commonly occurring carcinogens at Finnish work places were solar radiation (130,000 exposed workers), environmental tobacco smoke (100,000), crystalline silica (76,000), wood dust (56,000), radon (50,000) and diesel exhaust (37,000) out of the labor force of 2.4 million. Industries where heavy exposure to carcinogens is likely to occur could also be identified at the level of municipality, which enables the local labor safety authorities to focus their advisory and control activities. This procedure can be extended to non-carcinogenic exposures and to other regions, if it turns out to be helpful for the enforcement authorities and other actors working in the field of occupational health and safety.

Risk Assessment/Risk Management

Papers 429–434

429.

SOLVENT MIXTURES: A PROPOSED EXPOSURE HAZARD INDEX. M. Gagné, G. Lapointe, N. Gagnon, CSST, Montréal, PQ, Canada

The Répertoire toxicologique of the Commission de la santé et de la sécurité du travail du Québec (CSST), actively involved in the implementation in Canada of the WHMIS (Workplace Hazardous Materials Information System), received numerous requests on hazardous chemicals used in the workplace. Most inquiries concern solvents (pure or mixture) having a WHMIS classification or a threshold limit value. With the increase in the dissemination of information on these hazardous products came a rise in the number of inquiries for the selection of solvent substitute from among several chemicals with similar properties in order to reduce the exposure hazard.

Data were extracted from the database of the Répertoire toxicologique, a computer system containing information on about 8,800 chemicals used in the workplace in the Province of Quebec, available on the Web. As part of this procedure, we created a new database specifically for solvents most used in the workplace. The data were grouped by chemical class to facilitate the comparison between specific parameters namely: chemical properties, absorption, toxicity, corrosivity and regulation-recommendation value. This compilation allowed us to propose a global hazard index for solvent mixtures related with skin and respiratory exposure.

The exposure hazard index was obtained from several parameters involved directly or indirectly with the skin and respiratory route of entry. This index might be used for several applications such as selection of a solvent substitute (pure or mixture) presenting a lower exposure hazard and modification of engineering methods to control hazardous conditions.

430.

A DECISION-MAKING FRAMEWORK FOR HEALTH AND SAFETY CLEARANCE OF NEW CHEMICALS. A. Maier, P. Hakkinen, D. Briggs, A. Wullenweber, L. Haber, Toxicology Excellence for Risk Assessment, Cincinnati, OH; S. Kim, D. Seid, Applied Biosystems, Foster City, CA

An important aspect of effectively managing chemical health and safety is to use state-of-the-science approaches for screening potential health risks associated with chemicals prior to their introduction into facility operations. Although a variety of hazard categorization and ranking schemes have been developed for this purpose, published approaches for expanding these into more robust occupational risk assessments are more limited. To address the needs of company decision makers involved in clearing new chemicals for use, an occupational hazard identification and risk assessment framework has been developed via this collaboration to enhance existing company health and safety procedures. The framework includes a decision flow chart that guides the user through specific criteria for completing the four basic steps of human health risk assessment: hazard identification, dose-response assessment, exposure assessment, and risk characterization. The procedure was designed specifically to allow for the maximum use of the available data and current risk assessment methods. Criteria for developing toxicity and exposure potential ratings were developed drawing from a variety of published methods, with scientific rationale presented for the selection of the recommended approaches. A set of risk characterization tools that integrate information from the toxicity and exposure assessments, as well as their interpretation was also developed. Full implementation of the procedure is intended to support environmental safety and health decision-making for the clearance of new chemicals for use at facility operations.

431.

THE NIOSH FATALITY ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM. J. Burkhart, NIOSH, Morgantown, WV

The NIOSH Fatality Assessment and Control Evaluation (FACE) program is a research program designed to identify and study fatal occupational injuries. The program goal is to prevent occupational fatalities across the nation by identifying and evaluating work situations at high risk for fatal injury and then formulating and disseminating prevention strategies to those who can intervene in the workplace. FACE investigations are not intended to enforce compliance with law, or determine fault or blame. The FACE project has two major components. The in-house FACE program began in 1982. Five states (NC, SC, TN, PA, VA) voluntarily notify NIOSH of traumatic occupational fatalities occurring in the targeted areas, that have included confined spaces, electrocutions, machine-related, falls from elevations and logging. In-house FACE is currently targeting fatalities associated with machinery, deaths of youths under 18 years of age, and street/highway construction work zone. Once notified of a workplace fatality, NIOSH investigators travel to the incident site to gather facts and data about the event.

