gram that teaches mine operators how to recognize, evaluate, and control dust and noise hazards, MSHA and NSSGA have trained approximately 250 participants at 24 hands-on workshops since the December 1997 inception of the program. Attendees learn how to conduct on-site exposure monitoring, coordinate with an analytical laboratory, interpret the exposure data, keep appropriate records, and identify corrective measures. MSHA provides experienced instructors, classroom materials, and sampling equipment for hands-on training. NSSGA recruits the students and provides logistical support. Each workshop occurs at an NSSGA-member quarry. MSHA uses the course curriculum as a model for training metal and nonmetal inspectors, miners, and operators in other types of mining operations (e.g., gold, salt, iron ore). The materials developed and the techniques used could easily be adapted to train workers in similar industries, or by other agencies and educational institutions that wish to develop training with a strong hands-on component. The partnership with NSSGA has provided MSHA with a framework for working with other industry and labor organizations in similar joint ventures. The success of the MSHA and NSSGA cooperative training program is highlighted by collaborative development, innovative implementation, and significant achievement. Both organizations continue to demonstrate a strong commitment to the partnership.

36.

LIMITATIONS OF INTEGRATING IMPULSIVE NOISE WHEN USING DOSIMETERS. C. Kardous, R. Willson, C. Hayden, NIOSH, Cincinnati, OH

The National Institute for Occupational Safety and Health (NIOSH) conducted a noise-exposure assessment of the indoor firing range at the National Firearms Unit of the Immigration and Naturalization Service (INS). The purpose was to identify salient acoustic parameters associated with typical live firing activities and to provide noise abatement recommendations. Live fire measurements were obtained at 11 different positions throughout the firing range and adjacent areas using two different instrumentation systems. The first system used a Bruel and Kjaer (B&K) type 4136 1/4" microphone, a B&K type 2615 preamplifier, and a B&K type 2807 power supply that fed a Panasonic Model SV-255 DAT recorder. The second group of measurements was obtained with 11 dosimeters (Quest Model Q400). Spectral analysis of the DAT recordings was performed using MATLAB software routines. Analysis of the signals revealed that the dosimeter readings were nearly always in error. In some cases, the peak level from the weapons (as much as 163 dB SPL) exceeded the nominal input limit of the dosimeter (146 dB SPL). The Q400 dosimeters "clipped" the impulses by acting as if the gunfire had a maximum level of 146 dB SPL. In other cases, however, some peak levels (e.g., 108 dB SPL) were below the dosimeter input limit, but the dosimeters still showed a peak level of 146 dB SPL. While the OSHA standard requires and NIOSH recommends that sound levels from 80 to 140 dBA be integrated in the calculation of dose, the present data suggest this criterion may be inadequate. These results have found that some instruments are incapable of providing accurate measures of impulse sounds that may be commonly encountered because of their electroacoustic limitations. The authors will recommend electroacoustic criteria for systems intended for use in measuring impulsive sounds such as gunfire.

37.

RESULTS AND RECOMMENDATIONS OF NOISE SURVEYS OF PORTABLE TOOLS. E. Leslie, J. Reeder, Solutia, Inc., Greenwood, SC

Noise surveys of pneumatic tools, a drum vacuum, sandblasting and chipping were taken during field use to determine hearing protection device (HPD) requirements. Single HPD was required of the operator but no formal survey had been conducted to determine adequacy or if nearby employees also needed single HPD. A sound level survey was conducted and the Inverse Square Law was used to determine hearing protection requirements. The Inverse Square Law was used because not all of the distances were accessible or safe for the person taking the measurements while the various job tasks were being performed. The employees were notified of these findings and practices were put into place for the HPD requirements. As a result of this study, Solutia personnel are now adequately protected from noisy tasks when following recommended HPD practices.

38.

THE ATTENUATION OF HEARING PROTECTORS IN EXTREME CONDITIONS. E. Toppila, J. Starck, Finnish Institute of Occupational Health, Helsinki, Finland; I. Pyykkö, Karolinska Institute, Stockholm, Sweden

WITHDRAWN

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39.

