64.

BIOLOGICAL AND AIR MONITORING OF CHLORPYRIFOS EXPOSURES AMONG TERMITICIDE APPLICATORS: APPLICATION OF MIXED-EFFECT MODELS TO EVALUATE EXPOSURE DETERMINANTS. C. Hines, NIOSH, Cincinnati, OH; J. Deddens, University of Cincinnati & NIOSH, Cincinnati, OH

Biological and air monitoring was conducted for 41 termiticide applicators in North Carolina using chlorpyrifos. These exposure data were linked to detailed information on chemical use, tasks, personal protective equipment and hygiene in order to identify determinants of chlorpyrifos air exposures and urinary 3,5,6-trichloro-2-pyridinol (TCP) levels. Air and urine samples were collected on multiple days within one week from each applicator. Air samples were analyzed for chlorpyrifos according to NIOSH Method 5600. Urine samples were analyzed for TCP by gas chromatography with mass-selective detection. During the 202 applicator-days monitored, 415 treatment jobs were performed. Full-shift chlorpyrifos air exposures ranged from <0.048 to 110 µg/m3 (n=184), with a geometric mean (GM) of 10 µg/m3. TCP levels ranged from 9.42 to 1960 µg/g creatinine (n=271) and varied significantly by day of the week (GM range: 169-262 µg/g creatinine). Predictive models for chlorpyrifos air exposure and urinary TCP levels were developed using mixed-effects stepwise linear regression. Determinants of airborne chlorpyrifos exposure included minutes chlorpyrifos applied and enclosed crawl space treated (yes/no). Determinants of TCP levels (depending on the model) included day-of-the-week, the chlorpyrifos air concentration one and two days before urine collection, minutes of chlorpyrifos applied one and two days before urine collection, enclosed crawl space treated (yes/no), and commercial structure treated (time-weighted). Within- and between-worker variablity was similar for airborne chlorpyrifos; however, for TCP, between-worker variability exceeded within-worker variability by six-fold. The elimination half-life of TCP (26.9 h) and possibly the short sampling interval (one week) may explain the low TCP within-worker variability. Applicators' weekly mean ln(TCP levels) and weekly mean ln(chlorpyrifos air concentrations) were highly and positively linearly correlated (r2=0.73, p<0.0001). In summary, mixed-effects models were successfully constructed to predict airborne chlorpyrifos exposure and urinary TCP levels.

65.

HUMAN EXPOSURE SCENARIOS AND EXPOSURE MODELLING FOR BIOCIDAL PRODUCTS. J. van Hemmen, TNO Chemistry, Zeist, Netherlands

The European Biocidal Product Directive 98/8/EC requires registration of biocidal products on the basis of a risk assessment of their uses. There are 23 different biocidal product types, in four major groups: (1) disinfectants and general biocidal products, (2) preservatives, (3) pest control, (4) other biocidal products.

The aims of a project, funded by The European Commission and carried out by 7 Institutes and representatives from industry (Cefic), are: (1) to develop relevant exposure scenarios of humans to biocidal products, (2) to develop operational predictive model(s) and guidance on how to use these for the purpose of registration of the various biocidal active substances in the many different use and exposure scenarios identified. The project will be finished mid-2002.

Documented exposure data have been requested from industry (sectors), governmental agencies, and academia from North America and Europe. All relevant publications have been quality-assessed. From the study reports that were considered adequate, data are subtracted and compiled in a database. The majority of the data concern dermal exposures.

For use of the database two different approaches are taken. These are both based on the assumption that exposure is task-based and not dependent on specific chemical properties of the biocide. 1 For some tasks the database provides an adequate series of study results, meaning that for that task an exposure model can be developed. 2 A matrix is developed with two axes: one for width of distribution and one for central tendency of distribution, with 12 cells. All study results are entered in the matrix at the right cell(s).

In the second approach, Baysian statistics are used to develop an exposure assessment for tasks that have no specific exposure model, but do have assessable similarities with one or more of the other sets of data in the matrix.

66.

EXCRETION KINETICS OF SPECIFIC MERCAPTURIC ACIDS IN A VOLUNTARY AND A GROUP OF SUBJECTS OCCUPATIONALLY EXPOSED TO STYRENE. S. Ghittori, D. Cottica, S. Negri, A. Alessio, L. Maestri, Fondazione S.Maugeri, Pavia, Italy; M. Imbriani, Occupazionale e di Comunità - Università di Paviadi, Pavia, Italy.

Styrene (S) is an important chemical of wide industrial use. The initial step of S metabolism is conversion to styrene 7,8-epoxide (SO) that is considered directly responsible for most toxic effects of S and is present in two enantiomeric forms ((R)(+)-SO and (S)(-)-SO). The conjugation of SO with glutathione leads to the urinary excretion of specific mercapturic acids (PHEMAs), N-acetyl-S-(1-phenyl-2-hydroxyethyl)-cysteine (M1) and N-acetyl-S-(2-phenyl-2-hydroxyethyl)-cysteine (M2).

Here we studied the influence of alcohol consumption on the excretion kinetics of PHEMAs in a voluntary subject exposed to 20 mg/m3 of styrene for 8 hours with and without contemporary alcohol ingestion. Following exposure to S, the top of the excretion curve was obtained after 4 hours from the end of the exposure with a t 1/2 of 9 hours. The M1/M2 ratio changed from 0.67 at the end of exposure to 2.25 after 36 hours. After contemporary ingestion of alcohol the excretion of the metabolites was longer (t 1/2 = 15 hours) and the M1/M2 ratio was already inverted after few hours.

