the pickle tanks. The evaluating results of monitoring the gas composition present in the working sites were compared with the data from the laboratory simulation. The goals of the study were trying to clarify the probable existing hazardous gas present in the pickling process and formulate suitable guidelines for reducing potential accidents.

266.

WORKERS' EXPOSURES TO A MANGANESE AND ZINC SALT IN PESTICIDE FORMULATION FACTORIES. J. Jang, S. Jung, OSHRI for Kosha, Incheon, Republic of Korea.

Five pesticide formulation factories were investigated to identify workers exposure to the pesticide named mancozeb. Mancozeb is a complex of zinc and maneb containing 20% manganese and 2.55% zinc; the chemical name is ethylene bis(dithiocarbamic acid) manganese zinc complex. The wettable powder pesticide sampled on cellulose ester membrane filters through personal air sampling with 2 LPM sampling rate, was gravimetrically weighted for calculation of dust concentrations and analyzed for manganese and zinc by ICP. Forty-two workers participated in this study for the two consecutive days monitoring program. The data on mancozeb dust and metals in the pesticide distributed log-normally, rather than normally. Geometric means (geometric standard deviations) for dust, manganese, and zinc were 0.566 mg/m^3 (2.16), 5.36 mg/m^3 (4.94), and 1.06 mg/m^3 (3.71), respectively. ACGIH TLVs for 2005 are 0.2 mg/m^3 and 5 mg/m^3 for manganese and zinc oxide. AIHA WEEL for mancozeb is 1.0 mg/m^3 in 2005, while ACGIH has not published a TLV. Day-to-day variations using paired t-test showed no statistically significant differences, with $p > 0.05$ for dust, manganese, and zinc. Dust concentrations were highly correlated to manganese and zinc concentrations ($R^2 = 0.552$ and 0.447, respectively), indicating that metals were well-suited as identification methods for airborne mancozeb at pesticide formulation sites. Least solvents could dissolve the pesticide, which makes it difficult to be analyzed by GC or HPLC. Currently, there are no methods for mancozeb analysis in NIOSH or OSHA methods.

267.

AIRBORNE HEXAMETHYLENE DIISOCYANATE AND PARTICULATE EXPOSURES DURING FIRE/RESCUE VEHICLE LADDER FINISHING OPERATIONS. M. Methner, C. Achutan, NIOSH, Cincinnati, OH.

NIOSH received a health hazard evaluation request from a fire/rescue vehicle ladder manufacturer to evaluate employee exposures to hexamethylene diisocyanate (HDI) VOCs, particulates, and silica during sanding and painting activities. PBZ samples for HDI and VOCs were collected on 15 workers engaged in painting. Eleven workers were monitored for particulates while sanding ladders. Airflow rates within two side-draft spray booths were measured and compared with recommended guidelines. No air samples collected for HDI monomer exceeded the NIOSH REL of 35 micrograms per cubic meter (μg/m^3). No OSHA PEL for HDI monomer exists. However, the United Kingdom Health and Safety Executive (UK-HSE) publishes a Total Reactive Isocyanate Group (TRIG) eight-hour time-weighted average (TWA) limit of 20 μg/m^3 and a Ceiling Limit of 70 μg/m^3. Of the 15 painters sampled for HDI, six had PBZ levels that exceeded the TRIG eight-hour TWA, while four workers exceeded the TRIG Ceiling Limit. VOC samples were below occupational exposure criteria. All painters wore PPE; however, the choice of latex gloves offered little skin protection from isocyanates. Additionally, workers often got paint on their skin during mixing and used methyl ethyl ketone to remove it. Airflow measurements in one paint booth revealed inadequate ventilation (<100 fpm) while the other booth was approximately seven times higher. Two workers who sanded ladders had particulate exposures that exceeded the ACGIH TLV (10 milligrams per cubic meter of air [mg/m^3]), while another worker exceeded the OSHA PEL of 15 mg/m^3. No silica (quartz and cristobalite) was found in the air samples. Workers who sanded sometimes used N95 filtering facepiece respirators. Recommendations included: use of NIOSH-approved N95 filtering respirators during sanding; the development of a formal respiratory protection program; maintaining at least 100 fpm airflow in all spray booths; and use of nitrile gloves when mixing/spraying paint.

