

ence range of <0.1 milligrams per liter (mg/L), which suggests that the internal dose to toluene was low. Also, two workers from one region and three from the other had detectable MEK concentrations in their urine that were all an order of magnitude below the American Conference of Governmental Industrial Hygienists Biological Exposure Index (ACGIH BEI™) of 2 mg/L, but above the reference range of <0.1 mg/L for unexposed populations. Overall, the PBZ and urine samples suggest a very low level of VOC and element exposure from tree-marking operations. These sampling results indicated that the only individual compounds that a tree-marker might have been exposed to in detectable concentrations during these surveys and that have a slight but potential, association to reproductive health effects were MEK, toluene, and manganese. All the measured exposures were well below any current occupational exposure limits, but the relevant occupational exposure limits are not based on reproductive effects. Reproductive systems are quite sensitive, and even very low paint exposure could not be completely dismissed as a possible contributor to reproductive health effects, if any association is documented by the epidemiologic study.

### 339

**POLYCHLORINATED DIBENZO-P-DIOXIN AND FURAN SURFACE CONTAMINATION AND CHLOROFORM EMISSIONS AT A PAPER MANUFACTURER.** K. Hanley, R. Mouradian, M. Kiefer, NIOSH, Cincinnati, OH

The National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation to assess employee exposures to polychlorinated dibenzo-p-dioxin and furan (PCDD/F) congeners, and chlorinated volatile organic compounds (CVOs) formed as by-products during wood pulp bleaching. The survey included environmental monitoring for PCDD/F surface contamination and air monitoring for CVOs.

Surface wipe samples were collected and analyzed for the 2,3,7,8-tetra PCDD/F isomers as well as total tetra-chlorinated through octa-chlorinated PCDD/F isomers. The PCDD/F concentrations are reported as 2,3,7,8-TCDD toxicity equivalents (I-TEQ) using the 1989 International Toxicity Equivalency Factors. The I-TEQ levels from the wipe samples ranged from 13 to 651 picograms per square meter (pg/m<sup>2</sup>) in the bleach plant and from 86 to 1049 pg/m<sup>2</sup> in the paper mill. The highest PCDD/F contamination was obtained near the dry end of a paper machine and on a hardwood bleaching rinse tank. Surface wipe samples confirmed the potential for workers to be exposed to low levels of PCDD/F. However, all I-TEQ concentrations were well below the National Research Council guidelines of 25,000 pg/m<sup>2</sup> for PCDD/F surface contamination.

Area and personal breathing zone air samples were collected and analyzed for CVOs. Mass spectroscopy analysis qualitatively identified chloroform, 1,1,1-trichloroethane, carbon tetrachloride, dibromochloromethane, and bromodichloromethane as the major com-

pounds; these compounds were quantitatively analyzed with gas chromatography. Area concentrations of chloroform obtained near bleaching rinse tanks ranged from 1.8 milligrams per cubic meter (mg/m<sup>3</sup>) to 116 mg/m<sup>3</sup> and were highest at the hypochlorite stage. Some worker exposures exceeded the NIOSH recommended exposure limit (REL) for chloroform of 10 mg/m<sup>3</sup>. A follow-up visit was conducted to assess the impact of process changes on airborne chloroform concentrations. Chloroform levels were substantially lower, indicating that reduced use of hypochlorite during pulp bleaching was successful in lowering workers' exposures below the NIOSH REL.

### 340

**AN ALTERNATE APPROACH TO ESTIMATING THE FIT OF SINGLE USE RESPIRATORS: DEVELOPMENT OF A QUANTITATIVE FIT TESTING METHOD.** J. Campbell, U. Bickis, Phoenix OHC, Inc., Kingston, Ontario, Canada

Traditional quantitative fit-testing (QNFT) methods have involved the purchase of dedicated equipment and have not been applicable for use with single use dust/mist/fume respirators. A method for QNFT single use particulate respirators was developed using equipment and materials readily available to occupational hygienists.

Subjects donned probed respirators and were exposed to a sodium chloride aerosol inside a modified fit-testing hood. Two light scattering aerosol monitors, connected to a computer and chart recorder, continuously monitored the aerosol concentration inside and outside the respirators. Using this apparatus, QNFT was conducted on 25 subjects for 2 different makes of respirators. Fit factors were determined for both of the respirators while the subjects completed activities ranging from normal breathing and talking, to the spectrum described in CSA Standard Z94.4-93.

Geometric mean fit factors determined for individuals ranged from 33 to 1654. Activities that involved facial distortions (e.g., smiling, grimacing) generally yielded lower fit factors than other tasks. In conclusion, it was demonstrated that using traditional occupational hygiene equipment, single use dust/mist/fume respirators may be quantitative fit-tested. As this study was conducted in the laboratory, the reported fit factors are higher than would be expected under workplace conditions.

