

tor capable of measuring several different remote locations. By releasing a small quantity of SF₆ into the production area of the facility, a simulation of the entrainment of an air pollutant or industrial air contaminant was modeled.

The results of the tracer gas analysis effectively illustrated the locations throughout the facility that had the highest percentages of SF₆ when compared with the production area of the facility. The highest percentage was 12%, the lowest 6.3%. The locations where these concentrations occurred help characterize where the greatest concentration of air contaminant may accumulate.

These findings from both the air contaminant monitoring and the tracer gas analysis allow the conclusion that by conducting a preliminary tracer gas analysis of a facility, an entrainment model can be established. Thereafter, the model can be used in order to most effectively locate and sample for specific air contaminants.

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THE CONTINUING ADVENTURES OF NIOSH INVESTIGATORS DURING AN IEQ INVESTIGATION. G. Burr, K. Martinez, R. Malkin, NIOSH, Cincinnati, OH

In 1998, NIOSH conducted an indoor air quality (IEQ) evaluation at a large midwestern high school (3000+ students, 350 teachers) constructed in the 1970s. Staff and students were experiencing problems related to poor IEQ in the school, including sinus cancer, memory problems, inability to concentrate, metallic taste, bleeding lungs, dizziness, depression, respiratory problems, lethargy, chronic fatigue, chest congestion, burning eyes and throat, and nausea.

This survey included employee interviews and evaluation of the heating, ventilation, and air-conditioning (HVAC) systems, and a visual examination for fungal growth in the building. Measurements were made for carbon dioxide (CO₂), temperature, and relative humidity (RH), and bulk samples were collected for subsequent analysis of bacterial and fungal content. The CO₂ concentrations increased during the school day (peaking at 1500 ppm) while the temperature and RH ranged from 68°F to 75°F and 17% to 23%, respectively. Localized microbial reservoirs in the school existed at the time of the NIOSH site visit, and ongoing moisture incursion or moist conditions were noted.

The presence of *Stachybotrys* fungal species in some locations was probably indicative of a small residual from past contamination. The presence of *Cladosporium* fungal species in the interior duct insulation of several HVAC units suggested that the previous duct cleaning performed at the school might have been ineffective. In addition to the environmental sampling results, this poster discusses the employee interviews and examines other events that impacted on the conduct of this evaluation, including involvement by community action groups and the local media (newspapers and television stations).

This poster also describes recommendations made for a further evaluation of the ventilation systems, identification and correction of water incursion problems, remediation of identified localized patches of mold, and the hiring of an environmental quality manager at the school.

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EMISSION SOURCE IDENTIFICATION OF INDOOR AIRBORNE FIBER. J. Chen, Duke University Medical Center, Durham, NC

Man-made vitreous fiber (MMVF) released from

ventilation duct insulation was found to be a potential source of indoor pollutant. This study provides a quantitative method to differentiate airborne fiber emission sources from HVAC systems and room environments. Airborne fiber concentrations were measured in offices and laboratories in four buildings from 22 to 31 years old with internal MMVF ventilation duct insulation. The concentrations were determined according to NIOSH 7400 with sampling air volume greater than 2000 L for most samples.

One diffuser and one area sample were collected at each location. The diffuser sample was collected inside a bag that was attached to the diffuser and, thus, isolated the supply air through the HVAC system from the room environment. A concurrent area sample was taken in the same room for comparison. An outdoor sample was also taken for each sampling date.

Twenty-nine paired diffuser and area samples and 11 outdoor samples were taken and analyzed between August 1998 and August 1999. Concentrations of diffuser samples ranged from 0.00000 fibers per cubic centimeter (f/cc) to 0.00143 f/cc, area samples ranged from 0.00015 f/cc to 0.00955 f/cc, and outdoor samples ranged from 0.00029 f/cc to 0.00126 f/cc.

