable analytical method for the quantification of isocyanates sampled from skin and work surfaces. Sample preparation and analysis were performed according to NIOSH draft Method 5525 for total aliphatic isocyanates in air with some modifications. The pads, impregnated with polypropylene glycol, were obtained from a commercial source. Once a surface or area of skin has been wiped, the pad is placed in the field in a solution of 1-(9-anthracenylmethyl)piperazine (MAP) in methylene chloride for immediate extraction and reaction. Samples are subsequently acetylated to react with excess MAP reagent then processed through a 0.45um filter and a reversed-phase, solid phase extraction (SPE) cartridge. The SPE cartridge significantly reduces interferences from surface and skin wipe samples. The compounds of interest are eluted from the SPE cartridge with acetonitrile and methanol. The analytical method LOD has been conservatively estimated to be 10 ng for both HDI and IPDI. Laboratory spiking of pads was performed to determine extraction efficiency. Pads were spiked with oligomers of HDI isocyanurate (n=24) and IPDI (n=21) at seven different concentrations, ranging from 0.067 to 3.1 and 0.041 to 1.1 ug NCO, respectively. Recoveries for HDI and IPDI were found to be concentration dependent. Correction factors for the recovery of HDI and IPDI were determined from the regression equations of spiked versus recovered oligomer. The HDI oligomer showed an average recovery of 79% while the IPDI oligomer showed an average recovery of 66%. The skin and surface wipe method described

here is shown to be a sensitive and reliable approach for the quantification of total aliphatic isocyanates.

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PARTICLE PENETRATION THROUGH INTACT SKIN AND A METHOD FOR DETERMINING POTENTIAL EXPOSURE THROUGH SURFACE CONTAMINATION. M. McCawley, S. Tinkle, M. Berakis, NIOSH, Morgantown, WV; M. Kent, Brush Wellman, Inc., Elmore, OH.

Results from studies of intact skin samples have shown that particles less than one micrometer in size are capable of penetrating intact skin. This occurs when the skin is flexed, but is not seen when particles are placed on stationary samples. This mechanical transport is capable of moving the particles through the stratum corneum and into the epidermis and dermis. In these latter layers of the skin, particles are potentially available for recognition by the immune system. This may have implications for any immunological disease and is of particular concern for chronic beryllium disease (CBD) as well as latex sensitivity. To determine the potential for exposure from surface contamination we used a personal impactor operated at 20 liters per minute with only the seventh stage and final filter. The calibration cowl was used with the impactor to provide a 0.5 cm opening and sufficient vacuum to remove particles from surfaces. Particles collected in this way on the final filter were less than one micrometer. Not only were solid surfaces and soiled clothing found to contain measurable amounts of submicrometer beryllium in beryllium manufacturing facilities, but washed clothing and surfaces, especially fabric surfaces, in presumably clean office areas also contained measurable amounts of beryllium. This may help explain the occurrence of CBD in office workers in the beryllium industry.

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EFFECTS OF ETHANOL AND PHENOBARBITAL ON HEMOGLOBIN ADDUCTS FORMATION IN RATS EXPOSED TO BENZIDINE AND DIRECT BLACK 38. C. Kim, J. Roh, H. Kim, Y. Yoon, Yonsei University, Seoul, Republic of Korea; S. Lee, Catholic University, Seoul, Republic of Korea.

The objective of this study is to evaluate the effects of pretreatment of ethanol (EtOH) and phenobarbital (PB), which are known to affect metabolism of xenobiotics, on the formation of hemoglobin adducts in the rats administered benzidine (BZ) and Direct Black 38 (DB38). The experimental rats were divided into BZ and DB38 groups; each group was subdivided into control, EtOH, and PB groups. The blood was separated into hemoglobin and plasma immediately after taking the blood samples, and the adducts were undergone basic hydrolysis to convert them into aromatic amines. Hydrolyzed BZ, monoacetylbenzidine (MABZ), and 4-aminobiphenyl (4ABP) were separated by reversed-phase liquid chromatography without derivatization, and quantitative analyses of them were performed by a high performance liquid chromatograph equipped with electrochemical detector. The quantitative amount of the metabolites was expressed by hemoglobin binding index (HBI). BZ-, MABZ-, and 4ABP-HBI of BZ-EtOH and BZ-PB groups were increased more than those of BZ-control group. In DB38 group, all of HBIs but BZ-HBI were increased more than those of DB38-control group regardless of the pretreatment. These results are attributable to the fact that EtOH and PB induced N-hydroxylation related to the hemoglobin adduct formation. Above results indicate that EtOH increased the adduct formation by inducing N-hydroxylation, but also induced N-acetylation. PB induced N-hydroxylation and increased the adduct formation in BZ group, but decreased the adduct formation in DB38 group due to decreasing the azo reduction. This result suggests that the effects of EtOH or PB need to be considered in the biochemical monitoring of BZ and DB38 for the assessment of intermittent exposure of BZ and DB38.

