

medias. Statistically significant exceedances included (1) garnet - 95% confidence > OEL 34% of the time for manganese; and (2) copper slag - 95% confidence > OEL for silica 87%, for arsenic 36%, for cadmium 10%, for lead 27%, and for manganese 7% of the time.

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Mapping of Respirable Particulate and Noise Exposures Using Geographical Information System in Selected Stone Crushing Units in Central India

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In India, stone quarrying and crushing industries are an important class of essential industry that supplies the raw material for different scale of construction and transport-related projects. In stone crushing units, workers are involved with various dust-emitting and noise-creating operations such as loading, feeding, crushing, screening, and unloading. Few previous studies have attempted to recognize, evaluate, and map hazards in this sector. Lack of baseline information, confounded by lack of awareness and lack of willingness among unit workers, has resulted in extreme exposures being prevalent in this sector. The present exercise was carried out to generate an exposure profile and map spatial gradients so that specific cost-effective engineering and administrative control recommendations may be made. Measurements for respirable particulate were made using NIOSH protocol 0600. Area noise measurements were taken according to ANSI protocol S12.19-1996, using a direct read-out sound level meter. Measurements were performed on different days in both the first and second shifts. Numbers and activity of workers in each area were noted to see the workers exposure. Once the data were collected, they were averaged and referenced to the plant geography, and then the data were imported into Mapinfo GIS. The maximum time-weighted average (TWA) concentrations of respirable dust were found in primary and secondary crushers (range 10.709-5.288 mg/m³) followed by screening (range 8.838-3.582 mg/m³), unloading (range 4.163-1.736 mg/m³), and loading (range 0.942-0.232 mg/m³) operations. Whereas the maximum TWA measurements of noise were recorded in feeding (range 100 - 102 dBA) followed by primary crushing (range 97-99 dBA), secondary crushing (range 96-98 dBA), screening (range 93-96 dBA), and the unloading end (range 84-88 dBA). Following the creation of the exposure profile, a combination of dust and noise control strategies have been developed.

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Investigating the Aspiration Efficiency of a New High-Flow Inhalable Aerosol Sampler

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This work focused on preliminary computational fluid dynamic (CFD) assessment of a new sampler designed to meet the inhalable particulate mass criterion at 10 Lpm sampling flow rate. A sampler with increased flow rate will increase the

detection limit for inhaled aerosol exposure methods, which is critical to assessing and protecting the risk to workers in sensitive, low-concentration operations such as found during beryllium machining. This sampler uses a flat, porous mesh as a new inlet of the standard three-piece 37-mm cassette. The surface of this new meshed cap used 1043 254- μ m pores in the central 15-mm of the sampler, resulting in 30% open area within the porous region. This sampler was oriented facing the wind, but 30 degrees below the horizon, mounted on an elliptical cylinder in a three-dimensional flow simulation. Three mesh densities were explored at three global tolerance levels to evaluate the quality of the fluid flow field in these simulations. Particle simulations were conducted for seven unit-density particle sizes and four bounce conditions to investigate both solid and liquid particle aspiration. Solid particles were aspirated within the range of aspiration efficiency reported by wind-tunnel manikin and CFD studies. The percentage of particles that hit the face of the sampler before being aspirated contributed from 24% to 64% of the critical area defining aspiration. The difference between solid and liquid particle aspiration efficiency increased with increased particle size through 50 μ m. However, this difference decreased with increased particle size above 50 μ m. Our results indicate that particle bounce is a critical component to porous-sampler aspiration. Consequently, this design and likely other small-porous samplers may underestimate the actual inhalable fraction when used to estimate exposures to liquid aerosols.

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Personal Sampler Performance for Coarse Aerosols in Ultralow Wind Speed Environments

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The development of personal inhalable aerosol samplers is based on criteria for the inhalable aerosol fraction under the assumption that such conventions were set with regard to realistic workplace conditions. Most of the research used to develop such standards was performed in fast-moving air, at wind speeds above 0.5 m/s. Aside from highly ventilated environments such as underground mines this is not representative of most modern workplaces where typical wind speeds are in the range from 0.25 m/s to 0.35 m/s. The research presented here was therefore intended to provide an assessment of personal samplers, specifically for the inhalable fraction, in very low wind speed environments. This required the use of a wind tunnel that was capable of creating a distribution of aerosols uniform in both concentration and particle size, and yet accounted for the increased effect of gravitational settling on aerosols in such environments. The ultralow-speed wind tunnel developed for that purpose was used in conjunction with a simulated life-size heated, breathing human manikin, continually rotated over a full 360 degrees. Four personal samplers commonly used by industrial hygienists (closed-face cassette, IOM inhalable sampler, GSP conical inlet sampler, and button inhalable sampler) were attached to the manikin for concurrent sampling. The aspiration efficiency of each sampler was compared with the inhalable aerosol concentration as measured by the breathing manikin. Results showed that while the closed-face

cassette did not provide a good assessment of the inhalable fraction, the IOM, GSP, and button samplers all proved adequate. These findings will be important considerations for industrial hygienists doing not only routine monitoring, but also taking measurements for epidemiological studies attempting to link personal sampling data to health outcomes.

