measurements represent bismuth-210 (and indirectly lead-210) while gross alpha measurements represent polonium-210. Measurements of gross beta and gross alpha activity increased dramatically during the Cerro Grande fire, which burned part of Los Alamos National Laboratory (LANL) in May 2000. Based on limited analyses for polonium-210 and lead-210, the cause of these increases was attributed to the long-term deposition and accumulation of these radon decay products on the vegetation and the forest floor which were resuspended by the fire and added to the existing ambient concentrations. With the heightened public scrutiny of LANL created by the Cerro Grande fire, the need to understand the gross alpha and gross beta measurements has also increased. About 400 archived filters were recounted for gross alpha and gross beta activity and then radiochemically measured for polonium-210 and lead-210. Our results show that the gross beta measurements represent bismuth-210 that is in radioactive equilibrium with its parent radionuclide (lead-210) as indicated by the constant concentrations since the original gross beta activity counts. The gross alpha measurements have increased since the original counts indicating that in-growth of polonium-210 from bismuth-210 has occurred. However, the gross alpha measurements are lower than the polonium-210 measurements apparently due to depth of radionuclide burial in the filters.

24.

TERRORISM PREVENTION PLANS FOR WATER SYSTEMS. C. Marlowe, Camp Dresser & McKee, Scotch Plains, NJ

The events of September 11th reminded us that environmental science and engineering exist to create places in which citizens can live free from harmful chemical and biological agents. The society that resulted after the planes crashed may require our talents and capabilities in new ways. For years, water and wastewater utilities have planned for emergencies in accord with AWWA pamphlet # M - 19 Emergency Planning for Water Utility Management and WEF manual of practice SM - 8 Emergency Planning for Municipal Wastewater Facilities.These emergency plans have always addressed the prevention of terrorism. That element has become more important. The authors of these procedures were probably thinking about hurricanes, but the principles apply well to control of terrorism. The rules require: a formal review of the potential system disruptions, a determination of the exposures that are unacceptable, and development of ways to mitigate for those unacceptable exposures.

This paper will describe the process by which authorities identify, evaluate, and control their vulnerabilities. Examples will be drawn from water extraction, plant operation, water storage, and distribution.

PF 105. Occupational Epidemiology

Papers 25–31

25.

DEVELOPMENT OF A RETROSPECTIVE JOB EXPOSURE MATRIX FOR CAPACITOR WORKERS EXPOSED TO PCB. N. Nilsen, M. Waters, M. Hein, M. Prince, E. Whelan, A. Ruder, E. Ward, NIOSH, Cincinnati, OH

Introduction: The carcinogenicity of polychlorinated biphenyls (PCBs) is being investigated in several NIOSH cohort studies. The purpose of this work was to develop period-specific job exposure matrices for a cohort of capacitor manufacture workers (n=7512, 22% women) who worked with PCBs from the 1940's until PCB use was banned in 1977. Methods: Records containing work histories, job descriptions, capacitor production factors, PCB usage trends, air samples, and serum levels were obtained. The job exposure matrix (JEM) was developed in five steps: (1) all job codes (n=509) were assessed for exposure determinants such as activities, mobility, and plant location, (2) jobs with similar exposure determinants were categorized together resulting in 33 categories, (3) for each category, exposure intensity (high-medium-low-baseline) and frequency (continuous-intermittent) were qualitatively rated separately for inhalation and dermal uptake, (4) for each category, the product of intensity (assigned based on the air sampling data) and frequency (fraction of day exposed) was calculated, and (5) categories with similar intensity-frequency products were collapsed into 12 exposure groups. Each job code was then assigned to one of the twelve exposure groups. The JEM was then modified for each era of stable exposure conditions. Results: The JEM was evaluated by comparison to serum levels for 171 workers in the cohort. Estimation based on the JEM was a better indicator of lower-chlorinated PCB serum levels than duration of employment (JEM r=0.40, duration r=0.18) and equivalent indicator of higher-chlorinated PCB serum levels than duration (JEM r=0.58, duration r=0.55). Conclusion: The JEM will be linked with work histories to develop individual cumulative PCB exposure estimates for use in assessing risk of cancer mortality and incidence in this cohort. These exposure estimates, derived from a more systematic and rigorous use of the exposure determinant data, should lead to improved accuracy of the risk estimates.

26.

CHEMICAL PROCESS BASED RECONSTRUCTION OF EXPOSURES: COUPLED VINYL CHLORIDE - CHLOROPRENE EXPOSURES DURING PROCESS CONTROL SAMPLING. N. Esmen, T. Hall, M. Phillips, E. Jones, University of Oklahoma, Oklahoma City, OK; G. Marsh, University of Pittsburgh, Pittsburgh, PA

In occupational epidemiology the exposure assignment requires the availability of sufficient amount of proper measurement data. The lack of such data would necessitate either extensive sampling of the tasks related to a process or in the absence of such a possibility, modelling of the exposure probabilities related to these tasks. We modelled the coupled vinyl chloride (VC) and chloroprene (CD) exposures for a specific job title of workers in a discontinued synthetic rubber production process during their normal duties, which included quality control sampling. Based on interviews conducted, operational information was gathered. Using operational process information, thermodynamic properties of the process stream constituents, assumptions that would be correct from the plant-engineering point of view and frequency as well as duration of quality control sampling, a complete mathematical model was constructed and evaluated. In order to obtain reliable results, it was necessary to utilise minute details such as hampered sample bottle handling containing fluid at -18°C by the use of heavy gloves.

