Program to audit its installations. The ECAS program identifies environmental and related occupational health and safety concerns for the U.S. Army and its installation commanders, requires development of corrective actions, identifies resource needs, and tracks corrective action implementation. The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) conducts audits of U.S. Army installations on a 3-year cycle. The assessments are conducted throughout the continental United States, Alaska, Hawaii, Puerto Rico, Japan, Korea, and the South Pacific.

Each ECAS team consists of specialists from the USACHPPM industrial hygiene and environmental health programs. Industrial hygiene personnel assess, at a minimum, the installation asbestos, radon, lead, hazardous materials control and management, and hazard communication programs. These assessments help the U.S. Army meet federal (OSHA, EPA, and HUD), state, local, and U.S. Army regulations.

Presently, several positive trends have been identified: improvement in hazardous materials control and management; establishment of installation radon reduction programs and childhood lead poisoning prevention programs; continued minimization of risk to building occupants from asbestos exposure; and establishment of environmental, health, and safety programs at overseas installations which are comparable to or better than their stateside counterparts. Areas identified needing improvement are: meeting U.S. Army regulations for installation asbestos and lead hazards management programs and staffing shortages for safety and industrial hygiene personnel at numerous installations. The ECAS program enables the U.S. Army to maintain an Army-wide assessment database, to reallocate resources, and to develop proactive procedures.

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THE COST OF NOT PREVENTING BACK INJURIES IN NURSING PERSONNEL IN LONG-TERM CARE FACILITIES. L. Achimore, Onondaga County Risk Management, Syracuse, NY; M. Brophy, University of Albany, Rensselaer, NY

Back injuries continue to extract a high toll, both in terms of human suffering and financial resources, from primary care givers who move patients not able to bear weight. Intervention strategies based on ergonomic principles have often been recommended and implemented, but there is a dearth of information on long-term effects of such interventions. In a 650-bed long-term care facility in Onondaga County located in upstate New York, the back injury rate in nurses aides went from 19 per 100 full-time workers in 1992 to 10 per 100 full-time workers in 1995. During that same approximate period 9 Hoyer lifts, 1 Arjo lift, 10 hydraulic stretchers, with their associated slings, as well as transfer belts and smooth movers, were purchased by the facility for a total cost of $73,400. The cost of replacement and compensation salaries for back injuries in 1993 was $1,000,800. The saving in replacement and compensation salaries during 1994 and 1995 was $759,700. This is a return of $9 saved for every dollar spent. The average number of lost work days per full-time nurses' aide was reduced from 9.0 in 1993 to 4.2 in 1994 and 5.0 in 1995. Concomitant with the purchases of patient handling equipment, an ergonomics evaluation team was established along with ergonomics classes for patient care givers, an accident review committee, maintenance checks for lifting equipment, and direct access to management and purchasing departments. In addition to the savings documented in worker comp costs, there was a decrease in patient skin tears, dislocated shoulders, and patient bruising.

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A PILOT ANTHROPOMETRY STUDY FOR WORKERS OF SEMICONDUCTOR FACTORIES IN TAIWAN. C. Lu, Kaohsiung Medical College, Kaohsiung, Taiwan; J. Yu, Center for Industrial Safety and Health Technology, Hsinchu, Taiwan, ROC; H. Shyu, C. Chou, L. Chen, S. Huang, Taiwan Semiconductor Manufacturing Co., Taiwan, ROC

Anthropometry is the science that deals with the measure of human body. The results of statistical data can be a fundamental data for tool and equipment design or development. In Taiwan, most semiconductor factories purchased equipment, from USA or Japan, which is not designed for the users in Taiwan. Some control panels are too high to be touched or some spaces are too small to work comfortably.

The subjects of this study are 582 persons belonging to four different factories, about one-fourth of all workers. The research team included occupational nurses, ergonomics specialists, and industrial hygienists. The segment link length of operators was measured to create anthropometric data.

The results indicated the average of operator stature, eye height, and shoulder height were 158 cm, 148 cm, and 129 cm, respectively. The length of upper arm, forearm link, hand, and shoulder were also measured. The anthropometric data will be a reference database for new equipment purchase and plant layout design.

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USE OF VISUAL CUES IN REDUCING THE RISK OF FALL DURING WORK AT ELEVATED AND/OR INCLINED SURFACES. A. Bagchee, A. Bhattacharya, P. Succop, M. Medvedovic, University of Cincinnati, Cincinnati, OH

As per the Bureau of Labor Statistics, falls from elevated and/or inclined surfaces at construction sites are one of the major causes of fatality and injury. Visual input received by the worker at inclination/elevation is modified, adding to the increased burden on the postural balance. This study was designed to use strategically placed visual cues in the visual field of the subject to reduce the risk of fall by minimizing the postural imbalance. Ten subjects (age=38.55 +/-9.2 years) participated in this study. A combination of two elevations (0 inches and 24 inches), two inclinations (0 degrees and 26 degrees), and seven visual cue arrangements were used. The subjects performed two tasks of 30-second duration: stationary (quiet stance) and reach (reaching forward/downward to retrieve a 5.5 lb weight from knee level). The subjects stood on a combination platform (with proper elevation and/or inclination) placed on a force plate. The enclosure walls were fitted with a combination of vertically and/or horizontally placed phosphorescent strips as visual cues. Length of the CP travel obtained from the force plate (sway length, SL) presents an indirect measure of the body's postural stability. Higher SL may be associated with greater effort in maintenance of balance. A repeated measures analysis indicated that SL increased significantly with increasing elevation and incline ($p<0.05$). Addition of visual cues significantly lowered the SL in static tasks ($p<0.05$). The increase in the SL with elevation was minimum for both tasks when using a visual cue involving a vertical line and a horizontal line forming an inverted T, directly in front of the subject. Results from this study would be useful in designing intervention in the workplace in the form of carefully placed visual cues that would reduce the postural imbalance in workers at elevated/inclined surfaces, thus reducing the risk of fall.