RETROSPECTIVE EXPOSURE ASSESSMENT IN A NICKEL SMELTER USING BAYESIAN METHODS. G. Ramachandran, University of Minnesota, Minneapolis, MN

A Bayesian framework was used for retrospective exposure assessment of workers in a nickel smelter.The reconstruction of exposure in epidemiological studies relies on piecing together information from work histories, occupational exposure data, and knowledge of the work environment. Typically, actual exposure data are sparse or nonexistent for many etiologically relevant periods. Exposure assessment strategies, measurement criteria, instruments, and analysis methods for nickel have changed over the past several decades. Using only sparsely available historical measurements resulted in estimates with large uncertainties. However, additional information, in the form of expert judgments informed by knowledge of historical plant conditions, and physical modeling based on these expert inputs, can be brought to bear on this process. The experts, who are experienced industrial hygiene professionals and aerosol scientists, were provided with an information packet that contained historical process information, process throughput levels for each year, the dimensions of the workplace, ventilation records, and task descriptions for each job category. Based on this information, the experts provided subjective prior probability distributions for input parameters (aerosol emission rate, ventilation flowrate, mixing efficiency, aerosol removal by mechanisms such as settling) to a general ventilation model that predicts building concentrations. Expert input was also obtained from a plant industrial hygienist, in the form of probability distributions, regarding the amounts of time spent by each job category in different locations in the building. Monte-Carlo sampling, from the "prior" probability distributions of concentrations in different micro-environments and the probability distributions of time spent by each job category in those micro-environments, was used to obtain worker exposures using a time-weighted averaging model. These priors were synthesized with the historical measurements using Bayes theorem. The prior distributions of exposures were updated using the average measured exposures (historical measurements) and their associated variances to obtain the posterior probability distributions for worker exposures.

40.

EXPOSURE ASSESSMENT FOR THE GLOBAL BURDEN OF OCCUPATIONAL INJURIES. D. Nelson, M. Concha, A. Pruess, J. Leigh, M. Fingerhut, C. Corvalan, WHO, Geneva, Switzerland

As part of the WHO project on Comparative Risk Assessment (CRA) of the major risk factors contributing to the Global Burden of Disease and Injuries, we have estimated probability of exposure to potentially hazardous conditions which may result in occupational injuries, by gender and CRA region. (CRA regions are comprised of countries with similar geography, epidemiology, infrastructure and economic situations.) According to the CRA methodology, estimates of exposure prevalence to a specific risk factor are combined with the associated relative risks to estimate the resulting attributable fraction of deaths and/or disabilities.

For each CRA region, the distribution of employment was determined by occupation (office, services, manual). The proportion of

workers exposed to potentially hazardous conditions for injury was judged to be low for office jobs, moderate for service jobs, and high for manual jobs. The distribution of the labor force by occupation was determined by gender, and then weighted by the probability of exposure to hazardous conditions. This information was used to compute the proportion of the total population with exposure to potentially hazardous conditions for injury in the workplace, by gender, for each CRA region.

Exposure to potentially hazardous conditions for injury in the workplace is consistently higher for men than women, due both to higher rates of male employment overall, and their higher employment in agriculture and production. The highest exposure occurs among males in Southeast Asia and Africa, and is lowest in the high-income regions of Europe, America, and Western Pacific, as well as Eastern Mediterranean. In general, the probability of exposure of males generally decreases with increasing development.

The exposure assessments were combined with injury rates to estimate the global occurrence of deaths and long-term disabilities resulting from occupational injuries (to be released in the WHO *World Health Report 2002*).

41.

ASSESSMENT OF CARBON MONOXIDE EMISSION FROM SMALL ENGINE TOOLS: A NEW ELEMENT IN THE INDUSTRIAL HYGIENE TOOL BOX. M. Baril, D. Drolet, C. Beaudry, IRSST, Montreal, PQ, Canada

Tools powered by small combustion engines are often used in work area that are either poorly or non-ventilated. In some cases, these tools are used simultaneously for long periods such as on construction sites. With the aim of eventually reducing the number of carbon monoxide (CO) incidents among workers, the IRSST has established a list of small-engine-powered tools used in industries including the construction sector. From the literature and especially from EPA USA, CO emission data were collected for each tool in relation to the type of engine involved (diesel, propane, 2-stroke gasoline and 4-stroke gasoline). The amount generated could range from 200 up to 900 g of CO/hp/hour in the worst cases. In a specific workplace, the concentration of CO at equilibrium could be estimated using a Microsoft Excel worksheet that takes into account the volume of the working area, the percentage of the volume occupied by materials, the rate of ventilation, or in case of construction sites, the percentage of open walls, the type and number of pieces of equipment used, and the type of engine involved. From theses values, the time to reach the TLV and the IDLH can be estimated as well as the ventilation rate necessary to avoid CO concentrations above the TLV-STEL.This bilingual user-friendly tool will be available for downloading from the IRSST web site and will also be part of the thinkpad package of the Quebec occupational safety and health inspectors to help them to assess very rapidely the risk of CO intoxication in the establishments that they visit.