The state-based FACE program began in 1990. Currently, 15 State health or labor departments have cooperative agreements with NIOSH for conducting surveillance, targeted investigations, and prevention activities at the state level using the FACE model. state-based FACE programs conduct surveillance of all work-related fatalities in their respective states.

NIOSH staff have completed 615 fatality investigative reports, and state staff have completed 1,100 reports. NIOSH uses this information to identify new hazards and case clusters. FACE information may suggest the need for new research or prevention efforts or for new or revised regulations to protect workers. Publications and articles are developed to highlight these high-risk work situations and to provide safety recommendations. Reports, Alerts, and other publications generated as a result of the FACE Program are available through the NIOSH web site.

432.

UTILITY OF NIOSH HEALTH HAZARD EVALUATION DATA FOR HAZARD SURVEILLANCE. J. McKernan, A. Martinez, J. Boiano, R. Hartle, NIOSH, Cincinnati, OH

As part of NIOSH's planning efforts associated with the National Exposure at Work Survey (NEWS), selected occupational databases have been searched to provide information on the scope and magnitude of hazards and exposures by occupational group in health services (SIC 80), the first of many industry sectors to be surveyed in the NEWS. This information has been used, in addition to other sources, to prioritize hazards and occupations for subsequent evaluation in the NEWS. One of the searched databases, representing a rich source of hazard data for various occupational groups and industries is the NIOSH Health Hazard Evaluation (HHE) tracking datadase. This unpublished database was developed to track relevant data from NIOSH HHEs since the program's inception in 1971 and includes such data elements as report number, standard industrial classification (SIC) code, hazard, occupation, process, and reported health effects. A search of the HHE database focused on identifying HHEs within SIC 80 which were completed within the past 10 years. The search yielded 179 HHEs which represented most of the health services groups. Predominant hazards of concern included ethylene oxide, gluteraldehyde, anesthetic gases, latex, ribavirin, tuberculosis and ergonomic risk factors. Occupational groups most notably associated with these hazards included nurses, physicians, dentists and optometrists. A rank

order listing of the top hazards and affected occupational groups will be presented by hazard type and other data elements. Apart from descriptive information, strengths and limitations of the HHE database will be presented relative to its applicability for hazard surveillance. Furthermore, these data can be used by the healthcare industry to target intervention activities for exposed occupations.

433.

A RISK ASSESSMENT APPROACH FOR INDIVIDUAL CHEMICALS IN COMPLEX HYDROCARBON MIXTURES. J. Dennison, Colorado State University, Fort Collins, CO

We present an approach for evaluating the kinetics of specific chemicals in gasoline, a complex mixture of petroleum hydrocarbons. Occupational exposure limits (OELs) have been established for several components of gasoline, including benzene, n-hexane, alkyl aromatics, and for the mixture as a whole, based on toxicological data of varying completeness. Toxicological data on gasoline are especially incomplete, considering its variable composition. Therefore, an approach that can provide risk estimates for individual chemicals in the mixture is valuable. The challenge lies in being able to properly account for the inhibition of each component's metabolism in the mixture. We used gas chromatography to follow the timecourse of benzene, toluene, ethylbenzene, xylene (BTEX) and n-hexane during vapor uptake chamber experiments with rats acutely exposed to different levels of gasoline mixtures. Samples of the air in the exposure chamber were serially analyzed to determine the uptake and metabolism of chemicals. The chemicals of interest were isolated on chromatograms and the remaining chemicals were integrated together. A physiologically-based pharmacokinetic (PBPK) model was then developed to enable risk assessment for the chemicals, based on appropriate biomarkers. The model was rescaled to human occupational exposure conditions, including human specific factors for physiology, uptake, and metabolism. The model described the timecourse of BTEX and hexane in humans, incorporating the lumped pseudo-chemical to address the inhibition of BTEX and hexane clearance. This data-validated modeling approach provides a means for assessing the occupational risks of specific chemicals when exposure to them occurs as part of a complex mixture, and may be useful for assessing risks to specific components in other hydrocarbon mixtures such as Stoddard solvent or jet fuel.

