considerably workers' balance on the narrow roof planks.

In conclusion, proper shoe selection and improvements in the design of specialized work footwear would enhance workers' stability at height, and can be an effective intervention strategy to reduce the risk of falling.

Podium Session 128: Aerosols

Papers 213–221

213

AEROSOLIZATION OF FINE PARTICLES AND ENDOTOXIN FROM METALWORKING FLUIDS CONTAMINATED WITH MICROORGANISMS. H. Wang, S. Grinshpun, T. Reponen, University of Cincinnati, Cincinnati, OH.

Metalworking fluid (MWF) exposures have been associated with adverse health effects, such as dermatitis, respiratory symptoms, asthma, and in some cases hypersensitivity pneumonitis. No sufficient information has yet been collected on the size distribution of particles aerosolized from MWFs contaminated with microorganisms and airborne endotoxin concentration. We have recently developed a laboratory-scale setup, which simulates grinding operations in the MWF industry. Our preliminary study with this simulator showed increased aerosolization of fine particles from semisynthetic MWF after the fluid was inoculated with *Pseudomonas fluorescens* under laboratory-controlled conditions. In the present study, we investigated the aerosolization of fine particles and endotoxin from two types of water-soluble MWFs—semisynthetic MWF and soluble oil—after the fluids were inoculated with *P. fluorescens* in the laboratory. The simulator was also utilized to test used fluids that were brought from the field sites. The concentration of fine particles was measured using a condensation nucleus counter (P-track, model 8525, TSI Inc.). Particle size distributions and collection of particles for endotoxin analysis were performed by an electrical low-pressure impactor (ELPI; 3935 series, Dekati Ltd., Tampere, Finland). The endotoxin analysis was performed with limulus amoebocyte lysate assay. It was found that after bacterial inoculation, semisynthetic MWF had a greater increase of fine particle aerosolization than soluble oil. The peak of the fine particles aerosolized from used MWFs (aerodynamic diameter, $d_a = 0.029$ μm) and that from MWFs inoculated with bacteria ($d_a = 0.037$ μm) were smaller than that of pure bacterial water suspension. Particles at the size smaller than intact bacterial cells contained significant concentration of endotoxin. This indicates that some of the fine particles may come from the cell wall fragments of the bacteria in the MWFs.

214

MIST GENERATION FROM VEGETABLE OIL-BASED METALWORKING FLUIDS BY THREE MECHANISMS. S. Kim, P. Raynor, University of Minnesota, Minneapolis, MN.

Vegetable oil-based metalworking fluids (MWFs) may pose fewer health concerns and reduce disposal costs relative to traditional MWFs made using petroleum-based oils. Mist generation by the impaction, centrifugal force, and evaporation/recondensation mechanisms for several experimental vegetable oil-based MWF formulations was measured. The amount of mist formation was compared to generation with a traditional petroleum-based soluble oil. The mist generated by a lathe-mimicking apparatus traveled through a wind tunnel and was sampled by a real-time particle counting and sizing instrument. Five experimental emulsions were formulated and tested with one commercial petroleum-based formulation and one commercial vegetable oil-based formulation. The vegetable oil-based emulsions produced about the same quantity of particles by impaction as the petroleum-based emulsion, except for the air-oxidized experimental fluid. Most of the vegetable oil-based fluids generated more droplets by centrifugal force than the soluble oil. However, the numbers of droplets measured for the air-oxidized soybean oil were generally not different statistically from the quantity of mist observed using the soluble oil. Although the commercial vegetable oil-based emulsion demonstrated about the same amount of mist generation as the soluble oil in the evaporation/recondensation tests, the experimental fluids generally exhibited between 30 and 90% less mist formation than the soluble oil. The experimental fluid that performed best in these experiments was the air-oxidized modified soybean oil. Actual machining tests with this fluid are necessary to verify reductions in mist generation.

215

AIRBORNE RESPIRABLE CRYSTALLINE SILICA FROM FLY ASH AT COAL FIRED POWER PLANTS. J. Hicks, Exponent Inc., Oakland, CA; J. Yager, EPRI, Palo Alto, CA.

Coal fly ash is the primary solid waste generated from coal combustion. Workers at coal fired power plants may encounter this fine powered ash material during day to day handling of the solid waste, and during maintenance activities, especially during routine outages when interior chambers of the boiler and ash removal equipment are entered by work crews. Much of the ash is in the respirable size range, and may easily become airborne. In interior chambers of the boiler and associated structures, ventilation is often limited, and airborne ash is readily noticeable. This ash contains detectable levels of crystalline silica, in the form of alpha quartz, representing a potential silicosis hazard. This study presents the results of breathing-zone respirable air sampling and analysis for quartz during both nonmaintenance and maintenance activities at six coal fired power plants that utilized different types of coal. This work was conducted as part of a large coal fly ash exposure assessment, in which the field work was completed approximately 10 years ago. The coal types studied included western sub-bituminous, interior and eastern bituminous, and lignite, all mined domestically in the United States. Workers engaged in a wide cross-section of normal activities were sampled over their full work-shifts to determine airborne concentrations of respirable crystalline silica. Air samples were collected using standard miniature cyclones as the pre-selection dust sampling device, and the collected dust samples were analyzed by gravimetric and X-ray diffraction methods. The air sampling and analytical results are compared to current and proposed occupational health exposure limits. The results revealed that a significant fraction of the maintenance-related work activities, and a smaller fraction of the nonmaintenance activities, had time-weighted average airborne concentrations above the current and proposed TLVs or PELs, indicating the need for appropriate exposure control procedures.

