exposure intensity and location, reveal hot spots to identify sources, and provide exposure intensity distributions.

In this study, the LPS was field-tested during USCG security patrols along the Houston Ship Channel. By linking the LPS to a direct reading 5-gas monitor, position information was fixed with contaminant levels for each patrol. The field test was conducted over a six-day period in August 2003 and at different times of the day. Statistical information, maps showing peak concentrations, frequency, and time-weighted averages along the route of the patrol were created using software developed by NIOSH for the LPS. Results showed sulfur dioxide ranged from none detected to 0.2 ppm, hydrogen sulfide from none detected to 1.3 ppm, and volatile organic compounds from none detected to 5.5 ppm.

The information obtained from the LPS allows safety professionals to better understand exposure information and focus controls where they may be more aptly applied. Modular software that enhances the utility of the system as a valuable tool to researchers for improved identification, documentation, analysis, and control of exposures was developed to download the data collected from the prototype LPS.

370.

DESIGN AND CONDUCT OF AN INDUSTRIAL HYGIENE FIELD SITE MONITORING STRATEGY FOR A PIPELINE COMPANY TO DOCUMENT THE POTENTIAL FOR OCCUPATIONAL EXPOSURES TO CHEMICAL AND PHYSICAL HAZARDS.

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A workplace exposure assessment project was initiated for a pipeline transportation company during 2002 with continuing annual work during 2003–04. Due to recent and continuing mergers and acquisitions involving changing field sites, corporate safety personnel for the crude oil and conventional products/LPG areas requested consulting assistance for a three year baseline industrial hygiene assessment project. The project scope of work involved the following: occupational exposure monitoring for full shift hydrocarbon exposures; short-term work task monitoring for benzene and/or hydrocarbons; personal noise dosimetry; and field site surveys for the presence of asbestos-containing materials (ACM), lead-based paint, sound pressure levels, and naturally occurring radioactive materials only at LPG locations. Representative personal monitoring by job position including operators, technicians, gaugers, and truck-drivers was conducted.

Corporate safety personnel identified specific field locations for both crude oil and conventional products/LPG to be assessed on an annual basis. A Certified Industrial Hygienist (CIH) with either an industrial hygienist or technician completed the scheduled site visits. The sampling strategy was appropriately revised and implemented at each field site and all personal and bulk samples were analyzed by a local AIHA accredited laboratory. Digital photographs were documented of "suspect" materials and/or site locations requiring further investigation.

An annual report was prepared summarizing all the laboratory analytical data. Separate tables for each type of chemical and/or physical hazard were documented for each facility field site location. A summary report was also appended for the collected project data with both general and specific recommendations. Presentations were made at annual meetings of the safety representatives and any follow-up monitoring or site investigations were outlined by the client. Further industrial hygiene consulting work activities were identified including ergonomic workstation assessments, performance of negative workplace exposure assessment, and airborne fiber monitoring for ACM pipe coating removal.

Biological Monitoring

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371.

FIELD EVALUATION OF A PORTABLE BLOOD LEAD ANALYZER IN WORKERS LIVING AT A HIGH ALTITUDE: A FOLLOW-UP INVESTIGATION.

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This study further evaluated an electroanalytical field-portable instrument which rapidly analyzes venous blood lead levels in individuals. The instrument, which employs anodic stripping voltammetry (ASV) to measure lead in blood, was used on blood samples from an Andean worker population (almost entirely male) at an elevation of ~3800 meters in Peru. The portable ASV instrument was evaluated utilizing paired samples from 243 employee volunteers. Each worker donated two venous blood samples, one of which was analyzed by the ASV device, and the other by a reference analytical method, graphite furnace atomic absorption spectrometry (GFAAS). Hemoglobin levels of the workers' blood samples were also measured. According to the GFAAS results, the mean blood lead concentration measured was 46(±16) µg/dL; this was significantly greater than the mean ASV measurement of 32(±11) µg/dL (paired t-test; $p<0.0001$). The accuracy of the ASV estimation decreased as the measured blood lead concentration increased. The mean hemoglobin concentration in this Andean worker cohort was 17.3 g/dL, which contrasts with the mean hemoglobin level of 15.3 g/dL in U.S. males living near sea level. Hemoglobin levels were unrelated to blood lead concentrations ($r^2 = 0.00905$; $p = 0.143$). The ASV evaluation results from this investigation, which was carried out at a very high elevation, were significantly different from the previous study, which was conducted near sea level. The exact causes for the discrepancies between the portable ASV results from the two studies are unclear, but are thought to be related to differences in blood chemistry between the Midwestern United States and Peruvian Andes worker cohorts. Analytical results from portable ASV measurement of blood lead levels in extremely high-altitude populations should be treated with caution.

372.

DEVELOPMENT OF A BIOLOGICAL MONITORING METHOD FOR XYLYLENE DIAMINE IN URINE.

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This describes a method for the extraction and analysis of m-xylylene diamine (m-XDA) (CAS 1477-55-0) from the urine of exposed workers. XDA is used as a hardening agent for epoxy resins. Its main health effect is irritancy although limited human data suggest it may be a potent skin sensitiser. The method uses GC-MS for a sensitive and specific determination of occupational exposure.

Urine samples are acid hydrolysed and then extracted using diethyl ether followed by derivatisation with heptafluorobutyric anhydride. The derivatised extracted is then injected into the GC inlet by a splitless injection. Detection is by negative chemical ionisation using m/z 508 for m-XDA and m/z 585 for the internal standard ethylene dianiline.

The method was linear over the range 0–400 nmol/l, with a detection limit of 5 nmol/l. The coefficient of variation at ~50 nmol/l was <20%. m-XDA levels in spiked urine showed no degradation when stored at room temperature, at ~4°C and at ~-20°C for at least 7 days. No m-XDA was found in urine from nonoccupationally exposed people (n = 10).

m-XDA levels in 244 pre- and 261 post-shift urine samples of 42 exposed workers were analysed, and m-XDA levels in the range ND–13.93 µmol/mol creatinine (mean 0.418, geomean 0.121) were measured for pre-shift samples and m-XDA levels in the range ND–12.61 µmol/mol creatinine (mean 0.679, geomean 0.1528) were measured for post-shift samples. m-XDA levels in 20 acid hydrolysed samples from workers exposed to m-XDA were significantly higher ($p<0.0001$) than samples that had not undergone any hydrolysis. p-XDA was also extracted and detected in spiked urine, although none was found in samples from workers.

The method described here is a sensitive, robust method suitable for the detection of m-XDA in the urine of exposed workers.

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