The results suggest that in synthetic rubber production, even though vinyl chloride was a relatively "unimportant" by-product that was disposed of, there might have been significantly high VC exposures and the CD exposures are considerably higher than the exposures experienced after the changes that led to the discontinuation of the sampling process. We were able to categorise each exposure at three levels to be cumulated over time. While the results lead to a quantification of the potential range for exposures, it must be recognised that the quantities assigned must be treated as relative exposures and to ascribe a sense of absolute to the exposure levels to these numbers would not be justifiable. However, the relative values obtained may be anchored to exposures measured at current and past operation where measurement data is available and generate a relative continuum.

27.

CHEMICAL PROCESS BASED RECONSTRUCTION OF EXPOSURES: CHLOROPRENE EXPOSURE DURING BOIL-OVER IN OPEN KETTLE SYNTHETIC RUBBER PRODUCTION. T. Hall, N. Esmen, M. Phillips, P. Jones, University of Oklahoma, Oklahoma City, OK

In occupational epidemiology the exposure assignment requires the availability of sufficient amount of proper measurement data. The lack of such data would necessitate either extensive sampling of the tasks related to a process or in the absence of such a possibility, modeling of the exposure magnitude and probabilities related to these tasks. During the early years of synthetic rubber production (1940 mid 1970s) synthesis took place in open kettles. During open kettle operations, exposure to process emissions is dictated by surface area of the reaction mixture and the physical chemical characteristics of the reaction constituents.

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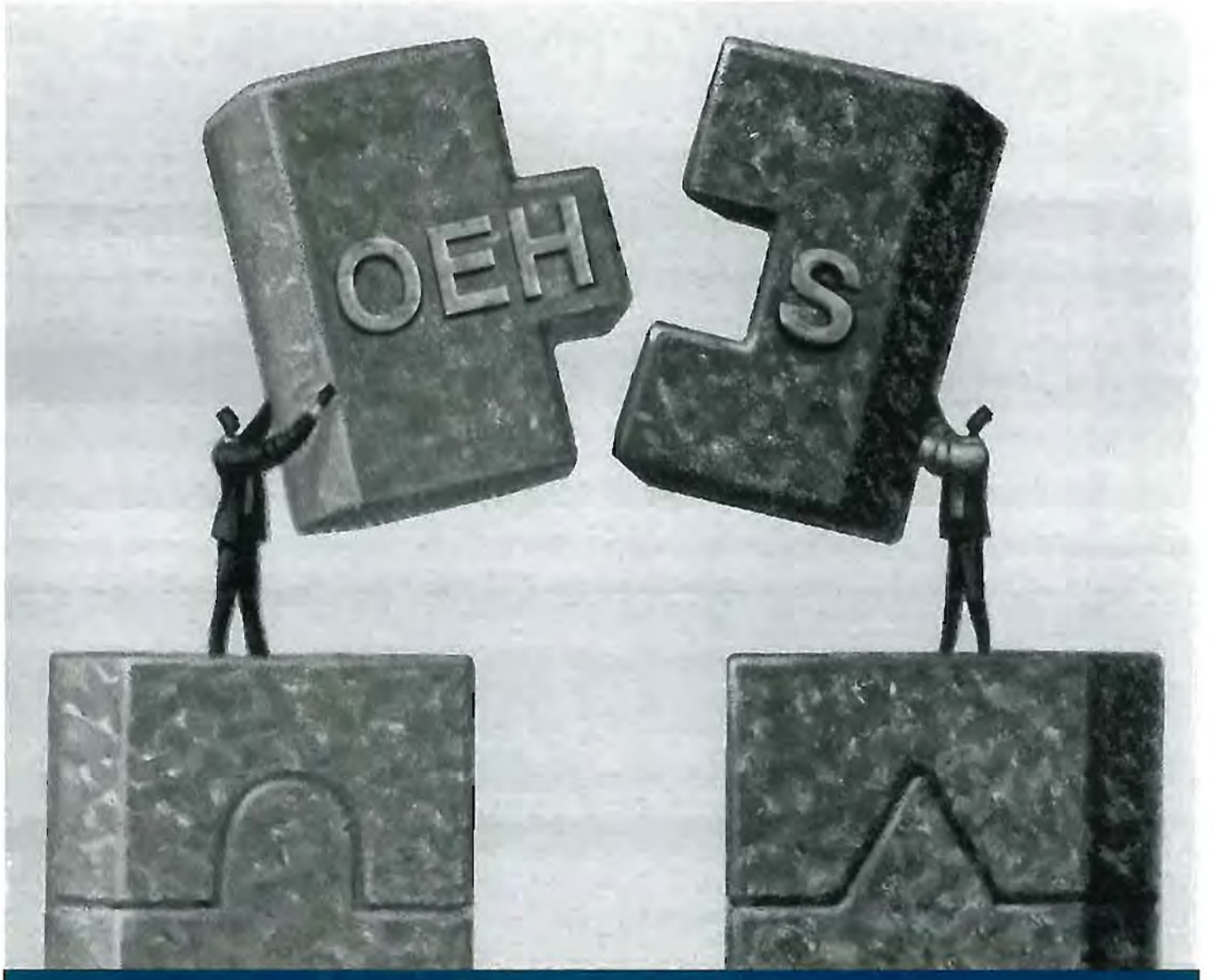

ABSTRACTS

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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