216

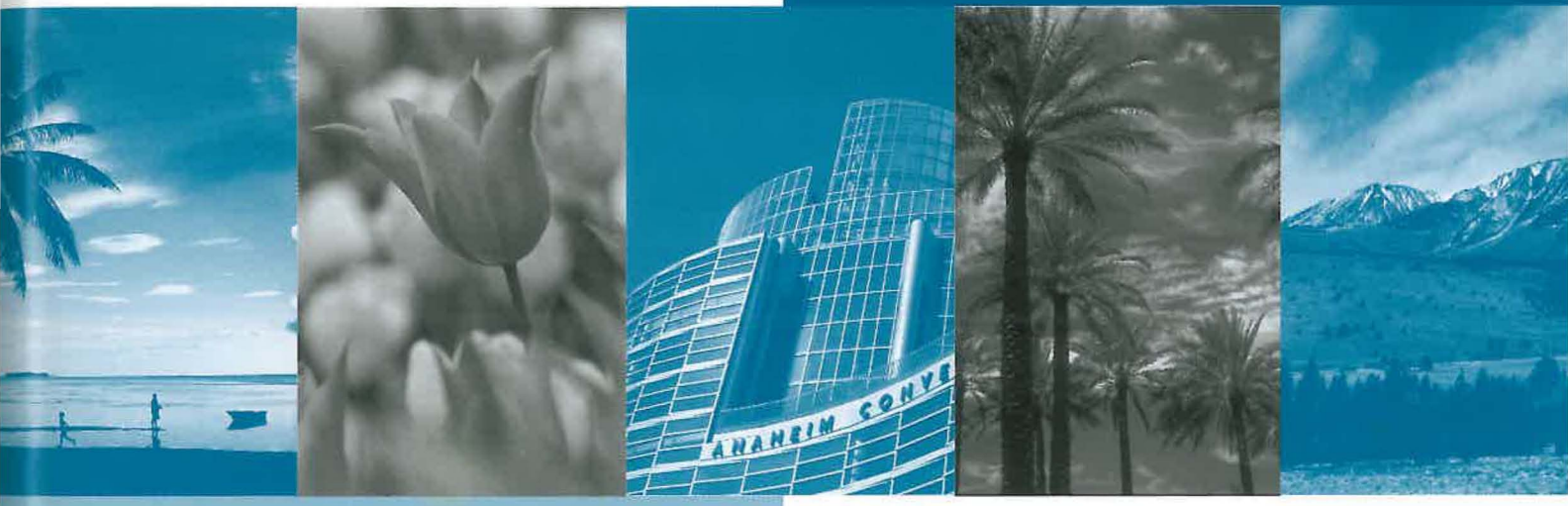
CHROMIUM PARTICLE SIZE DISTRIBUTION AND SPECIATION IN PAINT SPRAY AEROSOL: A FIELD STUDY. R. Sabty-Daily, California State University–Los Angeles, Los Angeles, CA; P. Harris, W. Hinds, J. Froines, University of California–Los Angeles, Los Angeles, CA.

Spray painting of chromate-containing paint represents a potential source of occupational exposure to Cr(VI) in the aerospace industry. Two field studies were conducted to determine the size distribution and speciation of Cr in chromate-based paint spray aerosol. Sampled paint consisted of strontium chromate in an epoxy resin matrix. Personal aerosol samples were collected using Sierra Marple cascade impactors and analyzed for Cr(VI) and total Cr. Size distributions of total Cr and Cr(VI) particles had a mass median aerodynamic diameter of 7.5 μm (GSD = 2.7 μm) and 8.5 μm (GSD = 2.2 μm), respectively. Particles larger than 2 μm were log normally distributed and constituted ≥ 90% of the total Cr and the Cr(VI) mass in all sampled aerosols. The target respiratory deposition site of Cr was estimated based on Cr mass distribution according to particle size. On average, 62% of the Cr and Cr(VI) mass in the paint aerosol consisted of particles > 10 μm. Results showed 71.8% of Cr(VI) mass in paint spray aerosol potentially inhaled by a spray painter may deposit in the head airways region. Only ≤ 2.0% of Cr(VI) mass may potentially deposit in each of the alveolar and tracheobronchial regions. Cr(VI) mass to total Cr mass ratio was determined in bulk paint; the data indicate Cr was predominantly in the Cr(VI) state, before spraying. The same ratio was determined in paint aerosol samples. Results showed there was reduction of Cr(VI) regardless of Cr aerosol particle size. Cr(VI)

Abstract Book
AIHce

May 21–26, 2005
Anaheim, California

Celebrating Innovation



Co-sponsored by AIHA and ACGIH®

aihce

The Premier Conference and Exposition for Occupational and Environmental Health and Safety Professionals

www.aiha.org/aihce.htm