National Occupational Research Agenda 2002

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CDC Workplace Safety and Health

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NIOSH

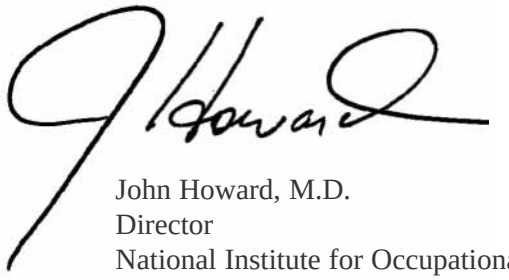
• Foreword •

In 1996, the National Institute for Occupational Safety and Health (NIOSH) worked with diverse partners to develop the National Occupational Research Agenda (NORA). Reflecting input and review by more than 500 individuals and organizations, NORA defines the national research that will do the most to protect the safety and health of workers.

As a working blueprint for innovative research, NORA has stimulated strong support and broad partnerships across industry, labor, government, and academia. Through NORA and its collaborative structure, the Nation is better positioned to counter the toll of workplace injury, illness, and death in this time of unprecedented change in the American workplace.

This document contains summaries of current research projects conducted or supported by NIOSH under NORA. For convenience, 448 projects are classified as intramural or NIOSH-supported extramural research, and they are grouped by NORA priority area. The 177 extramural projects and 271 intramural projects illustrate the range of NORA priorities and the high quality of research that continues to result from these national partnerships. They also provide further evidence for NORA's strategic importance in guiding the research that will yield the highest dividends in worker safety and health for decades to come.

In reassessing our own research priorities at NIOSH, we have been inspired by NORA. As we continue to build new collaborations, we hope others will share this same excitement.



John Howard, M.D.
Director
National Institute for Occupational
Safety and Health

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1 Extramural Research Projects

Grants

• Allergic and Irritant Dermatitis •

Dermatopharmacokinetics and Pharmacodynamics

Investigator: Karla Thrall, Ph.D.
Affiliation: Battelle Memorial Institute
Richland, Washington
Telephone: (509) 376–6115
Keywords/Phrases: Dermatitis, paint, toluene, methyl ethyl ketone

Purpose:
To understand the influence of paint product formulations on the dermatopharmacokinetics of toluene and methyl ethyl ketone (MEK).

Abstract:
This research will enhance the ability to accurately extrapolate animal studies to relevant human exposure scenarios and will improve hazard and risk assessments. Experimental studies will be conducted with rats using a novel real-time breath analysis system coupled with physiologically based pharmacokinetic (PBPK) modeling to determine the penetration rate of toluene and MEK through the skin. The resulting data from these comprehensive evaluations are directly applicable to regulatory agencies in establishing dermal absorption guidelines that mimic actual occupational exposure situations. The specific research objectives are (1) to describe dermal absorption of toluene and MEK using PBPK models to determine skin permeability constants, (2) to evaluate the kinetics and dermal bioavailability of exposure to aqueous toluene and MEK, and (3) to compare different paint product formulations regarding the percutaneous absorption of toluene and MEK.

Dermal Absorption of Cutting Fluid Mixtures

Investigator: Ronald Baynes, Ph.D.
Affiliation: North Carolina State University
Raleigh, North Carolina
Telephone: (919) 513–6398
Keywords/Phrases: Dermatitis, metalworking fluids, mixed exposures

Purpose:
To investigate the dermal disposition and cutaneous toxicity of chemical additives and contaminants in cutting fluid formulations.

Abstract:
This research project uses an experimental paradigm that takes into account the difficulty of testing all commercial cutting fluids or oils. The long-term goal is to understand chemical and biological interactions in a chemical mixture that modulates dermal disposition of irritants or chemicals and to be able to predict chemical and biological interactions in a chemically defined mixture in the workplace. The central hypothesis is that many chemical additives or components in cutting fluid formulations behave as solvents, co-solvents, or surfactants. These additives can modulate percutaneous absorption by altering the normal anatomy and physiology of the skin through discrete mechanisms; eventually they determine the fate of the irritant(s) and thus its potential to cause irritant dermatitis.

Confocal Histopathology of Contact Dermatitis In Vivo

Investigator: Salvador Gonzalez, M.D.
Affiliation: Massachusetts General Hospital
Boston, Massachusetts
Telephone: (617) 724–1915
Keywords/Phrases: Hypersensitivity pneumonitis, method development, dermatitis

Purpose:
To establish new criteria for differentiating acute irritant contact dermatitis (ICD) from allergic contact dermatitis (ACD) by using a video rate (real-time), near-infrared confocal reflectance microscope.

Abstract:
Contact dermatitis (CD) affects approximately 20 percent of the population in the United States and is the most common form of occupational dermatosis. This condition is divided mechanistically into ICD and ACD. The ICD is produced by the toxic effect of certain chemicals on the skin, whereas ACD is induced by a delayed hypersensitivity response of the host to an antigenic chemical. The latter form is characterized by a cascade of immunologic events that occurs mostly in the superficial layers of the skin. Morphologic features of both forms of CD are very similar on gross and microscopic examination, and it is difficult to differentiate one from the other. The use of a noninvasive confocal reflectance microscopy to evaluate the states of allergic and irritant skin reactions in vivo, as well as to enhance patch test-

ing, may help physicians improve their diagnostic skills in this area and facilitate better understanding of the pathogenesis of these inflammatory skin conditions. The lack of artifacts from conventional histology gives a more realistic picture of pathophysiology. Investigators also expect that our results may ultimately translate into more rational and effective care for patients with this common and frequently disabling problem.

• Asthma and Chronic Obstructive Pulmonary Disease •

Lung Disease in Chinese Textile Workers

Investigator: David Christiani, M.D.
Affiliation: Harvard School of Public Health
Boston, Massachusetts
Telephone: (617) 432–1260
Keywords/Phrases: Pneumoconiosis, cotton dust, endotoxin

Purpose:
To further assess the respiratory health of workers chronically exposed to organic dust (specifically cotton dust) and endotoxin.

Abstract:
Exposure to gram-negative bacterial endotoxin has been described in laboratory studies as producing acute respiratory symptoms and lung function change. A similar study has addressed the relative contributions of cotton dust and endotoxin in producing both acute and chronic respiratory effects. In addition, the investigators will examine the long-term effects on the respiratory health status of workers who were removed from exposure by retirement. This is possible because of documented accessibility to workers who have left the workforce. Pulmonary effects caused by endotoxin are important in the cotton textile industry as well as in other environments with significant concentrations of airborne endotoxin.

The study population (closed cohort) has been followed since 1981. It is unusually well suited for epidemiologic study because of low turnover, very low smoking prevalence among women workers, and reliable baseline data. A suitable comparison group was studied. The population included 447 cotton textile workers and 465 silk textile workers first surveyed in 1981 and later in 1986, 1992, and 1996 with excellent followup. The proposed study is unique because exposure estimates for both dust and endotoxin over a 20-year period allow assessment of exposure-response relationships for both dust and endotoxin for the full study interval.

Longitudinal Study of Isocyanate Asthma in Body Shops

Investigator: Mark Cullen, M.D.
Affiliation: Yale University
New Haven, Connecticut
Telephone: (203) 785–6434
Keywords/Phrases: Diisocyanates, occupational asthma, cross-sectional study

Purpose:
To assess the incidence, healthy worker effect, and mechanism and biomarkers associated with isocyanate asthma.

Abstract:
Diisocyanates remain the most frequent cause of occupational asthma (OA) in developed economies. Four years ago, the investigators initiated a multidisciplinary, large-scale cross-sectional study of autobody shops in New Haven (the SPRAY study) to address outstanding questions for primary and secondary control of this highly relevant condition. Ancillary studies were initiated simultaneously in humans and animals to elucidate mechanism. To date the investigators have demonstrated several key associations between patterns of exposure and clinical, physiological, and immunological parameters, and they have begun to elucidate the immunology of the disease. However, success has been hampered by inherent limitations of cross-sectional design and evident healthy worker selection pressures in this industry. The investigators now propose to take further scientific advantage of this extraordinary cohort and the relationship with the subjects and shops to (1) characterize the natural history of isocyanate exposure by following SPRAY subjects over the next 5 years with repeated exposure assessment and measurements of respiratory and immunologic function, (2) address healthy worker effect by supplementing the existing cohort with an inception cohort of new workers hired during the followup period, and (3) confirm all cases developing new-onset asthma by specific inhalation challenge to establish the exposure patterns, preclinical physiologic and immunologic features, and host factors that confer risk for isocyanate asthma.

Physiologic Characterization of Occupational Asthma

Investigator: Susan Sama, Sc.D.
Affiliation: Harvard University
Boston, Massachusetts
Telephone: (617) 432–1260
Keywords/Phrases: Asthma, airflow patterns, disease prevention

Purpose:
To characterize occupational asthma.

Abstract:
Occupational asthma (OA) accounts for 5% to 36% of asthma in adults, and occupational exposures are major contributors to morbidity among adult asthmatics. Early detection and intervention are essential for primary as well as secondary prevention of OA. Unfortunately, the physiologic manifestations of OA are poorly understood, and easily measured noninvasive biomarkers of OA are sorely needed. Current methods based on peak expiratory flow (PEF) diaries are effort-dependent, and the quality of the efforts and records cannot be controlled. This project will address these pressing needs by illuminating the relationship between the four work-related asthmatic airflow patterns (WRAAPs). This relationship will be determined by examining (1) responsiveness to bronchodilators, (2) a biomarker of airway inflammation in exhaled breath, (3) occupational exposure, (4) quality of life, (5) atopy, and (6) the degree of asthma morbidity. The project will use portable electronic spirometers and a more sophisticated physiologic and noninvasive biomarker of airway inflammation. This study will lay the foundation for application of these new methods—not only in future occupational epidemiologic studies, but also in industrial screening and outpatient clinics. This study will provide improved detection and prevention of OA.

Chronic Obstructive Pulmonary Disease Risks in Carpenters

Investigator: David Wegman, M.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
Telephone: (978) 934–3265
Keywords/Phrases: Carpenters, chronic airway obstruction, methods of data collection

Purpose:
To investigate the risk among carpenters of chronic airway obstruction other than asthma.

Abstract:
Evidence of a relationship between occupational dust exposures and chronic airway disease, including chronic obstructive pulmonary disease (COPD), has been demonstrated in a number of studies in occupational and community settings. Apart from studies focused on the classical dusty trades, however, very little is known about the possibility of risk from more moderate exposures to a diverse mixture of different types of particulates. Evidence is mounting for mechanisms that might underlie a relatively nonspecific toxic effect from particulate exposures. In addition to respiratory tract irritation, high particulate exposures can overload the clearance mechanisms of the lung, producing a cascade of responses that may culminate in chronic lung injury. To contribute to the study of risk associated with exposure to a mixture of particulates, the investigators propose to target a working population of union carpenters. Carpenters have a diversity of aerosol (wood dust being only one) and chemical exposures and excess risk for pulmonary disease. Apart from studies of occupational asthma, there have been few investigations of respiratory disease associated with this trade, despite the fact that carpentry is one of the largest specialty trades among construction workers. The proposed study is therefore designed as a pilot investigation of the risk among carpenters of chronic airway obstruction other than asthma. The specific objectives of this pilot study are to develop and evaluate methods to (1) identify incident cases of COPD in the Carpenters Combined Benefits Fund of Massachusetts medical insurance records database and (2) assess a diverse range of different aerosol and gas exposures occurring in carpenters' jobs. The outcome of the pilot study will be methods that can be applied in a subsequent case control investigation designed to provide quantitative data on the associations between COPD and different aerosol exposures experienced by carpenters. The case control study will be the subject of a separate proposal, contingent on successful development of the necessary methods.