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WIPE SAMPLING TO ASSESS PESTICIDE EXPOSURES ON SKIN: PRELIMINARY METHOD EVALUATION. M. Boeniger, T. Carreón, W. Sanderson, NIOSH, Cincinnati, OH; M. Nishioka, Battelle, Columbus, OH.

Background: Skin exposures to pesticides in agriculture are considered to be the primary route of worker contact. However, there remains a paucity of data about how to quantify and interpret sampling results. A preliminary range finding and method evaluation survey was recently performed in California in preparation for a larger study to determine exposure reduction intervention effectiveness. Methods: Hand wipes (using the NHEXAS isopropanol moistened J&J Sof-Wick gauze wipe method consisting of 2 consecutive wipes) were obtained during harvesting of a strawberry field that had been previously sprayed with malathion. Various approaches were used that would provide useful information for a larger study. Results: Mean whole hand pre-wash and post wash malathion loading (n=6) was 6696 ng and 2469 ng, representing a 63% reduction of surface hand concentration, while mean digit pre-wash and post-wash malathion loading (n=6) was 1312 ng and 893 ng, for a 32% reduction, respectively. Consecutive wiping of contaminated skin did not indicate highly efficient removal with each wipe. Average decline was 47% for 2nd digit wipe and 37% for 3rd digit wipe. Conclusions: The EPA hand wiping method did not apparently efficiently remove the amount of malathion loading present either before or after washing, although when loading was low (as when wearing gloves) removal appeared complete. Perhaps alternative sampling methods are more efficient, but this would need to be similarly evaluated. Efficiency of skin sampling methods and comparison to other methods continues to be a significant need in exposure assessment characterization.

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DEVELOPMENT AND EVALUATION OF A PESTICIDE RISK REDUCTION PROGRAM IN THAILAND. O. Krissanakriangkrai, P. Bigelow, R. Buchan, Colorado State University, Fort Collins, CO; S. Pannarunothai, Naresuan University, Phitsanulok, Thailand.

Thailand, one of the largest users of pesticides in South East Asia, allows the use of over 300 pesticides including many that are banned or subjected to restrictions in other countries. The result is often the sale of unregistered products with poor labeling, making it difficult for farmers to choose the appropriate product and apply the products in a safe manner. Most farmers have limited knowledge and awareness about how to properly use pesticides. In Thailand, they routinely mix several types of pesticides to apply at one time to eradicate and control diverse kinds of pests, however, this leads to pest resistance and major pest outbreaks. The goals of this program were to reduce the risk of pesticide use, promote sustainable agriculture, and strengthen the human resource development for health promotion in the community, by demonstration workshops to local public health volunteers and farmers. The study incorporated a Pretest, Posttest Control Group design. Questionnaires were used to obtain information in order to evaluate changes in knowledge, attitudes and behaviors related to the proper use of pesticides and Integrated Pest Management (IPM). A cholinesterase blood test was used to evaluate pesticide exposures. Ninety-nine farmers (majority growing rice) in Prompiram district, Phitsanulok Province, Thailand were enrolled in the study. After the training the use of respiratory protection increased and there was a significant reduction in post-test knowledge, attitudes, and cholinesterase levels ($p<0.05$). The results indicate that pesticide risk reduction programs can be effective; however, further research is needed in the area of agricultural economics as the costs of IPM and pesticide safety for individual farmers impedes implementation.

