

ing the application of the information from the training package by NAs on the floor. The most frequently cited work-related risk factors and obstacles were developed into questionnaires. Evaluation of the work environment was through use of the questionnaires, and videotaping of the NAs. Exposure assessment data was organized into a training package. The application of ergonomic principles by the NAs was accomplished by statistical comparison from 3 different sets of data comparing pre- and post-training questionnaires. Results show two new risk factors not previously identified for nursing personnel in the peer-reviewed literature: 1) lifting fallen patient from floor (7.21 out of 10) and 2) patient starting to fall (6.93 out of 10). Quizzes given to the nursing personnel before and after training indicated a significant improvement in understanding the principles of ergonomics and patient-handling techniques. Statistical analysis comparing the pre- and post-training questionnaires showed no significant decrease in musculoskeletal risk factors and no significant reduction in pain or discomfort. The short time interval between training and post-training questionnaires (approximately 35 days), staffing shortages, and turnover may have competed with the application of ergonomics training principles for NAs.

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ERGONOMIC EVALUATION OF PRESS OPERATION AT A RUBBER MANUFACTURING COMPANY. N. Kittusamy, J. Flannagan, C. Underdonk, Marshall University, Huntington, WV.

Awkward posture has been documented as an important risk factor in the development of work-related musculoskeletal disorders. An ergonomic evaluation of the press operation was requested by the company to understand the risk factors at this specific operation. The objective of this study was to evaluate the postural requirements of the workers at the press operation. The ergonomic assessment consisted of videotaping the job and evaluating the postural requirement of the operators using the simulated real-time methodology. The results indicate that the operators were required to assume awkward postures of the trunk during most of their cycle time. Also other risk factors such as forceful exertions and repetition were of concern. Forceful exertions were noted when the workers pulled the stock from the press. Sometimes the rubber would stick inside the press and the workers have to use significant force to pull out or remove the stock. Repetition is of concern since there were eight racks in each press and the workers perform this job repeatedly throughout the workday. The above mentioned risk factors can adversely affect the health of the operators. Some recommendations that were forwarded to management for addressing these risk factors include: 1) moving the worker or part/machine (e.g., using a personnel lift); 2) using mechanical aids; 3) installing semi or full automation into the process; 4) allowing active breaks; and 5) providing job rotation. Furthermore a proactive approach to safety and health is recommended. To this extent, it is suggested that a corporatewide ergonomics program be implemented.

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IDENTIFICATION OF ERGONOMIC HAZARDS ASSOCIATED WITH LEAD HAZARD REDUCTION WORK USING FOCUS GROUPS. J. Gordon, W. Menrath, E. Auyang, L. Kincl, A.

Bhattacharya, University of Cincinnati, Cincinnati, OH.

Focus Groups, consisting of experienced lead hazard reduction workers, were comprised to obtain the workers "expert" opinion in identifying problem/high ergonomic risk tasks. The groups were divided between Lead Risk Assessors/Inspectors and Lead Abatement Contractors/Workers. The meetings were useful in identifying the sequence of job tasks required for each type of work, as well as determining which of these were the most physically demanding/strenuous. A self-reported symptom survey was used to capture information regarding typical body part discomfort experienced at the end of a workday or during particular tasks. The Risk Assessors/Inspectors rated performing x-ray fluorescence (XRF) readings as most physically demanding/strenuous task. Symptom surveys provided from this group showed that pain and discomfort was most often found in the neck, mid-to-lower back, and wrists. Participants indicated that the XRF instrument caused ergonomic problems and should be re-designed. The Lead Abatement Contractors/Workers ranked demolition as one of the most physically demanding/strenuous tasks. Here, symptom surveys showed pain and discomfort was most often located in the mid-to-lower back. Areas of improvement mentioned by both groups included increasing ergonomic training and selection of ergonomic tools. Participants were able to provide some ideas for reducing the physical effort levels required for certain tasks. Participants also discussed physical environmental conditions common at work-sites. Cold and heat stress, poor lighting, slip/fall hazards, and deteriorated building conditions were most common in both groups. Some participants had received medical treatment for work-related injuries such as cuts/scrapes, back problems, knee problems, and broken bones. These meetings helped to increase the understanding of the study team regarding job task requirements, as well as providing information useful in conducting future in-depth ergonomic assessments.