Isocyanate Exposure Intervention Study in Body Shops

Investigator: Youcheng Liu, M.D., Sc.D.
Affiliation: Yale University
New Haven, Connecticut
Telephone: (203) 785–5969
Keywords/Phrases: Intervention, auto body workers, diisocyanates

Purpose:
To test the hypothesis that an integrated intervention program will significantly reduce the inhalation and skin exposure of auto body workers, particularly painters, to aliphatic diisocyanates.

Abstract:
Diisocyanates, a group of highly reactive compounds extensively used in the collision repair industry, are the most commonly reported cause of occupational asthma. The investigators' preliminary data revealed a high inhalation exposure to isocyanate oligomers and extensive skin exposure in auto body shop workers. Control technologies and strategies to reduce these exposures are urgently needed in order for shops to comply with EPA and OSHA regulations and to achieve the overall goal of asthma prevention; however, little research has been done in this industry to evaluate the effectiveness of exposure control measures. The researchers propose an intervention study to test the hypothesis that an integrated intervention program will significantly reduce the inhalation and skin exposure of auto body workers, particularly painters, to aliphatic diisocyanates. Specific aims are to (1) implement an educational training program and assess the effectiveness of training, (2) implement a product (process) change and engineering control program and evaluate their effectiveness in exposure reduction, (3) implement an administrative program to supply more protective equipment and evaluate its effectiveness in exposure reduction, (4) implement a behavioral intervention program and evaluate its effect on work practices, and (5) evaluate the overall effectiveness of this intervention program with feedback from shop management and workers, using urinary biological monitoring tools. The overall study design will be a prospective field experimental study with 10 shops each in the intervention group and control group and 120 workers. The investigators will evaluate the intervention at baseline, 6 months, and 1 year. Effects of intervention will be assessed for the two groups at 6 months and sustainability of intervention effectiveness will be evaluated among intervention phases. This should allow the researchers to identify effective exposure intervention strategies, recommend them for wide application in this industry and other similar industries, and contribute significantly to a better prevention of asthma in auto body shop workers.

Pulmonary Effects of Machining Fluid Aerosols

Investigator: Terry Gordon, Ph.D.
Affiliation: New York University
Tuxedo, New York
Telephone: (845) 731–3536
Keywords/Phrases: Pneumonitis, *Mycobacterium chelonae*, workers,animal model

Purpose:
To determine whether *Mycobacterium chelonae* is responsible for the induction of hypersensitivity pneumonitis in machining fluid workers using an animal model of hypersensitivity pneumonitis.

Abstract:
This research will test the hypothesis that *M. chelonae* contamination of machining fluids produces hypersensitivity pneumonitis in exposed workers. The results of previous studies suggest but do not prove a link between hypersensitivity pneumonitis and exposure to *M. chelonae*-contaminated machining fluid aerosols. Thus a new occupational problem has surfaced in which a targeted microbe, *M. chelonae*, has not been routinely assayed in machining fluids or previously considered in the pathogenesis of hypersensitivity pneumonitis. Since epidemiological studies can typically provide only relational information, this research proposes to use an animal model of hypersensitivity pneumonitis to determine whether *M. chelonae* is responsible for the induction of hypersensitivity pneumonitis in machining fluid workers. Although indirect evidence suggests that *M. chelonae* is involved in the recent outbreaks of hypersensitivity pneumonitis, the findings from the proposed controlled laboratory studies are needed to prove causality before instituting control strategies such as the appropriate biocide for eradicating the critical microbial contaminant of machining fluids.

Chemokine Biomarkers of Diisocyanate-Induced Occupational Asthma

Investigator: David Bernstein, M.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
Telephone: (513) 558–4701
Keywords/Phrases: Exposure assessment, airborne contaminants, asthma

Purpose:
To establish an immunologic in vitro assay as a sensitive and specific biomarker of diisocyanate-induced occupational asthma (DA) and to define a relationship between in vitro diisocyanate (DIISO) antigens, enhanced peripheral blood mononuclear cells (PBMCs) production, and airway inflammation in DA.

Abstract:
DA is the most prevalent form of occupational asthma. Severe chronic disability due to DA can be prevented by early diagnosis and cessation of workplace exposure; however, there are no sensitive biomarkers of DA to facilitate an early diagnosis. In the past 10 years, bronchoalveolar lavage and bronchial biopsy studies of workers with DA have defined an important pathogenetic role of airway inflammation. Previous studies have identified diisocyanate antigen-specific cellular responses in DA

patients. These studies revealed that clinically confirmed DA is significantly associated with antigen-specific enhancement in peripheral blood mononuclear cells (PBMCs) of the chemoattractant cytokine, monocyte chemoattractant protein-1 (MCP-1) and of TNF. Hypotheses generated from these preliminary studies that will be tested in this proposal are as follows: (1) DIISO antigen-enhanced production of MCP-1 is a biomarker of DA and validation of the MCP-1 assay as a clinical test will allow differentiation of DA from non-DA; and (2) PBMC production of MCP-1 in response to in vitro stimulation with DIISO antigens correlates with increased secretion of MCP-1 and TNF in induced bronchoalveolar lavage (BAL) fluid of workers with DA as well as with other indices of lung inflammation elicited by workplace exposure to DIISOs. Once validated as a diagnostic biomarker, the MCP-1 assay can be used as a diagnostic method for differentiating workers suspected of DA from those with non-DA or from those with nonoccupational asthma.

A Validated Asthma Questionnaire for Health Care Workers

Investigator: George Delclos, M.D.
Affiliation: University of Texas
Houston, Texas
Telephone: (713) 500–9459

Keywords/Phrases: Healthcare workers, asthma

Purpose:

To develop, validate, and field test a new survey instrument for work-related asthma among health care workers. This survey permits the assessment of occupational and nonoccupational exposures that may result in the development of work-related asthma.

Abstract:

Occupational asthma (OA) is currently the most frequently reported diagnosis of work-related respiratory disease in developed nations. Health care workers, who represent approximately 7% of the U.S. workforce) are among the occupational groups at risk of developing OA. There have been reports of increased occurrence of asthma in nurses, animal handlers, respiratory therapists, physicians, and manufacturers of pharmaceuticals. Relatively few studies have been published with information about formal validation of asthma questionnaires, and validation to date has largely focused on the ability of questionnaire items to predict asthma in populations.

This 3-year study will be conducted in two phases. The aim of Phase I will be to develop and validate a new survey instrument of work-related asthma for use in health care settings. The questionnaire will be validated by administering it to a convenience sample of 100 health care workers (with and without asthma) and comparing results to the "gold standards" for asthma (methacholine bronchial challenge test) and nonoccupational exposure risk factors (RAST IgE-specific antibody panel against common environmental aeroallergens and latex). The aims of Phase 2 will be to (1) cross-validate and field test the new survey instrument in a population-based sample of four occupational groups (n=1,400 per group) of health care workers (nurses, physicians, respiratory therapists, and occupational therapists) identified through their respective licensing boards in Texas, (2) estimate and compare the prevalence of work-related asthma among these four occupational groups, (3) analyze associations between occupational and nonoccupational exposures in health care workers with and without asthma in this population, and (4) estimate the occupational burden of asthma in these four occupational groups.

Environmental Factors in PI*Z Alpha 1-Antitrypsin Deficiency

Investigator: Lee Newman, M.D.
Affiliation: National Jewish Medical and
Research Center
Denver, Colorado
Telephone: (303) 398–1296

Keywords/Phrases: Chronic Obstructive Pulmonary Disease, PI*Z, respiratory irritants

Purpose:

To understand obstructive pulmonary disease resulting from occupational exposure in homozygous PI*Z individuals.

Abstract:

Occupational dust, fume, and gas exposures have been associated with the development of chronic obstructive pulmonary disease (COPD). Genetic and familial factors also contribute to the risk of COPD. Individuals with alpha1-antitrypsin deficiency (a1-ATD) comprise one of these genetically susceptible populations. The major environmental risk factor for COPD in a1-AT deficient PI*Z individuals is personal tobacco use. Preliminary studies suggest that occupational respiratory exposures may also contribute to the severity of this disease. The researchers hypothesize that exposure to occupational and environmental respiratory irritants (dust, fumes, smoke, and gas) increases the risk of both chronic respiratory symptoms and airflow obstruction in genetically susceptible individuals with PI*Z (a1-AT deficiency).

This research will (1) evaluate the association between certain occupational and environmental respiratory exposures and the presence and severity of specific pulmonary symptoms and airflow obstruction; (2) assess the

potential interaction or confounding effects that different types of respiratory irritant exposures and/or personal and environmental exposures to tobacco smoke might have in predicting the risk of respiratory symptoms; (3) assess the potential interaction between exposure to personal or environmental tobacco smoke and respiratory infections in predicting risk of respiratory symptoms and airflow limitation; and (4) validate the model developed as a predictive model by repeated resampling of the original data set (i.e., bootstrapping) that could help health professionals counsel and educate PI*Z patients about their risks from environmental and occupational exposures. A cross-sectional design will be used in an expanded cohort of more than 300 patients with PI*Z. This research offers an opportunity to investigate environmental and genetic interactions where the gene trait that confers susceptibility is known but in which the environmental triggers are not.

• Cancer Research Methods •

Time Factors in Exposure Effects Among Uranium Workers

Investigator: David Richardson, Ph.D.

Affiliation: University of North Carolina
Chapel Hill, North Carolina

Telephone: (919) 843–3193

Keywords/Phrases: Radiation mortality, cohort study, uranium workers

Purpose:
To improve the methods used to evaluate the effects of latency, time since exposure, and agent-exposure in studies of repeated or chronic exposure.

Abstract:
The proposed study investigates the association of radiation with mortality in a cohort of workers employed at the U.S. Department of Energy's Y-12 uranium processing facility. The Y-12 cohort was recently expanded, and vital status information was updated through 1990. Radiation lung dose estimates for workers at Y-12 (based on bioassay and in vivo monitoring records) are available in computerized form; however, no analyses of dose-response associations have been conducted using this updated information. The proposed research will take advantage of previously collected data to conduct investigations of occupational exposure-disease associations. Detailed analyses will be conducted of variations in radiation-mortality associations with latency, time since exposure, and agent-exposure. The results of this study will help address analytical questions about radiation-lung cancer associations in this cohort, while reducing exposure misclassification by better identifying the etiologically relevant period of exposure.

P53 Biomarker and Intervention in Occupational Cancer

Investigator: Paul Brandt-Rauf, M.D.

Affiliation: Columbia University
New York, New York

Telephone: (212) 305–3959

Keywords/Phrases: p53 tumor suppressor gene, cancer prediction, carcinogens

Purpose:
To study the p53 tumor suppressor gene as a tool for predicting cancer and suppressing its development in humans exposed to carcinogens in the workplace.

