Penicillum/Aspergillus. The proportion of Penicillium spores indoors is usually elevated compared to outdoor levels. This increase appears to be more pronounced in buildings with extensive moisture damage.

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AIR INLET VELOCITY PROFILE: AN IMPORTANT FACTOR IN COMPUTATIONAL FLUID DYNAMIC SIMULATION OF INDOOR CONTAMINANT DISPERSION. E. Lee, C. Feigley, University of South Carolina, Columbia, SC.

Determining airborne contaminant transport and distribution in buildings is often essential for understanding indoor air quality problems. Computational fluid dynamics (CFD) has been used increasingly to simulate airflow and contaminant transport processes, but many simulation efforts have not been wholly successful. Thus, understanding the factors affecting the accuracy of such simulations is critical. The goal of this study was to test and validate CFD approaches for simulating the dispersion of gases and vapors. Tracer gas concentrations were measured at points in a three-dimensional grid throughout a 1-m × 0.3-m × 0.7-m chamber using a photoionization detector. Air flowrates were scaled using kinematic similarity criteria to represent a full-sized room at two realistic Reynolds numbers (Re = 500 and 5000). Also, chamber tracer concentration was simulated using CFD, initially assuming that air inlet velocity was normal to and uniform across the inlet face. The simulated three-dimensional distribution of tracer gas concentration matched measured patterns moderately well at the high Re, but significant differences in these patterns were observed at the low Re. Measured air velocity was found to vary substantially across the inlet face and the velocity profile differed for the Re numbers tested. Thus, another set of CFD simulations accounting for inlet velocity variation was performed. For the high and low Re numbers respectively, the average differences between measured and CFD concentrations were 41% and 55% assuming uniform inlet velocity, but only 9% and 1% using measured inlet velocity profiles in the simulations. Graphical comparisons revealed that CFD underestimated observed concentrations for both inlet boundary condition treatments, but use of measured inlet velocity profiles produced much better agreement with observed concentration levels and spatial patterns. These results suggest that use of realistic air inlet boundary conditions is important for accurate CFD simulation of contaminant dispersion in rooms and other enclosed spaces.

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INDOOR AIR QUALITY TOOLS; EDUCATION, PREVENTION AND INVESTIGATION. P. Maynard, University of California, Berkeley, Berkeley, CA; L. Morris, University of California Santa Cruz, Santa Cruz, CA.

Industrial Hygienists at the University of California, Environment Health and Safety offices feel that indoor air quality (IAQ) problems should be addressed in a consistent manner following best practices. A work group was created to focus on IAQ and prepare a guidance document that could be used by the nine campuses and three national laboratories in the University of California. The seven members of the work group met and had monthly conference calls for approximately 2 years. The resulting work product is a 90-page document titled "Indoor Air Quality Tools; Education, Prevention and Investigation." The collaboration allowed industrial hygienists to focus on common IAQ problems, and share knowledge, experience and solutions. Many of the work group's experiences and successes are incorporated into the details of the IAQ Tools document. "IAQ Tools" is available at www.ehs.ucsc.edu/ih/IAQC/iaq/IAQC.html. The document is divided into proactive and reactive sections. The five proactive chapters include topics such as organization, HVAC design, operation, maintenance, and how to control microbial growth. The reactive section gives suggestions on how to conduct an IAQ investigation, and includes a number of forms and flowcharts that promote a consistent approach to the confusing practice of IAQ investigations. The reactive section also includes information and fact sheets on what occupants' can do to improve the air quality of their work spaces. The systematic approach described in the document provides structure and logical endpoints to IAQ investigations which otherwise might be difficult to conclude. The University of California Indoor Air Quality work group continues to meet to discuss technical topics and controversial subjects, and to share case studies. The plan is to keep the web-based document "IAQ tools" up to date with the latest proactive and reactive information on indoor air quality.

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MEASUREMENTS OF AIRBORNE MICROORGANISMS AND MVOCS AT AN ELEMENTARY SCHOOL IN WEST VIRGINIA. P. Gao, R. Boylstein, S. Berardinelli, G. Feather, E. Hnizdo, G. Kullman, NIOSH, Morgantown, WV.

