

erated via a Miller-Nelson controller. Active sampling methods were utilized as the reference comparison for all studies. When this method was coupled with analysis via gas chromatography on dual 60m capillary columns of differing polarity, more than 20 distinct MVOCs could be sampled, identified, and analyzed.

382.

MYCOTOXINS IN DUST AND BULK BUILDING MATERIALS. L. Saarinen, T. Tuomi, T. Johnsson, K. Reijula, Finnish Institute of Occupational Health, Helsinki, Finland.

It is frequently pointed out that mycotoxins present in bulk materials infested with toxigenic fungi are carried indoors by fungal spores. It follows that mycotoxins in indoor environments are inhaled with dust particles containing the fungal spores. To test this theory, bulk samples of moldy interior surfaces were analysed by HPLC-MS/MS concomitantly with settled dust for the presence of 12 trichothecenes. Samples were collected from four work places in southern Finland, including two university buildings and two children's day-care centers. The samples from one site were tested with trichothecene-sensitive feline fetus lung cell line, and with chemical analysis. All the examined sites had a history of health complaints, likely connected to mold exposure.

Diacetoxyscirpenol and T-2 toxin were the most prevalent trichothecenes found in the samples. Apart from these, 3-acetyl-deoxyvalenol, T-2 tetraol, verrucarol, and roridine A were occasionally present. Satratoxins G and H were also found at two of the examined sites, both of which were contaminated with *Stachybotrys chartarum*. Biological analysis with the feline fetus lung cell line correlated with the presence of T-2 toxin, but not with verrucarol.

Mycotoxin concentrations per fresh weight of extracted material were consistently highest in dust. The presence of individual toxins in the dust reflected the mycotoxins found in the bulk materials. When the goal is to investigate the presence of mycotoxins in indoor environments, collection of the deposited dust should be part of the research procedure. Also, air sampling of mycotoxins to filters should be considered, as this reveals mycotoxin concentrations in the ambient air. However, judging from the present results, the collection time should be in the range of days- or even weeks- rather than hours.

383.

MOULD REMEDIATION BASED ON TYPE OF MATERIAL AND EXTENT OF CONTAMINATION. D. Sahaj, Construction Safety Association of Ontario, Etobicoke, ON, Canada.

The Construction Safety Association of Ontario in conjunction with other safety associ-

ations developed a chart to communicate in a clear and comprehensive way mold control procedures recommended by the U.S.

Environmental Protection Agency. The chart indicates how mould growth can be prevented for various kinds of material within 24-48 hours of water damage and also provides general advice on remediation. Users begin at the center ring of the chart, and proceed one step, or one ring, at a time.

In the first ring, identify the material you are concerned about. In the next ring, find out what actions to take within the first 24-48 hours of clean water damage. Actions are spelled out under the "Action within 24-48" hrs column outside the chart. Proceed to the next ring if mould growth is apparent and more than 48 hours have elapsed since water damage. Determine whether the contaminated area is less than 10 square feet, between 10 and 100 square feet, or greater than 100 square feet. Proceed to the next ring and follow the clean-up method indicated for the size of the contaminated area. Methods are spelled out under the "Clean-up Methods" column. In the next ring, decide on the level of personal protective equipment (PPE) required. These requirements are explained in the "PPE" column. Finally, establish from the outermost ring whether containment is necessary and, if so, whether it must be limited or full. Each is spelled out under the "Containment column."

A summary of basic mould remediation procedures, the chart is extremely useful as a quick and simple training document for health and safety professionals, health and safety committee members, and workers concerned about mould remediation.

384.

VARIABILITY OF AIRBORNE FUNGAL MEASUREMENTS AT AN OFFICE BUILDING IN THE EASTERN UNITED STATES. J. Park, J. Cox-Ganser, C. Rao, K. Choe, NIOSH, Morgantown, WV.

Good sampling strategies for measuring airborne fungi require information on reproducibility as well as spatial and temporal variability. We examined variance components and reproducibility of airborne fungal measurements. We measured airborne culturable fungi (colony counts) and spore levels with single-stage multi-hole impactors loaded with malt extract agar plates and Air-O-Cell cassettes, respectively, at 30 locations in an office building with a history of water damage. Simultaneous duplicate samples were collected at 15 of those locations. We sampled at 4 time points (AM and PM on Monday and Thursday) within a week during a dry summer. Random models were used to analyze spatial and temporal variability of fungal levels and reproducibility (coefficient of variation = CV) of the duplicates. The temporal variability (within-location geometric standard deviation, $GSD_w = 1.44$) of total colony counts was about 1.3 times higher

than spatial variability (between-location $GSD_b = 1.11$). The temporal variability ($GSD_w = 1.87$) of total spore counts was about two-fold higher than spatial variability ($GSD_b < 1.01$). For colony counts, the temporal to spatial variance ratio was highest for *Penicillium/Aspergillus* (*Pen/Asp*) species (ratio = 1.8). For spore counts, the temporal to spatial variance ratio for basidiospores was highest (3.4), followed by *Pen/Asp* species (2.6), *Cladosporium* (2.2), and ascospores (2.1). Duplicate analyses showed that reproducibility was better for total colony counts (CV = 10%) than for total spore counts (CV = 20%). *Pen/Asp* species in colony counts (CV = 25%) and spore counts (CV = 40%) were the least reproducible of all identified fungal taxa. Given the high observed temporal variability of fungal measurements, a single sample at one time point provides a very limited assessment of exposure to airborne fungi in a given location within an office building. Random sampling and analytical error significantly contributed to the total variance of airborne fungal measurements, especially for *Penicillium/Aspergillus* species.

385.

PERFORMANCE COMPARISON OF INDOOR AIR CLEANERS. C. Chen, K. Chang, T. Lin, C. Hsu, Y. Lee, National Taiwan University, Taipei, Taiwan, Republic of China; Y. Kuo, Chung Hwa College of Medical Technology, Tainan, Taiwan, Republic of China; C. Lai, Chung Shan Medical University, Taichung, Taiwan, Republic of China.

Indoor air cleaners, in addition to the HVAC system, are often used to remove airborne particles in order to reduce allergic reactions of people suffering from respiratory problems. In the present study, two types (ESP and filter) of commercially available indoor air cleaners were acquired from local departmental stores for testing collection efficiency, pressure drop across the air cleaner, and energy consumption in a bench test system. Polydisperse aerosol particles were generated using a constant output aerosol generator and an ultrasonic atomizing nozzle. Aerosol outputs from both generators were then neutralized by using a radioactive source (Kr-85) to neutralize the aerosol particle to the Boltzmann charge equilibrium. The main aerosol size-spectrometers were a Scanning Mobility Particle Sizer and an Aerodynamic Particle. These air cleaners were also used in a small meeting room similar to the ANSI/AHMA AC-1-2002 air cleaner certification chamber to measure the Clean Air Delivery Rate (CADR), but without the humidity and temperature conditioning. The decay rates were measured by using real-time aerosol instruments and a mini infrared analyzer.

The results showed that aerosol penetration through ESP- or filter-type air cleaners increased with increasing face velocity (corresponding to flow rate) for submicrometer-sized particles. For micrometer-sized particles, the

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