submitted to our laboratory for 1996, 1997, and 1998 were analyzed to characterize the concentrations and types of airborne fungi. The study included indoor and outdoor fungal air samples from 1717 buildings across the United States over a three-year period.

This analysis is a description of the relationship between types and concentrations of airborne fungi with independent variables such as region of the country, season of the year, and indoor air vs. outdoor air. Study buildings were eligible for the study if samples were received from 1996 through 1998 inclusively, if samples were collected using a calibrated Andersen N6 sampler, and if both indoor and outdoor air samples were collected.

Statistically significant differences in fungal counts between seasons were observed, with the highest counts generally observed in the fall. Statistically significant differences in fungal counts between some regions were observed, with the highest counts generally found in the Southeast region. Indoor fungi concentrations were significantly lower than outdoor concentrations, with a median indoor/outdoor ratio of 0.15.

Some of the predominant types of fungi detected both indoors and outdoors for each season and region were *Cladosporium*, *Penicillium*, non-sporulating, and *Aspergillus*. Some toxigenic fungi reported to be rarely found in air samples, such as *Stachybotrys chartarum*, were detected in a surprisingly high proportion of buildings, suggesting that these organisms may be more common in indoor air than previously reported. This descriptive study of airborne fungi provides industrial hygienists, allergists, and other public health practitioners with information on what concentrations and types of culturable fungi can be expected in both indoor and outdoor air across the country by region and season.

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COMPARISON OF CULTURABLE FUNGAL DATA USING DIRECT PLATE AND SERIAL DILUTION BULK SAMPLE PROCESSING. P. Heinsohn, Exponent, Inc., Menlo Park, CA; T. Rand, Mycotaxon Consulting Ltd., Halifax, Nova Scotia; M. Shum, K. Zhao, R. Ray, Exponent, Inc., Menlo Park, CA

There are no NIOSH-validated analytical methods of bulk samples for culturable fungi. Laboratories usually offer only one sample-processing method prior to culture analysis. Serial dilution or direct plating of samples can be done prior to inoculation onto growth media for isolation, identification, and enumeration of fungal colonies.

This study was undertaken to determine whether data generated by the two methods are comparable. A total of 176 paired bulk samples of different types of building materials and furnishings were prepared for culture using both direct plate and serial dilution. The diluent used for serial dilution was sterile water with 0.1% peptone and 0.01% Tween 80. All sample preparations were inoculated onto malt extract agar and DG–18. More different fungi were isolated from the direct plate preparations than from serial dilution preparations. The number of fungi isolated was higher for the serially diluted sample preparations.

When the AIHA criteria for interpretation of such data published in 1996 were used to interpret the data, striking differences were noted. In those sample pairs where both pair members indicated that the sample was supporting fungal growth, the same fungus was dominant only 77% (85/110) of the time.

Direct plate and serial dilution are not comparable sample processing techniques. The choice of method directly affects how data are interpreted and, thus, conclusions for documenting potential hazard.

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EFFECTIVENESS OF POLYETHYLENE SHEETING ON CONTAINMENT OF FUNGAL SPORES AND MVOCS DURING MOLD REMEDIATION. P. Morey, A. Worthan, E. Horner, Air Quality Sciences, Gettysburg, PA; R. Krell, IAQ Technologies, Syracuse, NY

Air sampling for culturable fungi and microbial volatile organic compounds (MVOCs) was performed in a large (>1800 m?) residence that had undergone partial restoration (extensive fungal colonization in the basement had been mostly removed; water problem had not been fixed). Sampling was performed under quiescent conditions in the basement, on the upper two floors of the residence, and at grade level in the front and rear yards.

At the time of sampling, the basement was isolated (full containment) from the rest of the residence, and negative air machines had been turned off for several hours. *Aspergillus versicolor* dominated 48 of 54 air samples collected in the basement (*Aspergillus versicolor* concentrations often approached or exceeded 10; CFU/m; on cellulose and DG–18 media). *Cladosporium cladosporioides* dominated all 44 samples collected outdoors and 68 of the 69 samples collected on floors 1 and 2. Concentrations of total MVOCs and individual MVOCs (e.g., 3-methyl-1-butanol; 2-heptanone, etc.) were 10–1000× higher indoors on all three floors (total MVOC concentrations in the 100–500 ?g/m^3 range indoors) than background outdoor levels.