Abstract:
Research methods for occupational cancer are needed to develop early markers of adverse health effects from workplace exposures and to devise ways for interrupting the pathways between workplace exposures and resulting cancers. The p53 tumor suppressor gene product is a potential target for both of these approaches. Certain occupational exposures can produce mutations in p53 that cause the generation of an immune response with circulating p53 autoantibodies even before the occurrence of clinically detectable cancers. Thus these antibodies may serve as useful early markers of adverse effects. In addition, certain short peptide sequences from p53 have been demonstrated in cell culture to be able to cause mutant p53 to revert to normal function, resulting in the death of cancer cells containing mutant p53 but having no effect on normal cells with wild-type p53. This approach may therefore be useful for interrupting the pathway between workplace exposures that produce p53 mutations and resulting cancers. The purpose of the proposed research is to examine both of these approaches for occupational cancers caused by asbestos exposure in two related projects. For the first project, banked serum samples from a cohort of workers with asbestosis will be examined for the presence of p53 autoantibodies by enzyme-linked immunosorbent assay and immunoblotting to determine whether the presence of the antibodies correlates with the subsequent development of cancer as well as with the presence of p53 mutations in the resulting tumors. The second project will involve investigating the effects in cell culture of a p53 peptide sequence (delivered as the peptide or as a plasmid-based minigene) on asbestos-associated lung cancer and mesothelioma cell lines with and without p53 mutations and corresponding noncancer cell lines with wild-type p53. The second

project will also determine the mechanism of action of the peptide for inducing death in these cells.

• Control Technology and Personal Protective Equipment •

SBIR Bioelectronic Telemetry System for Fire Fighter Safety

Investigator: Michael Fred Masterman
Affiliation: Extreme Endeavors and Consulting
Philippi, West Virginia
Telephone: (304) 472–6446

Keywords/Phrases: Telemetry, monitoring, fire fighters

Purpose:
To develop personal telemetry and physiological monitoring systems to enable fire departments to monitor the physiological condition and environments of fire fighters in extreme conditions.

Abstract:
Every year fire fighters are killed in the line of duty as a result of the strenuous nature and environmental conditions in which they must work. This research will develop a bioelectronic monitoring system to inform incident commanders in real time when personnel are in trouble and when they must discontinue their duties to avoid endangering themselves and team members. The investigators will develop a monitoring system to observe the fire fighter's physiological status and the environmental conditions surrounding the fire fighter. Research will be done to implement a repeater system to transmit the signal out of the structures in which fire fighters must work. The properties of the transmission required for this application will be analyzed, modeled, and tested among the various structures. The bioelectronics previously developed by the research team will be combined to construct a simple prototype. The simple prototype will be field-tested for further evaluation. This system will provide real-time information about the fire fighter's condition for the incident commander or safety officer, allowing them to be removed from the hazards while making decisions about protecting fire fighters.

Measurements and Control Diesel Emissions in Underground Mines

Investigator: Mingming Lu, Ph.D.
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Cincinnati, Ohio
Telephone: (513) 556–0996

Keywords/Phrases: Control technology, diesel particulate matter, exhaust emissions, miners

Purpose:
To develop control technology to reduce diesel particulate and other diesel exhaust emissions in underground mines.

Abstract:
The diesel particulate matter (DPM) that emissions in underground mines are much higher than other occupational exposures that pose health threats to mine workers. This project is aimed at developing a novel control technology to substantially reduce DPM and other diesel exhaust emissions and to determine the impact of this control method by performing a thorough characterization of DPM emissions in target underground mines. DPM emission measurements (such as area-of-interest sampling, personal exposure, and emission source sampling) will be performed, and the technology will be implemented in a selected mine or mines for demonstration purposes.

Improved Health and Safety in Mining through Helical Drilling and Rock Bolt Anchoring

Investigator: John Hill, M.S.
Affiliation: UTD Incorporated
Manassas, Virginia
Telephone: (703) 393–0800

Keywords/Phrases: Drilling system, anchorage capacity, mining

Purpose:
To develop a rock hole bolt drilling system and hardware to improve anchorage capacity.

Abstract:
The investigator proposes to develop an innovative rock bolt hole drilling system based on new Helical Drag Bit technology and new rock bolts that address rock mass stabilization (reducing risk of catastrophic rock mass failure) by doing the following: (1) improving grouted rock bolt anchoring through improved hole geometry; (2) improving mechanical rock bolt anchoring capacity through new rock bolt designs that take advantage of new hole geometry; and (3) using a directly measured drilling parameter (torque) to reliably interpret rock properties

and conditions (function of new proven bit design). The new drilling and rock bolt system will significantly reduce the risk of ground slope failure due to the increased load capacity and higher pullout strength. As the same time, this new system will reduce total installation and operation costs as a result of savings in power consumption and drilling speed. The new system also will reduce respirabable dust produced during the drilling process. Furthermore, it will reduce noise from drilling hydraulics machinery through use of a new bit design that requires significantly less power than commercially available bits to excavate the same volume (beneficial to human health) and incorporate a portion or all of the drilling process directly into the rock bolt for reduction in installation handling requirements (potential for reduction in handling injuries and rock fragment injuries).

Engineering Control of Longwall Machine Noise

Investigator: Yi Luo, Ph.D.

Affiliation: West Virginia University
Morgantown, West Virginia

Telephone: (304) 293–7680

Keywords/Phrases: Technology, reduction of machine noise, underground longwall faces

Purpose:

To develop and test engineering controls for the reducing overall levels of machine noise in the underground longwall faces.

Abstract:

Longwall mining is the safest and the most productive mining method in underground coal mines. Because of the high degree of mechanization and the confined environments, noise levels at the longwall mining faces are normally high. Constant exposure to such a noisy environment for an extended period could lead to permanent hearing loss. The two major sources of noise at a longwall face are (1) noise produced by the mining machines (i.e., shearer, face conveyor, stage loader and crusher, etc.) and (2) the background noise produced by the breakage and movement of surrounding rock strata as they reach a new equilibrium after being disturbed by the mining activities. The machine noise is the major contributor to the worker's noise exposure. Because background noise provides useful information for workers to detect and predict harmful ground movements, it is desirable to leave the background noise intact. The object of this proposed research is to develop and test a technology for reducing overall levels of machine noise at the underground longwall faces while keeping the background noise basically unaltered. The investigators propose to do this by combining the traditional passive methods and the active noise control (ANC) technology. Because of the maturity and successful applications of the ANC technology in many other industrial environments, the investigators expect the active method to produce the most dramatic reductions in noise exposure to the longwall miners. By reducing the overall noise levels in the longwall panels, miners' hearing loss can be reduced greatly over their working lives.

Permeation of Irritant Mixtures Through Protective Materials

Investigator: Shane Que Hee, Ph.D.

Affiliation: University of California
Los Angeles, California

Telephone: (310) 206–7388

Keywords/Phrases: Model, dermal exposure, gloves

Purpose:

To evaluate a mathematical model to predict the permeation of mixtures through gloves and to determine whether the index of skin irritation is useful in assessing the risk of dermal exposure when gloves are worn.

Abstract:

The hypothesis is that an already existing mathematical model can be confirmed to predict permeation of mixture components through glove materials. A secondary hypothesis is to assess whether the index of skin irritation (the Corrositex rating) will be useful in assessing the worker's risk of dermal exposure when gloves are worn. The aims are to (1) select the irritative mixtures to be investigated, identify and quantify the major components, and select the types of gloves; (2) select the types of challenges; (3) determine the skin-irritative components in all challenges using the Corrositex assay; (4) determine the kinetic parameters of permeation, the steady-state permeation rate, and the lag time for each component using an American Standard for Testing and Materials-type permeation cell with liquid collection and GC/MS, LC/MS, and FT/IR; (5) evaluate the permeation characteristics of the reconstituted formulations and inert component mixtures; (6) measure Corrositex ratings for all challenge and collection systems; (7) confirm whether the logarithm of the steady state permeation rate and logarithm of the lag time depend on the logarithm of the mass composition, the logarithm of the molar volume, and the logarithm of the octanol/water coefficient; and (8) assess whether a multivariate model that also accounts for interactions among the three solvent parameters and glove parameters might produce a more general model. The mixtures to be studied are formulations of irritant pesticides (three being liquid when pure and four being solid when pure) and two cutting oils, one semi-

synthetic metalworking fluid, and a standard kit of chemicals used in the patch-testing of soluble metalworking mixtures. In addition, challenges with the smallest recommended dilution in water will be evaluated for each component or mixture. The gloves to be evaluated are lined and unlined nitrite and butyl, Silver Shield laminate, Viton industrial chemical-resistant gloves, and nitrite and butyl gloves. The relationship of the fundamental independent variables to the kinetic parameters of permeation and to the Corrositex rating as the index of irritation will be determined and compared.

Respiratory Protection Against Bioaerosols in Agriculture

Investigator: Tina Reponen, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio 45267
Telephone: (513) 558–0571
Keywords/Phrases: Field-compatible method, protection, respirators, dust

Purpose:
To develop a new field-compatible method to measure the protection respirators afford against dust in agricultural environments.

Abstract:
Agricultural workers are exposed to high concentrations of airborne microorganisms and thus have an increased risk for developing respiratory diseases. Respirators, when properly selected and used, can decrease the exposures in agricultural environments. In this study, a new field-compatible method will be developed to dynamically measure the protection provided by respirators against dust in agricultural environments. Another method will be developed to determine the protection provided by respirators against fungal and actinomycete spores. The new methods will be evaluated first in the laboratory under controlled conditions using four test aerosols: NaCl, PSL, and fungal and actinomycete spores. The laboratory tests will be conducted using three respiratory flow rates, three concentrations for test particles, and three sampling probe locations. After that, the new methods will be tested in the field during different agricultural operations while farmers are using the new N95 filtering-facepiece respirators. The field evaluation will be performed during different tasks: feeding animals, seeding, and harvesting. Tests related to animal feeding will be performed during two seasons—fall and winter, when the concentrations in the animal confinements are expected to be most significantly different. The field-testing will include both small- and large-scale farming operations. The design of the proposed laboratory and field experiments will include a combination of traditional time-consuming microbiological methods and advanced dynamic and compact aerosol measurement techniques. This dual approach combined with our extensive experience on respirator and bioaerosol studies will allow us to collect a representative data bank in the shortest possible time. The results will include dynamic measurements of respiratory protection as a function of time and particle size. The field-testing will be conducted for different agricultural activities in different seasons. The data will provide the basis for recommendations and, if desired, regulations for the respiratory protection of agricultural workers against organic dust. The methods developed and tested in this study are critically needed for further epidemiological and intervention studies in agricultural and other occupational environments.

Use of Digital Imagery to Characterize Rock Masses

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Keywords/Phrases: Imaging techniques, open-pit slopes, underground pillars

Purpose:
To characterize the discontinuities associated with open-pit slopes and underground pillars.

