

ASPHALT INDUSTRY CROSS SECTIONAL EXPOSURE ASSESSMENT STUDY
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An industry-wide assessment to characterize worker exposure to neat asphalt and asphalt fume was conducted. Air and dermal wipe samples were collected from employees engaged in work places where asphalt is most commonly manufactured and used in the United States. Additional objectives of the study were to observe skin contact and personal hygiene practices to evaluate dermal exposure to liquid asphalt or condensed fume; to observe exposure controls; to determine if other exposures occur that may confound the measuring of airborne asphalt fume concentrations; and to determine the usefulness and validity of recognized sampling and analytical procedures. This paper presents the summarized results of the sampling and analytical component of the study.

The industries included in this study are refineries and asphalt distribution terminals, hot mix asphalt facilities, paving operations, asphalt roofing manufacture, and asphalt roofing application. Study sites were selected so that each industry category was represented at least once in each of the major geographical regions of the continental United States. Thirty-one companies were examined during the study. Six separate locations of the five industry categories were visited, except refinery/terminals; seven locations were selected for this category due to the diversity of activities associated with these operations. Air samples were collected during two consecutive days at each site. Dermal wipe samples were collected at representative sites. In addition to collecting samples, observations were made regarding specific site characteristics, exposure control practices, personal hygiene practices, weather conditions, and information on the asphalt material being used.

A total of 219 air samples and 131 dermal wipe samples were collected during the investigation and subjected to various analyses. The majority of air samples were analyzed by a modified combination of NIOSH methods yielding total particulate, benzene soluble fraction, and selected polynuclear aromatic hydrocarbon (PAH) concentrations. A fraction of the air samples were collected and analyzed for respirable particulate. Dermal wipe samples were analyzed for selected PAH species. A summary of the results of air sampling and analysis, and dermal sampling and analysis, as well as common observations and work practices will be presented. Conclusions and significant observations, including comparisons to applicable PELs and performance of sampling and analytical procedures will be discussed.

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OCCUPATIONAL EXPOSURE LEVELS TO CHEMICALS ASSOCIATED WITH FERROUS FOUNDRIES
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Occupational exposures to 48 different chemicals were assessed in a large malleable iron foundry with approximately 1,250 hourly and 180 salaried employees. This old facility has seen many renovations and process modifications over the years. Currently the facility covers approximately 1,000,000 square feet, pours about 1,500 tons of iron per day on its three main foundry lines, and produces Armasteel and malleable iron castings such as: pistons, drive line yokes, gears, crankshafts, connecting rods, differential cases, and steering gear housings.

Air sampling was conducted in two sequential phases. The first phase of 190 air samples, screened those chemicals that were perceived, but not confirmed to be present in the foundry setting. The second phase of 1,129 air samples were then collected in a stratified random sampling

strategy designed to assess the full range of exposures to defined aromatic hydrocarbons, carbon monoxide, formaldehyde, defined metals, nitrogen oxides, defined polycyclic aromatic hydrocarbons, respirable dust, silica, total particulates and triethylamine.

The methods and results from the 1,319 air samples collected will be presented and discussed. Summary statistics for plant-wide, department specific, and selected spatial zones will be presented for the array of chemicals representative of other modern ferrous foundries.

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MEASUREMENTS OF SOLVENT AND LEAD RELEASE IN A MICROCIRCUIT PRODUCTION FACILITY
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Ventilation and air concentrations were collected in two areas within a microcircuit production facility. In one area (~2800m³), methyl chloroform was used as a solvent in three degreasers to clean parts which had been processed in a lead reflow oven. None of the degreasers had local exhaust systems. One-hour average concentrations were measured, using adsorption on charcoal tubes and a GC-FID analytical finish, at 0.6 m and 1.4 m from each degreaser for a total of 12 hours over two days. Board through-put and other measures of source activity were recorded for each of the degreasers at two-minute intervals. The average near concentration was 23.8 ppm and that further away, 8.7 ppm. Average concentrations of dioxane, a contaminant of the methyl chloroform, were 2.36 mg/m³ at 0.6 m and 0.63 mg/m³ at 1.4 m away from the degreaser with the greatest solvent emissions. Measurements of concentration and air flow rates were also made on supply and exhaust air. A mass balance on the space over the two days yielded an equivalent emission rate from all three degreasers of between 141 and 171 kg of methyl chloroform/month. This was in good agreement with the usage value of 132 kg/month estimated from inventory records over a 2 month period.

The other space (~5200m³) contained three wave soldering lines, each served by a local exhaust (partial enclosure) system. One-hour air samples were collected on polycarbonate filters at a calibrated pump rate of 3-5 lpm, and were analyzed for 29 elements using PIXE (proton induced x-ray emission). Twelve 1-hr periods were monitored over two days by sampling at two locations at different distances from each wave soldering machine, and in the duct of each local exhaust system. Observations of source activity, such as board throughput and frequency and duration of lead pot dedrossing, were recorded at two-minute intervals. For lead, the average near concentration (i.e., within 1.2 m of a lead pot) was 3.57 µg/m³, the far value (air recirculation) was 1.88 µg/m³, and 17.94 µg/m³ was measured in the hoods. Hood concentrations much higher than room values were found for lead and tin (major components of solder), chlorine and potassium (from the flux added before soldering), and sulfur and silicon, indicating that these elements were integral to the soldering process. This pattern was not seen for concentrations of other elements, such as calcium, iron, nickel, copper, strontium, molybdenum, erbium, lutecium, hafnium and tungsten. For both spaces, the relationships between source activity and hourly concentrations provide a more specific measure of the emissions from each device.

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EVALUATION OF EXPOSURES TO FLUOROCARBON 113 DURING AEROSPACE COMPONENTS CLEANING
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Lethal cardiac arrhythmias arising from exposure to 1,1,2-trichloro-1,2,2-trifluoroethane, also known as Freon® 113 or Fluorocarbon (FC) 113, have been implicated as the cause of sudden death among workers exposed to high concentrations in confined spaces. However, estimated exposures for these cases ranged from 7600 ppm to 300,000 ppm. As part of a study to determine whether FC 113 exposures at levels below or near the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit

ABSTRACTS



American Industrial Hygiene Conference & Exposition

"Work & Health—Tradition & Revolution"

June 1-5, 1992

John B. Hynes Veterans Memorial
Convention Center
Boston, Massachusetts

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