397.

ON THE NATURE OF AEROSOLS GENERATED DURING FLOCK PRODUCTION AND COATING. C. Piacitelli, W. Jones, NIOSH, Morgantown, WV

Flock refers to short fibers which are applied to a surface to produce a velvet-like finish. We have previously reported on dust levels and aerosol characteristics in a plant where nylon flock fibers are produced and applied to fabric backing material. High dust levels were recorded and microscopic analysis was used to identify a variety of particle types including small shreds of nylon.

Herein we report on results obtained from two additional flock plants. One plant produces flock fiber while the other is exclusively engaged in the process of applying flock fibers to backing material. In addition to nylon, these plants processed rayon, acrylic and polyester fiber.

Measurements were made for respirable, thoracic and total dust. Fiber counts were made using the NIOSH 7400 method. In order to relate workplace dynamics to exposure, real time dust measurements were made using photometers and related to time synchronized video. Dust samples were examined using both light and electron microscopy.

Average area fiber counts were about 0.5 fibers/cm^3 in the flock production plant and 3 fibers/cm^3 for the flock coating operation. Area levels of the various measures of size selected particulate were generally less than 0.3 mg/m^3 in the flock production plant and 1.5 mg/m^3 in the coating plant. Personal measures of dust and fiber at both plants were typically below 1 mg/m^3 and 1 fiber/cm^3 respectively. Real time dust/video analysis clearly linked peak exposures to cleaning operations.

Although the dust examined at these plants was qualitatively similar to the dust measured in our first study, levels were lower. Microscopic examination of air and bulk samples suggests that the tendency to form small shreds of synthetic fiber during this process is not unique to nylon.

398.

EMERGING ISSUE: ULTRAFINE PARTICLES FROM COARSE SILICA GEL AS A POTENTIAL INHALATION HAZARD. J. Martin, M. Hoover, J. Cocalis, NIOSH, Morgantown, WV

Silica gel is not known to produce significant disease or toxic effects when total dust exposures are kept under 10 mg/m3. In response to a worker inquiry as to whether silica gel desiccant used in a well-ventilated confined space could cause or exacerbate small airways disease, NIOSH obtained a bulk sample of the silica gel desiccant for analysis by scanning electron microscopy. Photomicrographs showed the dominant particles to be greater than 200-400 micrometers in diameter, which by definition are non-inhalable and would not relate to small airways disease.

A closer look at the SEM samples revealed that the surfaces of the large particles were littered with smaller particles. Most were less than a micrometer in diameter and some were smaller than 0.2 µm. If detached, these particles could penetrate into the small airways.

Mild agitation of the bulk silica gel produced a visible plume similar in appearance to that of a fine aerosol. Plume samples revealed ultrafine particles with exponentially more surface area per unit mass than the coarse particles. Some of the fine particulate was fiber-like in shape. The particles were found to be amorphous, not crystalline. This ultrafine component may have differing toxicity and exposure potential than the coarse particulate. For example, coarse particles of titanium dioxide are not associated with toxic effects, but ultrafine particles of titanium dioxide cause severe lung injury.

The presence of an ultrafine component to coarse silica gel powders indicates the need for adequate engineering controls and respiratory protection when handling these materials. Additional evaluations, including inhalation toxicology studies are needed to determine whether ultrafine silica particles pose a special hazard.

399.

PERSONAL EXPOSURE TO POLYCYCLIC AROMATIC COMPOUNDS AND PARTICLE SIZE DISTRIBUTIONS IN ASPHALT PAVING FUME. K. Hanley, J. Fernback, NIOSH, Cincinnati, OH; J. Meeker, M. McClean, R. Herrick, Harvard University, Boston, MA

Asphalt fume is a complex mixture of aliphatic and aromatic hydrocarbons, cyclic alkanes, and heterocyclic compounds containing S, N, or O. Irritation has been reported and low levels of possible carcinogenic polycyclic aromatic compounds (PAC) are present in asphalt fume. The objective of this study was to measure the particle size of asphalt paving fume to more effectively characterize worker's exposures. Eight area and 8 personal full-shift air samples were collected with impactors and HPLC analysis was used to determine PAC concentrations with cut-points of 10, 3.5, 1, and 0.5 mm. Because of analytical limitations from co-eluting compounds, total PAC was measured with NIOSH method 5800 using 370 and 400 nm emission wavelengths. The 370 nm detector is more sensitive to 2-3 ring PAC; the 400 nm detector is more sensitive to larger PAC. Vapor PAC was sampled with sorbent tubes behind the impactors. Particle size distributions were also screened using an optical particle counter (OPC) and scanning electron microscopy (SEM).

Workers' exposure to particulate concentrations ranged from 24-149 and 3.4-29 mg/m3 for PAC370 and PAC400, respectively, suggesting smaller PAC was more abundant. Breathing zone PAC results show that asphalt paving fume is a fine aerosol, with approximately 81-96% being respirable; mass median diameters (MMD) were 0.8-1.2; 0.6-1.0; and 0.6-0.7 µm for the paver operator, screed operators, and lutemen (most GSD ~ 2-3). Vapor PAC accounted for 21-41% of the total PAC. The OPC showed that ~90% of the fume was detected in particles <3.5 µm and confirmed that lower MMDs occurred as the work location was further removed from the paving tractor. SEM analysis revealed the fume to be bimodal with large numbers of particles <0.5 µm. This study demonstrates that paving workers are exposed to PAC which penetrates to the alveolar regions.

Lead

Papers 400–406

400.

