

RH and temperature with RH reaching saturation levels during nights. One group of pDRs including two passive, one active and one heated active operated inside the chamber. A 2nd combination of pDRs, excluding the heated active, were placed inside a heated field chamber within which RH was reduced. The field chamber was placed inside the walk-in chamber. Both chambers were continuously purged with outdoors air. Sampling runs were conducted for 24 hours while monitoring temperature and RH within both chambers. Statistical tests were applied to the results. Passive pDRs under high RH showed, up to several folds, higher concentrations compared to the co-located passive pDRs within the dry field chamber whereas there was no significant difference between the same two samplers during moderate RH levels. A strong positive correlation between the RH and the passive pDR outputs was observed. The active pDRs under high RH also showed higher outputs than those within the dry field chamber. However, the continuous flow of air over the instrument's optic system seemed to somewhat reduce the interfering effect of high humidity. The MIE heated pDRs outputs were also higher than those of active pDRs inside the dry field chamber. Our heated field chamber, however, showed good potential for use as a RH shelter for ambient air sampling when encountering high RH. Factors responsible seem to be growth of hygroscopic particles, increase in surface refractive index and condensation of water vapor.

84. PORTABLE X-RAY FLUORESCENCE SPECTROMETRY FOR MEASURING MULTIPLE AIRBORNE METALS: A NIOSH SCREENING METHOD UNDER DEVELOPMENT. N. Lawryk, B. Chen, NIOSH, Morgantown, WV

In welding and other metalworking operations, illnesses can result from excessive inhalation exposures to metals such as chromium, nickel, and zinc. Portable XRF can help determine airborne metal concentrations within minutes of sample collection, thereby facilitating exposure assessment and control strategies. A set of 128 experimentally generated welding fume samples were collected on 37 mm diameter filters of four different media (cellulose ester, polypropylene, Teflon, and PVC). All filters were analysed by portable XRF for iron, chromium, nickel, zinc, copper, and manganese. Four welding procedures were sampled: gas metal arc welding and flux core arc welding on mild and stainless steel substrates. Fume deposit masses ranged from less than 0.5 to 60 milligrams, equivalent to a range from less than 0.3 to greater than 10 times the occupational exposure limit (OEL) for most metals of concern. XRF calibration was verified using Mylar backed thin film standards. Elemental concentrations were directly proportional to total fume mass (correlation coefficient > 0.98) for total fume

deposits less than 30 milligrams. To simulate workplace dust in the samples, Arizona road dust (1-80 micrometer particle diameter) deposited on the filters at a mass equivalent of 0.5 times the OEL did not change the spectra reported by the instrument when compared to samples without dust deposits that were collected under identical conditions. Teflon filter media had the lowest metal contamination and therefore lower limits of detection and quantitation than cellulose ester. Further testing of the XRF on location at workplaces is planned. Field portable XRF spectrometry continues to show promise as a fast, reliable, and comparatively inexpensive screening technology for assessing airborne metal exposures.

85. FIELD COMPARISON OF TOTAL AND SIZE-SELECTED PARTICULATE MEASUREMENTS IN THE WOOD-PROCESSING INDUSTRY. R. Rando, D. Mokadam, H. Poovey, J. Brisolaro, H. Glindmeyer, Tulane University, New Orleans, LA

Historically, dust in wood processing industries has been measured with the 37-mm closed-face cassette "total dust" sampler. The ACGIH recently suggested a conversion factor of 2:1 between inhalable and "total" wood dust. In this work, 57 sets of area samples were collected in ten wood-processing plants including saw mills, secondary millworks, furniture and cabinet manufacturing. Side-by-side sampling was performed using the "total dust" sampler and various reference samplers: the SKC aluminum cyclone for respirable particulate, the GK 2.69 cyclone for thoracic particulate, the IOM sampler for inhalable particulate, and the Respicon -- a 3-stage virtual impactor that simultaneously collects all 3-size fractions. A subset of samples also included the Accucap, a total dust sampler modified to incorporate particulate deposited on the walls of the filter holder. Samplers were placed in selected areas of the plants, either in the free-field or mounted on a 2-dimensional "bluff body". The mean (range) dust levels across all plants were: inhalable, 2.11 mg/m³ (0.11 - 11.06); thoracic, 0.42 mg/m³ (0.05 - 1.38); respirable, 0.13 mg/m³ (0.02 - 0.54); and "total dust", 1.03 mg/m³ (0.03 - 6.53). Multivariate regression analysis of total dust measurements versus the reference measurements along with sampling mode (free-field v. bluff-body) and operation (sanding v. other) showed no statistical correlations with either respirable or thoracic dust. In contrast, total dust correlated well with inhalable dust ($p << 0.01$), but with highly significant differences between the sampling modes and the types of operation sampled. Thus to convert between total and inhalable dusts, separate conversion factors for various wood dust sampling conditions would be needed. Total dust measured by Accucap exhibited less variability than that measured by the traditional closed-face cassette.

86. SAMPLING AND ANALYSIS OF MICROBIAL VOLATILE ORGANIC COMPOUNDS (MVOCS). J. Campbell, C. Casteel, K. Chen, M. Taday, Performance Analytical Inc., Simi Valley, CA.