It was concluded that the indoor airborne fiber concentrations were low and most of the fibers observed were not MMVFs. This indicated that little MMVF was released from the duct insulation. Concentrations of area samples were significantly higher than diffuser samples using two-tailed, paired t-test (CI = 95%, p = 0.007). This implied that sources, including human, other than from the HVAC system would significantly increase the indoor airborne fiber concentration. Research relating to fiber release from the HVAC system should conduct diffuser samples instead of area samples to avoid bias.

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PROACTIVE BUILDING INDOOR AIR QUALITY INVESTIGATIONS. J. Koehn, S. Coleman, JK, Inc., Houston, TX

Building owners and/or management company personnel have become increasingly aware of the effect of current indoor air quality (IAQ) status on building occupants. Various responses have ranged from reactive to proactive measures with respect to reports of sick building syndrome (SBS) as well as complaints of odors or poor indoor air quality.

Our consulting group has seen implementation of a more proactive approach to assessment of IAQ status for a wide range of facilities, including school districts, leased tenant spaces, and general management of occupied high rise buildings. Some clients have contracted for conduct of quarterly monitoring of basic IAQ parameters as well as microbial agents. Other clients have specified monitoring for standard chemical parameters, particulates, total volatile organic compounds (TVOCs), and airborne bioaerosols associated with building renovation work activities in order to provide baseline documentation.

The goal of most monitoring projects is to document existing environmental conditions related to current facility indoor air quality. Initial walk-through surveys of buildings by industrial hygienists have yielded information for development of an appropriate air sampling strategy to best measure concentrations of "potentially hazardous" substances that could reasonably be expected to exist within the workplace environments.

Scheduled monitoring efforts have been performed based on specific needs such as quarterly or

annual time intervals in order to document conduct of a representative IAQ based on accepted work practices and procedures or to complete workplace surveillance to identify potential harmful occupational exposures.

A flexible approach to implementation can be designed to obtain the appropriate monitoring data to best describe and document current IAQ status. Based on the results obtained, appropriate control measures can be developed.

Respiratory Protection Papers 418-422

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RESPIRATORY PROTECTION REQUIRED DURING AUTOBODY PAINT SPRAYING. L. May, OSHA, Bridgeport, CT

There is national, state, and local interest in respiratory illnesses associated with spray finishing operations, particularly those using isocyanates.

According to NIOSH, approximately 30% percent of adult asthma cases may be attributed to occupational exposure.

Of the known work-related asthmagens, isocyanates are referenced as the most common cause of occupational asthma. Problems tend to range from respiratory irritation to occupational asthma. Cases of isocyanate-induced asthma in autobody workers have been documented to be between 5% and 10% in Connecticut.

Having recognized the potential respiratory hazards found within autobody operations, we inspected 25 autobody establishments within our jurisdiction. Of these 25, deficiencies were found at 19 establishments. The total number of employees exposed to potential hazardous conditions was 101. The most frequently found problem during our inspections was deficiency in the employer's respiratory protection program. Of the 101 potentially exposed employees, 86% or 85% had not been medically cleared to wear respirators.

In 10 establishments, the proper respirators were not being used, specifically when there was potential for an IDHL atmosphere, for spraying products containing isocyanates. In these 10 inspections, 54 employees (or 53% of the total population) were potentially exposed.