AN EVALUATION OF LEAD EXPOSURES DURING EXTERIOR RENOVATION ACTIVITIES. G. Piacitelli, A. Sussell, NIOSH, Cincinnati, OH

The National Institute for Occupational Safety and Health (NIOSH) conducted a study of lead exposures during exterior renovation involving lead-based paint (LBP). Worker personal airborne lead (PbA) exposures were assessed for eight different paint removal tasks during a demonstration project at a vacant multi-family housing site. Workers performed randomly-assigned tasks during limited work periods on painted surfaces; paint lead concentrations ranged from 0.23% to 34% Pb by weight.

Personal PbA exposures were highly variable and ranged from none detected (ND) to 660 µg/m^3 (GM=22 µg/m^3, GSD 4.3). Task, worker, and paint lead concentration were jointly significantly associated with PbA exposures in a multi-variate model ($p<.0001$). Paint lead concentration alone was poorly correlated with PbA exposure (R=0.30).

High-exposure tasks were dry manual sanding (GM=49 µg/m^3), dry manual scraping (53 µg/m^3), power finish sanding (44 µg/m^3), and power finish sanding with dust bag (68 µg/m^3). Low-exposure tasks were power sanding with HEPA filter (GM=6.9 µg/m^3), wet manual sanding (6.2 µg/m^3), wet manual scraping (16 µg/m^3), and flame burning (23 µg/m^3).

Since task-associated exposures were measured over short durations (average time=28 minutes), results are not directly comparable to the OSHA PEL-TWA (50 mg/m3). However, the GM was used to determine the time that a task could be performed without exceeding the PEL over an 8-hour period. For the high-exposure tasks, the average time to reach the PEL ranged from 2.4 hours for power sanding with bag to 4.4 hours for dry manual scraping. Exposures from the low-exposure tasks would not, on average, exceed the PEL within 8 hours.

Results from this study indicate that prolonged use of certain types of paint removal tasks, such as dry sanding, dry scraping, or power sanding without HEPA-filtered exhaust, should be avoided when renovating exterior surfaces with lead paint.

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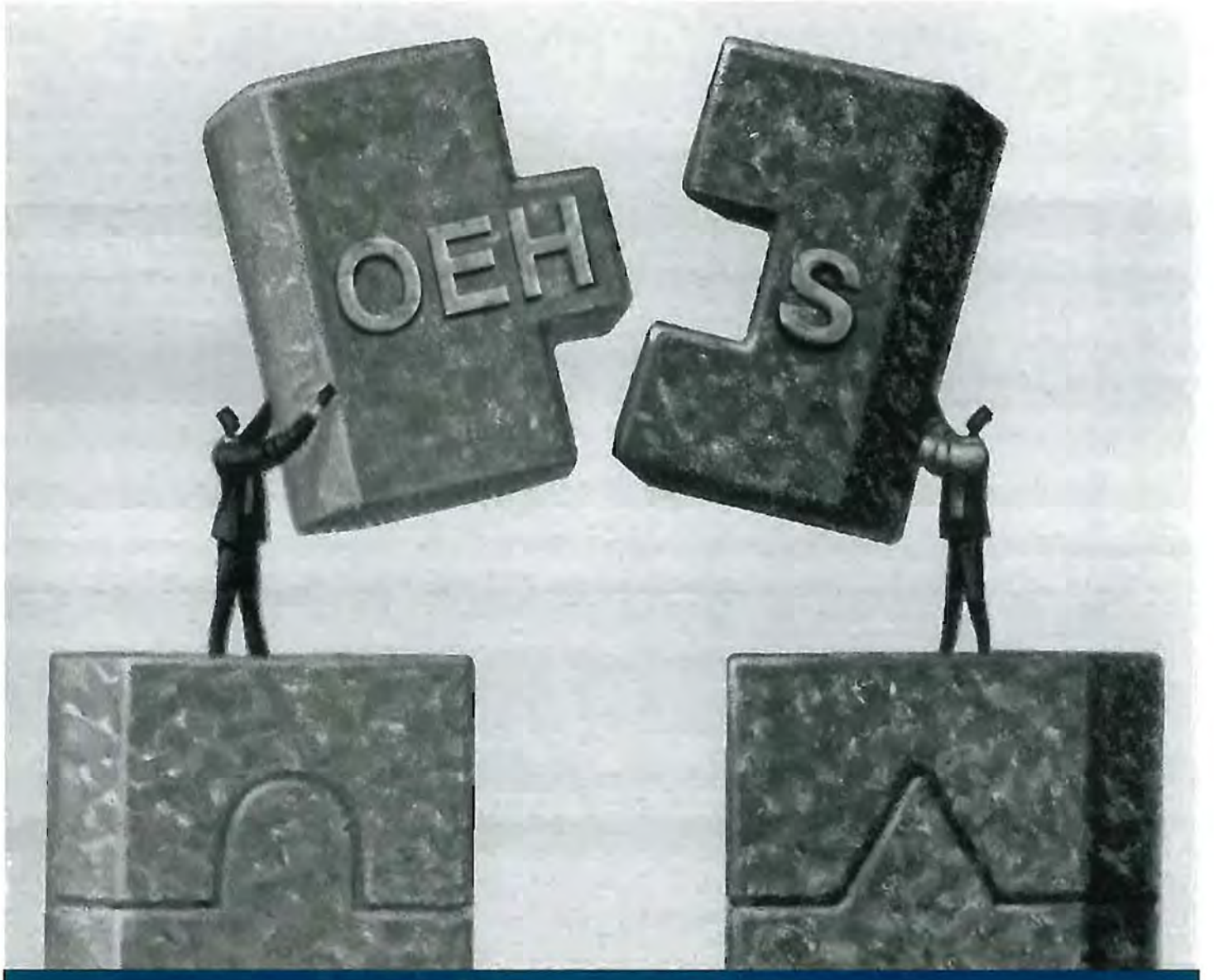

ABSTRACTS

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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