hierarchy of controls, substituting a less toxic material for sand in abrasive blasting should be considered. However, if sand is to be used, these data suggest that respirable quartz airborne concentrations might be reduced without sacrificing cleaning rate or increasing sand consumption by selecting abrasive sands with small initial particle sizes and adding a commercial dust suppressant.

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CONTROL OF EXPOSURES TO CRYSTALLINE SILICA IN STONE MONUMENT MANUFACTURING. R. Kurimo, L. Blade, H. William, NIOSH, Cincinnati, OH.

National Institute for Occupational Safety and Health (NIOSH) researchers conducted a field survey at a small manufacturer of stone monuments (mainly cemetery markers) to characterize workers' exposures to respirable crystalline silica and to evaluate exposure control methods. These exposures result from the use of abrasive blasting for engraving and texturing, since the abrasive agent and/or the stone may contain crystalline silica. Partial-work-shift air sampling, covering three- to six-hour periods during which abrasive blasting was performed, revealed breathing zone concentrations between 19 and 43 micrograms of respirable crystalline silica per cubic meter of air ($\mu g/m^3$), below the NIOSH recommended exposure limit (REL) of 50 $\mu g/m^3$. However, since the abrasive blasting was done on a part-time basis with time allotted for preparatory tasks, and substantial portions of the sampling periods included these other tasks, full-shift exposures could be significantly greater at a similar facility where blasting is performed continuously. The primary engineering dust-control measure employed — a commercially available, exhausted, automated-blasting enclosure with a screened opening for viewing — was evaluated by measuring parameters such as face velocities (which were at least 160 feet per minute), using smoke tubes, and conducting real-time particulate monitoring synchronized with videotaping. The results revealed that this system effectively controlled the dust generated during automated blasting. The real-time video monitoring also revealed deficiencies in the operation, including the use of a compressed-air hose during cleanup, and an abrasive agent recycle chute that was not enclosed, substantially contributed to the measured exposures. Correction of these minor problems can maintain exposures below the NIOSH REL even if continuous blasting is conducted.

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OZONE EXPOSURES DURING A TREATMENT PROCESS OF RAW BEEF. R. Hall, K. Martinez, K. Gwin, NIOSH, Cincinnati, OH.

NIOSH conducted a Health Hazard Evaluation (HHE) during an ozone research and development (R&D) sanitation treatment process of raw beef. Prior to the assessment, the company had conducted two R&D tests. During the first test, the workers did not use respiratory protection, and the ozone generator was shut down after approximately 15 minutes when workers reported respiratory symptoms (lung discomfort, nose and throat discomfort, and asthma attacks) and nausea. During the second test, workers wore half-mask air purifying respirators equipped with cartridges intended for ozone. The company monitored for ozone during the second test and reported concentrations of 0.2 parts of ozone per million parts of air (ppm). The workers did not report any symptoms during the second testing procedure which lasted approximately 2 hours. During the NIOSH HHE, workers and NIOSH representatives wore full face pressure-demand self-contained breathing apparatus to protect against ozone inhalation. During the NIOSH evaluation, peak ozone concentrations of 5 ppm (measured with detector tubes and a real-time monitor) were indicated near the inlet of the tumbler where a worker would occasionally insert raw beef products. Measurements collected with an ozone real-time monitor indicated average ozone concentrations ranging from 0.1 to 1 ppm in the general tumbler area with an 8-hour time-weighted average of 0.05 ppm. Ozone detector tube samples taken around the tumbler area during the testing procedures indicated concentrations ranging from 2 to 3 ppm. The measured peak ozone concentration of 5 ppm exceeds the NIOSH ceiling limit (0.1 ppm), and is at the NIOSH recommended immediately dangerous to life or health limit (5 ppm) for ozone. The eight-hour TWA is below the OSHA PEL, and is at the ACGIH® TLV® for exposure during heavy physical exertion. However, ozone peak concentrations exceeded excursion limits. Based on the NIOSH study, management personnel at the company have decided to discontinue the use of ozone to kill bacteria in beef products.

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AIRBORNE RESIN ACID EXPOSURES AMONG WORKERS AT A MAGAZINE PRINTING COMPANY. C. Cook, E. Page, NIOSH, Cincinnati, OH.

Background: In September 1999, the National Institute for Occupational Safety and Health (NIOSH) conducted a health hazard evaluation at a magazine printing company to assess exposures to resin acids during lithography printing and bindery processes. Workers reported symptoms consistent with occupational contact dermatitis, respiratory irritation, and asthma. Inks used were complex chemical mixtures containing epoxy and phenolic resins. Printed paper materials were dried by ovens and bound using a hot-melt adhesive containing colophony (rosin). Resin acids are components in rosin that are responsible for dermal and respirable sensitization. Methods: An air sampling strategy was devised to measure resin acids released by heated inks and hot-melt adhesives. Thirteen personal breathing-zone (PBZ) and 11 area air samples for resin acids were collected on polytetrafluoroethylene (PTFE) filters using air sampling pumps calibrated at 2 liters per minute. Analysis was performed by a high-pressure liquid chromatography (HPLC) procedure for the analysis of resin acids, specifically abietic and dehydroabietic acids. Results: Full-shift PBZ air samples for resin acids collected on printing press operators and bindery operators revealed time-weighted average (TWA) concentrations up to 2 micrograms per cubic meter (ìg/m3) for dehydroabietic acid, while only trace abietic acid concentrations were measured. General area air sampling revealed concentrations up to 4.5 ìg/m3 for abietic acid and 9.2 ìg/m3 for dehydroabietic acid at printing presses, and up to 6 ìg/m3 for abietic acid and 77 ìg/m3 for dehydroabietic acid in the bindery department. Although there is no NIOSH recommended exposure limit (REL), the American Conference of Governmental Industrial Hygienists' (ACGIH) recommends reducing exposures to as low as possible. Conclusions: Workers were exposed to airborne resin acids generated by both the printing and bindery processes. While resin acids are known to derive from heated materials containing rosin, heated inks containing epoxy and phenolic resins were suspected of generating resin acids.