This sampling evaluation at an intermediate point in the restoration process showed that the polyethylene sheeting used to isolate the basement from the rest of the house was effective in containing fungal spores but was not effective in containing MVOCs.

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VOLATILE METABOLITES PRODUCED BY *STACHYBOTRYS CHARTARUM* ON RICE AND GYPSUM BOARD. J. Martin, P. Gao, NIOSH, Morgantown, WV

Concerns about the adverse health effects associated with fungal exposure in homes and the workplace have increased in recent years. Cases of pulmonary hemosiderosis among infants have been attributed to exposure to *Stachybotrys chartarum* in water-damaged buildings.

Although microbial volatile organic compounds (MVOCs) have been used as an indicator for fungi (such as *Aspergillus spp.* and *Penicillium spp.*) hidden within building structures, there is little information on what MVOCs can be produced by *S. chartarum*. It has yet to be determined whether MVOC analysis is an appropriate measure of *S. chartarum* growth.

In this study, MVOCs produced by three different strains of *S. chartarum* cultivated on two types of media — rice and gypsum board — were determined. Clean humidified air was constantly supplied to the cultures. Air samples were collected after one, two, three, four, and six weeks of cultivation using Tenax® TA tubes. MVOCs were analyzed by gas chromatography/mass spectrometry (GC/MS) with thermal desorption. Dozens of volatile metabolites were detected on each culture and several compounds were found at a greater frequency throughout the experiment (e.g., methyl ester benzoic acid, 1,2-dimethoxy benzene, 3-cyclohepten-1-one, 2-methyl-3-buten-2-ol, and 1-chlorodecane). A few unique MVOCs — those volatiles not released by building materials or other sources, such as 1-butanol, 3-methyl-2-butanol, and thujopsene — were detected in at least two cultures.

When compared with our previous studies of *Aspergillus spp.* on gypsum board under the same experimental conditions, fewer volatiles were produced by *S. chartarum*. This may indicate that MVOCs produced by *S. chartarum* represent a relatively small fraction of the total MVOCs present in water-damaged buildings where *Aspergillus spp.* and other fungi usually exist.

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ELIMINATING CHILDHOOD LEAD-BASED PAINT POISONING IN 10 YEARS — ACHIEVING THE FEDERAL GOAL. D. Jacobs, U.S. Department of Housing and Urban Development, Washington, DC; T. Matte, New York Academy of Medicine, New York, NY; J. Rodman, U.S. Environmental Protection Agency, Washington, DC

Childhood lead-based paint poisoning can be virtually eliminated in 10 years. Blood lead levels in children younger than 6 years have declined more than 80% since the mid-1970s by concerted governmental effort and voluntary private actions. However, nearly 1 million children have blood lead levels greater than 10 ?g/dL; prevalences are 16% for low-income children in pre-1946 housing vs. <1% for middle income children in post-1972 homes.

The most common source of childhood lead poisoning is lead-based paint in older housing and the contaminated dust and soil it generates. Eliminating lead paint hazards in older, low-income housing is the most important remaining challenge in eradicating childhood lead poisoning.

This presentation gives an overview of the Federal Lead Poisoning Prevention Strategy and shows why it is feasible to virtually eliminate childhood lead poisoning from residential exposure to leaded paint by the year 2010. Key elements are residential lead-based paint hazard control, public education to parents and communities, blood lead screening with early intervention (especially Medicaid-eligible children), enforcing federal lead paint laws, research to decrease costs and quantify certain exposure pathways, and surveillance to assess progress.

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A HEALTHY HOMES MODEL BASED ON A SUCCESSFUL LEAD PROGRAM. D. Jordan, Alameda County LPP, Oakland, CA

A comprehensive approach to multihazard environmental interventions will be discussed with an emphasis on efficacy, sustainability, and cost-effectiveness. The focus will be on lead, moisture control, molds, integrated pest management (IPM), safety, and toxics in residential properties. The model presented will be replicable across a broad range of organizations and properties.

The model used links two interrelated types of residential settings: Licensed family child care homes in high risk communities and the primary family residences of the children cared for in these facilities.

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