

## 401.

### **WHEN CLEAN IS NOT REALLY CLEAN—RESULTS OF HAND WIPE SAMPLES FOR LEAD.**

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**Background:** NIOSH investigators conducted a health hazard evaluation at a manufacturer of industrial lead-acid batteries used for motor-powered applications and stationary installations. Workers were concerned about potential health hazards with the manufacture of lead-acid batteries.

**Methods:** In addition to air monitoring, a total of 49 hand and surface wipe samples for lead were collected to evaluate the effectiveness of worker hand-washing and identify surface lead contamination in the employee lunchroom. All of the wipe samples were collected by using individually wrapped towlettes according to NIOSH Method 9100. Employees were requested to wipe their hands prior to entering the lunchroom. Another hand-wipe sample was collected immediately following lunch but prior to entering the work area. Surfaces sampled included door handles, a turn-style bar, vending machine push buttons, and a phone handset. A direct-indicating qualitative check for lead contamination on workers hands was also done.

**Results:** The results from hand wipes from workers before lunch was 653 micrograms ( $\mu\text{g}$ ) of lead per hand wipe, compared to an average of 891  $\mu\text{g}$  of lead per hand wipe after lunch. Additionally, workers from high airborne lead exposure departments had more lead on their hands (even after washing their hands) than the employees working in lower airborne lead exposures areas. The surface wipe sample results ranged from 90 to 750  $\mu\text{g}$  of lead.

**Conclusions:** Employees emerged with more lead on their hands than when they first entered the lunchroom and surface lead was found. Workers were reminded of the potential of getting lead on their hands when they touched contaminated clothing and other articles. Further investigation was recommended to check how thoroughly employees washed their hands and to identify sources of lead contamination in the lunchroom. The qualitative lead check method used in this study would be a useful personal hygiene evaluation technique.

## 402.

### **A FIELD TEST OF TWO MOIST-CLOTH WIPES FOR SAMPLING LEAD IN SURFACE DUST.**

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A recent NIOSH health hazard evaluation, conducted for a small neon-sign manufacturer, provided an opportunity to compare two moist cloth wipes (Ghost wipes® and Wash'n Dri®) used to sample lead (Pb) in surface dust (NIOSH Method 9100). Each of two work surfaces (right and left) was sampled using a template in four side-by-side locations. In one of these four locations, a first-wipe sample with a Ghost® wipe was followed by second-wipe

sample with a Wash'n Dri®. In other locations, a Wash'n Dri® was followed by a Ghost® wipe, a Ghost® wipe was followed by a Ghost® wipe, or a Wash'n Dri® was followed by a Wash'n Dri®. This same pattern of samples was repeated on the second work surface, resulting in a total of eight samples. Both types of wipes were analyzed using NIOSH Method 7300. A t-test of the two types of surface wipes revealed no significant difference between them with regard to the amount of Pb collected on the first wipe (Ghost® mean = 47 micrograms Pb, Wash'n Dri® mean = 34 micrograms Pb,  $p = 0.67$ ). However, a marked difference existed between the lead collected from the two work surfaces (mean of left surface = 12 micrograms Pb, range 10 - 13; mean of right surface = 71 micrograms Pb, range 46 - 90). More important, the relative collection efficiency, defined by ASTM as the ratio of the amount of lead collected with the first-time wipe to the amount of lead collected with the second-time wipe, was less (range from 1.4 - 4.1) from an area with a heavy lead loading than with a light lead loading (range from 4.8 - 8.7). Based on the differing relative collection efficiencies, we concluded that wipe samples may have limitations when comparing surfaces containing differing amounts of lead.

## 403.

### **EVALUATION OF BIAXIAL ELECTROGONIOMETERS FOR ERGONOMIC POSTURE LOADING DURING LEAD ABATEMENT AND RISK ASSESSMENT TASKS.**

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Risk factors of lead abatement work and lead risk assessments are task dependent and can involve awkward postures and repetitive motions. An electrogoniometer system was tested for ergonomic posture evaluations on the wrist and elbow. Accuracy testing and lab-evaluation were performed on two types of biaxial electrogoniometers (Penny and Giles Ltd.). These electrogoniometers are designed to measure the angular displacement between two end blocks of an electrogoniometer in two planes. First, the electrogoniometer was attached to a manual universal goniometer (JAMAR) and moved about the axis in 2° increments to measure angles between -150° and 150° (as recommended by the manufacturer). Based on three trials, regression coefficients for electrogoniometers XM65 (wrist) and XM110 (elbow) in the X plane were 0.9996 and 0.9997, respectively. In the Y plane, regression coefficients were 0.8321 and 0.9987, respectively. Next, the electrogoniometers were evaluated in the laboratory by comparing arm posture angles with a 3-D computerized motion analysis system (MOTUS, Peak Performance Technology). For this evaluation, a subject wore the electrogoniometers as well as passive reflective markers on the joints of interest. The subject began in a neutral position and then performed static and dynamic posture tasks in a standard protocol which

included bending the elbow 90° or extending the wrist 40° in both planes. These tasks were performed on two different days to address not only the evaluation of the system, but also placement issues. The average difference in degrees during static and dynamic tasks for the XM110 was 7°. The average difference during static and dynamic tasks for the XM65 in the X and Y planes was 4°. These two evaluations showed that the electrogoniometers meet our requirements for obtaining posture data on lead abatement workers and risk assessors. The electrogoniometers are currently in use at lead risk assessment and abatement sites.

## 404.

### **THE INFLUENCE OF EXTERIOR LEAD-CONTAMINATED DUST AND SOIL ON POST-INTERVENTION INTERIOR DUST LEAD LOADING.**

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To aid in understanding the contribution of exterior dust/soil lead to post-intervention interior dust lead, a subset of housing in the Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program was selected for collection of exterior entry and street dust, obtained by a vacuum method, and composite building perimeter soil core samples. Although interior dust wipe lead samples were collected by Evaluation grantees at several times, both pre- and post-intervention, exterior dust samples were not collected and soil samples were collected by only a few grantees. Results from 500 dwelling units revealed a wide range of exterior dust and soil lead levels both within and across the 12 contributing grantee sites. Minimum and maximum geometric mean dust lead loadings, by grantee, were: 126 and 14,400  $\mu\text{g}/\text{sq ft}$  for exterior entry dust; 325 and 4,750  $\mu\text{g}/\text{sq ft}$  for street dusts and for soil lead mean concentrations ranged from 383 and 2,710 ppm. Exterior entry dust lead concentration was about five times as high as street dust lead concentration suggesting that lead in dust near housing was a source of lead in street dust. Geometric mean exterior dust lead loading was more than five times higher than window trough dust lead loading and at least an order of magnitude higher than interior entry dust lead loading. Soil was not present for almost one-half of the housing units and although statistical analysis revealed several paint factors contributing to soil lead, a pathway from soil lead to dust lead was not detected. Statistical modeling revealed statistically significant pathways from both exterior entry and street dust lead to interior dust lead loading on entryway floors, other interior floors, window sills and troughs. The inclusion of measures to mitigate the role of exterior sources in lead hazard control programs needs consideration.

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## ABSTRACTS



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## PF 101 Agricultural Health and Safety

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### 1. RELATIONSHIPS BETWEEN WORK EXPOSURE AND RESPIRATORY OUTCOMES IN POULTRY WORKERS.

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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 fac-

ilities. 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<sup>3</sup>, 10.01 ±8.84 mg/m<sup>3</sup>; endotoxin 6046±6089 EU/m<sup>3</sup>, 5457±5934 EU/m<sup>3</sup> 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<sub>1</sub>, 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