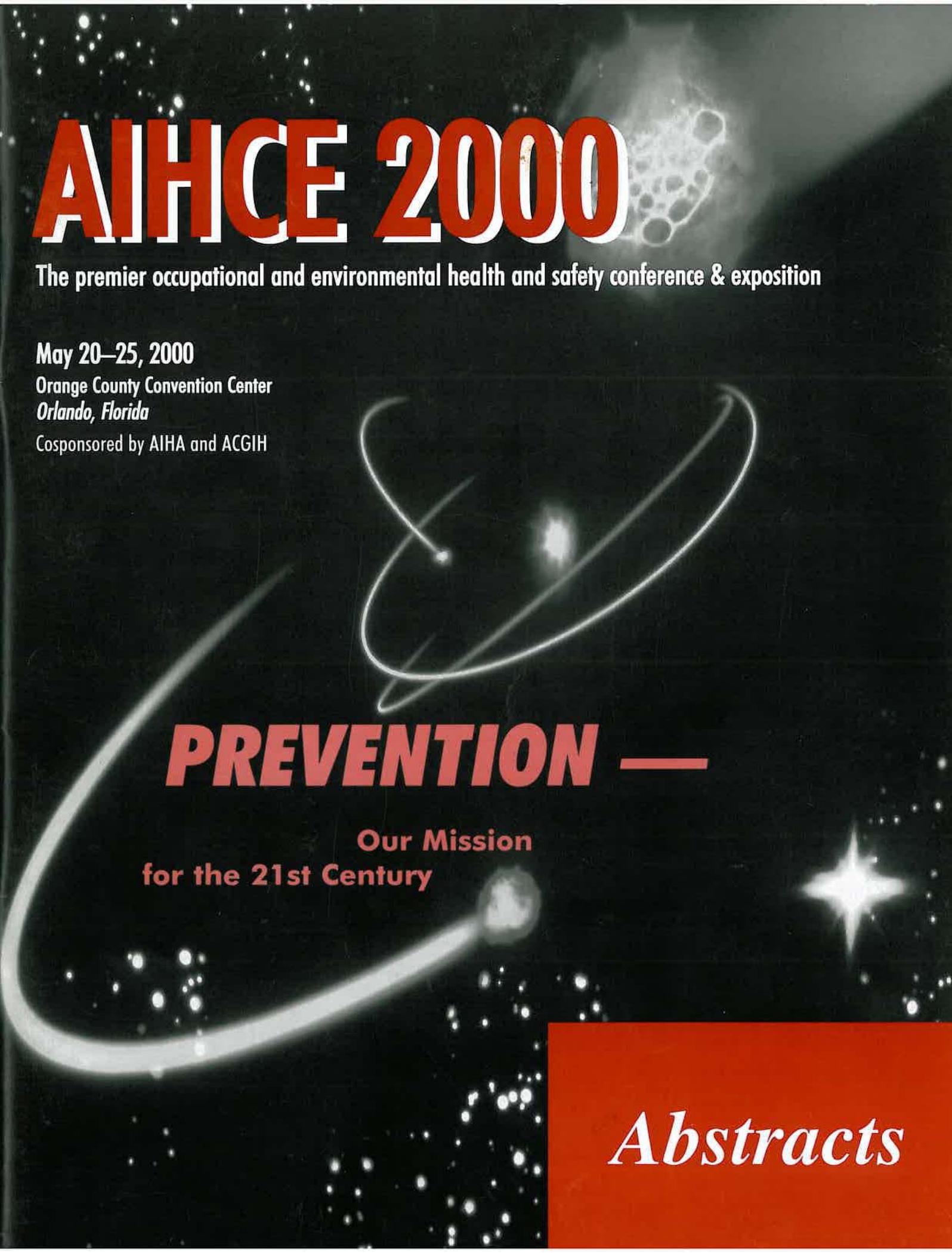
Most employers were not aware of the fact that isocyanates are primary sensitizers and that if an employee became sensitized, he or she would no longer be able to work in a job that would expose him or her to these materials. The inspections revealed that in nine establishments 49 employees (or 49% of the total population) had not received any training in hazard communication, which included training of the potential hazards of isocyanate exposure.

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RESPIRATOR SUBJECTIVE ASSESSMENT IN AUTOBODY REPAIR SHOPS. Y. Liu, J. Sparer, M. Cullen, M. Stowe, C. Holm, C. Redlich, Yale University School of Medicine, New Haven, CT; S. Woskie, D. Bello, University of Massachusetts-Lowell, Lowell, MA

Subjective evaluation of respiratory protection devices (RPDs) used in autobody shops has been rarely reported. The purpose of this study was to evaluate subjective estimates of comfort and efficiency of negative- and positive-pressure respirators in real autobody work conditions. As part of a large epidemiologic study, 47 workers from 12 autobody shops participated in this evaluation. Subjective

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