

study shows that under the conditions tested, the OVMs provided better overall accuracy than the traditional active charcoal tube/pump method.

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IMPROVED SIDE-BY-SIDE COMPARISON OF ACTIVE AND PASSIVE SAMPLERS. C.

Manning, Assay Technology Inc, Pleasanton, CA.

Due to their practical advantages, diffusive samplers are desirable in full-shift sampling applications if validation testing has been conducted. Validation has been described in ANSI/ISEA 104-1998 and ASTM D6246 which describe evaluation parameters used in a lab setting to assess the effect of environmental factors on sampler performance. While these protocols reflect predictable challenges, they may not anticipate all challenges posed by field conditions. Thus, the ANSI/ISEA 104-1998 states: "...confirmation of sampler performance under field conditions is desirable when there is a likelihood that environmental factors not studied (in the laboratory) may be encountered..." Field Evaluation Criteria were developed using guidelines below and evaluated under field conditions in comparing Diffusive Samplers to Active Samplers for sampling formaldehyde and organic solvents. (1) Determine variation in environmental parameters where the Samplers will be used. (2) From Laboratory Data, estimate variance due to environmental factors under Field Conditions. (3) Based on survey data, design study to obtain widest possible range of contaminant concentrations. (4) Design apparatus to expose Test and Reference Samplers to identical air samples. (5) Perform comparison of statistically significant number of Test and Reference Samplers. A variety of studies were performed in which active and passive samplers were exposed to formaldehyde, methylene chloride, methyl ethyl ketone, perchloroethylene, and other organic vapors under field conditions. By far the greatest source of error encountered (frequently >50%) was point-to-point variation in chemical exposures when sampling was conducted near to a chemical emission source. Whe, portable devices, developed to ensure that uniform exposures were presented to both samplers, were used in a side-by-side field test environment, experimental error was reduced by 53%.

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FIELD-PRODUCED JP-8 STANDARD FOR CALIBRATION OF LOWER EXPLOSIVE LIMIT METERS USED BY JET FUEL TANK MAINTENANCE PERSONNEL. S. Martin, P. Jensen, NIOSH, Morgantown, WV; J. Pleil, US EPA, Research Triangle Park, NC.

Thousands of military personnel and tens of thousands of civilian workers perform jet fuel tank entry procedures. Before entering the confined space of a jet fuel tank, OSHA regulations (29CFR1910.146) require the internal atmosphere be tested with a calibrated, direct-reading instrument for oxygen content, flammable gases and vapors, and potential toxic air contaminants. These checks are typically done using lower explosive limit (LEL) meters which provide the percent LEL and oxygen level in the atmosphere, and many have other sensors installed (e.g., carbon monoxide, hydrogen sulfide, etc.). Most manufacturers suggest the meters be calibrated using a known methane or pentane standard. However, a previous NIOSH study found that manufacturer-recommended calibration techniques do not match instrument performance when monitoring jet fuel vapors. JP-8

and Jet-A fuels are generally C9 to C16 compounds. Because most LEL meters are calibrated against n-alkanes less than C9, some meters may underestimate the explosive potential of jet fuel vapor in the tanks after removal of the most volatile components. Also, maintaining a stock of pure calibration gases can be troublesome, particularly in the case of military deployments. In this study, liquid jet fuel was introduced into tedlar bags and the atmosphere inside the bag allowed to equilibrate. Once equilibrated, the concentration of the jet fuel vapors can be easily calculated using the ambient temperature and known vapor pressure vs. temperature curves. Furthermore, the vapor concentration can be controlled by temperature. Thus, actual jet fuel calibration standards can easily and routinely be produced in the field and used to calibrate LEL meters. Comparing the performance of various LEL meters and a Foxboro TVA 1000B, with flame-ionization detector, calibrated per manufacturer instructions and using the field-developed standards shows the field-produced standards work very well for the calibration of LEL meters.

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DETERMINATION OF COMPLIANCE WITH EXPOSURE LIMITS FOR MIXTURES OF VOLATILE ORGANIC COMPOUNDS WITH A FIELD PORTABLE GC/MS. K. Meekin, M. Jankowski, Los Alamos National Laboratory, Los Alamos, NM; R. Miller, Inficon, Inc., East Syracuse, NY.