268.

EVALUATION OF QUESTIONNAIRE MODES AND DISTRIBUTION METHODS IN A LARGE MEDICAL CENTER—RESULTS OF A PILOT TEST. J. Boiano, G. Piacitelli, K. Sieber, NIOSH, Cincinnati, OH; J. Catalano, N. Heyer, B. Payne, Battelle Centers for Public Health Research and Evaluation, Seattle, WA.

The National Exposures at Work Survey (NEWS) is intended to collect descriptive data from employees regarding health and safety practices and perceptions, potential exposures, and interventions in workplaces across the United States. The feasibility of collecting this type of information using a self-administered employee questionnaire in the health services sector was evaluated by pilot-testing paper and web-based modes and selected distribution protocols in a large medical center. The employee questionnaire consisted of a core module (for completion by all employees) addressing broad-based health care issues (e.g., overtime, violence, stress) and 10 targeted hazard modules addressing selected chemical agents (e.g., antineoplastics, sterilants, anesthetics). Approximately 1,000 employees were divided into two distribution groups: (1) employees (n = 501) who received a personalized letter with a paper core module, and (2) employees (n = 499) who received a personalized letter only. The letters provided a toll-free number for assistance on how to request additional paper modules if needed (Group 1), and how to request a customized paper questionnaire (Group 2), based on responses to screening questions. Both groups were also provided instructions on how to access the Web-based survey. Overall, 35% of sampled employees completed the survey, including 42% (n = 210) in Group 1 and 29% (n = 146) in Group 2, with the Web survey being slightly preferred (51%). Seventy-nine percent of Group 1 respondents preferred the paper mode, whereas 95% of Group 2 respondents preferred the Web. Accurate completion of the paper questionnaire was a problem for 82% (n = 44) of the respondents who failed to request additional modules even though their responses to screening questions indicated that they needed to complete (and therefore request) one or more hazard modules. This problem was not observed in the Web survey; it was seamless with respect to the modules. Methods of improving the paper survey and overall response rates will be presented.

269.

EXPOSURE TO FORMALDEHYDE DURING USE OF A NAIL CARE PRODUCT. E. Goswami, R. Kalmes, Exponent, Oakland, CA.

Several investigations of occupational exposures to volatile compounds among nail salon workers have been published. However, few studies have investigated personal exposures outside of nail salons to consumers using nail care products. Exposures to carcinogens such as formaldehyde, which is found in fingernail hardening products, is of particular concern in California where product warnings are required if exposures are greater than specified no-significant-risk levels. An exposure study was conducted in which four participants were monitored during three 20-minute product use simulations. Participants were asked to apply two coats of a nail-hardening product containing formaldehyde to their nails and allow them to dry during each 20-minute session. Prior to each session, sampling rooms were adequately ventilated by use of a negative air machine, and background samples were collected prior to initiating each exposure simulation. Breathing-zone samples during product use simulations and background room samples were collected by passing air through DNPH silica gel tubes by means of a personal pump at a flow rate of approximately 0.7 liters per minute for 20 minutes, for a sampling volume of approximately 14 liters each. The silica gel tubes were analyzed by NIOSH method 2016 (HPLC/UV). The 12 concentrations measured during the simulation ranged from 2.8 to 12.1 μg/m^3, with a mean of 6.8 μg/m^3. According to the U.S. EPA, formaldehyde is normally present at low levels, usually less than 0.03 ppm (37 μg/m^3), in both outdoor and indoor air. These levels are within this range. In addition, daily dose calculations for regular use of nail-hardening products indicate that potential formaldehyde exposures are less than California's no-significant-risk level.

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