

taneously achieve contaminant removal and eddy reduction in the wake region by introducing a directionally oscillating jet. A 50th percentile male mannequin was placed in a nearly uniform flow of approximately 35 fpm. While the cross-sectional velocity profile varied somewhat, smoke release studies indicated no back flow except near the supply wall. A low-velocity tracer gas source (isobutylene) was held in the standing mannequin's hands with the upper arms vertical and the elbows at 90 degrees.

Four ventilation scenarios were compared in terms of time-weighted average (TWA) concentration in the breathing zone as measured by photoionization detectors: 1) uniform flow; 2) addition of a steady jet (~1000 fpm) directed at the mannequin's back, parallel to the main flow; 3) making the jet oscillate to 45 degrees on either side of the centerline with a period of about 12 seconds; and 4) introducing a blockage at the centerline so the oscillating jet never blows directly at the worker.

At the 95% confidence level, the interrupted oscillating jet (Case D) achieved at least 90% exposure reduction compared with the uniform flow by itself or with the steady jet (Case A or B), and at least 35% exposure reduction compared with the unblocked oscillating jet (Case C).

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THE EFFECT OF WIND SPEED UPON AEROSOL PENETRATION INTO AN ENCLOSURE. W. Heitbrink, NIOSH/Division of Physical Sciences and Engineering, Cincinnati, OH; E. Thimons, J. Organiscak, A. Cecala, NIOSH/Pittsburgh Research Laboratory, Pittsburgh, PA

Environmental enclosures are used on vehicles used in agriculture, construction, and surface mining to protect the operator from exposure to air contaminants such as pesticides and respirable crystalline silica. A recent ASAE standard (S525) specifies an enclosure static pressure of at least 6 mm of water. This specification was based on professional judgment rather than data. Application of Bernoulli's equation indicates that air infiltration through holes occurs when the enclosure static pressure is less than the wind's velocity pressure.

To test this hypothesis, the effect of wind speed on aerosol penetration into an idealized enclosure was studied. The idealized enclosure was a plywood box, 1.2 m × 1.2 m × 1 m in volume. Two fans supplied 1.7 m³/min of filtered air to this enclosure at a static pressure of 2.8 mm of water. The enclosure had three 1.6 cm diameter holes in the front and a 7.5 cm diameter vent port that was isolated from the airflow around the enclosure.

The airflow from an ultralight aircraft was directed at the front of the enclosure to simulate wind. The air speeds were varied between 14 km/hr and 36 km/hr, as measured by a rotating vane anemometer. An electronic manometer measured the static pressure in the enclosure. Two optical particle counters measured the particle number concentration of particles between 0.35 µm and 0.5 µm inside and outside the enclosure. Aerosol penetration into the enclosure was computed as the ratio of the aerosol concentration inside the enclosure to the concentration outside the enclosure. Aerosol penetration into the enclosure and cabin static pressure increased linearly with air velocity above 20 km/hr.

When simple linear regression was used to model the observed penetration as a function of the estimated penetration, the value of the slope was 0.69±0.12 ($p < 0.0001$).

The experimental data are consistent with the hypothesis that the enclosure static pressure must be higher than the wind's velocity pressure to minimize aerosol penetration into an environmental enclosure. Thus, the aerosol penetration into enclosures meeting the ASAE requirement of 6 mm of static pressure would be unaffected by wind speeds that remain below 35 km/hr.

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FILTRATION EFFICIENCY OF ENVIRONMENTAL TRACTOR CAB FILTERS. E. Moyer, S. Martin, NIOSH, Morgantown, WV

In the United States, more than 5 million workers are involved in agricultural production. NIOSH has a long-standing initiative for investigation and prevention of occupational health and safety problems within the agricultural industry. A key component of this program is protecting the respiratory health of workers in the agricultural industry.

Agricultural workers can be exposed to pesticides, dusts and mists, bacteria, fungi, endotoxin. Exposure to these particulates can take place within environmental tractor cabs. Cab filters are not required to meet the same testing criteria as particulate respirator filters certified under 42 CFR 84.

