enforcement states (28% vs. 84% participation, $p = 0.0003$). Among responding shops in the high-enforcement states, 69% reported that every step in the fabrication process was performed mostly or entirely wet, compared to 40% of responding shops in the low-enforcement states. This result was not statistically significant. Fabrication methods reported for granite and quartz surfacing were nearly identical.

Conclusions: Due to potential nonresponse bias, the relationship between degree of enforcement in a state and self-reported use of wet methods could not be determined. The reported prevalence of wet methods in the manufacturing of granite and quartz countertops in the high-enforcement states of Minnesota and New Mexico was much higher than the previously self-reported prevalence of wet methods in Oklahoma, a low-enforcement state.

SR-104-05

Efficiency of Intact and Damaged HEPA Filters and their Gaskets under Different Flowrate and Pressure Drop Conditions

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Objective: High efficiency particulate air (HEPA) filter, a main element of industrial or domestic ventilation systems, can be damaged during handling and installation. Then, the question is how the damage would alter the performance of the filter. This project was to evaluate HEPA filter capture efficiency of intact or damaged gaskets and filters.

Methods: The filters (60 x 60 x 29 cm) for: (a) "gasket testing" used PTFE with one piece poured gasket; and, (b) "filter testing" used glass fiber, with a dove tail gasket. Poly Alpha Olefin particulate was used as aerosol challenge. Aerosol generators with specific nozzles were to generate known diameter (e.g., 0.3 µm) particles. A counter instrument was used to count the particles at the inlet and outlet of a custom designed filter housing. Each finally reported count was an average of 6 readings. Known diameter holes to the gasket and filter were created by using a set of standard cylinders. The gaskets and filters were tested within the filter housing at two system airflows ($28.3x10^3$ and $56.6x10^3$ L/min) and two pressure drops (25 and 50 mm water gauge). Gaskets and filters were tested under following conditions: (1) best fit: no known gasket or filter leak, and (2) man-made holes: gaskets and filters with 6 sizes man-made holes of 0.5, 0.8, 1.6, 3.2, 4.8 and 6.4 mm diameters.

Results: The best fit HEPA filter performed at capture efficiency of more than 99.99%. Particle leakage increased with the diameter of hole. However, at 0.5, 0.8 and 1.6 mm diameter holes the capture efficiency remained above 99.99%. At 3.2 mm hole the efficiency dropped to 99.98% and at 4.8 and 6.4 mm holes the capture efficiency dropped below the HEPA quality capture efficiency of 99.97%.

Conclusions: The capture efficiency of HEPA filters remained above 99.97% at or smaller than 3.2 mm hole in either gasket or filter media. Additional tests are recommended to further verify these findings.

CS-104-06

Carbon Dioxide Exposures at Meat Batching Operations

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Situation/Problem: Liquid carbon dioxide is used at meat product batching operation in order to cool the meat so that it can be formed into nuggets or patties. As meat product is loaded into the batch mixer(s) along with liquid flavorings, it is necessary to inject liquid carbon dioxide into the meat mixture within the batch mixer. If this injection process is not properly contained/ventilated, excess carbon dioxide vaporizes and is released into the work room. Resulting exposures can exceed applicable exposure limits.

Resolution: Carbon dioxide levels were measured using an appropriate direct reading instrument. Employee exposures were measured using passive diffusion tubes. Based on the initial survey, excessive exposures were determined. Survey also identified sources of excessive exposures so that corrective actions could be considered and implemented.

Results: Initial measurements of process indicated that exposures can exceed the applicable exposure limits. After modifications are made to process, exposures were reduced to levels that were well below the applicable exposure limits.

Lessons Learned: Excessive exposures at this operation were due to: Leakage of carbon dioxide gas into the work room due to excessive volume of liquid than could be removed by the exhaust ventilation system; Inadequate seal between the batch mixer lid cover on the top of the batch mixer hopper; and lack of control of flow and volume of liquid carbon dioxide into the batch mixer. Excessive exposures were corrected with the following process controls: Assure that the exhaust system is not clogged. (Carbon dioxide can sublime and deposit within the exhaust duct causing obstruction of the ducts and causing the exhaust fan to freeze; Assure a tight seal around the batch mixer during carbon dioxide injection; Control the volume, distribution and flow rate of the liquid carbon dioxide into the batch mixer to prevent excess volume of carbon dioxide in to the batch mixer. Control of flow rate and distribution of carbon dioxide allows carbon dioxide to be better absorbed by the batch (meat product).

PO105

Advances in Construction and Confined Space Safety

Monday, June 1, 2015, 10:30 AM - 12:50 PM

CS-105-01

Personal and Area Monitoring for Airborne Concentrations of Methylene Diphenyl Diisocyanate (MDI) and 2-Ethylhexanoic Acid (EHA) during and after Application of Low Pressure Polyurethane Foam Insulation in a Residential Crawlspace

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Situation/Problem: The objective of the study was to determine personal exposures and area concentrations of Methylene Diphenyl Diisocyanate (MDI) and catalyst during and after application of a closed cell spray polyurethane formulation to the rim joist of a residential crawl space.

Resolution: Industrial hygiene air monitoring was conducted using two different ventilation rates during two applications of spray polyurethane foam insulation in the crawl space of a residential home as a part of a product stewardship program. The crawl space was isolated from the other areas of the home by using a temporary barrier and ensuring that a separate source of makeup air was available. EPA and Center for the Polyurethanes Industry (CPI) Ventilation Guidance for Spray Polyurethane Foam Application, as well as the International aih ce

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