ardous chemicals or by careful in-house design of exhaust ventilation systems. The results also stress the need for employers to routinely monitor employees' exposures and implement control measures when necessary.

265.

A HAZARD EVALUATION OF *CRYPTOCOCCUS NEOFORMANS* AND *HISTOPLASMA CAPSULATUM* EXPOSURE AT A SILICA PLANT IN RESPONSE TO A CASE OF CRYPTOCOCCAL MENINGITIS. B. King, D. Trout, S. Lenhart, NIOSH, Cincinnati, OH.

NIOSH researchers conducted a health hazard evaluation (HHE) at a facility that produces ground silica for paints, glass, and various other sand products. The evaluation was in response to a request made by the company management regarding potential employee exposures to the fungi *Cryptococcus neoformans* and *Histoplasma capsulatum* associated with large accumulations of bird manure. An employee who had worked at the plant had been diagnosed with cryptococcal meningitis. These concerns centered around an old screen tower at the plant. The screen tower, built in 1937, is a seven-story building, which the plant had used infrequently after a new tower was built in the 1950s. Due to holes in the walls and ceiling used as entry points, the old screen tower had become a roosting site for pigeons and other birds. The result was the build-up of several inches to a foot of guano on the top floors of the building. During the evaluation, the NIOSH investigators performed a walk-through of that building and others of concern at the plant. Additionally, meetings were held with employees, union officials, and management to answer questions and address concerns. Informational material, including the NIOSH-produced CDC guidelines, "Histoplasmosis: Protecting Workers at Risk," was distributed. The NIOSH investigators concluded a potential health hazard existed in the old screen tower, although it was impossible to directly relate the current illness of the employee with a specific occupational exposure at the site. Recommendations were provided for both immediate and long term measures which the company could implement for prevention of employee exposure to these fungi. These included the use of personal protective equipment such as full facepiece, powered air-purifying respirators (PAPRs), disposable coveralls and gloves during work in the screen tower, re-evaluation of current work duties in the building, and removal or isolation of the guano.

266.

A FOLLOW-UP STUDY OF VISION DISTURBANCES AMONG WORKERS AT A PRINTING COMPANY. G. Burr, M. Methner, E. Page, NIOSH, Cincinnati, OH.

Background. NIOSH received a request for a health hazard evaluation from a label printing company where employees in the Line Division of the plant were experiencing intermittent blurred vision, but workers in an adjacent area (the Prime Division) were not experiencing visual disturbances. In 2001, following medical questionnaires, eye exams, and extensive industrial hygiene monitoring for two types of tertiary amine compounds, dimethylaminoethanol (DMAE) and dimethylisopropanolamine (DMIPA), NIOSH investigators associated amine exposure with visual and ocular changes. In 2002, following various production changes by the company, NIOSH investigators conducted a follow-up survey to collect additional air samples and to interview employees on the extent of any visual problems. **Methods.** A total of 108 and 125 full-shift personal breathing-zone air samples for these amines were collected in the initial and follow-up studies, respectively. Air samples were collected on XAD-7 sorbent tubes and analyzed by gas chromatography/flame ionization detection. **Results.** In the Line Division, while mean time-weighted average (TWA) concentrations of DMAE declined from 2.3 to 0.76 mg/m^3 between the initial and follow-up surveys, mean TWA DMIPA concentrations declined sharply from 7.8 mg/m^3 to trace amounts (<0.36 mg/m^3). In the Prime Division, between the initial and follow-up surveys, mean TWA concentrations of DMAE remained essentially unchanged (3.2 vs. 3.1 mg/m^3) while concentrations of DMIPA declined from 1.9 mg/m^3 to trace levels. In contrast to the initial survey, none of the employees reported visual disturbances during the follow-up study. **Conclusions.** Exposure to both the tertiary amines DMAE and DMIPA was initially associated with visual and ocular changes. Following production changes by management in an effort to lower amine concentrations, NIOSH investigators, in a follow-up survey which included additional air samples and employee interviews, concluded that DMIPA had been responsible for these visual disturbances.

267.

WORKERS' EXPOSURES TO HEXAVALENT CHROMIUM, AND OBSERVED EXPOSURE-CONTROL TECHNOLOGIES, IN A LARGE INDUSTRIAL BOILER-REFURBISHING OPERATION USING ATOMIZED ALLOY-SPRAY "METALLIZATION" COATING PROCESS. L. Blade, NIOSH, Cincinnati, OH; J. Catalano, Battelle, Seattle, WA.

