generated for 50, 100, 150, 200, and 250 ppm. Next, air stream containing 10, 20, and 50 ppm of sulfur dioxide was injected into a mixing chamber using a mass flow controller, mixed with the air stream containing toluene and passed through the test charcoal bed. Toluene breakthrough curves were again determined and compared with those obtained previously. Results show that breakthrough occurred 3% to 12% faster for all toluene concentrations when 50 ppm of sulfur dioxide was present in the air stream. At 50 and 100 ppm toluene, the breakthrough curve was also slightly modified when 10 and 20 ppm sulfur dioxide was present, but no change was noticed at higher toluene concentrations. Applying the Dubinin-Raduskevich model the theoretical reduction in the adsorbed toluene was computed and compared with experimental data. The difference between prediction and experimental data is attributed to the competing mechanism of chemical and physical adsorption of sulfur dioxide onto charcoal.

193.

TWO NEW APPROACHES FOR DEVELOPING RESPIRATOR FIT-TEST PANELS REPRESENTATIVE OF U.S. WORKERS. Z. Zhuang, NIOSH, Pittsburgh, PA; J. Odencrantz, P. Jensen, C. Coffey, J. Guan, H. Hsiao, NIOSH, Morgantown, WV

The respirator fit-test panels currently used are 25-subject panels, developed by Los Alamos National Laboratory (LANL). The LANL panels are based on data from the 1967-1968 survey of U.S. Air Force men and women. Military data may not represent the great diversity in face size and shape seen in civilian populations. In addition, the demographics of the U.S. population have changed over the last 30 years. Thus, it is necessary to assess and refine the LANL fit-test panels. This paper presents two new approaches for developing fit-test panels representative of U.S. workers.

Data from the 1987-1988 anthropometric survey of U.S. Army men and women were obtained for this study. As a partner in the project titled "Civilian American and European Surface Anthropometry Resource (CAESAR)," NIOSH received the manual measurements of 2391 civilian subjects (only two facial dimensions were measured). The CAESAR data were used to determine if the military data were appropriate for civilian workers.

Two fit-test panels were developed using the LANL approach based on the Army data: a panel with cells based on face length and face width (for full-facepiece respirators), and a panel with cells based on face length and lip length (for half-mask respirators). These two panels were then revised with subject weighting to match the racial composition of the U.S. population as determined from the 2000 census. A panel for half-mask respirators was also developed using the first three principal components obtained from a set of six facial dimensions (race-adjusted) that have been shown to be associated with respirator fit and leakage. Respirators designed to fit these panels based on military data are usually assumed to accommodate more than 95% of U.S. workers. However, the LANL and new panels for full-facepiece respirators accommodate only 84% and 83% of the CAESAR subjects, respectively.

194.

DETERMINATION OF KNOWN EXHALATION VALVE LEAKAGE USING AN IRRITANT SMOKE TEST KIT. E. Snyder, NIOSH, Cincinnati, OH; R. McKay, University of Cincinnati, Cincinnati, OH

This study evaluated the ability of a qualitative fit test method (irritant smoke) to detect known exhalation valve leakage. The OSHA protocol for the irritant smoke test mandates the use of a low flow air pump at 200 mL/minute or aspirator squeeze bulb. Many commercial test kits include an aspirator bulb, which is subject to variation from depth and frequency of squeeze. Previous studies on irritant smoke used a hand held squeeze bulb. This study evaluated the effectiveness of a constant low flow pump to detect exhalation valve leakage using an irritant smoke fit test kit.

Twenty subjects wearing North 7600 series full-face respirators equipped with P100 filters were fit tested with a Portacount Plus to ensure adequate fit. After successful fit was demonstrated, the exhalation valve was replaced with a damaged valve and/or rotated approximately 90 degrees to produce a fit factor below 100. Having induced an exhalation valve leak, the irritant smoke test was performed using the OSHA irritant smoke protocol. To avoid introducing additional unknown leakage, all head movement exercises were replaced with the head straight, normal breathing maneuver.

Irritant smoke did not detect 40% of respirators with leaking exhalation valves. Sixty percent of the subjects were able to detect the irritant smoke. Test sensitivity was 60%, well below the ANSI Z88.10 recommended 95% criterion. Of the 12 subjects that detected irritant smoke, none detected the smoke in less than a minute; the average detection time was 3:05 minutes. Other findings to be presented include suppression of the irriant response.

These findings suggest that qualitative fit testing using an irritant smoke fit test with a 200 mL/minute continuous flow pump does not have adequate sensitivity to detect fit factors less than 100.

195.

AN INTEGRATED SAMPLING SYSTEM FOR MEASURING WORKPLACE PROTECTION FACTORS FOR GASES AND VAPORS. W. Groves, The Pennsylvania State University, University Park, PA; S. Reynolds, University of Iowa, Iowa City, IA