Microbial volatile organic compounds (MVOCs) are increasingly being used as an investigative tool in indoor air quality (IAQ) evaluations. These compounds represent challenges in terms of sampling and analysis, since the list of MVOCs frequently quantified in IAQ investigations include polar and non-polar compounds with a wide range in boiling points (66 to >250 C). The approach most frequently cited involves collection on a solid sorbent (e.g., Anasorb 747) with solvent desorption and analysis by gas chromatography / mass spectrometry (GC/MS) using selective ion monitoring (SIM) mode. However, very little work has been done to validate this method at the levels that are being reported in the scientific literature (e.g., 0.01 mg/m³ based on a 48 liter sample).

This paper presents the results of validation of a sampling and analytical method for MVOCs performed utilizing the NIOSH approach. Two different sorbents (coconut shell charcoal; Anasorb 747) and several different desorption solvent combinations were examined as part of this process, which included analysis of samples collected from known atmospheres and during field trials. Based on the combined results of desorption efficiency, instrument detection limit, method detection limit, one month storage and breakthrough studies, as well as tube artifacts, it was concluded that 12 of the 15 MVOCs collected on either sorbent could be consistently and reliably quantified down to a method reporting limit (MRL) of 1 mg/m³. Desorption efficiencies of greater than 75% were determined at this MRL for all compounds except three alcohols (1-octen-3-ol, 3-octanol, 2-octen-1-ol), which had a MRL of 20 mg/m³. In contrast, a much lower MRL was achieved for geosmin and 2-MIB. Although these MRLs are substantially higher than those reported in the literature, they were all below the available odor thresholds for the compounds in question.

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87. EMPIRICAL DATA AND MODELING OF A FLAMMABLE SPILL IN A CHEMICAL FUME HOOD DO NOT SUPPORT THE NEED FOR FIRE SUPPRESSION WITHIN THE CHEMICAL FUME HOOD. P. Harnett, M. Greenhalgh, COEH, Inc., Ringoes, NJ

Some local jurisdictions' recent interpretations of NFPA 45 (1996) have resulted in requests to use fire sprinkler systems within chemical fume hoods (CFH). Although with

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ABSTRACTS



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PF 101 Agricultural Health and Safety

Papers 1-6

1. RELATIONSHIPS BETWEEN WORK EXPOSURE AND RESPIRATORY OUTCOMES IN POULTRY WORKERS.

S. Kirychuk, J. Dosman, P. Willson, L. Dwernychuk, University of Saskatchewan, Saskatoon, SK, Canada; J. Feddes, A. Senthilselvan, C. Ouellette, University of Alberta, Edmonton, AB, Canada

A pilot study was conducted on 74 poultry barn workers in Western Canada during the winters of 1998-2000. General respiratory health, current, chronic and work related respiratory symptoms; general work duties, and work-site factors were ascertained, pre-exposure, by questionnaire. Personal airborne exposure levels and changes in symptoms and lung function were measured across the work-shift for all workers. Workers were classified according to the type of poultry operation (floor based, n=53; cage based, n=13) in which they worked. There was no significant difference in daily hours spent in the barn between those who worked with caged poultry (5.41±2.35 hours) and those who worked with floor-based poultry (4.42±2.48 hours). Age of birds was 47.10±58.36 days for floor based versus 155.91±63.01 days for cage based facilities.

There were no significant differences in personal environmental measurements between cage-based and floor-based facilities (ammonia 13.22±13.70 ppm, 17.34±16.35 ppm; total dust 5.74±4.85mg/m³, 10.01 ±8.84 mg/m³; endotoxin 6046±6089 EU/m³, 5457±5934 EU/m³ respectively). There were no significant differences in across work-shift change in pulmonary function indices between workers from cage and floor-based operations. For the entire sample total dust dose (work hours/day x total dust) significantly correlated with across-shift change in FEV₁, whereas endotoxin dose and ammonia dose did not. Stocking density was significantly correlated with average ammonia (ppm, p=0.002) and ammonia dose (ppm x work hours/day; p=0.004) in floor based operations and with total dust (particles/ml, p=0.002) in cage based populations. Stocking density was also significantly correlated with chronic cough (p=0.003) and across work-shift cough (p=0.05) and chest tightness (p=0.06) for workers from floor based operations; and with phlegm when working (p=0.018) and chest tightness across the work-shift (p=0.004) for workers from cage based operations. Type of poultry production operation and therefore type of work exposures appear to significantly impact symptoms experienced by workers exposed to these atmospheres.

2. DUST GENERATION SYSTEM FOR AGRICULTURAL SOIL DUST. K. Lee, R. Domingo-Neumann, R. Southard, UC Davis, Davis, CA

Agricultural workers are prone to exposure to mixed dust of inorganic and organic compounds. Diverse working conditions and operations in agriculture make direct measurements of the mixed dust exposure difficult. This study was conducted to develop a new dust generation system to determine possible exposure potency indicators of soil samples. The dust generator consists of a blower, a rotating chamber and a settling chamber. The rotating chamber has inner baffles to provide sufficient agitation of the samples while the chamber is rotating. A blower provides air into the rotating chamber, and the suspended dust is moved to the settling chamber through a perforated pipe. A small fan inside the settling chamber helps maintain suspension of the dust. Various size fractions of dust are sampled on filters suspended in the chamber via outlet ports and attached pumps. Air pressure is released through a filter plate mounted on the wall of the settling chamber. Various operating conditions were evaluated: air intake from blower, speed of rotation, soil mass and sampling time. To evaluate the characteristics of dust from the system, we collected dust samples from agricultural fields while the soil was prepared for