The National Institute for Occupational Safety and Health (NIOSH) conducted 21 field surveys in selected industries, to characterize workers' exposures to hexavalent chromium-containing airborne particulate and evaluate existing exposure-control technologies. Hexavalent chromium (Cr[VI]) is a respiratory irritant, and chronic inhalation may cause lung cancer. Primary evaluation methods included collection of full-shift, personal breathing-zone (PBZ) air samples for Cr(VI), measurement of ventilation-system performance parameters, and recording of descriptive information about processes, work practices, and personal protective equipment. One field survey evaluated the refurbishment of a large industrial boiler at a paper mill. Inside the multi-story combustion chamber of the boiler, abrasive blasting was used to remove corrosion from the surfaces of the steam tubing surrounding the chamber and prepare the surfaces for the application of a metal-alloy protective coating. The application of this coating was performed with a "metallization" process, which uses an electric arc to melt the metal alloy, provided as a wire feed to a hand-held spray-application unit, and compressed air to atomize the molten alloy and propel it onto the surface. Process conditions oxidize some of the metallic chromium in the alloy to Cr(VI), and generate fumes, creating a potential for inhalation exposures to workers. Workers' PBZ exposures during 300-minute spray-application periods, measured outside their respirators, exceeded 1100 micrograms of Cr(VI) per cubic meter of air ($\mu g/m^3$), far exceeding the 1 $\mu g/m^3$ NIOSH recommended exposure limit (REL). The NIOSH assigned protection factor of the painting-type supplied-air respirator hoods used is only 25. Full-shift PBZ exposures to workers who remained outside the chamber during spraying, and did not wear respirators, ranged up to 47 $\mu g/m^3$, exceeding the REL. NIOSH researchers believe that both better ventilation and more-protective respirators are needed to improve worker protection.

268.

GUIDELINES FOR TROUBLE-SHOOTING HIGH LEAD EXPOSURE PROBLEMS IN INDOOR FIRING RANGE. A. Khan, NIOSH, Cincinnati, OH.

The National Institute for Occupational Safety and Health (NIOSH) was contacted by a federal agency regarding concerns about potential lead exposures to its officers in its newly designed indoor firing range. NIOSH researchers investigated the lead exposure problems and narrow down the causes for the lead exposures in the range to two problems. Range overhead garage door was a major source of leakage into the facility, and the downrange airflow velocity at the firing line was inadequate. A smoke generation machine confirmed that lanes closest to the overhead door had more eddies and back-flow, causing turbulence near the shooters and flow of lead contaminated air back to the shooter. Upon the recommendation of NIOSH researchers, the overhead door was removed and the wall was completely sealed with concrete blocks. The airflow velocity measured at the firing line when the system was operating under maximum capacity was inadequate. NIOSH researchers recommended upgrading the ventilation of the range by replacing the existing 30HP with 50HP electrical motors. The air velocity measured at the firing line with the upgraded ventilation was found to be much

higher—closer to the ideal velocity of 75 fpm as recommended in the NIOSH document "Lead Exposure and Design Considerations for Indoor Firing Ranges." This presentation will describe the problems, methods for evaluating the ventilation system, recommendations made and implemented, and results obtained after implementing the engineering solutions.

269.

PREPARATION OF DECOMMISSIONED SHIPS FOR USE AS ARTIFICIAL MARINE HABITATS. M. Plisko, J. Spencer, Environmental Profiles Inc., Baltimore, MD.

The use of decommissioned ships and other discarded products of heavy industry for artificial marine habitats is on the rise. From the sinking of obsolete subway cars off of the New Jersey coast to the scuttling of ex-Navy benefits to ous. lth, and ely impact t also the workers who prepare such artificial reefs.

Many obsolete vessels sought as candidates for reefing were constructed using solid and liquid PCBs, heavy metals, mercury, asbestos-containing materials, and in some cases, radioactive materials. Other potential environmental hazards including but not limited to oils and fuels, residual cargo, and contaminated bilge water must also be managed.

The successful preparation of a ship for an artificial marine habitat must be carefully planned and executed in order to avoid unnecessary exposure of shipboard personnel to regulated materials and to avoid creating a contamination pathway to the marine environment. A comprehensive safety, health, and environmental plan must be developed and successfully implemented to address OSHA, EPA, and local regulatory requirements.

The safety and environmental management plans described herein were successfully developed and implemented during the recent preparation of a decommissioned U.S. Navy ship for use as an artificial marine habitat. The project was hailed as a safety and environmental success by several governmental agencies, project investors, and those who prepared and implemented the plans.

PPE

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270.

NOISE-LIMITING RADIO HEADSET USE IN HIGH NOISE AREAS: PROCESS AND PRELIMINARY RESULTS. A. Butler, Vought Aircraft Industries Inc., Hawthorne, CA; B. Bixby, Vought Aircraft Industries Inc., Stuart, FL; M. Gasper, M. Kelley, Vought Aircraft Industries Inc., Dallas, TX.