42.

DEVELOPMENT AND USE OF A RADIO-TELEMETRY VIDEO EXPOSURE MONITORING SYSTEM TO IDENTIFY AND CONTROL AIRBORNE PARTICULATE EXPOSURES IN A PHARMACEUTICAL MANUFACTURING FACILITY. J. McGlothlin, L. Slivovsky, J. Roggenbauer, , Purdue University, West Lafayette, IN

Exposure to airborne particulates during material handling is a potentially serious risk to employees involved in jobs such as loading and sampling an industrial dryer at pharmaceutical manufacturing facilities. The objectives of this study were to identify exposure sources to employees, to provide information on effective exposure control techniques, and to determine the effectiveness in reducing occupational exposures to airborne particulates during manufacturing processes using two training methods. This study developed a video exposure monitoring system that uses radio-telemetry for wireless transmission of particulate exposure data from real-time industrial hygiene instruments in conjunction with a Multi-media Video Task Analysis (MVTA) system to synchronize these readings with video of an employee performing desired jobs. Training video and particulate data were collected while monitoring employees performing these jobs. The system was used to identify task elements composing each job, exposure levels during each task, and to develop control techniques for tasks associated with potentially high exposure levels. Immediate feedback training and classroom training sessions were provided to demonstrate to employees their potential exposure levels during different task elements and control techniques to reduce these levels. The two training methods show that modified work practices were effective in reducing exposure levels. Post-training data collection for a rotary vacuum dryer sampling task resulted in a 28% reduction from pre-training data. Post-training data collection for a cake-loading task found a 34% reduction from pre-training data collection sessions. Additionally, potential exposures levels were more significantly reduced after classroom training compared to immediate feedback training. Based on the success of this video exposure monitoring system, technical advances have been made to include motion sensing and true real-time evaluation of work environments. Recent applications include bench-top monitoring of airborne particulates that are potentially toxic to the operators.

43.

AN EVALUATION OF INHALABLE AND RESPIRABLE DUST EXPOSURES IN THE NORTH AMERICAN CARBON BLACK MANUFACTURING INDUSTRY. H. Muranko, Muranko & Associates, Inc., Scottsdale, AZ; S. Kerr, The Valspar Corporation, Minneapolis, MN

An evaluation of inhalable and respirable dust exposures was performed at carbon black manufacturing facilities in North America as the exposure assessment component of a respiratory morbidity study. Breathing zone dust exposure concentration was assessed at 22 manufacturing locations representing seven manufacturers throughout the summer and fall of 2000. Up to 25 employees at each location were selected from five major job categories (Administration, Laboratory, Maintenance, Production, and Material Handling) comprising 25 distinct job titles. Each selected employee was sampled twice. The Institute of Occupational Medicine (IOM) personal inhalable dust sampler with MultiDust Foam Discs was selected as the measurement device. IOM samplers equipped with modified stainless steel filter cassettes were fitted with polyurethane foam discs designed to meet the ACGIH/ISO/CEN convention for sampling the respirable dust fraction. The dual-fraction samplers were analyzed by gravimetric means and simultaneously yielded both inhalable fraction and respirable fraction exposure concentrations. Each inhalable dust exposure concentration was subsequently converted to a 'total' dust concentration (the concentration of dust collected using a standard 37-mm closed-face cassette) using a conversion factor established from previous side-by-side intersampler comparison research previously reported. The resulting data set contained over 1000 sample results for each of the three fractions. The industry-wide mean exposure concentration was calculated to be 0.26 mg/m3 for the respirable fraction, 1.46 mg/m3 for the inhalable fraction, and 0.49 mg/m3 for 'total' dust. Exposures were highest for Material Handling/Warehouse jobs and lowest for Administrative jobs, where mean inhalable dust exposures were 2.70 mg/m3 (0.91 mg/m3 'total') and 0.36 mg/m3 (0.12 mg/m3 'total'), respectively. Only slightly more than one percent of 'total' dust exposures converted from inhalable values exceeded the current ACGIH TLV of 3.5 mg/m3, indicating exposures are well controlled across the industry.