Abstract:
Ground failures are a serious problem for the U.S. mining industry. Mine Safety and Health Administration statistics for 1994–1998 show that 47% of mine fatalities and 16% of mine injuries in underground mines were attributable to ground failures. In open-pit mines, statistics from 1995 through 2000 revealed that 33 workers were killed in slope-failure-related accidents. This proposal addresses three types of ground failures associated with mining in the United States: (1) catch-bench failure in open-pit mines, (2) large-scale slope failure in open-pit mines, and (3) pillar failure in underground mines. The behavior of rock masses is dominated by rock discontinuities. Rock discontinuities reduce the overall rock mass strength and also provide specific pathways for rock failure. Rock discontinuities are presently being characterized with traditional methods, including scanline surveying, cell mapping, and geologic mapping. These methods are time-consuming and hazardous on unstable slopes; and even under the best circumstances, only a small data set of discontinuity properties can be obtained. The proposal is to use state-of-the-art imaging technologies to characterize the discontinuities associated with open-pit slopes and underground pillars. Two

primary imaging technologies will be investigated. The first is the use of still digital cameras along with image-processing software. The second is the use of high-resolution laser-scanning devices. Each of these two technologies has advantages and disadvantages in different circumstances. The plan is to investigate these two technologies and to determine how they can be used together to provide superior information over a wide range of surface and underground conditions. A 3-year project is proposed. The first year will focus on open-pit gold and copper operations in Nevada and Arizona. The second year will focus on underground gold and stone operations in Nevada and other western states. Studies in the first 2 years will include field studies, the processing of field data, and the automated input of these data into geomechanical models. In the third year, techniques will be investigated to automate the process of acquiring image information in the field in both underground and open-pit applications.

Integrated Stability Mapping System for Mines

Investigator: Keith Heasley, Ph.D.

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Keywords/Phrases: Stability mapping system, ground falls, mining

Purpose:

To reduce the injuries and fatalities associated with ground falls in underground mines.

Abstract:

This research will develop a state-of-the-art stability mapping system that tightly integrates geomechanical stress analysis, geological mapping, and roof support design. The primary output of this project will be a user-friendly software program that takes the site-specific mining plan, geology, and stability criteria as input and produces a map of the mine showing the relative stability index of the different mining areas and the recommended support requirements for those areas. The calculated stability index in this program will include the appropriate geologic influences at the mine along with the geo-mechanical stress effects from overburden depth, pillar design, adjacent seams, stream valleys, and other user-defined influences. The roof support recommendations in the program will be derived from present NIOSH research. The proposed software development will incorporate, modify, and enhance present software (AutoCad—drafting/mine mapping, SurvCADD—geologic modeling, and LaModel—mine stress analysis) as much as possible to speed the development and provide software that is already familiar to the mine design engineer.

Once the software is created, the program will be field tested and validated with field studies at several mines. Through this field-testing process, practical weighting factors for the various inputs to the stability index and practical support requirements can be developed and validated. Also, by working with producing mines, the practical application of the developed software can be evaluated and enhanced with input from practicing mine design professionals. Ultimately, the final stability mapping system will be transferred to the mining industry through publications, workshops, and other presentations as appropriate.

Control Measures for Silica Exposures for Tuckpointing

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Keywords/Phrases: Evaluation, vacuum cleaners, exhaust ventilation, dust collection

Purpose:

To test the effectiveness of wet-dry vacuum cleaners.

Abstract:

During exterior building renovation, deteriorated mortar is removed with a grinder to a depth of 1 to 2 cm and replaced with new mortar in a process termed "tuckpointing." Typically, the grinders used in tuckpointing are 10 cm in diameter with a rotational speed of 10,000 to 12,000 rpm. During mortar removal, worker exposures to reparable crystalline silica are as much as 5 mg/m3, a level 100 times the NIOSH recommended exposure limit (REL) and approximately 50 times the OSHA permissible exposure limit (PEL). Because of these excessive exposures to respirable crystalline silica, workers are at risk for developing silicosis. Dust control is achieved by partially enclosing the grinding wheel with a ventilated shroud. To exhaust air from the shroud, a vacuum cleaner can be used, functioning as an air mover and particulate collection device. Recently, vacuum cleaner bags and filters have become commercially available for wet-dry vacuum cleaners. If these bags and filters are shown to efficiently collect respirable dust, wet-dry vacuum cleaners may be a useful control option for dust control during mortar removal. They could also meet the size and weight requirements for equipment to be used on scaffolding that may be only 0.8 m wide, as well as providing a cost-effective option in a competitive, cost-conscious industry. Using laboratory and field

evaluations, the proposed work will test the capability of wet-dry vacuum cleaners to provide the needed exhaust ventilation and dust collection. In the laboratory phase of the study, the particulate collection efficiency of wet-dry vacuum cleaner filter bags will be studied. For the vacuum cleaners to maintain exhaust flow rates necessary to capture the dust, the filter bags must efficiently collect enough dust to keep the final filters from becoming clogged. The relationship between pressure loss and exhaust flow rate will also be studied to characterize the ability of the vacuum cleaners to move air. Laboratory studies have shown that an exhaust rate of 2.2 m3/min (80 cubic feet per minute [cfm]) is needed for optimal control of the dust. The field phase of this project will focus on the overall dust exposure implications of using four wet-dry vacuum cleaners and one vacuum cleaner with reverse-pulsing filters that discharge the dust into a collection bag.

SBIR On-Board Diagnostic Sensor for Respirator Breakthrough

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Keywords/Phrases: Sensor, breakthrough, respirator cartridges

Purpose:
To further develop a sensor that could be used to detect breakthrough in respirator cartridges.

Abstract:
The investigators propose to develop an extremely sensitive, low-temperature, low-cost, and miniaturized chemiresistive detector that can be mounted inside a respirator to warn users when toxic organic vapors are present inside the respirator. The sensor will alert the wearer when the respirator's filter cartridge has been consumed, when the respirator doesn't fit properly, or when the respirator has been compromised for any reason. Current methods of predicting filter breakthrough are inexact and inefficient. An active end of service life indicator would provide a significant advance in worker safety.

The investigators demonstrated during Phase I that it is feasible to use novel materials selection (including polymers and nanoscale ceramic powders) to overcome present limitations of solid state sensor technology, including high operating temperature (300–400 ºC), significant power consumption (a result of the high operating temperature), poor reproducibility from one sensor to the next, and a lack of stability over time. The development of new and unique polymer and ceramic composite sensors has resulted in a stable, reproducible sensor that is responsive to a wide range of toxic volatile organic compounds at temperatures well below current state of the art. During the Phase II, these results will be extended to many more classes of organic compounds, and low-cost packaging and electronic circuitry to power the sensor will be developed. The resulting sensor will be marketed to respirator manufacturers for integration into their products. Preliminary work has already attracted the attention of a major respirator manufacturer who will provide expertise on regulatory and packaging issues associated with integrating this technology into a respirator.

A Device Eliminating Electrocutions by Mobile Cranes

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Keywords/Phrases: Construction, control technology, fatalities

Purpose:
To develop and field-test an electronic sensor system that will detect the voltage intensity and the distance of overhead high-voltage power lines from mobile cranes.

Abstract:
The sensor system being developed will alarm the crane operator when the crane boom is too close to a power line. If the boom is dangerously close, the system will trigger a loud alarm and a flashing light to warn the crane operator and those working near the crane. A number of sensors attached to the crane boom will be connected by a powered sensor bus and a microprocessor in the operator's cabin. A smaller system using similar design will also be developed for conductive scaffolds, aerial manlifts, boom trucks, and other self-propelled machinery that make physical contact to a power line. At least 50% of the crane manufacturers and rental companies are expected to install this system on their cranes, saving millions of dollars per year, 85 lives, 100 permanent total disabilities, and 993 severe injuries. The system will be field tested. Several crane manufacturers and rental companies will be approached later for testing the system on construction sites. Two companies will work in consortium to develop the proposed system.

Hearing Protector Allowing Acoustic Communication

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Keywords/Phrases: Hearing, noise

Purpose:
To develop an advanced prototype of a hearing protector that combines maximum attenuation of ambient sounds with signal processing that extracts the most important components of the source field for controlled presentation to the user.

Abstract:
By processing the signal from a microphone array mounted on the headband of a hearing protector, this advanced hearing protector device will enhance desired signals from a specified "look" direction relative to signals from other directions, allowing face-to-face acoustic communication in many high-noise environments where it would be impossible otherwise. In addition, the signal processing allows the preservation of sound localization ability. Work in Phase I developed implementations of array-processing algorithms on a portable processor and evaluations of their impact on listeners' sound localization and speech reception performance. The goal of Phase II, a fully-specified prototype device ready for manufacturing, will be achieved through work in (1) development of algorithms for directional gating and automatic spectral shaping, (2) development of the capability to deliver acoustic stimuli to ear canals with combined hearing protection from muffs and insert plugs, (3) active noise reduction in the combined-protection mode for maximum sound reduction, and (4) electronic and mechanical design to allow the microphones and circuitry to be mounted entirely on the headband of a muff-style hearing protector.

Field Studies with Innovative Safe Excavation Technologies

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Keywords/Phrases: Confined space, traumatic injuries

Purpose:
To evaluate new excavation technologies for reducing hazards that promise to radically reduce several hazards related to backhoe excavation in construction.

Abstract:
This research will (1) extend the capabilities of the excavator-mounted buried utility detection system (EM-BUDS) (which is presently capable of locating metallic pipes and power lines) so that it can locate plastic and concrete pipe; (2) address the questions raised with the pipe manipulator (PIPEMAN) about remotely setting the bedding; (3) design and fabricate a smaller version of PIPEMAN (PIPEMAN, Jr.) that can lay smaller pipes such as polyvinyl chloride (PVC) and steel pipes and investigate the issues of jointing the pipes that have requirements that are different from concrete pipes; (4) integrate the expanded EM-BUDS and PIPEMAN, Jr.; (5) improve the human-machine interfaces of the EM-BUDS, PIPEMAN, and PIPEMAN, Jr.; (6) demonstrate the technologies at field sites; and (7) disseminate information through journal articles, conference papers, and Web sites.

• Exposure Assessment Methods Development •

Electrostatic Sampling of Airborne Microorganisms

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Keywords/Phrases: Sampler, microorganisms

Purpose:
To determine if the electrostatic sampler is capable of retaining airborne microorganisms through laboratory and field testing.

Abstract:
Each year, millions of respiratory allergies and infections are caused by airborne microorganisms present in agricultural, industrial, and indoor environments. The exposure concentrations indicated by bioaerosol samplers depend on the instrument used and the sensitivity of the microorganisms. In an effort to collect such microorganisms more gently, at low power, and at minimal pressure drop, an electrostatic sampling technique has been developed and evaluated in the laboratory. As a major part of this development, an electrostatic particle-size classifier and a microorganism dispersion device with optional induction charging were developed to study the electric charges on airborne microorganisms. It has been experimentally proved that laboratory-dispersed indoor air bac-

teria such as Pseudomonas fluorescens have a net negative charge. Some of the bacteria were found to carry several thousand negative or positive charges. In contrast, particles of nonbiological origin were found to carry very few positive or negative charges. This finding suggests that the electrostatic sampler will be capable of retaining airborne microorganisms by its electrostatic collecting field without first charging the microorganisms in the inlet section, thus reducing the complexity and power consumption for sampling in occupational environments. This will be evaluated in the laboratory with common bacteria and fungal spores and in the field through sampling of (1) microorganisms present in indoor air environments, (2) liquid-borne microorganisms in metalworking fluid environments, and (3) high concentrations of airborne microorganisms in agricultural environments. The new method will be used in occupational environments where airborne microorganisms are naturally present or are released by industrial processes.

Pesticide Dose Monitoring in Turf Applicators

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Keywords/Phrases: Statistical model, pesticides, identification of health risks

Purpose:

To use a prospective cohort study to investigate and develop a statistical model for the exposure of turf applicators to pesticides.