Existing methods for measuring workplace protection factors (WPFs) typically entail continuous sampling of ambient and in-mask environments using two personal sampling pumps. This project focused on the development of an intermittent sampling system designed to measure the concentration of gases and vapors inside the respirator during inspiration, while sampling the ambient environment during exhalation. This approach addresses several potential problems associated with continuous sampling including biased results due to lower contaminant concentrations in exhaled air, high sample humidity, and the need for two pumps. The system is based on a pressure transducer circuit that activates a solenoid valve such that a single pump can be used to alternately sample the in-mask and ambient environments. Solid granular adsorbent tubes are used to trap the contaminants making the approach applicable to numerous gases and vapors. A pressure transducer, sampling pump, solenoid valve, and data-logger are integrated into a single battery-powered unit measuring 8"x4"x2.5" and weighing < 2.5 lb. Interface circuitry has been developed to log heart-rate and in-mask pressures, thus allowing estimates of work/ventilation rates to be associated with the resulting WPF measurement. Pressure transducer calibration curves relating in-mask pressure to inspiration flow rate for different types of cartridges and respirators were developed. The resulting calibration curves can be used to yield instantaneous flow rates, which when integrated with respect to time, provide a measure of the cumulative filtered air volume. Laboratory evaluation of the sampling system was conducted for half- and full-face respirators from two different manufacturers using an exposure chamber containing a headform connected to a breathing machine. Low ppb contaminant concentrations corresponding to WPFs on the order of 2,000-25,000 were successfully measured inside respirators. The resulting integrated sampling system should be a valuable tool for evaluating the effectiveness of respirators for gases and vapors in the workplace.

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196.

RISK ASSESSMENT, SCENARIO PLANNING, AND COMPETITIVE ADVANTAGE. C. Armstrong, Viridescent, Inc., San Antonio, TX

The only sustainable competitive advantage is the ability to continue to learn faster than your competition. The importance of developing breakthrough technologies, securing access to raw materials, creating innovative designs, and ensuring optimal environmental, health, and safety performance has been magnified by this simple fact, and the need to do each process quickly is equally important. To help decision-making throughout these processes, various forms of risk assessment have been adapted to qualify and quantify risk. While

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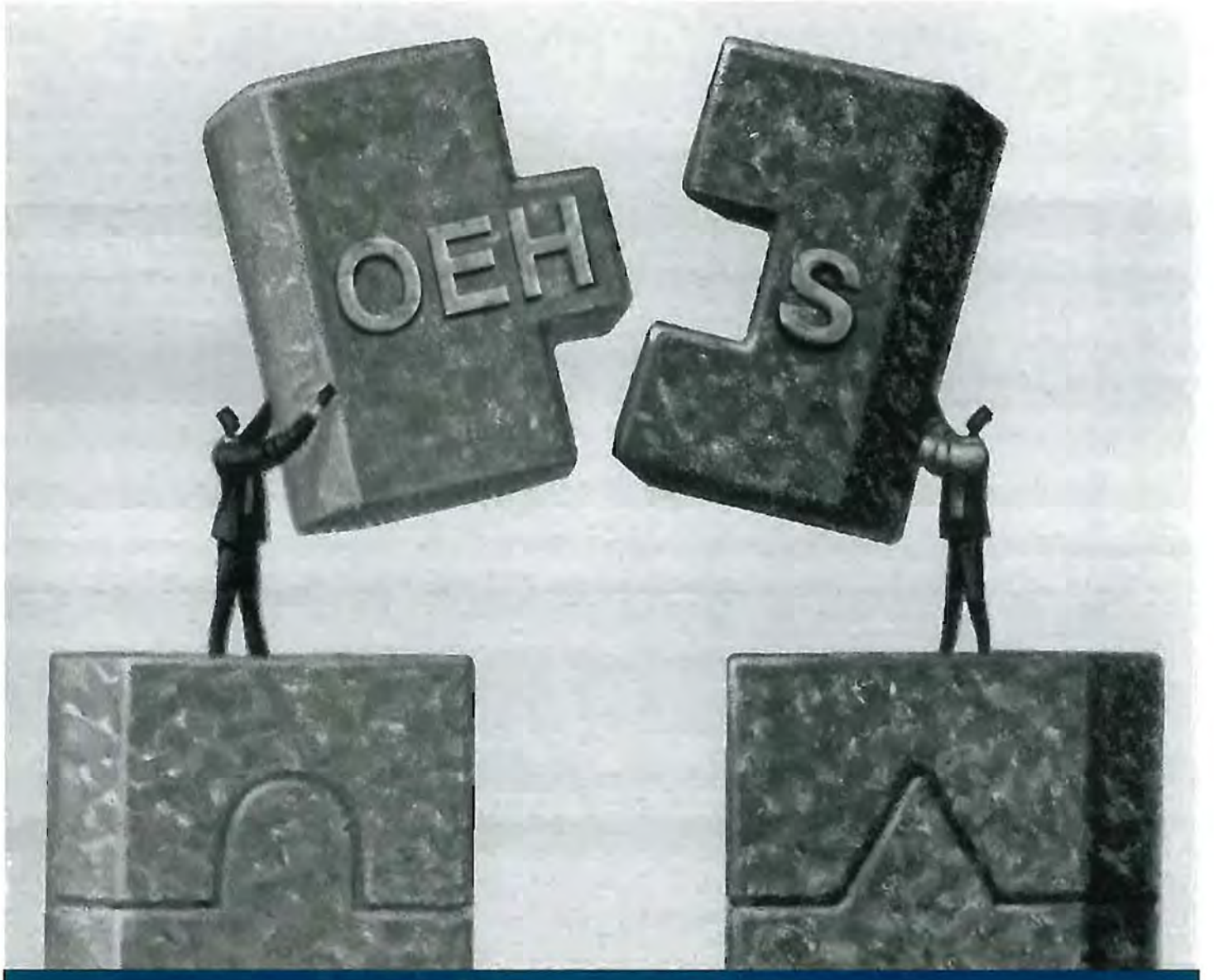

ABSTRACTS

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2002 Abstract Index by Session Topic

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/m^3, 10.01 ±8.84 mg/m^3; endotoxin 6046±6089 EU/m^3, 5457±5934 EU/m^3 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 FEV_1, 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