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434.

HARMONIZING METHODS FOR DERIVING OCCUPATIONAL EXPOSURE LIMITS: A CASE-STUDY FOR METALS AND OTHER COMPOUNDS RELATED TO METAL AND MINING OPERATIONS. A. Maier, L. Haber, Toxicology Excellence for Risk Assessment, Cincinnati, OH

Harmonization of OEL derivation methods has a long-term goal of working towards convergence in scientific criteria, while acknowledging the appropriateness of differences in approaches that are based on considerations unique to individual OEL-setting bodies. Increased harmonization promotes standardization of protection for global workforces, increased transparency of OEL values, and increased pooling of resources for setting OELs. This latter benefit decreases duplication of effort and allows for more resources to be directed towards expanding the number of substances for which OEL guidance is available. We conducted a critical analysis of OEL documentation for compounds related to metal and mining-related operations to determine the degree to which standard scientific criteria are used to address critical steps in the derivation of health-based OELs among international organizations. A comparison of OEL values for case-study chemicals revealed significant differences among organizations, and these differences often reflected diversity in scientific criteria that were applied. We present an analysis of disparities and agreements in methods for addressing a number of key aspects of occupational risk assessment that are involved in setting an OEL. In this analysis we evaluated current approaches and provide recommendations for harmonization in the following areas: 1) establishing criteria for a minimum database, 2) documenting the degree of confidence in OELs, 3) using poorly documented epidemiology data, 4) documenting the point of departure estimate, 5) using dosimetry adjustments for extrapolating from animal data, 6) applying uncertainty factors, 7) and using mode of action data for setting OELs for carcinogens. Based on this analysis, we conclude that greater harmonization of the scientific criteria used for setting OELs will enhance their value for promoting global worker-health.

(Sponsored by the International Council on Metals and the Environment.)

Communication and Training

Papers 435–438

435.

SILICA EXPOSURES FOR SANDBLASTERS: A WEB-BASED INTRODUCTION TO OCCUPATIONAL EPIDEMIOLOGY AND INDUSTRIAL HYGIENE. T. Lentz, B. Malit, NIOSH, Cincinnati, OH

Exposure to airborne crystalline silica is a serious occupational hazard potentially affecting at least 1.7 million U.S. workers, many of whom are exposed to concentrations that exceed limits defined by current regulations and standards. Each year, more than 200 silicosis-associated deaths still occur, and an unknown number of workers continue to die from silica-related diseases such as pulmonary tuberculosis and lung cancer. Workers who perform abrasive blasting using silica sand are especially at risk for exposures to high concentrations of airborne crystalline silica. Focusing on sandblasters and the associated silica exposures, NIOSH researchers have developed an Internet-based educational model that presents occupational epidemiology and industrial hygiene concepts. The module was developed for the EXCITE program of the Centers for Disease Control and Prevention, accessible via the Internet as an educational resource for high school teachers. The program is designed to introduce high school students to epidemiology and public health. Drawing from the example of an actual silicosis outbreak that occurred among sandblasters in Texas in 1988, the module describes how a multidisciplinary team of investigators traced the disease to an occupational exposure source. Students are challenged with questions about the investigation and possible strategies for addressing specific situations. Industrial hygiene is explained with an emphasis on the methods used to control and eliminate hazards. Illustrations are provided to indicate analytic techniques, engineering controls, personal protective equipment, and work practices. The module, which was written according to an easy-to-read format, provides the basis for a NIOSH worker education publication to address the risk of silicosis for sandblasters and methods to control hazards.

436.