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A Personal Sampler for Assessing Inhaled Nanoparticle Exposures

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The goal of this work was to develop an accurate, sensitive, and specific method to assess personal exposures to engineered nanoparticles. We designed and constructed a small thermal precipitator to measure human breathing-zone concentrations of airborne nanoparticles. Specifically, our approach was geared toward distinguishing engineered nanoparticles from other incidental nanoparticles (i.e., ultrafine particles) that are ubiquitous in typical workplace and environmental atmospheres. We hypothesized that engineered nanoparticles could be identified and distinguished from incidental and biogenic nanoparticles based on the use of energy-dispersive spectroscopy conducted directly on collected particles. This sampler used thermal force to capture airborne nanoparticles on transmission electron microscopy (TEM) substrates. Furthermore, by rotating several TEM substrates through the collection zone during the sampling period, we hoped to resolve an individual's exposure in time. These substrates were subsequently analyzed off-line to determine the size, shape, and chemical composition of individual particles. We will present results from initial laboratory testing, including collection efficiency as a function of particle size (5 - 250 nm), along with instrument sensitivity and specificity for identifying and quantifying concentrations of nanoparticle aerosols.

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Glass and Metal Arts Exposure Assessment

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Artists and artisans working in the metal and glass arts are potentially exposed to airborne contaminants generated in a wide array of tasks. Despite the potential for occupational exposure in the metal and glass arts, there is very little exposure assessment data available. Consequently, the relative risk posed by the use of different materials in different processes is not well understood, nor is the need for engineering controls or personal protective equipment. In the glass arts, primary exposures of concern include trace metals contained in colorants, leaded glass, crystalline silica, and combustion products. Exposure levels in the glass arts were typically found to be less than the respective OSHA permissible exposure limits. The cold processing of leaded glass, however, poses a concern as elevated lead exposures were associated with glass polishing, cutting, and grinding tasks, despite the use of water spray. Compared with the glass arts, the metal arts use many different processes and a wider array of feedstocks, providing a challenge to exposure monitoring. Low exposures to trace metals and flux components were associated with soldering and metal

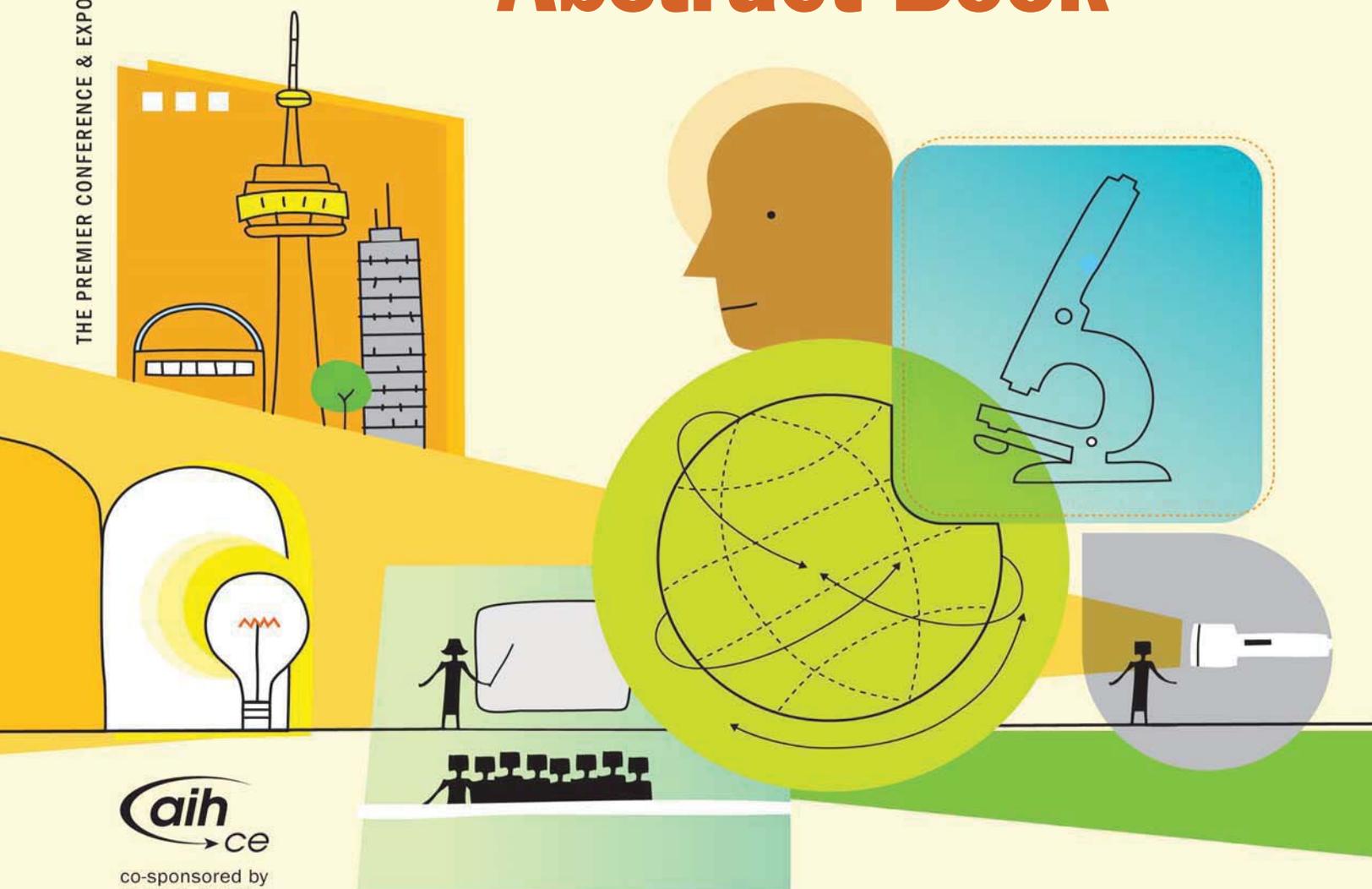
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