dust and silica concentration have been derived from 906 air samples collected with Dorr-Oliver type cyclone and analyzed by gravimetric and X-ray diffraction techniques. Results following the more recent adoption of dust control innovations and process changes were also included.

In sanitary ware factories, geometric mean levels at the department of casting, glaze preparation, glaze spray, and inspection were higher than the TLV-TWA adopted in Italy of 0.05 mg m3. The TLV-TWA exceedance frequency was 52% in glaze mixing and 73% in slip casting. In every crockery department, geometric mean concentration were not higher than threshold limit; however, concentration levels in 31% of samples collected in glaze mixing and 25% in trimming were higher than 0.05 mg m3.

Although exposure levels varied consistently among factories, for those where dust control measures and improved working practices have been introduced, mean concentration values for all process categories displayed an overall trend toward progressive reduction in exposure, both for respirable dust and crystalline silica.

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COMPARISON OF AIRBORNE FIBER CONCENTRATION AND SIZE DISTRIBUTIONS IN VARIOUS MAN-MADE VITREOUS FIBER INDUSTRIES IN KOREA. Y. Shin, School of Industrial Safety and System Engineering, Inje University, Kimhae, Republic of Korea; K. Yi, Industrial Safety and Health Research Institute, Inchon, Republic of Korea

The purpose of this study was to compare airborne fiber concentration and size distributions among man-made vitreous fiber (MMVF) industries in Korea. Airborne fibers were collected on 25 mm MCE filters at personal breathing zones and analyzed using the A and B counting rules of NIOSH Method 7400. The results by the B counting rule were significantly lower than those by the A counting rule for all MMVFs.

The average ratios of B/A counts for glass wool, rock wool, continuous filament glass fibers, and refractory ceramic fibers (RCF) were 0.66, 0.65, 0.48, and 0.84, respectively. These results indicate that the fiber diameters were different among industries and that the proportion of respirable fibers (<3 mm diameter) in RCF samples was higher than those in other types.

Personal exposure levels were significantly different among industries ($p < 0.001$). Average fiber levels (GM) at the workers' breathing zones were 0.57 fibers per cubic centimeter (f/cc) during installation of the rock wool and glass wool insulation products, 0.012-0.032 f/cc during manufacturing of the glass wool, rock wool, and continuous filament glass wool insulation products, and 0.26 f/cc during manufacturing of the RCF products.

None of the personal samples in the production of glass wool, rock wool and continuous filament glass fibers exceeded the ACGIH threshold limit value (TLV®) of 1 f/cc. However, 73% of personal air samples collected during installation of the products exceeded the TLV, and 80% of samples during manufacturing of the RCF products exceeded the proposed TLV (0.1 f/cc).

In conclusion, the diameter distribution of airborne RCFs was smaller than any other types, and workers could be exposed to higher levels of airborne fibers during installation of the rock and glass wool products and during manufacturing of the RCF products.

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WORKER EXPOSURES TO SUBSTANCES IN THE MANUFACTURE OF NONFERROUS, POWDERIZED, SPECIALTY METAL ALLOYS FOR THE AIRCRAFT-ENGINE INDUSTRY. L. Blade, R. McCleery, S. Burt, NIOSH/Division of Physical Sciences and Engineering, Cincinnati, OH

NIOSH conducted a health hazard evaluation (HHE) at a facility that produces specialty, nonferrous metal alloy billets, primarily for use in the manufacture of aircraft-engine turbine parts. The alloy-billet production process includes alloy powderization, size selection, containerization, and (at an offsite facility) extrusion to resolidify the alloy, followed upon return to this facility by various machining operations. The alloy powderization is achieved in ceramic-lined furnaces; the ceramic furnace linings are built on site.

NIOSH investigators conducted an environmental and medical investigation involving two site visits in response to this HHE request from employees concerned about the possible formation of hexavalent chromium (chromium [VI]) in the specialty alloy production operations, and of the potential health hazards from exposures to this and other materials associated with those operations. Based on initial environmental findings, the NIOSH investigators better characterized worker exposures to several of the metals used at the facility by conducting biological monitoring and additional environmental monitoring.