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RELIABILITY AND VALIDITY OF AN ON-SITE POSTURE ANALYSIS SYSTEM. C. Forrester, R. Stinson, Y. Li, Greater Cincinnati Occupational Health Center, Cincinnati, OH; G. Lemasters, A. Bhattacharya, University of Cincinnati, Cincinnati, OH

Poor working posture and other known risk factors such as vibration, repetition, and force have been identified as major risk factors for work-related musculoskeletal disorders (WMDs) in carpenters. Simple but reliable and valid posture analysis systems (PASs) are needed to identify problem areas which then may be reduced or corrected. The ability of a PAS to adapt to the numerous risk factors at a construction site is needed. In general, a PAS must be easy to learn and assess posture accurately with minor intrusiveness.

The purpose of this study was to evaluate a PAS that can be used with minimal training while maintaining high reliability and validity in identifying carpenters' gross body work postures. The study design consisted of two systems: an on-site observer posture analysis system (OPAS) and a videotape posture analysis system (VPAS). Both measured the same tasks, differing only in mode of observation. The seven tasks evaluated with both systems included floor to waist, waist to shoulder, and shoulder to overhead lift/lower tasks; and floor, waist, overhead, and carry tasks. 1464 OPAS tasks were compared to the exact same VPAS tasks (N=1464) collected from first-year union carpenter apprentices (n=37) observed and videotaped during school shop time.

Validity of the OPAS was evaluated by comparing data collected by a trained observer to that of an expert reviewer. Overall agreement was excellent (80%). Intermethod reliability was evaluated by percent agreement between data collected via OPAS to that of the VPAS.

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PRAGMATIC PRINCIPLES FOR AVOIDING MANAGEMENT PITFALLS. M.L. Sanders, Naval Engineering Field Activity, Poulsbo, WA

Making the transition from an industrial hygienist managing programs to a manager programming industrial hygienists can be traumatic and career damaging. Keen technical and verbal skills are common entrance requirements to the people-management arena, but industrial hygienists who desire to make that professional move must be aware of three particularly dangerous pitfalls which neither of those skills will protect against.

One pitfall results from failure to distinguish between leadership and management, another from failing to distinguish between organizational process and function, and the third for failing to recognize the customer. Industrial hygienists must have the insight to recognize and evaluate those pitfalls, avoiding or backfilling in order to walk safely over them.

Specific and succinct descriptions of principles for both the prevention and the resolution of these problem areas have been developed; use of these principles is the catalyst for efficacious management. Whether the professional industrial hygienist is in the private or the public sector, assuming the responsibility for a controlled management response using these principles in the face of business adversity can turn impending failure into resounding success and ensure career growth.

3

SCIENTIFIC CONTRIBUTIONS TO THE REVISION OF THE OSHA'S 1,3-BUTADIENE HEALTH STANDARDS. C.T. Chen, OSHA, Washington, DC

The current OSHA's 1,3-butadiene (BD) health standard is an 8-hour time-weighted average (TWA) exposure of 1,000 ppm for workers exposure to BD which is adopted from 1968 American Conference of Governmental Industrial Hygienist's (ACGIH's) threshold limit values (TLVs®) in 1971 to prevent irritation and narcosis effects. Due to the demonstration that BD causes multiple cancers in two animal studies in 1983, OSHA was petitioned by unions in 1984 and referred by EPA in 1985 for regulatory action. In 1990, OSHA published a proposed BD standard with an 8-hour TWA exposure of 2 ppm, a short-term exposure limit (STEL) of 10 ppm, and the ancillary provisions. There are many scientific studies contained in OSHA BD docket which enhanced the completion of a BD standard. Animal bioassays, human epidemiologic studies, experimental investigations on the metabolites and their mechanism in vitro and in vivo systems provides convincing evidence that BD is a probable human carcinogen. Three out of five quantitative risk assessments used NTP study with exposures of 6.25–625 ppm BD to calculate their best estimates of risk. Due to the availability of three breakthrough studies on BD, OSHA was able to allow the use of cartridges and canisters for respiratory protection that would enhance workers' protection, address industry's concerns, and reduce compliance cost. A series of plant visits conducted by the National Institute of Occupational Safety and Health (NIOSH) produced worker exposure profiles and information on technological feasibility which greatly helped in economic analysis. An epidemiologic study sponsored by the International Institute of Synthetic Rubber Producers (IISRP) completed in late 1995 clearly demonstrated an excess risk of cancer among workers exposed to BD which is complementary to the animal studies. This promoted IISRP to engage with unions to reach agreement on a standard with an 8-hour TWA exposure of 1 ppm, a STEL of 5 ppm, and other aspects of standard. This demonstrates that studies from various disciplines of science will greatly enhance the development of a workplace health standard. The opinion expressed here is sole of author.

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CIH PLUS IHIT UTILIZATION BY INDUSTRY OR INDUSTRY GROUP, AND PRELIMINARY PROJECTIONS OF FUTURE NEED FOR SUCH INDUSTRIAL HYGIENE PROFESSIONALS. L.W. Whitehead, CIH University of Texas-Houston Houston, TX, M. West Baylor College of Medicine, Houston, TX

Estimates of future need for public health professionals are very useful for planning educational programs and incentives for graduate education, and for staffing projections. No such estimates are known to exist for