Abstract:

One of the greatest barriers to obtaining useful results in epidemiologic studies is the lack of adequate exposure data. The broad, long-term objective of the proposed project is to improve the assessment of pesticide exposures in epidemiologic studies to permit the identification of health risks (such as cancer) that would not otherwise be found using traditional methods of exposure assessment. This study has been designed to evaluate total body dose of the commonly used pesticides MCPA, mecoprop, dicamba, cyfluthrin and imidacloprid by using biological urine monitoring in professional turf applicators. Previously developed dose prediction models will be validated (mecoprop, dicamba) and adjusted if necessary to improve dose prediction. The important exposure variables or predictor variables that will effectively predict total body dose in applicators without the use of biological samples will be evaluated, and this information will be used to determine exposure reduction strategies. Before the initiation of a full-scale field study, a comprehensive evaluation of the urinary excretion of MCPA, cyfluthrin, and imidacloprid will be conducted on a group of 10 workers. In the second year of the study, a sample of 100 workers employed by a lawn care company will be selected from approximately five different franchises, and information concerning the use patterns of pesticides for each employee will be obtained. The total amount of each pesticide excreted in the urine will be measured for two consecutive 24-hour periods following a minimum of 3 workdays. This process will be repeated three times: a spring evaluation of herbicide exposure, a summer evaluation of insecticide exposure, and a fall evaluation of herbicide exposure. During each sampling period, information will be obtained from each applicator on spraying practices, hygiene practices, and other variables that may affect their daily exposure to herbicides. Current pesticide use reported by the applicators will be compared with actual use data obtained from employer records. A previously developed quantitative exposure prediction model that is based on use records and other predictor variables will be validated; and based on the newly collected data, new models will be developed to better predict pesticide exposures if deemed necessary. Recommendations to reduce exposure to these pesticides are based on questionnaire and modeling data. They will be developed and provided to the participating company and subjects. In the short term, this type of research can be used to reduce pesticide exposures by identifying cost-effective controls in both occupational and environmental settings. In the long term, this research may help reduce both acute and chronic health risks.

Inhalation Dosimetry / Exposure Index of Fiber Aerosol in Human Respiratory Tract

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Keywords/Phrases: Inhalation dosimetry, fiber aerosol, human respiratory disease

Purpose:

To generate information about the dosimetry of inhaled fibers in the human respiratory tract.

Abstract:

Exposures to airborne asbestos and manmade vitreous fibers (MMVFs) increase the incidence of lung cancer, asbestosis, and mesothelioma. Fibers that are deposited in the bronchial and alveolar regions and subsequently

translocate to the parenchyma are thought to be responsible for the development of these diseases. Physicochemical properties of fibers, including length, diameter, and durability in the lung, are major factors in the etiology of these lung diseases. Because inhalation is the main route of exposure, the deposition pattern in the respiratory tract as a function of fiber dimensions is new information critical to understanding respiratory dosimetry and defining the index of exposure for health protection purposes. Controlled studies of fiber deposition in human volunteers are not available because of ethical concerns; however, total and regional depositions of inhaled fibers have been estimated from postmortem measurement, mathematical modeling, and animal toxicity studies. Increasingly, mathematical deposition models have been used to assess the dosimetry of inhaled MMVFs; however, current lung dosimetric models for fibers in the human respiratory tract are based on theoretical equations that have not been verified with experimental data. This proposal has three objectives: (1) to develop experimental information about the deposition of fibrous aerosols as a function of fiber diameter and length in realistic human respiratory tract replicas; (2) to verify and improve the prediction of fiber dose estimate in human lungs using both empirical data as well as a computational fluid dynamic technique; and (3) to define a size-selective exposure index based on fiber penetration data. Because lung diseases caused by inhaled fibers occur in the bronchial, alveolar, and parachymal regions, a thoracic fraction defined as the fraction of particles penetrating the larynx and reaching the lung must be established and will be defined from experimental data obtained in this study. This research will generate essential information about the dosimetry of inhaled fibers in the human lung, data for an improved mathematical lung deposition model, and a definition of the thoracic fraction of fibers for exposure assessment. Sampling devices based on this size-selection definition can be developed in the future for improved assessment of worker exposure.

Novel and Noninvasive Method of Dermal Sampling for Exposure Assessment

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Keywords/Phrases: Exposure assessment, skin, toxic chemicals

Purpose:

To develop a new method for exposure assessment of toxic chemicals in the skin.

Abstract:

The overall objective of the proposed studies is to develop a novel method of collecting contaminants from the skin to assess cutaneous exposure to hazardous materials. This method uses low-frequency ultrasound in combination with surfactants to extract contaminants from the superficial and deeper layers of skin in a controlled manner. Contaminants extracted in this way will be assessed using analytical methods to assess the exposure of the individual to hazardous substances.

Because of its large size, skin offers one of the most vulnerable organs for exposure to contaminants. One of the major issues in assessing skin exposure is the lack of methods to collect samples in a controlled way. Accordingly, better methods of meaningful sample collection are desired. In the proposed studies, the investigators plan to address this challenge. They hypothesize that a short application of low-frequency ultrasound along with surfactants can be used to extract contaminants from a fixed area of skin painlessly and noninvasively. The extracted sample can then be analyzed to assess dermal exposure to contaminants. The specific objectives of the proposed studies are as follows: (1) assess the composition of the ultrasonically collected sample, (2) assess the mechanisms of the ultrasonic sample collection, and (3) assess the safety issues of ultrasound application.

Improved Methods for Dermal Exposure Estimation

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Keywords/Phrases: Model, percutaneous penetration, tissue concentrations, clearance

Purpose:

To develop a mathematical model that closely resembles dermal exposure in human skin in vivo.

Abstract:

The investigators propose to develop a sophisticated yet accessible mathematical model that closely mimics percutaneous penetration, tissue concentrations, and clearance in human skin in vivo. This development will significantly advance the mechanistic understanding of allergic and irritant dermatitis and the mechanics of dermal exposure assessment. This objective will be accomplished through the construction and experimental verification of physiological and physical properties-based models for percutaneous absorption incorporating features not found in the mathematical models presently used to estimate dermal

exposure. Successful completion of the aims of the proposal will lead to the following: (1) an experimentally verified, microscopic model of transport in human stratum corneum and skin appendages (hair follicles, sweat glands); (2) a dermal vascular model that allows accurate predictions of permeant concentrations and clearance in the viable skin layers; (3) a transient diffusion model for calculating dermal absorption subsequent to low-to-moderate exposures to potentially volatile compounds; (4) a skin hydration model for linking the above with steady-state permeability models presently in use; and (5) an easy-to-use spreadsheet for dermal exposure calculations incorporating the most important features from the investigation. The research methods include modeling transport in heterogeneous structures and advanced graphical representation of these results. Detailed examination of stratum corneum ultra structure and microtransport properties will involve laser scanning confocal microscopy, fluorescence photobleaching, and other light microscopic techniques. Determination of diffusivities and partition coefficients of selected permeants in stratum corneum, epidermis, dermis, and hypodermis and the role of protein binding on these values will be assessed.

Predicting Relative Workload During Physically Demanding Work

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Keywords/Phrases: Model, metabolic demands, workload

Purpose:

To develop a model for assessing the relative metabolic demands of work without the need to directly measure maximum aerobic capacity.

Abstract:

Many work physiologists recommend expressing measured oxygen uptake as a percentage of maximum oxygen uptake (V02max), commonly known as relative workload, since it provides a subject-specific workload. In addition to accounting for individual differences in physiological capacities among workers, relative workload also enables more accurate assessment of potentials of physical fatigue.

Once a subject's V02max is known, the determination of relative workload is arithmetically simple. Determining V02max is accomplished through the use of direct (exact) measurement or prediction techniques. Exact measurement of V02max is impractical for applied research because of its intensive and intricate laboratory procedures as well as the risks it poses for unfit subjects. Prediction techniques offer an attractive alternative with numerous linear and nonlinear regression techniques available. The aim of this research is to develop a practical and direct method to predict relative workload from in situ collected submaximal oxygen uptake data without the need to determine maximum oxygen uptake. The method is developed by modeling the human cellular utilization system as a stochastic system. The method is based on the hypothesis that oxygen uptake data are serially dependent and that, by exploiting this dependence using time series analysis techniques, a regression model between relative workload and a statistical characteristic of collected oxygen uptake data can be developed. If successful, the technique proposed in this project will improve our understanding of the physical demands on today's workforce doing today's work. This technique will have widespread application in identifying excessively demanding tasks and matching these tasks to the abilities of subjects.

Validation of Biomarkers in Humans Exposed to PAHs

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Keywords/Phrases: Validate biomarkers, polycyclic aromatic hydrocarbons, risk assessment

Purpose:

To validate biomarkers for polycyclic aromatic hydrocarbons (PAHs) for use in risk assessment of humans exposed to PAHs at low ambient concentrations.

Abstract:

Polycyclic aromatic hydrocarbons (PAHs) are widespread environmental contaminants due to significant contributions from incomplete combustion of fossil fuels and other organic materials. Exposure to PAHs has been associated with lung and skin cancer in occupational settings, and a potential for increased risk of cancer in humans exposed to PAHs at low ambient concentrations is now becoming a major public concern. To address this problem, a variety of biomarkers have been developed to index the exposure concentrations or biological effects of PAHs. However, the validity of their applications in risk assessment of PAHs at low concentrations is uncertain. This proposed study will mainly focus on validating these biomarkers in a Chinese population with broad ranges of exposure to PAHs. The biomarkers to be validated include urinary 1-hydroxypyrene, DNA and protein (hemoglobin and albumin) adducts, and p53 protein. In addition, the polymorphisms of genes, including CYP1A1, microsomal epoxide hydrolase (mEH),

GSTM1, and p53 genes will be identified to assess gene-environment interactions. For this purpose, the investigators will conduct a study with five projects included. The aims of this study are to (1) determine whether these candidate markers can at least reliably detect differences between workers with relatively high levels of exposure and unexposed subjects; (2) examine the reproducibility of these biomarkers and assess their inter- and intra-individual variability; (3) estimate the effective half-lives of the exposure markers and evaluate whether they relate to the most current exposure or to integrated exposures over a period of time; (4) determine whether these markers can be reliably used to differentiate between unexposed subjects and exposed subjects at low ambient concentrations and to characterize their exposure-response relationships; (5) investigate the specificity of these biomarkers and identify possible effects of general confounding factors such as smoking, diet, age, and gender, on the concentrations of these markers; and (6) evaluate how gene polymorphisms of CYP1A1, GSTM1, mEH, and p53 interact with PAH exposure in relation to the concentrations of all candidate biomarkers. The ultimate goal of this study is to determine whether or not these biomarkers can be useful as markers for risk assessment in humans exposed to PAHs at low ambient concentrations in future large-scale epidemiological studies.

Biological Monitoring of Wood Smoke Exposure

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Keywords/Phrases: Biological markers, wood smoke, workers

Purpose:
To develop biological markers of human exposure to wood smoke.