New and used particulate filters from environmental tractor cabs have been evaluated for filter penetration as a function of particle size in the submicrometer size range of 0.03-0.4 µm. Further, the cab filter media were tested against a solid sodium chloride aerosol and/or a liquid DOP aerosol as explained in 42 CFR 84, except that flow rates were adjusted for velocity differences. The most penetrating particle size for these filters are in the range of 0.1-0.3 µm, as is the case for respirator particulate filters.

The data indicate that a broad range of filters and filter combinations with highly varying efficiencies (10%-99% at submicrometer particle sizes) are used in environmental tractor cab filtration units.

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AN EVALUATION OF WET AND DRY METHODS FOR DECREASING EXPOSURE TO REFRACTORY CERAMIC FIBERS (RCF) DURING GRINDING AND SANDING. K. Dunn, A. Cecala, S. Shulman, J. Cleary, NIOSH/Division of Physical Science and Engineering, Cincinnati, OH; D. Venturin, Unifrax Corporation, Amherst, NY; S. Chen, Thermal Ceramics, Augusta, GA; J. Treadway, Premier Refractories International, Erwin, TN

A cooperative research study is being performed by researchers at NIOSH and the Refractory Ceramic Fibers Coalition (RCFC) to determine cost-effective methods for lowering worker exposure to RCFs. The results of sampling at manufacturing and downstream plants have shown that many of the highest documented exposures were encountered in the finishing (grinding, sanding, and sawing) of RCF products.

A preliminary study was conducted to evaluate the potential for wet and dry control methods to reduce worker exposure during grinding and sanding. A series of test runs were carried out at NIOSH's Pittsburgh Research Laboratory. The local exhaust ventilation (LEV) consisted of two hoods, while the wet control method consisted of a simple compressed air atomization nozzle directed at the RCF product during machining. A series of test runs were performed according to the following sequence: 1) LEV on; 2) water mister on; and 3) control off. Personal breathing zone and area samples were collected during each 10-minute trial run.

Grinding data and sanding data were analyzed as two separate experiments. For grinding, the personal breathing zone (BZ) concentrations showed a 99% reduction for LEV relative to no control and a 88% reduction with water mist relative to no control. Overall, both comparisons are statistically significant at the 5% level.

For belt sanding, the personal BZ concentrations showed a 99% reduction for LEV relative to no control and a 42% reduction with water mist relative to no control. At the 5% significance level, the LEV reduction is statistically significant, but the water mist is not.

The results of this study may be useful in developing controls that can be used by both the manufacturer and downstream RCF customers.

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CONTROL MEASURES FOR REDUCING EMPLOYEE EXPOSURE TO CONCENTRATIONS OF TOTAL AND RESPIRABLE SILICA IN THE READY-MIXED CONCRETE INDUSTRY DURING TRUCK DRUM CLEANING. K. Sam, D. Williams, Illinois Department of Commerce, Chicago, IL

Periodically, drivers of ready-mixed concrete trucks enter the mixer drum to remove dry concrete buildup from the mixer. Using a pneumatic chipper and a sledge hammer, they chip out the concrete, which contains from 4% to 22% silica. During the chipping process, the drivers are exposed to concentrations of total dust containing silica and respirable silica that are as much as 10 times higher than the OSHA permissible exposure limits (PELs). This level of silica exposure is of significant concern to ready-mixed concrete facilities not only because of the health issues for their employees, but also because of OSHA's ongoing Special Emphasis Program for silica, which focuses enforcement efforts on companies where employees have the potential for silica exposure.

The purpose of this study was to identify effective and feasible control methods to reduce employee exposures to silica below the PELs during the chipping process. Personal air sampling was conducted at six ready-mixed concrete facilities using variations in ventilation configuration, portable exhaust ventilation, and wet methods during the chipping process.

Respirable dust sampling was conducted using a nylon cyclone with a flow rate of 1.7 L/min. Total dust with silica and respirable silica samples were collected and analyzed in accordance with the OSHA ID 142/NIOSH Method 7500.

Air sampling results confirmed employee exposure to silica can be reduced below the OSHA PEL during the chipping process by modifying the company's own pneumatic chipper using materials typically found in the maintenance areas of most ready-mixed concrete facilities. This would eliminate the need for respiratory protection for the employee and provide a safer work environment.