The environmental monitoring included collection of bulk-material samples and both personal breathing-zone (PBZ) and general-area air samples. The results of bulk-material sample analyses revealed that chromium (VI) is present in the facility. However, all chromium (VI) PBZ air-sampling results were below relevant evaluation criteria. The results of two air samples collected in the PBZs of a laboratory assistant and a furnace operator's helper (and analyzed for cobalt, total chromium, niobium, and nickel) exceeded the OSHA PELs for cobalt and nickel, and several PBZ air-sample results also exceeded the NIOSH RELs for those two metals.

All analytical results for total chromium were below relevant evaluation criteria. No current evaluation criteria exist for niobium. Biological monitoring for nickel, cobalt, and chromium also was conducted. The relationship between the environmental and biological monitoring results was examined.

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AN INDUSTRIAL HYGIENE EVALUATION OF NEW JERSEY LEAD ABATEMENT CONTRACTORS. D. Singh, D. Valiante, D. Schill, M. Coyne, New Jersey Department of Health, Trenton, NJ

This project was a cooperative effort between the New Jersey Department of Health and Senior Services (NJDHSS) and the New Jersey Department of Community Affairs (NJDCA) to help employers in reducing lead exposure to their employees. NJDCA, which has the responsibility to certify lead abatement contractors, issued a Lead Hazard Evaluation and Abatement Code, which governs work practice standards for the abatement of lead-based paint in commercial, steel structure, and public buildings.

Upon notification from NJDCA, NJDHSS conducted industrial hygiene evaluations at selected sites. In New Jersey, there are approximately 150 licensed lead abatement contractors. From June 1997 to July 1999, OHS conducted 22 industrial hygiene evaluations of 16 contractors at various lead abatement sites and provided written recommendations to the contractors on air monitoring, engineering controls, respiratory protection, hygiene facility and PPE, housekeeping, signs, fall protection, and training.

NJDHSS obtained positive responses from 10 employers to the recommendations provided. In some cases, where multiple site visits were conducted for the same employer, the recommendations provided for the initial work site were implemented at the second site.

Based on our study, we determined that greater intervention efforts should be focused on air monitoring, respiratory protection, and hygiene facilities. We also found there is a need to address health and safety training among non-English speaking employees at New Jersey lead abatement contractors.

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EXPOSURE TO SOLVENTS AND ABRASIVE-BLASTING MATERIAL DURING THE MANUFACTURE OF COPPER-BASED NOVELTY GIFTS. R. McCleery, K. Martinez, D. Mattorano, NIOSH, Cincinnati, OH

NIOSH conducted a health hazard evaluation (HHE) in response to an employee request concerning potential exposure to lacquer solvents, abrasive-blasting materials, and a patina solution. Employees reported rashes, nose sores, and hyperventilation. The facility bases many of its products on the manipulation of copper sheets and/or the use of abrasive-blasting to engrave impressions on stock materials. The finished appearance of the copper product is achieved through application of a patina solution (copper sulfate and various inorganic acids), a 2-butoxyethanol (2-BE) lacquer solution, abrasive-blasting (using aluminum oxide or small glass beads), or an acetylene/oxygen flame applied to the surface. The lacquer solutions consisting of 2-BE and methylene chloride/toluene are applied for the protection of exposed copper and copper/patina surfaces, respectively.

Personal breathing zone and/or area air samples were collected for metals, respirable dust, 2-BE, inorganic acids, and methylene chloride. Real-time sampling for airborne particulates was conducted with a light-scattering aerosol spectrometer designed for particle size discrimination. Data were collected to monitor the particulates generated by distinct events during abrasive-blasting operations. Air samples indicated that methylene chloride concentrations exceeded the NIOSH recommended exposure limit (REL) but did not exceed any other relevant evaluation criteria. All other results were below applicable evaluation criteria.

The real-time instrument measured total dust peak concentrations above 10 mg/m³ in the abrasive-blasting environment, which indicates the potential for exposures above relevant evaluation criteria. The computed mass median aerodynamic diameter (MMAD) indicates that a majority of the mass would be deposited in the thoracic region of the respiratory system, including a sizable portion in the lower respiratory system. Therefore, the practice of wearing respirators should be continued with the existing abrasive-blasting system.

NIOSH suggested modifications to the existing engineering controls, which could decrease or eliminate some personal protective equipment use during specific activities.

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