Abstract:
A validated biomarker of wood smoke exposure will facilitate exposure assessment for studies investigating adverse effects of wood smoke exposure in humans and could be used to evaluate the effectiveness of interventions to reduce wood smoke exposure in domestic and occupational settings. Exposure of humans to high levels of wood smoke is associated with adverse health effects including asthma, respiratory disease, and cardiovascular disease. In the United States alone, more than 100,000 people annually are exposed to elevated wood smoke levels from wildfires, prescribed burns, and agricultural field burning. In addition, each year 70,000 to 80,000 people involved in wildland fire fighting receive substantial occupational exposure to wood smoke. Investigating the relationship between wood smoke exposure and adverse health effects is hindered by inadequate methods of exposure assessment, which lead to exposure misclassification. Also, the setting of community-impact-driven guidelines for managed fires suffers from a lack of exposure-response data.

The primary objective of this proposal is to develop biological markers of human exposure to wood smoke. Preliminary work has shown that concentrations of a number of substituted methoxylated phenolic compounds are increased in urine following wood smoke exposure. The investigators hypothesize that the dose-dependent increase in urinary methoxyphenols after ingestion or inhalation of wood smoke combustion products can be related quantitatively to environmental wood smoke and thereby provide a biomarker basis for assessing wood smoke exposure in occupationally and environmentally exposed populations.

To test this hypothesis, the investigators plan to conduct human exposures to wood smoke from an open fire. Exposures will be characterized using time-integrated personal sampling and area monitors. The following parameters will be measured: particle mass, particle-associated methoxyphenols, and vapor-phase methoxyphenols. In addition, time-resolved exposures will be assessed using data logging nephelometers at fixed locations and personal nephelometers. Urinary methoxyphenols will be determined before and after wood smoke exposure by using gas chromatography/mass spectrometry. In addition, the investigators plan to measure methoxyphenol levels in urine samples collected from wildfire fighters. These workers have elevated occupational exposure to wood smoke. A validated biomarker of woodsmoke exposure will facilitate exposure assessment for studies investigating adverse effects of wood smoke exposure in humans and could be used to evaluate the effectiveness of interventions to reduce wood smoke exposure in domestic and occupational settings.

Real-Time In Situ Aerosol Monitoring in Mine Atmospheres

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Keywords/Phrases: Instrument, aerosol monitoring, mines

Purpose:
To test new instrumentation to look at near real-time aerosol concentration measurements.

Abstract:
Exposure to aerosol and certain chemicals can constitute an occupational health hazard in the mining and mineral-processing industries. The pneumoconioses, also known as the mineral dust diseases, have been associated with a miner's cumulative exposure to mine aerosol in the respirable range. They comprise a wide spectrum of conditions, ranging from diseases characterized by diffuse collagenous pulmonary reactions to relatively small lung burdens of bioactive dusts (e.g., silicosis, asbestosis) to diseases characterized by largely non-collagenous reactions to heavy lung dust burdens (e.g., coal workers' pneumoconiosis). The primary goal of the proposed research is to develop and field-test an in situ, real-time, continuous monitor of particulate matter and key gaseous chemicals present in mine atmospheres. This novel instrument will employ an array of complementary spectroscopic techniques to noninvasively probe an adjacent air column for aerosols and gases that represent an occupational hazard to miners. Optical signals from the sensor will be interpreted automatically to yield bulk chemical, size (for aerosols), and concentration information about these toxic materials. Specifically, the sensor will be designed to characterize mineral (silica and asbestos) and diesel exhaust (soot) particulate matter as well as measure gas-phase pollutants such as methane, hydrogen, and polycyclic aromatic hydrocarbons. Long-term objectives include the development of new compliance measurement techniques that can also be used to study the fundamental properties of mine aerosol. The proposed field studies are expected to contribute to the understanding of the dynamics of hazardous materials in mine atmospheres. The instrument will be developed, evaluated, refined, and tested in the laboratory, followed by extensive field evaluations and measurements, including (1) comparison studies with traditional methods using the University of Minnesota variable residence time micro-dilution system for measurements of diesel exhaust under controlled conditions, and (2) measurements in a mine environment alongside traditional sampling technology.

Real-Time, In-Use PM Measurement from Diesel Engine

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Keywords/Phrases: Particulate matter, diesel engine, mines

Purpose:
To measure and control respirable particulate matter produced by diesel engine equipment used in the mines.

Abstract:
The global objective of the proposed study is to accurately measure and control the genotoxic respirable particulate matter produced by diesel-engine-powered mining equipment. This study is aimed at highlighting differences between the engine out particulate matter emissions measured in a laboratory in accordance with the new Mine Safety and Health Administration (MSHA) regulations and the actual "real-world" particulate matter exhaust emissions emitted by mining engines operating over normal duty cycles in mine atmospheres. This study proposes to employ a portable real-time particulate matter mass monitor to quantify the genotoxic exposures by measuring diesel particulate matter (DPM) emissions from tailpipes of mining engines. It is proposed that an integrated approach be adopted that will involve a critical assessment of DPM exhaust emissions measured in the laboratory as well as direct on-board DPM emissions measured from engines operating in the mines. The inability of the adequate on-board particulate matter measurement technology that could consistently and accurately measure DPM in underground mines resulted in MSHA's requiring only in-laboratory engine tests. Very recent developments in particulate matter mass measurement systems may now enable in-field particulate matter exhaust emission measurements from diesel engines. This would provide researchers with the ability to evaluate the real-world contribution of particulate matter from diesel engines operating in the close confines common to mining environments. Moreover, this technology would provide a means of verifying in-use performance of proposed emission-curtailing devices and identifying emission control system failures in the field. The proposing team's experience has highlighted the imperative need to measure in-mine diesel particulate matter exposures, since prior work for the West Virginia Diesel Commission had shown that engines and exhaust after treatment systems that have passed certification tests in the laboratory may malfunction in the field, and have emission levels significantly greater than the certification standards. Such technology is imperative to accurately assess in-mine diesel particulate matter exposures so that the mining industry can effectively safeguard the health and safety of miners while enhancing the productivity and efficiency of mining operations.

Statistical Problems in Occupational Safety and Health

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Telephone: (410) 455–2418
Keywords/Phrases: Exposure assessment, method development, statistics

Purpose:
To develop a comprehensive set of statistical procedures for analyzing data on workplace exposure to contaminants.

Abstract:
For this research, the statistical problems to be investigated include calibration problems, detection limits, and tolerance limits. These problems will be studied in the context of models that include random effects, multivariate models, and some alternative models that better describe low workplace exposures (compared with linear regression models). The proposed research work for these models is motivated by two considerations: (1) typical exposure data cannot be treated as a simple random sample from a homogeneous population and linear regression models are very often inadequate (especially at very low concentrations of the contaminant), and (2) in the context of the suggested models, very little work has been done on the issues of calibrations, detection limits and tolerance limits. Results applicable to finite samples are mostly lacking. This calls for a thorough and comprehensive investigation of the above issues in the context of the suggested models. The development of results for finite samples will be a major goal. The research based on the suggested models is expected to result in methodology that is better suited and more accurate for exposure monitoring in a wide variety of workplace environments.

Making Heat Stress Assessment Relevant Again

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Telephone: (813) 974–6629
Keywords/Phrases: Exposure assessment, heat stress

Purpose:
To update present assessment techniques for heat stress to reflect contemporary occupational heat exposures.

Abstract:
Heat stress in the workplace can cause death or serious harm, routinely causes workers to experience a range of heat-related disorders, and is implicated as the contributing cause to injuries and accidents. Heat stress has been part of many industrial processes from the time the process was created, and it affects people at work and play. Because it is so common, heat stress is frequently discounted as an important hazard. The exposure assessment method developed in the early 1970s uses an index of the environment called the wet bulb globe temperature (WBGT), with a threshold value that decreases with increasing metabolic rate. The threshold curve establishes a sensitive measure for chronic, steady exposures to heat stress while wearing a cotton work shirt and pants. Short-term exposures and protective clothing greatly limit the current WBGT method to the point that it is often not applicable.

This research project will make the assessment process relevant to contemporary occupational health exposures. This will be accomplished by providing (1) WBGT adjustments for different categories of clothing, (2) information about the heat exchange properties of the clothing for use in short-term evaluation schemes, and (3) an empirical exposure limit based on clothing and WBGT. In the first year, the WBGT adjustments and heat exchange characteristics will be established for five clothing ensembles by looking for a range of environments in which subjects representing typical workers can maintain their body core temperatures at a moderate rate of work. In the second year researchers will closely examine the contribution of light, moderate, and heavy work on the same factors for a representative set of clothing. In the third year, the emphasis will be on high heat exposures that result in limited work times. This last year will be the test of the heat exchange model and the source of data for the empirical exposure limits.

Numerical Modeling of Size-Specific Aerosol Concentration

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Keywords/Phrases: Aerosols, algorithm

Purpose:
To develop numerical algorithms for predicting the concentration and size distribution of aerosols and to evaluate the major uncertainties in applying such a tool to occupational health problems.

Abstract:
Solutions to current challenges (such as modeling human exposure to inhalable and respirable particles, estimating the performance of size-selective aerosol samplers, and optimizing the design of ventilation systems for particu-

late control) are hindered by the lack of a comprehensive mathematical modeling methodology. Health effects such as chronic obstructive pulmonary disease are related to both the toxicity of the material and the particle size, as indicated in the size-selective sampling methodology for particles outlined by the American Conference of Governmental Industrial Hygienists (ACGIH).

Computational fluid dynamics (CFD) is a promising approach for these and other problems, but currently there is not a viable method for predicting aerosol concentration fields and size distributions. There are also many sources of uncertainty in the use of CFD simulations, including the turbulence model selected, the boundary conditions imposed, and the conceptual model of reality input to the computer code. This research will (1) provide a complimentary tool for use with CFD codes to predict aerosol concentration fields and size distributions and (2) develop and apply a methodology to evaluate uncertainties inherent in the use of this tool for occupational and environmental exposure problems. The aims are to (1) improve the existing computer algorithm to take output from computational fluid dynamics software and make predictions of size-specific aerosol concentration fields, (2) develop parallel implementations on large-scale machines to investigate convergence of the algorithm, (3) assess important sources of uncertainty in the prediction of aerosol concentrations relevant to occupational health problems, and (4) employ computational visualization tools to enhance interpretation of the results and to improve worker education.

Molecular Analysis of Mycobacteria in Cutting Fluids

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Keywords/Phrases: Mycobacteria, metalworking fluids

Purpose:
To develop and apply practical DNA-based approaches for real-time detection, quantitation, and identification of mycobacteria in metalworking fluids.

Abstract:
Microbial contaminants, including nontuberculous mycobacteria (NTM) in metalworking fluids (MWF), have been implicated in occupational respiratory illnesses. The research goals are to develop and apply practical DNA-based approaches for real-time detection, quantitation, and identification of mycobacteria in MWF for understanding the prevalent strains and their sources, growth, and survivability in commercial MWFs, including those associated with hypersensitivity pneumonitis. This project will (1) develop polymerase-chain-reaction-based protocols for real-time detection and quantitation of NTM in water-based MWF, (2) screen field samples of different commercial formulations of water-based MWFs for NTM followed by strain-specific identification of the NTM isolates using molecular typing methods, (3) investigate the sources and dynamics of growth and survival of the selected NTM strains in MWF in use in the identified industrial operations, and (4) characterize strains of NTM in MWF samples associated with physician-diagnosed cases of hypersensitivity pneumonitis.

New Methods for Evaluation of Organic Dust Aerosols in Colorado

Investigator: Stephen Reynolds, Ph.D.
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Keywords/Phrases: Methods, organic dust, agriculture

Purpose:
To develop better methods of measuring organic dust in the agricultural environment.

