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CORRELATION BETWEEN AIRBORNE TOLUENE DIISOCYANATE AND URINARY TOLUENE DIAMINE. J. Roh, K. Park, C. Kim, H. Kim, H. Kim, Yonsei University College of Medicine, Seoul, Republic of Korea.

Toluene diisocyanate (TDI) is widely used in the production of polyurethane foam, as well as in the formulation of polyurethane paints and coatings. The commercial material is generally a mixture of 2,4-TDI and 2,6-TDI. Studies indicated that exposed workers had elevated levels of urinary toluene diamines (TDAs), but a correlation between levels of TDA in urine and airborne concentration of TDIs in workplace could not be established. This study was conducted to investigate the correlation between levels of urinary TDAs and airborne concentration of TDIs, which are being sampled with open cassette holder (OCH) and the modified 2-piece cassette holder (2-PCH). The sampling was executed on the 22 workers from the factory where operated painting work by using polyurethane paints. This study identified the personal character of workers by using the questionnaire and analyzed TDIs from 44 samples each in the middle of morning and afternoon and TDA from the 17 workers by taking their urine. As a result of analysis, the concentration of TDIs in the air is higher on 2-PCH than OCH. There was no significant difference in the concentration of urinary TDA by general characteristics. The concentration of TDI in the air had significant correlation with the concentration of urinary TDA no matter what kind of sampling method was used, but the sampling technique by 2-PCH had more correlation than OCH. As a result of this experiment, the concentration of TDI by sampling with the each cassette holder has shown a significant relation with the concentration of urinary TDA.

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URINARY BROMIDE AND BREATHING ZONE CONCENTRATIONS OF 1-BROMOPROPANE FROM WORKERS EXPOSED TO FLEXIBLE FOAM SPRAY ADHESIVES. K. Hanley, B. Curwin, M. Petersen, NIOSH, Cincinnati, OH; W. Sanderson, University of Iowa, Iowa City, IA.

1-Bromopropane (1-BP) has been marketed as an alternative for ozone depleting solvents and suspect carcinogens and is in aerosols, adhesives, and solvents used for metal, precision, and electronics cleaning. Toxicity of 1-BP is poorly understood, but it may be a neurologic, reproductive, and hematologic toxin. Sparse exposure information prompted NIOSH to conduct an exposure assessment using air sampling, exhaled breath, and urinary metabolites. Mercapturic acid conjugates are excreted in urine from 1-BP metabolism involving removal of bromide from the propyl group. One research objective is to evaluate the utility of urinary bromide analysis for assessing 1-BP exposure using a relatively inexpensive method commercially available. Complete 48-hour urine specimens were obtained from 30 workers on 2 consecutive days at facilities using 1-BP adhesives to construct polyurethane foam seat cushions and from 7 unexposed controls. All of the workers' urine was collected into composite samples representing 3 daily time intervals: at work, after work but before bedtime, and upon wake-up. After collection, urine aliquots were dispensed into acid-rinsed Nalgene® bottles and analyzed for bromide (Br) by inductively coupled plasma-mass spectrometry. Full-shift breathing zone samples were collected for 1-BP on Anasorb-CMS sorbent tubes and analyzed by gas chromatography-flame ionization detection via NIOSH method 1025. Breathing zone concentrations of 1-BP ranged from 45–200 ppm for adhesive sprayers and from 0.8–60 ppm for other jobs. For sprayers, urinary Br concentrations ranged from 77–542 mg/g-creatinine (cr) at work, from 58–308 mg/g-cr after work, and from 43–672 mg/g-cr in wake-up samples. Overall, urinary Br concentrations for sprayers were substantially more than for the nonsprayers and controls, with geometric means of 166, 38, and 3.8 mg/g-cr, respectively. This study demonstrates that urinary elimination is an important excretion pathway for 1-BP metabolism and bromide may be a useful indicator of exposure.

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QSAR MODELS OF ALLERGIC CONTACT DERMATITIS. A. Fedorowicz, CDC/NIOSH, Morgantown, WV; H. Singh, E. Demchuk, CDC/NIOSH and West Virginia University, Morgantown, WV.

Allergic contact dermatitis is a common work-related skin disease that often develops after repetitive skin exposures to a sensitizing chemical. A variety of animal and human experimental assays have been suggested to assess the skin sensitization potential. The introduction of the murine local lymph node assay (LLNA) with its quantitative endpoint for skin sensitizing potency has provided continuous scale suitable for developing quantitative structure-activity relationships (QSARs) of skin sensitization, which relate physical-chemical properties of chemical compounds to their sensitization potential. However, at present many LLNA results are mostly reported using a dichotomous scale (+/-), which is consistent with the scale of guinea pig and human tests, which have been widely used in the past. Therefore, in this study only a dichotomous version of the LLNA data was used to develop QSAR models of skin sensitization. Using statistical methods, physical-chemical properties of chemicals, called molecular descriptors, were tested for their ability to predict the skin sensitization potential. A few of the most informative descriptors were subsequently selected to build QSAR models of skin sensitization with high prediction rates.

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ABILITY OF MINOR INCREASES IN INDOOR SHOOTING RANGE AIR VELOCITIES TO REDUCE LEAD CONCENTRATIONS IN THE BREATHING ZONE OF SMALL-ARMS SHOOTERS. D. Lillquist, B. Craig, University of Utah, Salt Lake City, UT.

If the ventilation systems are functioning improperly or are poorly designed in indoor firing ranges, high concentrations of airborne lead are typically present. Low cost temporary ventilation baffle mock-ups can be used to test proposed improvements to reduce airborne lead concentrations. Baffles were installed in an indoor shooting range to increase air velocities and modify airflow patterns in the shooters' breathing zones in an attempt to reduce personal exposures to airborne lead. Ventilation measurements and personal air sampling were conducted prior to and after the baffles were installed. The mean air velocity was increased from 6 to 13.4 feet per minute at the shooting line, and increased to 19.4 feet per minute at the gun position. Airborne lead concentrations were reduced from 645.2 to 30.9 $\mu g/m^3$ (8-hr time-weighted averages 67.2 to 2.3 $\mu g/m^3$, respectively). Although the mean velocities were much lower than the recommended air velocity of 50 feet per minute, significant reductions in airborne lead exposures were achieved. Other necessary improvements to the range were also identified, such as relocating the exhaust ventilation ducting to the bullet trap and improving the distribution of air across all shooting booths; however, the benefits of increased air velocity were observed prior to the additional investments.

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DEVELOPMENT OF A NOVEL ROBOTIC WELDING FUME INHALATION AND EXPOSURE SYSTEM. A. Afshari, J. Antonini, S. Stone, G. Fletcher, V. Castranova, D. Frazer, NIOSH, Morgantown, WV.

Epidemiological studies suggest that the long-term inhalation of welding fumes may lead to lung disease, neurotoxicity, and cancer. The fume generated during the welding process has been shown to consist of ultrafine particulates (e.g., chromium and nickel) as well as gases (e.g., ozone, nitrogen oxide, and carbon monoxide). Laboratory studies are needed to further investigate the adverse effects of exposure to welding fume. The objective of this study was to design an inhalation exposure system to be used in the evaluation of the toxicity of welding fume in rats. To ensure continuous delivery of the welding fumes without interruption of exposure, an automated computer-controlled robotic welder has been constructed. The robotic torch is combined with a programmable head stock capable of welding at a con-

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