In a subsequent study we followed the excretion of PHEMAs on 10 subjects occupationally exposed to the solvent during a working week in order to evaluate whether the biotrasformation rate (BTR) of S into PHEMAs remained constant in each individual after repeated exposures.

The results showed a noticeable inter-individual variability in both BTR and t 1/2 at the beginning of the week. On the basis of the BTR values the subjects could be divided into low and high converters and this characteristic did not change during the week: only in some cases there were significant differences. In some subjects the levels of PHEMAs in pre-shift samples trend to increase during the week as a consequence of the slow excretion kinetics.

PF 110. Ergonomics Intervention

Papers 67–72

67.

EFFECTIVE ERGONOMICS PART 1: WHAT PROBLEM ARE YOU TRYING TO SOLVE? F. Schneider, Humantech, Ann Arbor, MI

The simple question "What problem are you trying to solve?" has a galvanizing effect on the deployment of ergonomics. In the majority of cases this question has never been addressed, or if addressed, has been answered with assumptions. To be effective in ergonomics, issues must be properly defined with reliable and valid data sets. Companies must consider such questions as:

1. Do you have ergonomics issues? Not all facilities do. A structured risk factor checklist will help you identify risk factors associated with musculoskeletal disorders.

2. What is an acceptable level of risk for your company? It's necessary to take several business factors into account.

3. Where is the unacceptable exposure? This information guides you toward the proper program or intervention.

4. Can the problems be fixed? Knowing what problems cannot be fixed is critical to saving time and resources.

This session will explain the importance of accurate 'problem definition' and how to apply the process and metrics of ergonomics to your company's business improvement initiatives.

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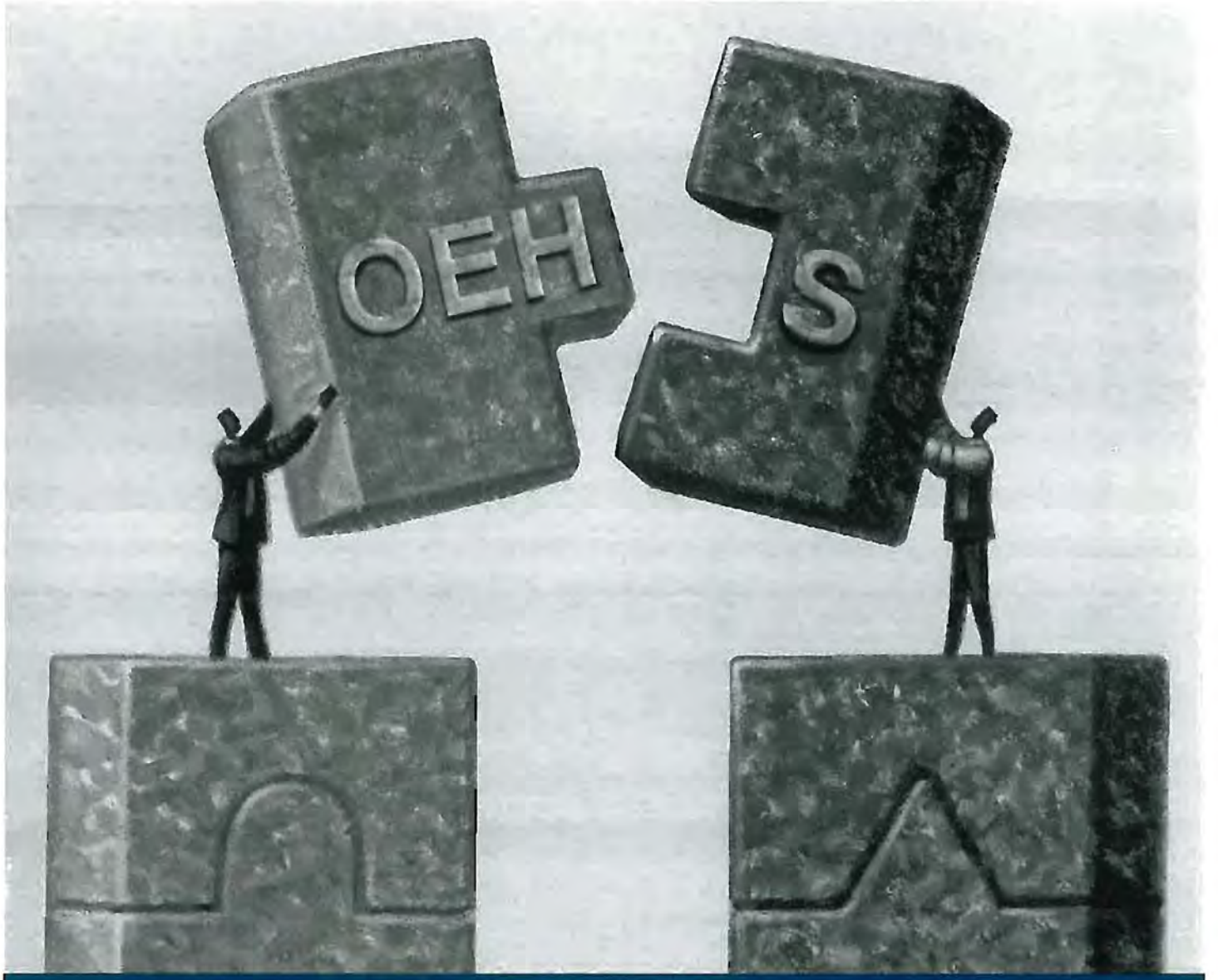

ABSTRACTS

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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