EVALUATION OF WEB-BASED TRAINING DESIGN FEATURES BY JOB CLASSIFICATION. W. Brazile, A. Turner, J. Harris, Los Alamos National Laboratory, Los Alamos, NM

An on-line web-based training (WBT) evaluation was developed at Los Alamos National Laboratory to measure adult learner preferences of WBT design features. The evaluation was developed for a new waste management course that targets approximately 4,000 employees. The target audience is composed primarily of three job classifications of workers: technical staff members, specialty staff members, and technical support employees. This research was designed, in part, to ascertain the preferences of WBT design features based on job classification. Trainees are asked to rank WBT design features on a scale from 1 to 5, with 1 being "very unimportant" and 5 being "very important." The six WBT design features that are being evaluated include provision of job resources, entertainment, media, interactive exercises, ability to take the on-line quiz at any point during the training, and relevancy of the training to the job. To date, of the approximately 350 trainees that have received credit for the training, 144 have completed the

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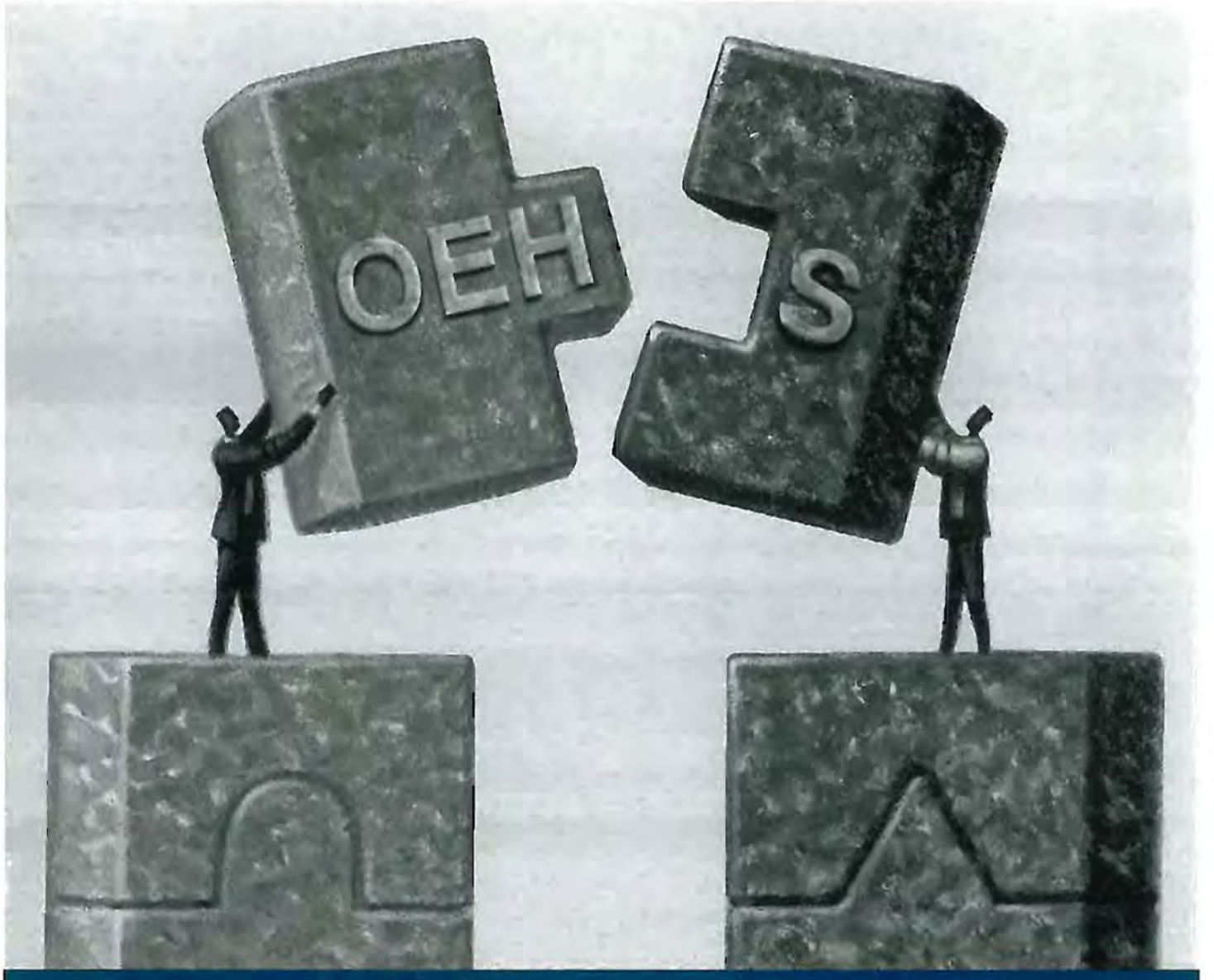

