Quantifying airborne endotoxin is necessary for determining exposure levels that cause these health effects. Several scientific studies have demonstrated that quantifying detectable endotoxin is affected by differences in sampling media, extraction technique, and analytical method. This study performed side-by-side endotoxin sampling (n = 10) using a liquid impinger, glass fiber (GF) filter, and a polycarbonate filter in a waste-water treatment plant. Study results show that detected endotoxin is highest using the impinger method. Sampling method coefficients of variation show the GF filter as having the least variability between results. A Spearman's Rank Order Correlation Test identifies a correlation between the impinger and GF filter ($r^2 = 0.927$, $p < 0.01$), implying a correction factor can be applied between sampling methodologies. Overall, for enhanced precision, accuracy, and facility of use, GF filters appear to be the best endotoxin sampling method.

393.

AIRBORNE MICROBIAL ECOLOGY IN AN UNDERGROUND COAL MINE. C. Rao, J. Martin, J. Cocalis, NIOSH Morgantown, WV

Underground coal mines may be an environment with exposures to airborne fungi and bacteria. The environments are often water-laden due to dust-suppression systems, ground water seepage and/or high relative humidities.

We investigated the airborne microbial ecology at the longwall face of an underground coal mine. Samples for bacteria and fungi in air were collected in duplicate on 0.2 micrometer polyethersulfone filters using open-faced 37-millimeter cassettes at four locations (one location outside and three locations underground: at the headgate, the shearer and the tailgate). Air was drawn through the filters at a rate of 2.5 Liters/minute for either 3 or 5 minutes. The filters were washed, serially diluted, and then cultured onto malt extract agar for fungal count and speciation, or cultured onto trypticase soy agar for bacteria counts and speciation.

Fungi concentrations in the mine ranged to 9.6 x 10^3 Colony Forming Units per cubic meter of air (CFU/m^3) and bacteria concentrations ranged from below the level of detection to 1.4 x 10^5 CFU/m^3. The predominant fungal genus outside the mine was Cladosporium and the predominant fungal genera inside the mine were Cladosporium, Penicillia, and basidiospores. The bacteria found in the mine air included Actinomycetes, Rhodococcus, Actinobacter, and Pseudomonas.

The results indicate that airborne concentrations at the three underground locations were dependent upon the shearer location in relation to the sampling location and shearer activity level. In addition, there were differences in microorganism concentration and species outside and underground.

394.

VARIABILITY IN VIABLE AND NON-VIABLE MOLD SPORE SAMPLING RESULTS. L. Swenson, GlobalTox, Portland, OR; C. Robbins, W. Geer, GlobalTox, Redmond, WA

Industrial hygienists are asked to conduct sampling to determine the presence or extent of mold and to make recommendations for mold remediation. We are often faced with the question of the significance of one or two spores or colony forming units (CFUs) that are found indoors but not outdoors or in unaffected areas. Although the particular mold type may provide clues to possible indoor reservoirs or other issues, the presence or absence of a few spores or CFU may represent the inherent limitations of short term sampling and analysis of mold particles from the air. Little information has been published on the variability between duplicate samples taken concurrently. This paper discusses the types of fungal spores and levels of spores identified during sampling indoors and outdoors and provides a comparison of air sampling results for viable and non-viable mold spores. It presents an analysis of low numbers of mold types in paired samples and provides an estimate of the uncertainty around a few spores or CFUs in short-term viable and non-viable samples. Sampling is conducted outside, in unaffected areas (when possible), and in potentially affected areas. Duplicate samples of each type at each location are obtained in sequential order. Paired sample results indicate there is considerable variability for these short-term sampling techniques, especially in the ability to detect low levels of particular spore or CFU types.

395.

BIOLOGICAL CONTAMINANTS ASSESSMENT AT A FORMER TANNERY. L. Delaney, NIOSH, Atlanta, GA

Background: A tannery was abandoned in 1994 leaving behind equipment, files, chemicals, and processed and unprocessed hides, fleshings (pieces of skin and fat), and animal hair of unknown origin. In the summer of 2001, remediation workers began cleanup and removal of biological and chemical contaminants from the site. Remediation employees were concerned about the potential for exposure to anthrax and other microorganisms during these planned remediation activities.

Methods: A walkthrough of the site was conducted to visually evaluate the extent of biological contamination, evaluate work practices, and discuss strategies to minimize exposures to biological contaminants. Additional research after the site visit included a literature search on the biological hazards associated with tanneries and potential anthrax exposure and consultation with infectious disease researchers.

Findings and Conclusions: The potential for zoonotic disease from remediation activities at this tannery was minimal. Most zoonotic diseases can only be spread while the animal is still alive and would not survive outside a living host for extended periods. While Bacillus anthracis B. (anthracis) can sporulate and survive for many decades, the potential exposure to remediation workers was minimal due to the characteristics of the bacteria (low secondary aerosolization potential and high infectious dose concentration). Visible microbial contamination, consistent with mold growth that would occur in unmaintained facilities, was present throughout the site. Remediation of the site would likely result in the disruption of these microbiological reservoirs. As such, recommendations on personal protective equipment and work practices (i.e., wet method of decontainment, barrier isolation, and decontamination procedures) were provided to reduce exposures to bioaerosols. In addition, hazard communication training for biological contaminants was also recommended.

Aerosols

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396.

