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DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) IN SKIN WIPE SAMPLES OF AUTOMOTIVE MECHANIC TRAINEES. A. Booth-Jones, NIOSH, Cincinnati, OH; C. Neumeister, NIOSH, Cincinnati, OH; G. Talaska, University of Cincinnati, College of Medicine, Cincinnati, OH

Epidemiologic evidence suggests that automobile and truck mechanics are at increased risk of bladder cancer. For mechanics, used gasoline engine oil (UGEO) is a major occupational exposure. UGEOs contain polycyclic aromatic hydrocarbons (PAHs) formed during combustion in engine operation. Because these PAHs have low volatility, mechanics have potential dermal exposure. Many PAHs found in UGEO are known or probable carcinogens.

The purpose of this study was to determine whether PAHs were detected in skin wipe samples of automotive mechanic trainees. Sixty-nine participants were enrolled from vocational schools in Ohio and Kentucky. Participants completed an informed consent; 36 were included in the intervention group and were provided with training and special cleansers; and 33 were placed in the nonintervention group.

Skin wipe samples were collected by filter paper after participants massaged corn oil into their hands. Successive skin wipe samples were taken from those in the intervention group after the intervention was in place. Samples were extracted by ultrasonification in acetonitrile, filtered, and stored until analysis.

Sixteen model PAHs measured by fluorescence and UV detectors were naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene (FLUOR), pyrene, benz[a] anthracene (BAA), chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a] pyrene (BAP), dibenz[a,h] anthracene (DAHA), benzo[ghi]perylene, and indeno[1,2,3-cd]pyrene (INDENO).

Eighty-one percent of those in the intervention group provided at least two skin-wipe samples. Measurable amounts of PAHs were detected in 90% of the samples.

The concentrations of PAHs ranged from 54.51 µg/µL to 0.18 µg/µL for FLUOR, BAA, BaP, DAHA, and INDENO, which are carcinogens. Mean levels of BAP and DAHA were 4.63 µg/µL and 1.88 µg/µL, respectively; more than 13 participants had levels above these mean values.

This study shows that PAHs from UGEO are present in hand-wipe samples of automotive trainees. Excess PAH exposure is hazardous, and interventions should be designed to reduce contact.

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PERSPECTIVES ON HUMAN EXPOSURE TO XENOBIOTICS. R. Earley, LabCorp, Burlington, NC

It is quite apparent today that the general population has many concerns about contact with any chemical substance. For example, there are media reports that readily illustrate this concern for xenobiotics (e.g., lead in paint, mercury in dental fillings, and pesticide levels in fish). To better focus these issues, a retrospective study of more than 35,000 biological monitoring results from a diverse population was compared with reference or literature criteria.

Analytical methods employed were inductively coupled plasma-mass spectrometry (ICP/MS), cold vapor atomic absorption spectrometry, and gas liquid chromatography. Determinants investigated were arsenic, cadmium, carbon monoxide, chlorinated pesticides, chromium, lead, mercury, PCB, phenol, selenium, and zinc protoporphrin.

An example of the data was blood lead, which was contrasted against a reference range, the ACGIH BEI®, and the OSHA lead standard. At the highest level of 40 mcg/dL, representing the OSHA lead standard, >95% of the studied population met the criterion. Even at lower levels of 30 mcg/dL (OSHA recommended level for men and women of childbearing years) and 20 mcg/dL (reference level), >90% of the population was within these specifications.

Mercury data exhibit similar characteristics to the blood lead population. The blood mercury reference range of <15 mcg/L encompassed >90% of the population, and the urine mercury range accommodated >95% of the data.

Looking at these determinants, it is plausible to conclude that while the population does come in contact with detectable levels of xenobiotics, the majority is within recognized reference intervals.

NOTE: The conclusions and opinions presented here are those of the author and do not necessarily reflect the views of Laboratory Corporation of America Holdings or its subsidiaries, including LabCorp.