Exposure to airborne microorganisms was investigated in relationship to health complaints among teachers at an elementary school in West Virginia. The school, constructed during the 1920's, is a four-story brick building of about forty classrooms. The basement had evidence of water leaks/incursions. A Health Hazard Evaluation (HHE) was conducted at the school during1999. A questionnaire survey showed that employees who worked in the basement area reported higher occurrence of asthma-like respiratory symptoms than employees who worked on the 1st or 2nd floor of the school. Almost all employees from the basement area (89%) reported wheezing and shortness of breath with wheezing during the last 12 months, and 66.7% reported taking medication for breathing problems. Air samples were taken to determine microbial volatile organic compounds (MVOCs), culturable fungi and bacteria, and total fungal spores in air, respectively. Sampling locations included three rooms in the basement area, a classroom on the ground floor, and a classroom on the 2nd floor. Samples were also taken outside the school for comparison. MVOC concentrations were determined to be 724 to1,876 ng/m3. Culturable airborne fungi and bacteria ranged from 132 to1095 CFU/m3 and 230 to 892 CFU/m3, respectively. Total airborne fungal spores ranged from 840 to 5,694 spores/m3. The basement area had a unique representation of Basidomycetes and Aspergillus species, and had higher representation of bacterial species not found in the ambient or 1st and 2nd floor air samples. Regression analyses yielded the highest correlation (R2 = 0.66) between MVOC levels and total culturable bioaerosols (fungi and bacteria), when compared to the correlation between MVOC levels and culturable airborne fungi (R2 = 0.58) or bacteria (R2 = 0.39) alone.

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IH EVALUATION OF HVAC SYSTEMS IN IAQ INVESTIGATIONS. T. Kallio, S. Rhodes, Council Rock Consulting, Inc., Columbia, MD; T. Traum, Council Rock Consulting, Inc., McLean, VA.

Inadequate ventilation was identified as a contributing factor of health complaints in 53% of the buildings investigated by NIOSH from 1971 to 1989. A review of 1362 building investigations conducted by Health and Welfare Canada (1984-1989) revealed that inadequate ventilation was contributory in 52% of the problems. It is obvious that HVAC system performance and maintenance is a major component of indoor air quality. We have developed and implemented a "HVAC System Evaluation Program" to assist the IH in the performance of a complete and accurate HVAC system assessment. This program overcomes jargon, system drawing communication, and survey completeness issues while improving report quality and findings communicability.

One of the goals in developing this assessment tool is to eliminate confusing jargon. Describing HVAC systems with a common "language" enables concise, accurate reporting of observed conditions and facilitates the development of sound and understandable recommendations. To ensure that all available information on the building and its ventilation system is obtained, a pre-inspection survey form is submitted to the facilities manager/building engineer. This form, returned to the industrial hygienist for review prior to the site inspection, provides basic building and systems information as well as alerts the IH of potential obstacles in the path of a complete and successful evaluation. To facilitate documentation of HVAC systems within the building, standardized diagrams of basic HVAC systems are marked-up to record the system components and observed conditions. A system specific checklist focuses the IH on critical components and operating parameters of the system. HVAC system documentation is supported with informational photographs.

This program and associated materials have resulted in the development of concise, readable, factual, and universally understood ventilation assessments for IAQ surveys. Further, this program can result in cost savings through reduced rework, improved quality and accuracy, and readily validated and defendable recommendations.

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AN INVESTIGATION OF SIZE-SPECIFIC PARTICLE CONCETRATIONS USING A REAL-TIME MONITOR IN A HOSPITAL SETTING. L. Sabatino, C. Rao, M. Berakis, K. Kreiss, NIOSH, Morgantown, WV.

Indoor air quality investigations would benefit from direct reading instruments that can quickly identify potential sources. Aerosols are an important factor in many IAQ investigations, being associated with both chemical and microbial contaminants. Particles with aerodynamic diameters <1 micrometer may be a health concern. Since size distributions and concentrations are variable, a convenient size-selective particle monitor for indoor environments is needed. Particle monitoring was conducted in an 8-story hospital. During the sampling period, forest fires burned approximately 60 miles away. Depending upon weather conditions, the city had clear and smoke-filled days. Seventeen indoor and one outdoor locations were monitored. GRIMM real-time data-logging dust monitors were used to

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ABSTRACTS