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DIRECT DATA ENTRY USING A PALM-TOP COMPUTER IN A LARGE EPIDEMIOLOGIC AND ENVIRONMENTAL STUDY. S. Reynolds, E. Svendsen, C. Taylor, K. Kelly, University of Iowa, Iowa City, IA

Small, versatile palm-top computers have proliferated in recent years, offering industrial hygienists a powerful tool for exposure assessment. These

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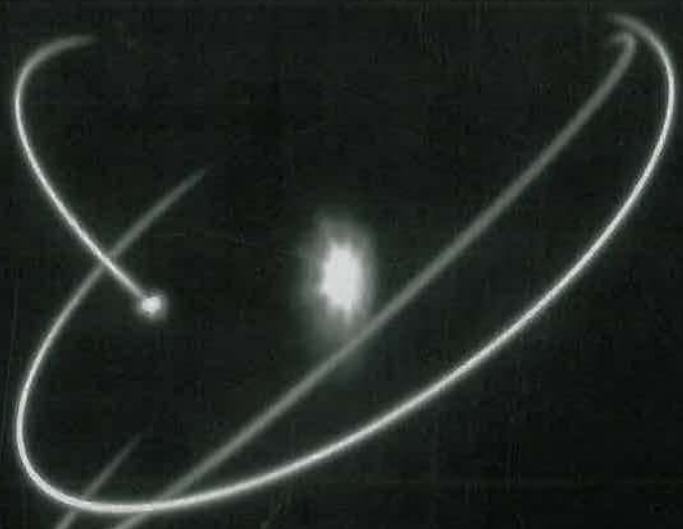
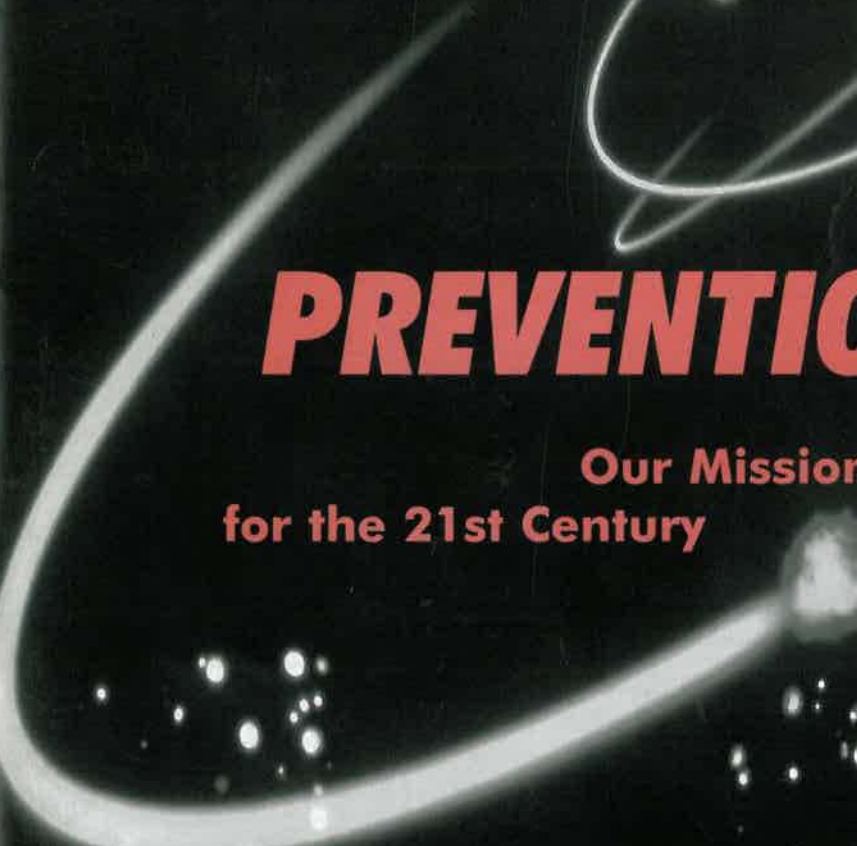


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