

417.

CONTROL OF WOOD DUST EXPOSURES DURING MANUAL SANDING.

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Woodworkers are routinely overexposed to wood dust when they use powered hand-sanding tools for the surface preparation of wood furniture. Exposure to wood dust causes nasal cancer in human, and other health effects including bronchial asthma, chronic bronchitis, hypersensitivity pneumonitis, and allergic contact dermatitis. Certain hardwoods, including those which are preferred in furniture manufacturing, appear to be associated with higher toxicity. In response to the research linking wood dust to adverse health outcomes, occupational exposure limits have been lowered. The current ACGIH TLV® is 5 mg/m³ for soft wood dust, and 1 mg/m³ for certain hardwoods.

The current study documents reductions of exposures in two cabinet shops, which were surveyed to evaluate employee exposure to wood dust during the use of non-ventilated palm sanders. At one facility, two face frame sanders were evaluated and at the second facility three case sanders were evaluated. Samples were collected in aluminum-shielded cassettes on 5-micron PVC filters, using Gilair 5 sampling pumps at 2.0 LPM. Analysis was done at the Wisconsin Occupational Health Laboratory (WOHL) per NIOSH methods 0500/0600. Breathing zone concentrations for the face frame sanders and case sanders ranged from 16 to 107 mg/m³ and both the OSHA PEL (15 mg/m³) and ACGIH TLV's® were exceeded. Both facilities changed to sanders with dust collection systems to reduce wood dust exposure. The follow-up exposure monitoring ranged from 1.4 to 10.7 mg/m³, a reduction of greater than 80%. Employee exposure to wood dust during hand sanding operations was substantially reduced. The controls used are readily available, and economically feasible. However, these effective controls are not in widespread use.

418.

A NUMERICAL AND EXPERIMENTAL INVESTIGATION OF CRYSTALLINE SILICA EXPOSURE CONTROL DURING TUCK-POINTING.

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Respirable crystalline silica continues to threaten the respiratory health of workers. National Institute for Occupational Safety and Health (NIOSH) researchers investigated control measures for the removal of mortar between bricks, using a grinder. This task, "tuck-pointing," is associated with crystalline silica exposures many times greater than the Permissible Exposure Limit (PEL) enforced by the Occupational Safety and Health Administration. Previous studies showed that local exhaust ventilation (LEV) of the grinding wheel through a shroud was often ineffective.

Tuck-pointing occurs on a scaffold, which limits the size and power of the LEV system. Thus, the goal of this study was to reduce the flowrate necessary for exposure control. Control addresses flow induced by the rotating grinding wheel, flow induced by the mortar particle stream, and particle momentum. Computational fluid dynamic (CFD) simulation of the grinder, supported by some experimental measurements, showed the relative importance of these factors through varying parameters and tracking particles. A simulation with the grinding wheel in a gap between the bricks, but with no particles, induced an airflow of 7.14 cfm out of the shroud exhaust, 6.5% less than the experimental measurement. With no gap the induced airflow was -0.461 cfm (0.461 into the exhaust take-off). However, when a stream of 10 um particles was launched from the grinding wheel edge, the simulations with and without the gap had nearly identical induced flow rates, 10.8 and 10.9 cfm. Experiments and simulations indicated that between 80 and 100 cfm was required for good control of silica exposure, making induced flows relatively unimportant. In the simulations angle of particle launch affected whether a particle was captured. Stopping the particle stream through collision greatly reduced the required flow rate. This is difficult in practice because the gaps between the shroud and the brick and between bricks create escape paths.

419.

MATERIAL CONTAINMENT SYSTEM EVALUATIONS USING SIZE SELECTIVE PLACEBOS TO BETTER PREDICT OCCUPATIONAL EXPOSURE CONTROL.

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Material containment systems for the pharmaceutical industry represent significant capital investments. Handling of bulk materials such as active pharmaceutical ingredients (API), isolated intermediates, and raw materials continue to pose both engineering and occupational exposure control challenges. Simply targeting exposure limit criteria as a primary design specification does not always guarantee success due to particle size inconsistencies between the vendor test material and bulk material of concern. Factory acceptance testing has become more prominent in recent years to provide assurance that selected controls can achieve desired levels of containment. By implementing a test method using a particle size selective placebo, evaluations of containment and barrier technology systems can be more effectively assessed based on material characteristics prior to equipment purchase. This test method was validated by utilizing a cost effective placebo selected for its particle size correlation, lower toxicity, physical property similarities, and cleanability. The evaluation included personal, area, diagnostic real-time aerosol monitoring, and swipe sampling

for multiple system configurations. The different monitoring techniques provided a unique perspective into the containment system operation including estimation of operator exposure, correlation of general contamination to fixed positions, and exposure source identification. Scenarios were structured to evaluate various system configurations such as material of construction, batch size, and ventilation parameters. After each scenario, real-time monitoring results provided feedback that enabled engineering control design optimization. These changes resulted in an engineering control system configuration that was capable of maintaining particulate concentrations below occupational exposure limits for the API of concern. The particle size selective placebo test method allowed effective evaluation of engineering controls prior to purchase. Benefits obtained included performance criteria verification, multiple scenario testing to avoid costly post purchase designs modifications (e.g., retrofitting), elimination of personal protective equipment needs, and ultimately compliance with occupational exposure limit goals.

420.

EXPOSURE CONTROL OF SOFTWOOD DUST IN MANUFACTURED HOME FACILITIES.

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Background: Inhalation of excessive levels of dust may cause nasal dryness, irritation, nasal obstruction, coughing, sneezing, wheezing, and nose bleeding. Other effects of inhalation may include bronchial asthma, sinusitis, prolonged colds, and respiratory problems. Skin and eye exposure may lead to allergic contact dermatitis and eye irritation. Additionally, wood dust is classified as a carcinogen to humans by the International Agency for Research of Cancer (IARC). The study was conducted at a manufacturing home facility in the Cabinet and Counter Top Assembly Area. This area has 5-7 employees whose job description requires them to use table saws to cut the wood they use to make cabinets and counter tops.

Methods and Results: This case study details an attempt to control over exposure to wood dust in a manufacturing home facility. Cabinet and Counter Makers operating table saws were overexposed to softwood dust. Results of personal breathing zone sampling ranged in concentration from 6.8 to 11.7 milligrams per cubic meter (mg/m³). At the time of the initial monitoring employees were not required to wear respirators and no engineering controls had been established. Results were above the American Conference of Governmental Industrial Hygienist (ACGIH) TLV of 5.0 mg/m³ for softwood.

Recommendations: Recommendations and designs were provided to the company to install exhaust hoods above the table saws. The hoods serve as both a guard and ventilation for the saw. During the interim employees were placed in a respiratory protection pro-

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ABSTRACTS



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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 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/m³, 10.01 ±8.84 mg/m³; endotoxin 6046±6089 EU/m³, 5457±5934 EU/m³ 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 FEV₁, 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