A CHRONIC BERYLLIUM DISEASE PREVENTION PROGRAM: USE OF A MULTIPLE EXPOSURE PATHWAY MODEL. M. Kent, M. Berakis, D. Deubner, Brush Wellman Inc, Elmore, OH; M. Corbett, M. McCawley, International Beryllium Consultants, Wilmington, DE

Despite numerous control measures taken between 1990 and 1998 in a beryllium ceramics facility, the rate of sensitization for chronic beryllium disease did not decline. Levels of air contamination were reduced as much as two orders of magnitude for some processes with a minimum of a ten-fold decrease overall. The sensitization rate remained at approximately 10% throughout this eight-year period with more recently hired employees becoming sensitized within as little as six months after their date of hire.

It was hypothesized that skin exposure might be the route of sensitization and that particle number concentration might be the pertinent metric for airborne exposure. Controls were then put in place based on these hypotheses. Gloves and shirtsleeves were required for all workers along with rigidly enforced change out procedures that included company provided clothing and mandatory showers. Powered air purifying respirators were made mandatory for all workers at all times while in production areas. Additional protection was supplied to workers at wet processes, where splashing was an issue, to maintain dry clothing and skin.

Sensitization rates for all new workers beginning after 1999, when the controls were put in place, dropped below one percent and have remained there for the last two years. It is unlikely that without sensitization any chronic beryllium disease will be seen in this group. These findings are being translated into programs at other facilities and into permanent control features within the ceramics facility.

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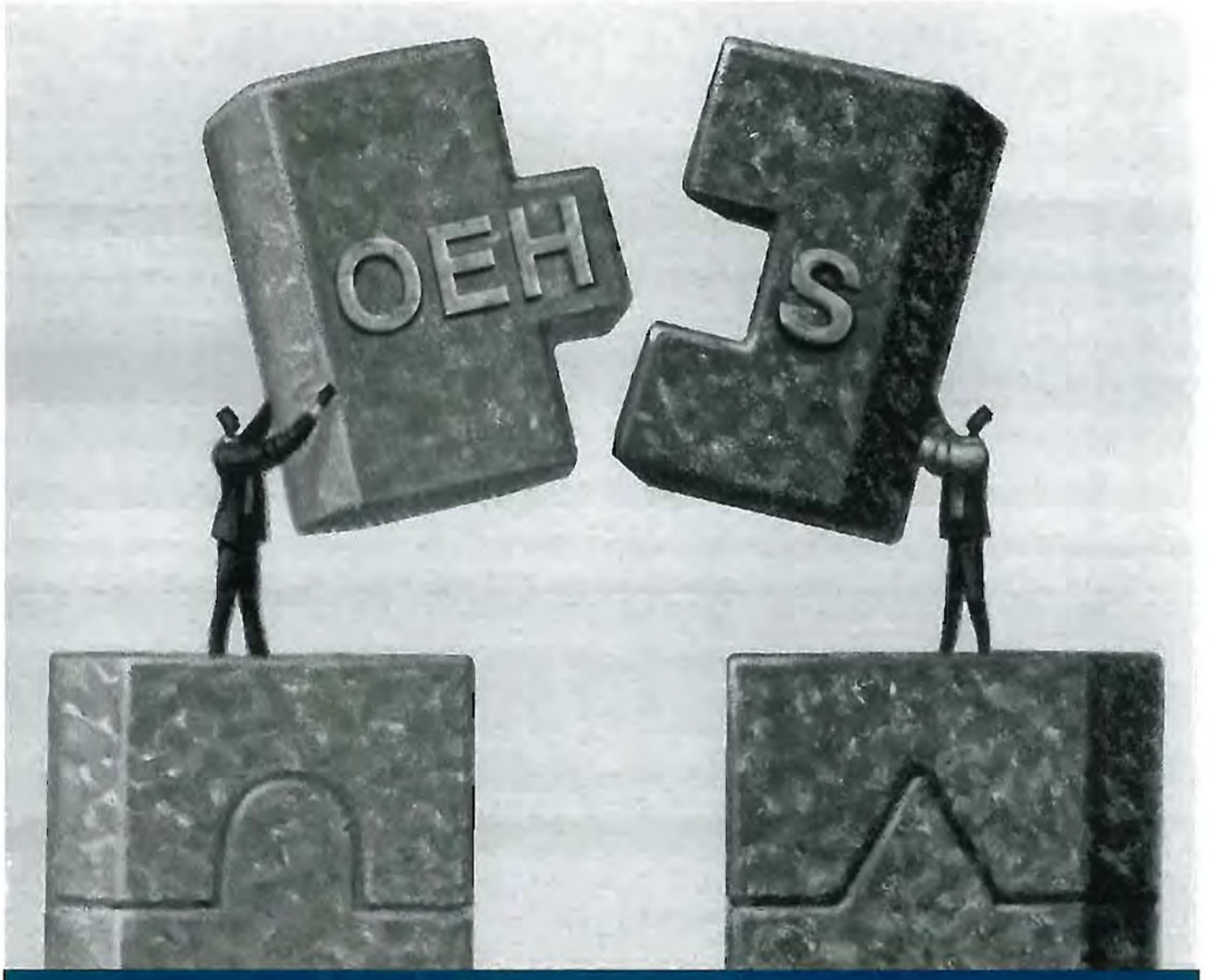

ABSTRACTS

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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