ABSTRACTS

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2002 Abstract Index by Session Topic

PF 101 Agricultural Health and Safety

Papers 1–6

1.

RELATIONSHIPS BETWEEN WORK EXPOSURE AND RESPIRATORY OUTCOMES IN POULTRY WORKERS.

S. Kirychuk, J. Dosman, P. Willson, L. Dwernychuk, University of Saskatchewan, Saskatoon, SK, Canada; J. Feddes, A. Senthilselvan, C. Ouellette, University of Alberta, Edmonton, AB, Canada

A pilot study was conducted on 74 poultry barn workers in Western Canada during the winters of 1998–2000. General respiratory health, current, chronic and work related respiratory symptoms; general work duties, and work-site factors were ascertained, pre-exposure, by questionnaire. Personal airborne exposure levels and changes in symptoms and lung function were measured across the work-shift for all workers. Workers were classified according to the type of poultry operation (floor based, n=53; cage based, n=13) in which they worked. There was no significant difference in daily hours spent in the barn between those who worked with caged poultry (5.41±2.35 hours) and those who worked with floor-based poultry (4.42±2.48 hours). Age of birds was 47.10±58.36 days for floor based versus 155.91±63.01 days for cage based facilities. There were no significant differences in personal environmental measurements between cage-based and floor-based facilities (ammonia 13.22±13.70 ppm, 17.34±16.35 ppm; total dust 5.74±4.85mg/m^3, 10.01 ±8.84 mg/m^3; endotoxin 6046±6089 EU/m^3, 5457±5934 EU/m^3 respectively). There were no significant differences in across work-shift change in pulmonary function indices between workers from cage and floor-based operations. For the entire sample total dust dose (work hours/day x total dust) significantly correlated with across-shift change in FEV_1, whereas endotoxin dose and ammonia dose did not. Stocking density was significantly correlated with average ammonia (ppm, p=0.002) and ammonia dose (ppm x work hours/day; p=0.004) in floor based operations and with total dust (particles/ml, p=0.002) in cage based populations. Stocking density was also significantly correlated with chronic cough (p=0.003) and across work-shift cough (p=0.05) and chest tightness (p=0.06) for workers from floor based operations; and with phlegm when working (p=0.018) and chest tightness across the work-shift (p=0.004) for workers from cage based operations. Type of poultry production operation and therefore type of work exposures appear to significantly impact symptoms experienced by workers exposed to these atmospheres.

2.

DUST GENERATION SYSTEM FOR AGRICULTURAL SOIL DUST.

K. Lee, R. Domingo-Neumann, R. Southard, UC Davis, Davis, CA

Agricultural workers are prone to exposure to mixed dust of inorganic and organic compounds. Diverse working conditions and operations in agriculture make direct measurements of the mixed dust exposure difficult. This study was conducted to develop a new dust generation system to determine possible exposure potency indicators of soil samples. The dust generator consists of a blower, a rotating chamber and a settling chamber. The rotating chamber has inner baffles to provide sufficient agitation of the samples while the chamber is rotating. A blower provides air into the rotating chamber, and the suspended dust is moved to the settling chamber through a perforated pipe. A small fan inside the settling chamber helps maintain suspension of the dust. Various size fractions of dust are sampled on filters suspended in the chamber via outlet ports and attached pumps. Air pressure is released through a filter plate mounted on the wall of the settling chamber. Various operating conditions were evaluated: air intake from blower, speed of rotation, soil mass and sampling time. To evaluate the characteristics of dust from the system, we collected dust samples from agricultural fields while the soil was prepared for