Abstract:
More than 700,000 men, women, and children working in livestock production are at risk for occupational lung disease from organic dust exposures. The goals of this project are to (1) evaluate a novel recombinant factor C endotoxin assay using organic dusts from livestock environments, (2) evaluate new methods for measuring inhalable particulates, endotoxins, and glucans/ergosterols that can be used to help establish occupational exposure guidelines for complex organic dusts in swine, poultry, dairy, equine, and sheep environments, and (3) evaluate and develop correction factors for direct-reading aerosol instruments that can be used by practitioners for interventions. The performance of inhalable samplers including the IOM, IOM with Multifoam discs, and Button Sampler, will be compared with traditional gravimetric methods in a laboratory wind tunnel and in the field. The utility and performance of these devices for measuring endotoxins and glucans/ergosterols will also be determined. Analysis using both assay (LAL and monoclonal antibody) and chemical (mass spectrometry) methods will help elucidate relationships between specific chemical components and potency of these microbial products in the various organic dust matrices, ultimately providing better tools for epidemiologic studies and standard setting. In the same laboratory and field experiments, two direct-reading devices, the DataRAM and HAM, will be compared with the gravimetric methods, and their performance will be char-

acterized in response to particle size distributions determined using a Grimm. Suitability for practical applications in these environments will also be determined. A unique aspect of this study is the evaluation of sampler performance when influenced by wind, validating the work performed at Iowa under quiescent conditions.

Comparison of Concentrations at Personal Exposure Sampling Location

Investigator: Steven Guffey, Ph.D.
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Telephone: (304) 293–4607
Keywords/Phrases: Sampling methods, industrial hygiene

Purpose:
To compare tracer gas and vapor concentrations taken at different sites during highly challenging conditions.

Abstract:
Industrial hygienists estimate inhaled concentrations of airborne contaminants using “personal” samples, which are almost always taken at the lapel of the sampled subject (i.e., a worker). Despite the importance of the assumption that lapel samples are representative of inhaled concentrations, it has not been convincingly demonstrated by published research, and significant doubts remain that concentrations at the lapel are always representative of inhaled exposures. It is quite plausible that lapel samples are unrepresentative of inhaled concentrations for some exposure conditions and that lapel samples bias results differently for different work environments. Given the complexity of the fluid flows near the body and the high variability of conditions in the workplace, modeling the relationship between lapel and inhaled concentrations for all exposure conditions is practicable only with computational fluid dynamics (CFD). However, with CFD and verification with experimental data, it should be possible to find the effects of important variables on (1) the levels of inhaled concentrations and (2) the errors associated with use of a surrogate sampling site instead of inhaled concentrations. It is reasonable to suspect that one or more adequate surrogate sites for inhaled concentrations can be found among the lapel, neck, sternoclavicular region, cheek, or forehead. Humans and mannequins in a wind tunnel will be sampled under various conditions of cross-draft velocity, cross-draft orientation, and source location to find the conditions that produce the greatest deviations between inhaled samples and surrogates. The experiments will also explore the effects of breathing on sampling error at the sampling sites. In addition, the scope of the findings will be extended by use of CFD modeling. Finally, the study will allow evaluation of the efficacy of modeling human exposures using mannequins and CFD.

Investigating Principles of Workroom Exposure

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Keywords/Phrases: Chemical hazards, workers, exposure assessment

Purpose:
To develop more reliable exposure assessment methods by investigating how physical factors in a workroom govern worker exposure and its variation.

Abstract:
Assessing exposures of workers to chemical hazards is an essential element of occupational epidemiology and industrial hygiene. Exposure assessment, however, is often the weakest link in research on the relationship between chemical exposure and occupational disease. Thus development of a more reliable basis for worker exposure assessment methods is a critical need. The physical factors of concern include work area airflow characteristics, work area physical configuration, source characteristics, and worker activities. The research will (1) determine the effect of worker presence on the workroom concentration fields and velocities, (2) determine the effects of worker presence and activities on worker personal exposure, (3) develop a deterministic model for exposure assessment that accounts for the fundamental physical determinants of workroom exposure, and (4) evaluate the use of this model in several workrooms. An experimental workroom will be built, allowing control of dilution airflow rate and tracer gas emission, and simulation of realistic workroom thermal characteristics. Experiments will be performed to characterize workroom concentration and velocity for different air inlets, thermal conditions, and airflow rates. Then experiments under the same environmental conditions will be performed with a person present to represent a worker. The "worker's" impact on the room velocity and tracer concentration will be determined. To provide additional insight into the phenomena observed, some experimental conditions will be simulated using computational fluid dynamics. A deterministic model relating exposure to room configuration, airflow, thermal boundary conditions, and contaminant source characteristics will be developed and implemented as an interactive computer program. Then the model will be tested and refined by application in several industrial workrooms.

• Fertility and Pregnancy Abnormalities •

Endocrine Disruptors and Neurodevelopmental Outcome

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Keywords/Phrases: Pesticides, neurological disorders, reproductive hazards

Purpose:
To determine whether in utero exposure to endocrine-disrupting (ED) pesticides, such as nonpersistent ED pesticides and organochlorine pesticides, is associated with adverse effects on the neurobehavioral development of children.

Abstract:
Agricultural pesticide use may be the most significant source of environmental endocrine disruptor exposure in the United States. California, the leading agricultural State in the Nation, is the only State that requires reporting of all agricultural pesticide use. The pesticide use reporting data indicate that more than 600,000 lb of ED pesticides are used annually in the Salinas Valley alone. On the basis of animal and human evidence, prenatal exposure to other endocrine disruptors such as polychlorinated biphenyls may result in neurodevelopmental effects, and these outcomes may be one of the most sensitive indicators of toxicity. Although animal studies suggest that ED pesticides could affect neurodevelopment, no studies to date have examined these effects in humans.

This research proposes to examine this relationship in approximately 550 children from predominantly low-income Latino farm worker families living in the Salinas Valley of Monterey County, California. These children, whose mothers were enrolled during pregnancy, are participants of CHAMACOS, a study of the Center for Children's Environmental Health Research, which is funded by the National Institutes of Health (NIH) and the U.S. Environmental Protection Agency (EPA. This study aims to investigate exposure to organophosphate pesticides and potential health effects in children. The investigators will measure biomarkers of exposure to (1) 14 organochlorine pesticides in archived CHAMACOS serum samples collected at 26 weeks of gestational age and (2) 16 nonpersistent ED pesticides or their metabolites in archived maternal urine samples collected at 13 and 26 weeks of gestational age.

The investigators will investigate the association of these biomarkers with neurodevelopment of newborns and 6-, 12-, and 24-month-old children. Mothers will be interviewed prenatally and postnatally about their sociodemographic characteristics, habits, housing, exposure, work, and medical history. Geographic coordinates of residences are determined in home visits and will be linked to the pesticide use reporting data. This study will provide the first data on exposure and health effects of ED pesticides in a highly exposed population, complete the exposure profile of CHAMACOS children, and target interventions to reduce child exposures.

Developmental Immunotoxicity of Atrazine

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Keywords/Phrases: Immune system, atrazine, prenatal exposure

Purpose:
To test the hypothesis that prenatal exposure to atrazine will adversely affect the normal development of the immune system.

Abstract:
Atrazine is the most heavily used single herbicide in the United States, with estimates of approximately 82 million lb applied to crops each year. It has been detected with very high frequency in the water in the United States as well in many major aquifers. Thus farm families are likely to be exposed to some concentration of atrazine during a growing season and perhaps throughout the year.

There is a relative paucity of published reports on the toxicity of atrazine, despite its very high usage. Also, we were able to find only one published report on the immunotoxicity of atrazine. This report showed a persistent decrease in primary antibody response up to 40 days after the administration of a single dose of atrazine. Other immune parameters showed more transient effects. Thus atrazine is immunotoxic in an adult exposed animal.

Many substances have been shown to have greater or different immunotoxicity when administered during the gestation of the animal. The very high use levels of atrazine and the potential for women to ingest atrazine during the gestational development of their child create a case to determine whether atrazine can affect the normal development of the immune system. Therefore, this application

seeks to test the hypothesis that prenatal exposure to atrazine will adversely affect the normal development of the immune system. This duplicates the paradigm of a human ingesting atrazine during the gestation of her child, nursing the child, and then assessing the immune response of the young adult offspring. This hypothesis will be tested by exposing gravid mice to atrazine throughout the gestational period. The offspring of these dams will be allowed to nurse their natural mother, will be weaned at day 21 of life, and will be assessed for a variety of immune parameters beginning at 6 weeks of age. This duplicates the paradigm assessing the immune response of the young adult offspring of a human who ingests atrazine during the gestation of her child and then nurses the child. The data will provide data to justify mechanistic studies on the effect of prenatal atrazine exposure on the developmental immune response.

Male Reproductive Effects from Occupational Exposure to Boron

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Telephone: (310) 825–8999
Keywords/Phrases: Boron, epidemiology, male reproductive toxicity

Purpose:
To investigate the relationship between workplace exposure to boron-containing compounds (including boric acid and borax) and adverse male reproductive effects.

Abstract:
In this epidemiologic study, boric acid has been identified as one of the highest priority chemicals for human field study. Prioritization was based on the strength of animal data, estimated numbers of humans exposed in the workplace, and lack of adequate reproductive health effects data for the human. The results of some animal and human studies may implicate boron as a reproductive toxin. The need still exists for a definitive human reproductive study. Therefore, this research will describe the relationship between boron exposure and direct measures of toxicity on male reproduction in (1) total sperm count, sperm density, viability, motility, morphology, and sperm MY chromosome ratios; (2) sperm chromatin integrity measured by sperm chromatin structure assay (SCSA), COMET, TUNEL, protamine I (P 1), protamines 2-4 (HP 2-4), and protamine 2 precursor proteins (HPI 1-2, HPS 1-2) in ejaculated sperm cells; and (3) blood and urine steroid hormone markers, including testosterone, free testosterone, serum hormone binding globulin, dihydrotestosterone, LH, FSH, estrone, estradiol, and estriol. In addition, this research will describe the relationship between boron exposure and indirect measures of toxicity on male reproduction, including fertility history and physical exam data. Also, it will describe the relationship between workplace, environmental, and dietary sources of boron with biomarkers of exposure and reproductive effect. This research will contribute critical information about the exposure level at which boron causes adverse effects on human male reproduction. The information could then be used to inform workplace practices and policies to protect the reproductive health of thousands of men who may be exposed to boric acid and other boron-containing compounds in the workplace.

• Hearing Loss •

Hearing Hazards Associated with Industrial Noise Exposures

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Telephone: (518) 564–7701
Keywords/Phrases: Noise, hearing loss, metrics

Purpose:
To develop and test the validity of an alternative approach to noise that will more precisely predict the audiometric and morphological consequences of an exposure.

Abstract:
This study will show that an energy metric combined with the statistical metrics of frequency- and time-domain kurtosis and the joint peak-interval histogram will provide necessary (and possibly sufficient) information to evaluate the potential for hearing loss in an industrial noise environment. Animals (chinchillas) will be exposed to non-Gaussian, nonstationary noises having the same energy and spectra as a Gaussian reference noise (two reference noise conditions will be used, each with spectral and level parameters typical of an industrial environment). Noise stimuli designed with very specific but diverse statistical properties will be produced using recently designed software. New analytical methods developed in the laboratories over the past 3 years involving the wavelet transform and higher-order, cumulant-based inverse filtering will be applied to the continuously sampled noise stimuli to extract temporal and peak statistical properties of the noise stimulus. Effects on hearing, quantified by pure-tone thresholds, otoacoustic emissions, and sensory cell losses, will be correlated with the noise metrics to establish the validity of these metrics.