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HISTORICAL EXPOSURES DURING FIBER GLASS PRODUCT MANUFACTURING. T. Smith, Harvard School of Public Health, Boston, MA; M. Quinn, University of Massachusetts-Lowell, Lowell, MA; R. Stone, G. Marsh, University of Pittsburgh, Pittsburgh, PA

Extensive exposure and operational data have been collected from four primary producers of fiber glass products at 14 plant sites, as a part of an ongoing cancer morality study. The major products included glass filament rovings and textiles, blowing wool, batt and board insulation, and small-diameter filter media. Retrospective exposure estimates have been developed for all of the plants contributing subjects to the cohort.

This paper reports on the analysis of the exposure data provided by the companies and validated by the investigators. Extensive quality and comparability evaluation was necessary to deal with changes in methodology and changes in survey objectives (routine evaluation vs. complaint driven).

Exposure data were combined with detailed technical historical information to examine the quantitative effects of product, operational and job activities, weather, and temporal trends. As expected from earlier published data, there was a wide range of exposures associated with different product types: glass filament products with diameters >10 mm had the lowest average exposures (frequently, <0.001 f/cc), and small-diameter filter media (<1 mm) without binder or oil showed the highest mean exposures, at times exceeding 1 f/cc.

Production of similar products using the same production techniques led to similar average exposures. A strong effect of survey date was found by analysis of variance, which was associated with changes in production rate, product type, and season. A broad downward trend was seen going from the mid-1970s to 1990, which was associated with a variety of process changes and the installation of exposure controls.

Systematic differences, two-fold or more for the same job and work location, were observed in comparing means between industrial hygiene surveys at the same plant. This variation limits the confidence that can be achieved for estimates derived from sampling data from a single survey.

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DEVELOPMENT OF A COMPUTATIONAL FLUID DYNAMICS MODEL OF WORKER EXPOSURE TO PARTICULATE MATTER DISPERSED IN A TIME-DEPENDENT AIRFLOW. J. Richmond-Bryant, M. Flynn, University of North Carolina, Chapel Hill, NC

Computational fluid dynamics (CFD) modeling of particulate transport in an indoor environment has the potential to be an economical method of assessing exposures over potentially large (i.e., room-size) domains without any physical intrusion to the work environment. Moreover, CFD modeling can become a cost-effective means for evaluating competing designs for particulate-capture ventilation hoods. However, development of a CFD model of aerosol transport is necessary before the model can be employed as a reliable tool for industrial hygiene applications.

In a typical industrial environment, low-turbulence airflow will induce periodic vortex shedding, which is believed to be a primary determinant of contaminant transport into a worker's breathing zone (BZ). For this reason, the authors combined a Lagrangian particle-tracking algorithm with a discrete vortex method (DVM) airflow model. The DVM was selected because it is well-suited for modeling time-dependent vortex shedding.

In the particle-tracking algorithm, a semianalytical form of the Newtonian drag equation is integrated numerically during each time-step. Preliminary simulations were performed for 1 mm, 10 mm, and 20 mm unit-density particles dispersed in an airflow of 0.246 m/s. Particles were released upstream of a 0.61 m diameter circular cylinder that represents the worker.

Results for the 10 mm and 20 mm simulations show that small numbers of particles will become entrained into the BZ, defined here as the region extending 0.14 m in front of the cylinder. In all cases, the particles followed the vortex clusters formed downstream of the worker.

In addition, 10 mm particles were released 0.15 m downstream of the cylinder. The particles in this case were observed traveling directly upstream and into the cylinder.

Computational effort was found to be inversely proportional to the size of the particle released.

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CONTROL OF WAKE-INDUCED EXPOSURE USING AN INTERRUPTED OSCILLATING JET. J. Bennett, K. Crouch, S. Shulman, NIOSH/Division of Physical Sciences and Engineering, Cincinnati, OH

Ventilation design often involves ideas drawn from potential flow theory. However, in the downstream region of a worker's body, the flow is turbulent, making the concept that a contaminant will flow from high to low pressure problematic.

With an air contaminant source in the wake region, reasonable though often ineffective exposure control approaches are to reduce the velocity to deprive the wake of energy needed for eddy formation (i.e., maintain laminar flow) or to increase the flow rate to provide sufficient dilution. In either case, one problem is solved while another is created.

From this coupling arose the motivation to simul-

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