Two years ago, this manufacturing site implemented an employee-driven program to allow the use of special, noise-limiting headset radios for hearing protection. Since that time, usage has spread to two other company manufacturing facilities. Initial objections to headset use involved the possibility of not preventing noise induced hearing loss in employees using the headsets, an increase in accidents caused by inattention, and communications problems between employees and supervision. This paper will document the process that was used to successfully manage the introduction of the equipment while minimizing the potential hazards. The usage rate has risen to approximately 50% in some high noise areas. Four different models from three different manufacturers have been in use in the company. This report will compare results of various factors (hearing loss, accident rate, and satisfaction rate) between the user group and the non-user group. Preliminary data shows that the use of noise-limiting headset radios is as protective of hearing as the more traditional muffs, does not lead to increased accidents or inattention, and produces a high level of satisfaction in the workforce.

271.

PERMEATION TESTING USING A NEWLY DEVELOPED DATA ACQUISITION SYSTEM. P. Gao, NIOSH, Pittsburgh, PA.

A new data acquisition system, referred to as the Permeation and Penetration Data Acquisition System (PPDAS), was developed in our laboratory for accurate permeation testing for chemical protective clothing and gloves. The system allows users to define, set up, and run chemical permeation/penetration experiments under controlled laboratory test conditions. The system takes readings from a gas analyzer at prescribed data acquisition intervals. Readings in voltage are automatically converted to concentrations based on a precalibration. PPDAS allows users to determine both breakthrough time and steady state permeation rate much more accurately when compared to a chart recorder which is widely used for such tasks. In addition, the numerical outputs of the permeation testing can be incorporated into a spreadsheet for further data analysis.

This system has been used to investigate extended permeation behaviors. For instance, when using the PPDAS coupled with a MIRAN infrared analyzer to determine the permeation rate of a nitrile/acetone combination, we found that the steady state was not fully developed yet even when the output had reached the whole scale of the analyzer recorder. The average permeation rate was calculated to be only 93.9% of that after the steady state was really established (n=6).

272.

HOW EFFECTIVE ARE THE PROTECTIVE GLOVES? M. Hayden, Safex, Westerville, OH; K. Hames, Ashland Chemical Inc., Dublin, OH.

Chemical protective clothing is used in a wide variety of applications to protect employees when engineering or administrative controls are not feasible or during implementation of these controls. Initially, considerable effort is put into selecting the proper chemical protective clothing based on chemical use and task. Frequently, the effectiveness of the selected clothing is not evaluated or well documented. This study is the result of a year-long evaluation of the effectiveness of previous selected chemical protective clothing, specifically gloves, used within a chemical company.

There are a number of factors that may influence the effectiveness of the selected chemical protective gloves. Research and publications have indicated that heat, perspiration, and the chemical mixture may affect the permeability of the gloves. Besides the performance of the glove material, other factors, such as personal hygiene, glove reuse, and the tasks that associates are involved in may also affect the effectiveness of the gloves. Little data is available to assist industrial hygienists with evaluating the effectiveness of the selected chemical protective gloves or glove usage.

Using a commercially available product, the effectiveness of chemical protective gloves was evaluated at a variety of manufacturing and distribution sites. The results assisted the industrial hygienists with evaluating the appropriateness of the selected gloves for the tasks as well as the overall success of the protective program at each facility. The challenges in implementing the program will also be discussed.

273.

DETERMINATION OF THE ATTENUATION PROPERTIES OF LABORATORY GLOVES EXPOSED TO AN ULTRAVIOLET TRANSILLUMINATOR. E. Gazdik, F. Rosenthal, W. Wang, Purdue University, West Lafayette, IN.

The array of applications of artificial ultraviolet (UV) light and the consequent need for accurate quantification of UV protection has increased over the last 30 years. One such aspect is laboratory work visualizing nucleic acids following gel electrophoresis with transilluminators having peak emission at 312 nm. Personal protective equipment (PPE) protecting the eyes and skin must be worn because of the chemical and UV hazards. This study determined the attenuation properties of laboratory gloves exposed to ultraviolet radiation (UVR) emitted from a transilluminator. Three brands each of vinyl, latex, and nitrile gloves were characterized and compared using two independent methods: (1) a laboratory spectrophotometer was used to determine the UV transmission vs. wavelength (295–400 nm); this data was then combined with a source spectrum and detector response to compute the effective attenuation of the glove material; (2) a radiometer with actinic response (as specified by the ACGIH action spectrum) was used to measure the attenuation directly.

Radiometer measurements were repeated after stretching the glove material by 30%

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