44.

PROBABILISTIC EXPOSURE ASSESSMENT OF BENZENE FOR THE RUBBER HYDROCHLORIDE (PLIOFILM) WORKERS (1936–1976). P. Williams, D. Paustenbach, Exponent, Menlo Park, CA

The current OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV) for benzene are based primarily on epidemiology data of the rubber hydrochloride (Pliofilm) workers. Previous assessments

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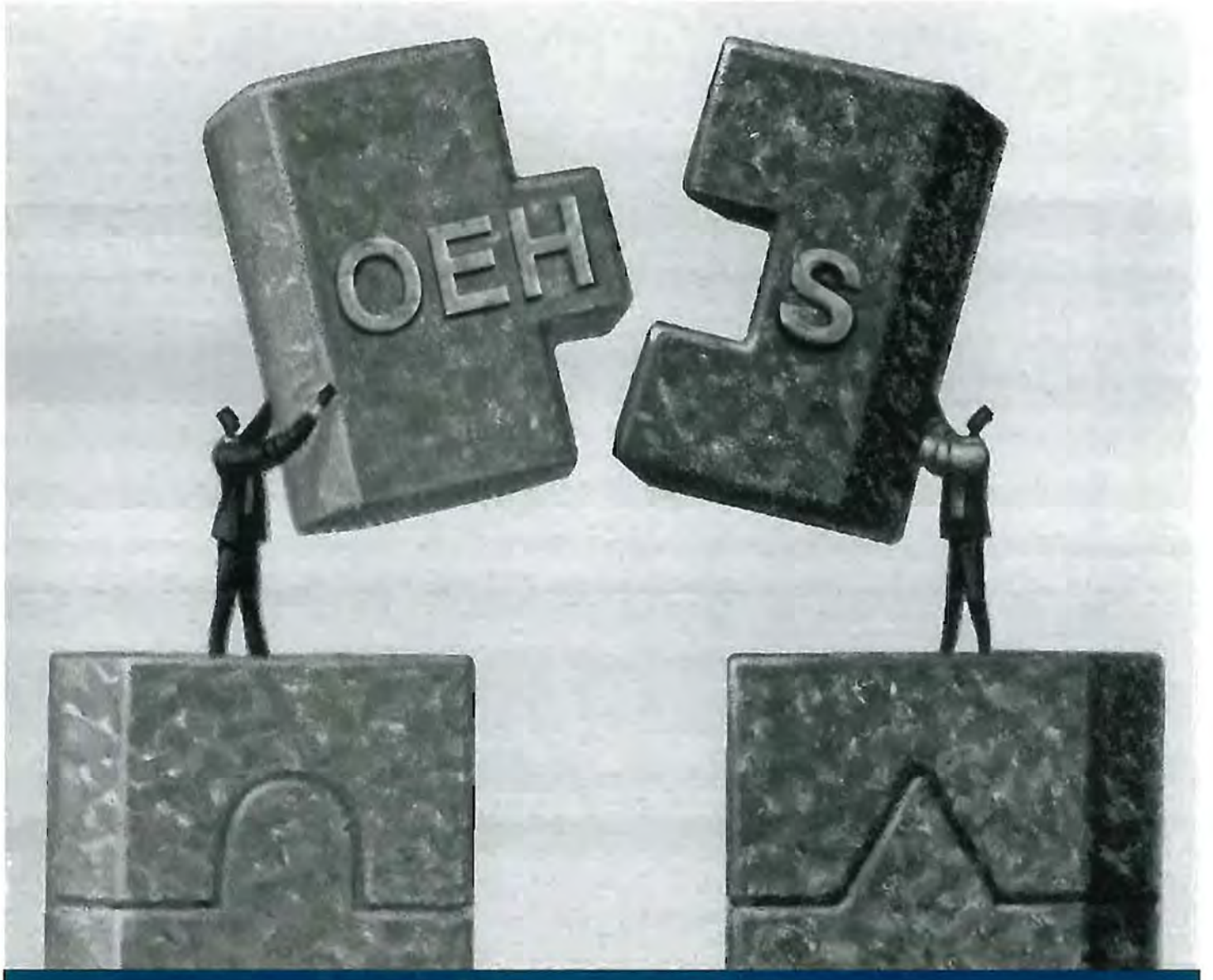

ABSTRACTS

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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