

advanced protein assay and A280nm. ELISA was used to compare purified allergen standards with current extract-based commercial standards. When comparing the Universal Standard and commercial ELISA standard, overlapping curves were obtained for Derp1, Feld1 and Canf1. There was a 1.7-fold difference for mite Group 2 allergens, and ~8-fold difference for Derf1 and a ~5-fold difference for Blag2. This suggests that Derf1 and Blag2 are significantly over-estimated using current extract-based ELISA standards, as compared to the purified proteins. A single Universal Standard of purified natural allergens can be used for allergen exposure assessment by ELISA or multiplex array technology. Allergen standards should be established based on protein determinations and International Reference Standards should be developed for calibration purposes. These standards will improve the quality and reproducibility of IAQ exposure assessments.

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GROUNDWATER VAPOR INTRUSION INTO A SCHOOL—MODELED CONCENTRATIONS VS. MONITORING RESULTS

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and should not be used to predict future indoor air concentrations; rather, it should be used to decide whether to gather additional air monitoring data.

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CHARACTERISTICS OF TRICHODIENE PRODUCED BY GROWTH OF STACHYBOTRYS CHARTARUM ON GYPSUM BOARDS USING SOLID PHASE MICRO-EXTRACTION (SPME) ANALYSIS

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In the past decade there has been increasing concern about the adverse health effects associated with fungal growth in the indoor environment. *Stachybotrys chartarum* is well known as a species colonizing wet building materials containing cellulose. *S. chartarum*, a toxigenic mould, can produce various volatile chemicals which collectively are termed microbial volatile organic compounds (mVOCs). We focused this investigation on one mVOC, trichodiene, which is a volatile sesquiterpene, and a biochemical precursor for the formation of non-volatile trichothecene mycotoxins.

To identify and characterize trichodiene production, *S. chartarum* spores were inoculated onto sterilized gypsum boards containing 2 lbs/msf borate preservative or no added borate control. Inoculated gypsum squares were incubated at room temperature in 2 litre jars supplied with one of the following atmospheres: 100%, 93.6%, 85%, 84.3%, or 75.3% relative humidity (RH). Mould growth was monitored by weekly changes in VOC profiles by SPME on a gas chromatograph with flame ionization detector. Levels of CO₂ and ergosterol, indicators of metabolism and biomass, were determined at the end of the experiment.

Trichodiene was identified and confirmed using gas-chromatography/mass spectroscopy. A trichodiene peak was detected beginning at 15 days of incubation, and reached a maximum at 35 days incubation, and then gradually decreased. Borates were effective at preventing or reducing mould growth. Borate-treated materials appeared to be resistant to *S. chartarum* growth and no trichodiene was detected. Sub-inhibitory levels of borates did not stimulate the production of different volatile metabolites, suggesting the lack of stress metabolism. Incorporating borate preservatives into building materials may provide a measure of protection against mould growth and enhance IAQ. CO₂ production, ergosterol, and trichodiene all showed a dose-response trend. *S. chartarum* grew on the untreated gypsum board, and produced trichodiene only at 100% RH.

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EVALUATION OF EXPOSURES AT A CERAMIC SHOP

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According to the Bureau of Labor Statistics, the number of craft artists entering the workforce has increased by 25% since 2004. Many studies and statistics on health hazards in the ceramic industry are based on industrial populations of workers, who have significantly different exposure and duration rates compared to employees working in smaller ceramic shops, schools, and private studios. These employees may be exposed to a variety of hazards including metals, respirable dusts and silica, kiln emissions, heat, and ergonomic issues. The National Institute for Occupational Safety and Health (NIOSH) performed an exposure assessment at a ceramic shop in response to employer concerns over possible long-term silica exposure in clay dusts and kiln emissions. Area and personal breathing zone samples (PBZ) for silica and respirable particulates were taken for all five full-time employees. Separate task-based PBZ samples were also taken while employees performed high dust-generating tasks, such as mixing raw materials for clays and glazes. Area air samples were taken for volatile organic compounds, sulfur dioxide, carbon monoxide (CO), and metals during kiln firing. One employee had a time weighted average silica (quartz) exposure that reached the NIOSH recommended exposure limit of 0.05 milligrams per meter cubed. The task of moving bags of raw materials seemed to contribute significantly to this exposure. Data loggers showed periodic increases of CO levels that reached 71.5 parts per million in areas around the kiln, indicating inadequate ventilation. Improper respirator use by employees was observed, including wearing respirators over facial hair. Our recommendations included installing an active exhaust system for the kiln and local exhaust ventilation in the area where clay and glazes are mixed. We also recommended establishing a respiratory protection program and providing personal protective equipment training until engineering controls can be implemented.

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ESTIMATION OF INDOOR CARBON MONOXIDE CONCENTRATION WHEN PROPANE-POWERED GENERATOR WAS USED INDOORS

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Propane-powered generators are not supposed to be used indoors. However, hundreds of people using gas or propane powered generators have been poisoned because the gas or propane-powered engines and tools produced hazardous concentrations of carbon monoxide (CO) even in relatively open buildings. This was the case where small generators were used indoors for welding in a warehouse. After a few days of the welding operation, workers showed CO poisoning symptoms. Due to the nonspecific nature of CO poisoning, hospital visit and formal diagnosis were completed after the 13-day welding op-