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MONITORING THE EFFECTIVENESS OF A CONTAINMENT DURING APPLICATION OF FLOOR COATINGS ADJACENT TO OCCUPIED AREAS. T. Kapfer, T. Froehlig, L. Henckel, Institute for Environmental Assessment, Brooklyn Park, MN.

To prevent indoor air quality complaints in adjacent areas to a chemical floor coating project at a large metropolitan airport, a containment with exhaust ventilation was constructed to place the area under negative air pressure. Operations continued in the area adjacent to the 12,362 sq. ft. floor coating application area. This study evaluated the effectiveness of the containment and exhaust ventilation performance during floor preparation and application of three membrane coatings. Sampling was conducted primarily at times when the level of contaminants were expected to be highest and included: total airborne particulate samples during concrete floor repair and prep work; volatile organic compounds and isocyanate samples during and after the application of the chemical membrane coats; and CO_2 and CO levels during most of the floor work. The highest contaminant levels detected inside of the containment included: airborne particulate levels of 15 mg/m^3 and CO levels of 10 to 80 ppm during the floor prep work; and airborne toluene levels around 300 ppm during the application of the final coat. At all times, the containment maintained floor coating-related contaminants outside the containment at levels well below regulatory exposure limits. And, in most cases, levels outside the containment were at or near background levels measured prior to commencement of the project. Airflow measurements were also collected for the two exhaust fans serving the containment. Based on our observations and sampling results, the containment and temporary exhaust system were effective in preventing airborne contaminants from migrating to the surrounding occupied areas.

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EVALUATION OF BERYLLIUM SURFACE CONTAMINATION IN WORK AREAS WHERE FINISHED BERYLLIUM PARTS ARE HANDLED AND STORED. G. Whitney, Los Alamos National Laboratory, Los Alamos, NM.

Non-destructive use and handling of finished beryllium parts ("articles") is not expected to result in exposure to airborne beryllium. However, concerns were raised that years of operations involving beryllium parts could have resulted in a build-up of beryllium contamination on work area surfaces. Los Alamos National Laboratory has a surface contamination limit of 0.2 ug/100 cm2 for "clean" work areas. To address these concerns swipe samples were collected in work areas where beryllium parts are handled and/or stored. This survey also helped to meet the beryllium inventory requirements of 29 CFR 850, Chronic Beryllium Disease Prevention Program. Surfaces most likely to be contaminated due to the nature of operations in the work areas (work benches, storage shelves, packaging materials, etc.) were swiped using paper filters wetted with distilled water. Beryllium parts were also swiped using dry linen circles. Samples were submitted to an on-site laboratory and analyzed by ICPES. A total of 135 swipe samples were collected in 7 work areas. Results were separated into three categories: beryllium parts (n=15, mean = 4.27 ug/100 cm2, 20% were < 0.2 ug/100 cm2); beryllium packaging materials (n=27, mean = 2.08 ug/100 cm2, 48% were < 0.2

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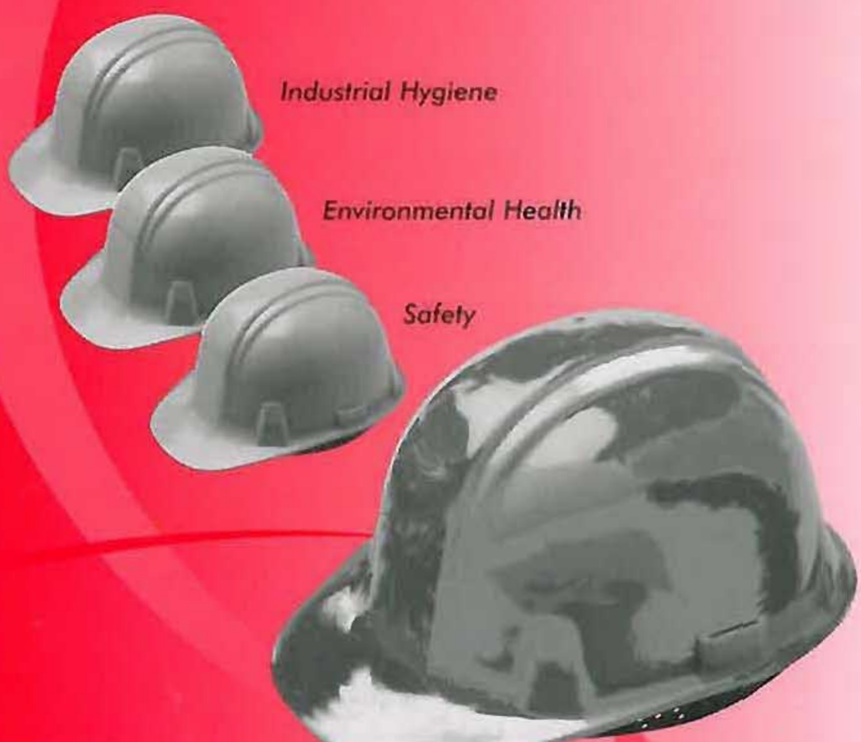

ABSTRACTS