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THE USE OF CAB ENCLOSURES FOR EXPOSURE CONTROL DURING COMPOSTING. J. Burkhart, C. Piacitelli, D. Yereb, G. Kullman, NIOSH, Morgantown, WV.

Industrial hygiene surveys were conducted at 3 composting operations through the National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation Program. These facilities composted green wastes, wood chips, and sewage sludge to produce Class A compost. Measurements were taken for respirable and total dust, endotoxins, culturable fungi, and culturable bacteria. Samples were collected inside and outside of the equipment cabs of scarabs, loaders, chippers, and trucks to assess worker exposures and the exposure reduction accomplished through routine cab enclosure.
Concentrations of total dust collected outside the cabs had a mean of 5.5 mg/m3 and a standard deviation (SD) of 8.2 mg/m3; concurrent total dust concentrations taken inside the cabs had a mean of 0.47 mg/m3 and a SD of 0.25 mg/m3. Concentrations of culturable fungi measured outside the equipment cabs had a mean of 1.5 × 105 CFU/m3 and a SD of 2.5 × 105 CFU/m3; concentration measurements inside the equipment cabs had a mean fungal concentration of 4.1 × 104 CFU/m3 with a SD of 1.1 × 105 CFU/m3. These data show that routine cab enclosure reduces worker exposures to organic dusts during the operation of composting equipment. Additional exposure reductions are possible through more efficient use of cab enclosures.

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MIGRANT TOBACCO WORKERS IN KENTUCKY: A SAFETY AND HEALTH GUIDELINE. T. Bernard, R. Keller, J. Morgan, N. Davis-Smith, Murray State University, Murray, KY.

America's largest producer of burley, dark fire-cured and air-cured leaf tobacco, is Kentucky, where tobacco is grown in 119 of the state's 120 counties. Production of dark tobacco increasingly relies on hired migrant labor at critical periods in crop development. Migrant workers are considered to be at higher risks of injury because: (1) their work is often concentrated in labor-intensive crops; and (2) lack of

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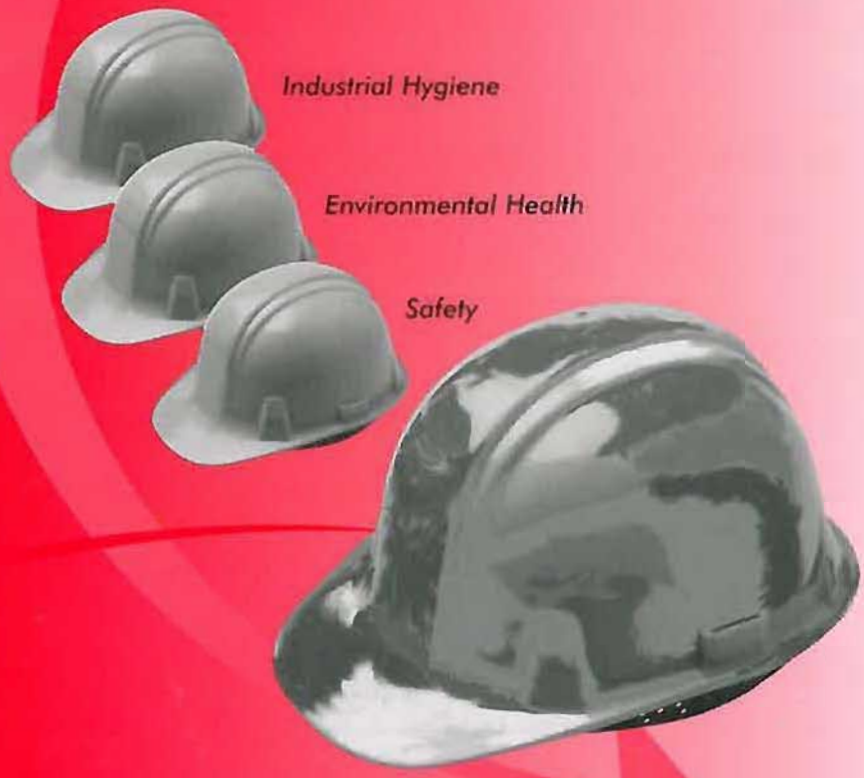

ABSTRACTS