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ENVIRONMENTAL ASSESSMENT OF A REFERENCE MYCOBACTERIOLOGY LABORATORY AND FIVE PUBLIC HOSPITALS IN MEXICO WITH REGARD TO OCCUPATIONALLY-ACQUIRED TUBERCULOSIS. K. Martinez, NIOSH, Cincinnati, OH.

In 1998, NIOSH responded to two separate requests for technical assistance from the Mexican National Institute of Diagnostics and Reference Epidemiology and the Mexican National Institute for Public Health to environmentally evaluate the federal reference mycobacteriology laboratory, five public hospitals, a primary care clinic, and a university research laboratory, all distally located across the nation. Specifically, the requests were concerned with environmental factors that could contribute to occupational exposures to *Mycobacterium tuberculosis*. On-site surveys were conducted that included observational assessment, smoke visualization to characterize air flow patterns, and measurements, where applicable, for air flow, air static pressure, and particle counts to quantify containment parameters. Measurements were also made of the energy produced by ultraviolet germicidal irradiation (UVGI) lamps. For the reference mycobacteriology laborato-

ry, deficiencies included inappropriate pressure relationships between adjacent areas (including the operation of the Biosafety Level 3 facility); the use of fume hoods as biological safety cabinets with inadequate exhaust; inappropriate respiratory protection; and the lack of a comprehensive UVGI program that includes interlocks, employee training, and preventive maintenance. For the hospitals, assessments were focused in areas where patients suspected of active tuberculosis may reside, such as the emergency room, the outpatient clinic, radiology, surgical recovery, the intensive care unit, and the bacteriology laboratory (where specimens from active patients may be sent for analysis). The level of environmental controls varied with the financial sponsorship of the hospitals, e.g., from natural ventilation to ventilation systems installed with high-efficiency particulate air filtration. Other control deficiencies included the lack of appropriate respiratory protection, improper pressure relationships between adjacent areas, poor isolation procedures (including poor isolation room design), and the lack of appropriate biological safety cabinets. Recommendations were made at the conclusion of each site visit that could be practically implemented, economically, given limited resources, and within a reasonable time frame.

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STRATEGIES FOR NURSING HOMES AND LONG-TERM CARE FACILITIES. J. Thelen, S. Cook, Michigan Department of Consumer and Industry Services, Lansing, MI.

Caregivers in nursing homes continue to suffer an epidemic of disabling workplace injuries and illnesses. In 1998, the Michigan Department of Consumer and Industry Services, Bureau of Safety and Regulation (MIOSHA) responded to this epidemic by initiating a 5-year special emphasis program for nursing homes and long-term care facilities. The program was designed to help MIOSHA focus its resources on long-term care facilities and reduce injuries and illnesses by at least 15 percent. Long-term care facilities are considered a high-hazard industry due to the number of MIOSHA recordable cases resulting in lost time days compared to other non-targeted industries. Providing both adequate patient lift and assist equipment and training for proper use, improves working conditions for employees while simultaneously improving the care for residents. MIOSHA is conducting five one-day seminars statewide in FY 2000-01 to demonstrate best practices and procedures. The seminars address specific hazards that contribute to injuries and illnesses. Each seminar attendee receives a guideline kit to assist with the development of solutions for specific hazards. The kit includes resources related to ergonomics for the healthcare employee, hazard recognition in the long-term care facility, and occupational health related regulatory issues including tuberculosis, bloodborne infectious diseases and respiratory protection. Additionally, patient lift assist equipment is available during the training program for the demonstration of successful and safe resident transfers.

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REFINEMENT OF METHODS FOR PARTICLE ANALYSIS OF INDOOR AIR IN HEALTH CARE FACILITIES. A. Streifel, D. Errede, N. Carlson, University of Minnesota, Minneapolis, MN.

Air quality analysis in health care settings has classically focused on the recovery of viable

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