

375.**CHARCOAL TUBES VS. PASSIVE DOSIMETRY FOR PERCHLOROETHYLENE: A COMPARISON OF TWO METHODS.** D. Almager, S. Shulman, NIOSH, Cincinnati, OH

PERC is a known animal carcinogen and is classified by the International Agency for Research on Cancer as a probable human carcinogen. The subject of this paper is a comparison of charcoal tube sampling versus passive dosimetry. Both sampling methods were used to assess worker exposures to perchloroethylene (PERC) during vapor degreasing; a process commonly used to remove grease, oil, temporary coatings, and dirt or other solids from all types of metal and solvent resistant plastics. A similar study comparing the two sampling methods was conducted by researchers investigating PERC exposures in the dry-cleaning industry. Passive dosimetry is a relatively easy, inexpensive method of sampling which could prove useful to companies utilizing vapor degreaser technologies. To allow for a direct comparison of the two sampling methods, personal breathing-zone samples were collected using charcoal tubes and passive dosimeters during a series of six sampling surveys. Worker exposures were measured by placing a passive dosimeter and a solid sorbent, coconut shell, charcoal tube connected to a battery-operated sampling pump in the worker's breathing-zone. All samples were analyzed via NIOSH Analytical Method 1003. Statistical analyses indicated that, on average, the difference between the two sampling methods was not statistically significant (5% significance level). However, statistical tests suggested that at the highest concentration levels (25 to 40 ppm), the charcoal tube concentrations were about 0.5 ppm higher than the passive monitor, while at the lower concentrations (0.1 to 2 ppm) charcoal tubes were about 0.2 ppm lower, each result statistically significant at the 5% level. Thus, it appears that the differences identified as statistically significant are not large enough to be of practical importance. While these results are similar to the dry-cleaning study at the lower concentrations, the result do differ in that the passive dosimeters gave lower readings at the higher concentrations.

376.**QUANTITATIVE DIRECT-READ MONITORING OF OZONE IN LOW CONCENTRATION RANGE.** K. Chapman, G. Mihaylov, K. Kirillos, K&M Environmental, Inc., Virginia Beach, VA

An ozone monitoring badge has been validated to quantify the presence of ozone selectively, in air. It can also be used as an alternative to active samplers to monitor time weighted average (TWA) concentrations of airborne ozone gas. The detection capability of the colorimetric device was as low as 80 ppb-hr, 1/10 of the OSHA permissible exposure limit (PEL), for ozone. The ozone monitoring badge was designed to read ozone concentration

within the ranges of 80 ppb-hr - 1600 ppb-hr, however, it can also be used in conjunction with the ozone color comparator for higher resolution within the range of 80 ppb-hr - 2600 ppb-hr.

The ozone monitoring badge was calibrated in a simulated atmosphere using an ozone generation system as well as a relative humidity generation system and a temperature control system. The badge, exposed to ozone, showed a mean coefficient of variation of ± 4.40 and a mean bias of 0.28% at ambient conditions. The badge operated satisfactorily between 14% and 83% relative humidity and between a temperature range of 12°C and 37°C. Face velocities ranging between 17 and 48 cm/sec showed no effect on the performance of the ozone monitoring system. To test for interchangeability effect, exposure times were varied from 60 to 1,920 minutes and ozone concentrations ranged from 50 to 200 ppb. The badge showed no interchangeability effect between ozone concentrations and sampling time.

377.**TENAX GR IN A PASSIVE DOSIMETER FOR MONITORING GASOLINE COMPONENTS.** L. Saarinen, M. Hakkola, J. Svinhufvud, Finnish Institute of Occupational Health, Helsinki, Finland

Objectives: The aim of the study was to develop a sampling method for monitoring workers' TWA 8-hour exposure to some components of reformulated gasoline (RFG). In distribution work, short-term or fugitive exposure typically takes place several times a day, and is often unpredictable. Passive samplers were assumed to be a convenient means for investigating this task type, as it does not entail problems with the approval of equipment to be used in hazardous locations.

Methods: The thick bed sampling tubes (Perkin-Elmer, ATD-400) were loaded with 150 mg of both Tenax-TA (35/60 mesh) and Tenax GR (35/60 and 60/80 mesh). In chamber tests, passive dosimeters were compared with activated charcoal tubes (SKC 226-01). The passive samplers were exposed to a mixture of methyl tert-butyl ether (MTBE) and methyl tert-amyl ether (MTAE), and to 95 octane reformulated gasoline. The chamber concentration was controlled by a third independent continuously measuring method. Samples were analyzed in a thermodesorption-gas chromatography-mass detector system (Perkin Elmer ATD-400, HP 5890, HP MSD and HP Chemstation).

Results: The mean sampling rates (ml/min) for MTBE and MTAE and gasoline components measured after the various exposure periods with Tenax GR and TA tube beds were as follows: Tenax GR (35/60); 0.33 for MTBE, 0.33 for MTAE and 0.35 - 0.40 for gasoline components. The sampling rates for pure MTBE and MTAE were: Tenax GR (35/60) 0.33 and 0.32, Tenax GR (60/80) 0.39 and 0.39 and Tenax TA (35/60) 0.37 and 0.36, respectively. The back diffusion of very

volatile components was observed and found to follow logarithmic decay.

Conclusions: The reasonable sampling rates were determined for Tenax GR to monitor the essential RFG components. The multicomponent standard preparation of very volatile analytes was a critical stage and should be developed further.

378.**A FIELD VALIDATION OF A NEW PASSIVE DOSIMETER FOR SHORT-TERM (15-MINUTE) FORMALDEHYDE SAMPLING IN A GROSS ANATOMY LAB.** S. Setzler, D. Easton, University of Virginia, Charlottesville, VA; J. Calpin, Analytics Corporation, Richmond, VA

In this field validation study, commercially available passive dosimetry badges were exposed concurrently with 2,4-dinitrophenylhydrazine (DNPH) tubes during several worst-case exposure procedures in the gross anatomy labs at the University of Virginia Medical School. For each sample, a badge was located immediately adjacent to the collection end of the DNPH tube and the samples were collected for 15 minutes. A total of 21 samples were collected. During the two days of the sampling, the students were dissecting the thoracic and abdominal cavities. An AIHA-accredited laboratory performed the DNPH tube laboratory analysis using NIOSH method 2016. Sample results ranged from 1 to 5 parts per million. In this fairly small study, the passive badge results had good correlation (following a modification of the analytical protocol) with the NIOSH method 2016 results.

379.**IMPROVED DIFFUSIVE SAMPLER FOR MERCURY VAPOR.** C. Manning, Assay Technology Inc, Pleasanton, CA; J. Snyder, Pittsburgh, PA

Due to the cumulative nature of toxicity arising from mercury exposures, personal monitoring of mercury is of special significance. Sampling for mercury is complicated by the low levels which must be measured (on the order of 0.01-0.05 mg/M3) and by the possibility of aerosol contamination during and after sampling. In response to problems encountered in routine sampling of mine environments, design improvements were made in the state-of-the-art of mercury samplers which resulted in improved performance. Specifically, catalytic adsorbents similar to hopcalite and hydrar were replaced by a gold film having extremely low background blanks and which was pressed against the sampling grid in a way that also minimized wind effects observed in prior samplers. A screen was installed on the sampler to repel aerosol contamination during sampling, and the sampler was encased in a contamination resistant case for return to the laboratory. These improvements resulted in a sampler which was resistant to aerosol contamination and characterized by low background levels. Laboratory and field trials resulted in agreement between the

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ABSTRACTS



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

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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 fac-

ilities. 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