A new, rapid on-site method for the determination of the exposure limit for a mixture of volatile organic compounds (VOCs) with similar physiological effects uses a field portable gas chromatograph/mass spectrometer (GC/MS). An Industrial Hygiene Concentration Report indicating the percent of a mixture's exposure limit is attainable after sampling a mixture of VOCs and downloading the data file to a computer loaded with the instrument manufacturer's software. In a spreadsheet, a GC/MS report displays the compounds found and their concentrations for the selected calibration library. Computer algorithms were developed that incorporate these results with their exposure limits in a separate Industrial Hygiene Concentration Report. Displayed on this separate spreadsheet is each VOC, its concentration, the percent of its exposure limit, and a total percent of the exposure limit for the mixture (utilizing the TLV® for mixtures formula). Values greater than 100% indicate an exceedance of the exposure limit. Normally, the GC/MS report would only give the individual concentration(s) and would not reference them to any occupational exposure limit. This would necessitate looking them up and then making calculations by hand while the workers stood by, often in warm conditions wearing protective clothing and full-face respirators. By developing the computer algorithm with the exposure limit values and the TLV® for mixtures formula, we were able to obtain a result at the same time as the GC/MS report that told us whether or not we were over the exposure limit for the VOC mixture. This new capability has allowed us to more quickly and accurately determine the required controls and to shorten the time the workers spent wearing any cumbersome PPE.

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VALIDATION OF A DIRECT READ MONITORING SYSTEM FOR CARBON DIOXIDE. K. Kirolos, J. Helms, G. Mihaylov, K&M Environmental, Inc., Virginia Beach, VA.

High concentrations of carbon dioxide are of major concern in confined and poorly ventilated work areas particularly with the concerns relating to sick building syndrome and indoor air quality. This work outlines the validation of a direct read, low cost personal monitoring system for carbon dioxide.

The monitoring system consists of a colorimetric badge type monitor and a color comparator. A new coating technology is used to fabricate the sensor. The color forming ingredients are encapsulated in a thin uniform layer on an inert surface to ensure stability, color uniformity and accuracy. The intensity of the color developed in the sensor is directly proportional to the exposure dose and hence the concentration of carbon dioxide. The monitoring system is capable of measuring carbon dioxide exposures between 1,800 and 80,000 ppmohr.

The monitoring system was tested at concentrations ranging from 1,300 ppm to 80,000 ppm. Exposure times ranged from 15 minutes to 15 hours. The badge's performance was tested at humidities ranging from 10% RH to 83% RH, and at temperatures ranging from 10°C to 35°C.

At ambient conditions the system showed a mean coefficient of variation (MCV) of ±8.49 and a mean bias of -2.67%. Humidity showed no effect on the performance on the badge in the range tested. Temperatures above ambient also showed no effect, however, for temperatures below 20°C correction factors must be applied according to the average temperature during exposure. Using the recommended correction factors, the experiments conducted at 10, 14, 15, and 17°C showed an overall mean bias of 0.96% and an overall MCV of ±6.99.

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VALIDATION OF A DIRECT READ MONITORING SYSTEM FOR AMMONIA. J. Helms, G. Mihaylov, K. Kirolos, K&M Environmental, Inc., Virginia Beach, VA.

Since the implementation of the Haber-Bosch process in 1912, ammonia has been among the most abundantly produced chemicals in the world. Due to its wide use and its toxicity, a cost-effective, easy method of monitoring ammonia is necessary to ensure the safety of workers in a variety of fields. This paper outlines the validation of a monitoring system composed of a direct-read, badge type monitor and color comparator.

The badge relies on an indicator layer, which changes from tan to black when exposed to ammonia. The badge contains six distinct cells. Each cell displays a color change through a different range of exposure doses. Using the color comparator to visually match the color on the badge with calibrated color standards provides better resolution.

To determine how the badge performs at ambient conditions, 15 experiments were conducted at 25, 50, 75, and 100 ppm. Conditions were maintained at 24°C-25°C, 50%-56% relative humidity (RH), and 13 cm/sec face velocity. Seven experiments were carried out to determine what effect concentration and sampling time have on the badge's integration of exposure doses. Concentrations ranged from 4.0 to 400.0 ppm and sampling times ranged from 1 minute to 15 hours. The effect of humidity was investigated at 10% RH and 98% RH. Temperature dependence was tested at 10°C and 40°C. The effect of face velocity was checked at 4.75, 13, 67, and 270 cm/sec.

At ambient conditions the system shows a mean coefficient of variation of ±10.83 and a mean bias of 2.59%. It is capable of detecting 3.0 to 600 ppmohr and has free mutual exchange of concentration

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ABSTRACTS