### 341

**IMPLEMENTATION OF A NEGOTIATED CONSENT AGREEMENT BETWEEN THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA) AND THE REFRACTORY CERAMIC FIBER COALITION (RCFC) TO COLLECT AIRBORNE FIBER EXPOSURE DATA.** E. Casey, Unifrax Corp., Amherst, NY; K. Dorman, Thermal Ceramics, Augusta, GA; J. Treadway, Premier Refractories & Chemicals, Inc., Erwin, TN

In 1993, the Refractory Ceramic Fibers Coalition (RCFC; an industry trade association) and the Environmental Protection

Agency (EPA) entered into a voluntary consent agreement to assess occupational exposures to airborne fiber. Under Section 4 of the Toxic Substances Control Act (TSCA), the consent agreement was implemented to provide data to assist in the assessment of occupational exposures to refractory ceramic fiber (RCF) both within primary manufacturing and end-user facilities. A major component of the consent agreement was continuation of a comprehensive product stewardship program (PSP) which commenced prior to the signing of the consent agreement. The PSP involves seven key elements: health effects research, workplace monitoring, exposure assessments, communications, product research, special studies, and study of workplace controls. To date, the RCFC has provided data to the EPA involving hundreds of workplace monitoring samples from RCFC manufacturing and end-user facilities. Following the conclusion of the 3rd year of the consent agreement, 90% of airborne fiber samples fell below the 1.0 f/cc 8-hr time weighted average (TWA) industry sponsored recommended exposure guideline (REG). To date, the PSP has shown significant progress in assessing and reducing occupational exposures to RCF.

### 342

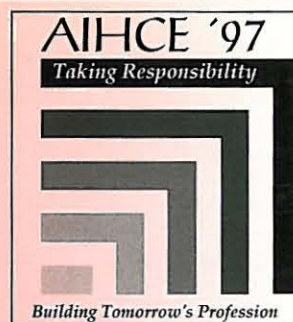
**AN EXPOSURE ASSESSMENT SURVEY OF AN ISOTHIAZOLINONE-BASED BIOCIDES AMONG POWER PLANT WORKERS.** C. Cook, NIOSH, Cincinnati, OH

In September 1995, the National Institute for Occupational Safety and Health (NIOSH) conducted an industrial hygiene survey at a manufacturing plant to assess power plant workers' exposures to biocide containing 1,5% isothiazolinones. After isothiazolinone-based biocide was first introduced at the plant in 1987, workers reported dermatitis, skin rash, eye and upper respiratory irritation while performing maintenance duties on water cooling towers. Employees became particularly concerned about the known mutagenicity properties of the biocide.

Isothiazolinones are heterocyclic organic compounds present in several chlorinated and unchlorinated forms. Isothiazolinones are nonoxidizing antimicrobial agents that are effective against gram-positive and gram-negative bacteria, as well as fungi, yeast, algae, and legionella pneumophila. Isothiazolinones are used industrially as antibiofouling and slimicides in metalworking fluids, paper mills, swimming pools, leather and fabric, and water cooling towers.

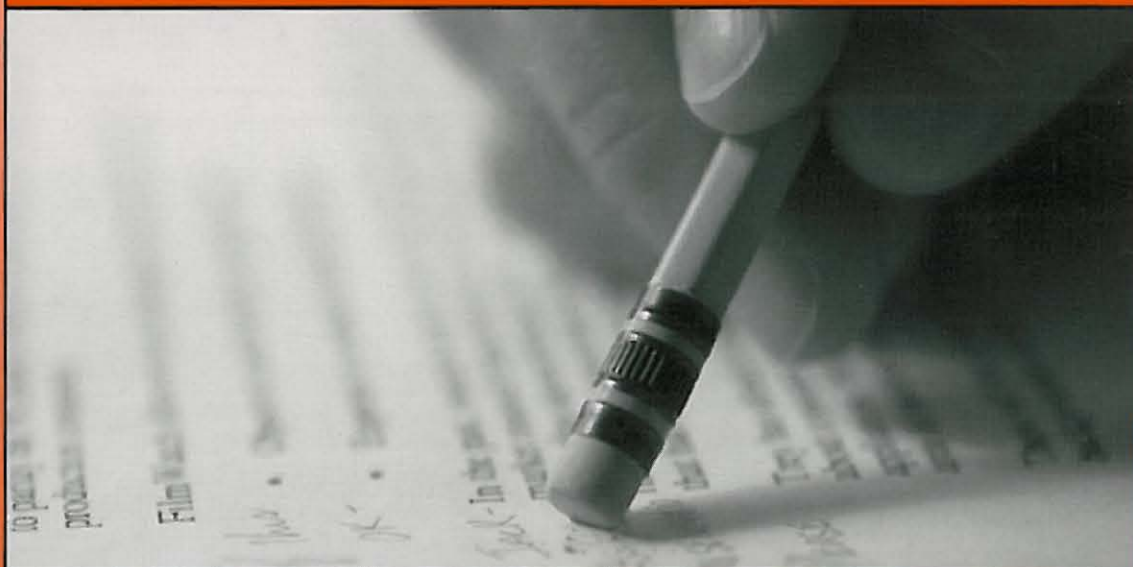
Sixteen personal breathing zone (PBZ) samples (13 full-shift, three 15-minute short-term) and 21 area air samples for isothiazolinones were collected. Analyses of PBZ samples revealed none-detectable levels. A 15-minute area air sample collected above a biocide storage tank measured isothiazolinone concentration of 0.92 milligrams per cubic meter (mg/m<sup>3</sup>), exceeding a chemical manufacturer's recommended 15-minute short-term exposure limit (STEL) of 0.30 mg/m<sup>3</sup>. A second area air sample revealed a trace concentration at an employee break area. Currently, there are no occupational exposure criteria established by NIOSH or the Occupational

# 1997 American Industrial Hygiene Conference & Exposition



*The premier conference for occupational and environmental health and safety professionals*

Conference May 19-23, 1997 • Dallas Convention Center • Dallas, Texas



## Abstracts

*Co-sponsored by American Industrial Hygiene Association and  
American Conference of Governmental Industrial Hygienists*