oped based on previously published work. The system scored exposure assessments on a scale of zero (no quantitative exposure information) to four (an ideal exposure assessment). Studies that looked at cancer as the health endpoint of concern had lower scores for their exposure assessment. This generally was due to a lack of demonstration that the sampling strategy used in the retrospective exposure assessment was statistically representative of all the workers. Studies that evaluated respiratory health effects as an endpoint scored higher, but did not achieve scores reflective of robust exposure assessments, limiting their utility in the standard setting process. In many of these studies, the lack of speciation of the aerosol exposures was a significant limiting factor. Exposures to the different types of MRF were often only considered qualitatively. Use of the reviewed studies in determining a new, appropriately protective OEL is limited due to gaps in the exposure assessments supporting the studies.

366.

CADMIUM EXPOSURES AND CONCENTRATIONS AT A COMMERCIAL SOLAR PANEL MANUFACTURING FACILITY. S. Milz, N. Herial, E. Schaub, Medical College of Ohio, Toledo, OH; K. Smigielski, First Solar, Perrysburg, OH.

From 2001–2003 a small manufacturing company in Northwest Ohio worked to bring a new process to full manufacturing strength. The process utilizes cadmium in the manufacture of commercial solar panels. The facility has maintained compliance with OSHA standards during this time and has established a statistically-based process control system to monitor cadmium levels throughout the facility. The goal for this monitoring system is to use engineering controls to keep emissions at nondetectable levels for all production operators with action limits established well below the required OSHA standard. Toward this end, 904 area air samples and 175 personal air samples were collected throughout the facility. The sampling data was provided to the Department of Public Health at the Medical College of Ohio for statistical analysis. The industrial hygienist at the manufacturing facility provided the data already categorized by task. The area air sampling data was analyzed for time trends by individual year and for all years combined. The personal air samples were used to perform exposure assessments for each task using the strategy of the AIHA publication *"A Strategy for Assessing and Managing Occupational Exposures"* (Mulhausen, Damiano, 1998). Again the data was initially analyzed by individual sampling year and for all years combined. Based on this data, engineering controls that include HEPA filtration systems have been proven effective in the control of emissions. Currently, several areas meet the emission goal using engineering controls only. A few areas require engineering controls and personal protective equipment. Continuous improvement activities are driving more data collection in these few areas in order to move them toward engineering controls only, eliminating the need for personal protective equipment.

367.

A CHEMICAL EXPOSURE ASSESSMENT STRATEGY DEVELOPED TO ANALYZE SOLVENT EXPOSURES AT THE DEPARTMENT OF ENERGY HANFORD SITE. D. Fleming, NIOSH, Cincinnati, OH; A. Markey, Westat, Rockville, MD.

Retrospective chemical exposure assessment for carbon tetrachloride and benzene at the DOE Hanford site has been developed as part of a multisite case-control study of leukemia among radiation exposed workers. The overall study purpose is to explore the relationship between low-level radiation exposure and death from leukemia, while accounting for potential confounding by internal radiation and chemical exposures. A job exposure matrix was created from work histories, process descriptions, chemical inventories, and monitoring records. Less than a dozen air samples for these agents were identified. Examination of the process documents at Hanford from 1944 to 1996 identified uses of benzene and carbon tetrachloride. Potential benzene exposure was limited to 8 activities. The potential for carbon tetrachloride exposure was identified in 13 activities. Of 908 chemical inventory records for Hanford, 2 reported benzene, and 8 reported the presence of carbon tetrachloride. Work histories for the 495 Hanford workers were extracted from available data at NIOSH which was supplemented from information from other employment and medical records from Hanford. Job titles, organization codes, and buildings were identified for the time periods worked. The three most frequent job titles were: power operator, clerk, and engineer. The percentage of person-years with an identified job title is 95.6%, with an organization code is 81.7%, and with an identified building is 62.8%. Comparison of these three factors allowed imputation of the missing values. Categories of exposure opportunities to these two chemicals were derived for the epidemiologic analysis.

368.

A HISTORICAL CHEMICAL EXPOSURE STRATEGY DEVELOPED TO ANALYZE SOLVENT EXPOSURES OF WORKERS AT THE SAVANNAH RIVER SITE. A. Markey, Westat, Cincinnati, OH; D. Fleming, NIOSH, Cincinnati, OH.

In support of a case-control epidemiology study of leukemia and external ionizing radiation at five U.S. Department of Energy sites, historical chemical exposure strategies have been developed for worker solvent exposure, a potential confounding factor. The size of the Savannah River Site population (207 workers) allows for an extensive exploration of potential chemical solvent confounders during the study period of 1951 to 1996. An exposure assessment strategy was developed to determine the levels of confounding by chemical solvent exposures, concentrating on benzene and carbon tetrachloride. The 207 study subjects have 86 unique job titles with the most frequent being mechanic, operator, patrolman, and engineer. The initial step in the exposure assessment process looked at potential exposures linked by job title, work location, and the time period in which the exposure was generated taking into consideration changes in personal protective equipment use, engineering controls, and removal of chemicals from the workplace. In order to implement this assessment strategy, work histories for each study subject were compiled using available information from electronic images of medical, personnel, and health physics records. A job exposure matrix (JEM) detailing the exposures to chemical solvents was developed through a comprehensive review of process descriptions, chemical inventories, and industrial hygiene monitoring data for each combination of site, work location, job title, and time period for each individual study location. After finalizing the JEM, the job title histories have a 93% completion rate (3331 of 3594 person-years); the division descriptor has a 95% completion rate (3405 of 3594 person-years), and the location descriptor has a 64% completion rate (2296 of 3594 person-years). Comparison of these three factors allowed imputation of missing values. Categories of exposures can be assigned with these different methods of examining chemical solvent use at the site.

369.

FIELD TESTING OF A SYSTEM USING GPS AND NEAR-REAL-TIME MONITORS FOR EXPOSURE ASSESSMENT WITH THE U.S. COAST GUARD. J. Hornsby-Myers, NIOSH, Morgantown, WV; K. Jones, U.S. Coast Guard and University of North Carolina, Chapel Hill, NC.

Workers in many outdoor occupations move about frequently during a typical day of work. Certain workers, such as those on U.S. Coast Guard (USCG) security patrols, are particularly mobile. The National Institute for Occupational Safety and Health (NIOSH) designed and developed a prototype exposure monitoring system which combines geographical location with up to four real-time sensors and outputs the information to a user-friendly interface. By linking worker location throughout the workday to exposure levels from real-time monitors, Local Positioning System (LPS) units with software processing of data identify and document where to focus exposure analysis and control efforts. Post-processing of LPS data enables researchers, regulatory inspectors, and industry safety and health personnel to map

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