Prospective Study of Hearing Damage Among Newly Hired Construction Workers

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Keywords/Phrases: Hearing loss, construction, hearing

Purpose:
To monitor occupational noise exposure in newly hired construction workers and characterize the effects of this exposure on hearing acuity (via standard audiometry) and distortion product otoacoustic emissions.

Abstract:
Noise-induced hearing loss is among the most common occupational afflictions, especially to construction workers. Hearing loss usually progresses unnoticed until it begins to interfere with communication, decrease quality of life and posing a serious safety hazard. Precise exposure-response relationships for noise-induced hearing loss are lacking, especially for highly variable noise exposures as found in construction. In recent years, the potential has been recognized for using distortion product otoacoustic emissions (DPOAEs) as a screening tool for early hearing damage and possibly as a marker of susceptibility for hearing loss. However, no prospective studies have been conducted on DPOAEs in relation to well-characterized noise exposure and standard audiometry. In this research, 400 construction apprentices and 100 medical students will be recruited. Each subject will be given an audiometric exam and DPOAE measurements every 6 months for 4 years. Baseline and followup questionnaires will be used to characterize other risk factors for hearing loss, nonoccupational exposure to noise, characteristics of work and use of hearing protective devices. Noise exposure will be monitored twice yearly on each subject using data-log in noise dosimeters in conjunction with time/activity cards. Analyses will be conducted to evaluate the relationships between noise exposure (using average levels and variable exposure metrics) and both audiometric changes and DPOAEs while controlling for covariates. The relationship between audiometric changes and DPOAEs will also be assessed while controlling for noise exposure metrics and covariates. The study will exploit the repeated measures design on a "naïve" cohort and individual measure or exposure to avoid and control problems of bias and exposure measurement error.

Development of School-Based Hearing Conservation Program for Use in Rural Areas

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Keywords/Phrases: Evaluation, hearing conservation, grade schools

Purpose:
This project will develop and evaluate two hearing conservation programs, one for children in the fourth grade of elementary school and one for children in the seventh grade.

Abstract:
A high prevalence of hearing impairment exists in rural areas, and substantial impairments appear in adolescence and early adulthood. Adolescents who work on farms or in agribusiness are at a much greater risk of hearing impairment than their peers. Training in hearing protection habits is needed before the onset of hearing impairment, and school systems represent a logical place to address this need. This project will develop and evaluate two hearing conservation programs—one for children in the fourth grade and one for children in the seventh grade. The fourth grade program will include hearing tests and an educational program designed to provide knowledge about auditory anatomy and physiology, knowledge about risk factors for hearing damage, instruction in avoiding hearing damage, and signs of hearing damage. The seventh grade program will consist of hearing tests, education programs, information about the use of hearing protection devices, display of the sound levels produced by various sound producers (farm equipment, shop equipment, etc.), and a simple procedure to monitor daily exposure to noise that could produce hearing damage. The seventh grade program incorporates components of the health belief model and the theory of self efficacy.

Noise, Solvents, and Hearing Loss

Investigator: Peter Rabinowitz, M.D.
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Telephone: (203) 785–7267

Keywords/Phrases: Noise, solvents, hearing loss

Purpose:
The study will investigate the effects of noise, solvents and hearing in a longitudinal cohort study of 8,800 workers.

Abstract:
Noise, one of the most prevalent occupational hazards and is well recognized as a cause of high-frequency hearing loss. But a growing body of evidence suggests that organic solvents, also widespread in industry, may also increase the risk of hearing loss. Longitudinal studies of exposed workers are needed to further investigate this possibility. Determining a dose-response relationship for solvents and hearing loss could affect further efforts to control exposures and prevent hearing loss.

This study will make use of the Alcoa database, a unique longitudinal data set of a large working population that includes a significant number of women and African Americans. This data set contains both detailed exposure information regarding noise and solvents, results of hearing tests on employees in U.S. Alcoa, and evidence that a significant number of workers are exposed to solvents. The long-term goal of the study is to examine the effects of chronic solvent exposure on hearing and the impact of noise-solvent interactions on the auditory system. The study will investigate these effects through a longitudinal cohort study of 8,800 workers hired at Alcoa between 1983 and 1997. This study would be the largest to date to examine noise, solvents, and hearing and it will allow calculation of the relative risks of developing hearing loss for solvent and noise-exposed workers. Modeling of industrial hygiene sampling data will allow for cumulative estimates of noise and solvent exposures. A nested case control study will match cases of hearing loss identified in the cohort with controls by age at hire, year of hire, and sex to further explore these relationships.

Adverse Effects of Noise on Hearing: Basic Mechanisms

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Telephone: (314) 362–7497
Keywords/Phrase: Threshold shift, chinchillas, hearing loss

Purpose:
To define mechanisms related to how workplace noise damages hearing.

Abstract:
Exposure to noise injures the cochlea, often irreversibly. Depending on the intensity and duration of the exposure, the ear may sustain a temporary threshold shift (TS) or permanent threshold shift (PTS). Moderate hearing losses may have devastating effects on all aspects of a person's life, including oral communication, employment opportunities, and the enjoyment of some of life's greatest pleasures—the human voice, music, and the sounds of nature. Several hypotheses exist on the pathogenesis of TTS and PTS, but none have been proved. No hypothesis has attempted to explain how workplace noise damages then destroys sensory cells, supporting cells, and nerve fibers in the cochlea. This research will determine how TTS and PTS are related, which existing noise-damage hypotheses are most likely to be correct, and what factors that are associated with increased noise susceptibility. In the studies proposed here, chinchillas will be exposed binaurally for 24 hours to a 4-kHz or a 0.5-kHz octave band of noise. The exposure level will be either 95 dB or 85 dB sound pressure level (SPL). These levels will produce a moderate TTS and sometimes a PTS. Auditory brainstem response (ABR) thresholds and distortion product otoacoustic emission (DPOAE) levels will be monitored before and several times after exposure. The outcome will provide information about possible mechanisms of noise damage in the cochlea as a basis for developing scientifically sound strategies for reducing noise-induced hearing loss in humans.

Asymptotic Hearing Threshold Shift and Otoacoustic Emissions in Chinchillas

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Telephone: (304) 293–1491
Keywords/Phrases: Temporary and permanent hearing loss, chinchilla model, hearing differences

Purpose:
To use a survival-fixation chinchilla animal model to address two important issues in noise-induced hearing loss, the relation between temporary and permanent hearing loss, and individual differences.

Abstract:
Exposure to noise injures the cochlea, often irreversibly. Depending on the intensity and duration of the exposure, the ear may sustain a temporary or permanent threshold shift. Moderate hearing losses may have devastating effects on all aspects of a person's life, including oral communication, employment opportunities, and the enjoyment of some of life's greatest pleasures—the human voice, music, and the sounds of nature. Several hypotheses exist on the pathogenesis of temporary and permanent threshold shift, but none have been proved. No hypothesis has attempted to explain how workplace noise damages then destroys sensory cells, supporting cells and nerve fibers in the cochlea. The studies proposed here will (1) determine how temporary and permanent threshold shift are related, (2) determine which existing noise-damage hypotheses are most likely to be

correct, and (3) identify factors that are associated with increased noise susceptibility. Chinchillas will be exposed binaurally for 24 hours to a 4-kHz or a 0.5-kHz octave band of noise. The exposure level will be either 95 dB or 85 dB sound pressure level. These levels will produce a moderate temporary and sometimes a permanent threshold shift. Auditory brainstem response thresholds and distortion product otoacoustic emission levels will be monitored before, and several times after exposure. The survival-fixation technique will be used to preserve an animal's two cochleae at two different times. Thus, each animal will provide two "snapshots" of the dynamic structural changes that which occur postexposure. This technique is effective because there is excellent left-right correlation with respect to damage when both cochleae are preserved simultaneously. Problems with data interpretation resulting from interanimal variations in noise susceptibility will be minimized. Because survival-fixation preserves the presumed in vivo relation between the stereocilia and the rectorial membrane (TM), this project will examine alterations in the TM-stereocilia relationship at different intervals postexposure. Hypotheses to be tested include temporary threshold shift results from pillar buckling and sagging of the reticular lamina that uncouple the stereocilia from the TM; temporary threshold shift disappears when the pillars are repaired, the height of the organ of Corti is restored, and the stereocilia are recoupled to the TM. Quantitative data on hair-cell and pillar losses and damage will be collected, compared between each animal's left and right cochleae, and correlated with auditory brainstem response threshold shifts and distortion product otoacoustic emission changes. The goal is to provide information on possible mechanisms of noise damage in the cochlea as a basis for developing scientifically sound strategies for reducing noise-induced hearing loss in humans.

• Indoor Environment •

Floor Supply Ventilation System

Investigator: Qingyan Chen, Ph.D.
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Telephone: (617) 253–7714
Keywords/Phrase: Indoor air quality, ventilation

Purpose:
To assess the performance of a floor supply ventilation system in terms of indoor air quality, thermal comfort, energy consumption, and costs.

Abstract:
Indoor environment is important to a worker's health and welfare because more than half of the U.S. workforce is employed indoors. Also up to 90% of a typical worker's time is spent indoors. A worker's productivity is related to factors in the indoor environment such as the indoor air quality and thermal comfort. Displacement ventilation seems to be a good ventilation system to improve the indoor air quality with an acceptable thermal comfort level. The widely used side-wall-supply displacement ventilation generates recirculations in the occupied zone of a large office or a workshop. These recirculations present the risk of cross infection between the workers. The floor-supply displacement ventilation could be a solution to avoid the recirculations. On the other hand, the floor-supply system could not remove a high cooling load (which is often found in most U.S. offices and workshops) because the cold air is directly supplied to the occupied zone. This proposed research will optimize the floor-supply ventilation system to minimize the risk of cross infection among the workers in large offices and workshops with suitable air supply and exhaust locations. The investigation will also improve the design of the floor-supply displacement ventilation system for the removal of a high cooling load without a draft risk. The research will use numerical simulations through computational-fluid-dynamics (CFD) to reduce the costs. Nonetheless, detailed and high quality experimental data will be obtained in a full-scale environmental chamber, and the data will be used to validate the CFD results. The parameters to be studied in this research include perforated degree, ventilation rate, supply air temperature, exhaust location, floor insulation, space size, furniture arrangement, etc., for five different climate regions in the United States. The results can be used to design the ventilation systems in large offices and workshops that provide a healthy and comfortable indoor environment.

Health and Socioeconomic Consequences of Nonspecific Building-Related Illness

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Keywords/Phrase: Indoor air quality, nonspecific building-related illness, office workers

Purpose:
To determine the health and socioeconomic consequences of nonspecific building-related illness (or sick building syndrome) in workers diagnosed with this prevalent disorder.

Abstract:
More than half of the U.S. workforce is now employed in indoor nonindustrial environments. Various symptoms and illnesses have increasingly been reported in such nonindustrial indoor environments. Nonspecific building-related illness (NSBRI) refers to a common nonspecific disorder that is usually associated with a particular building. Although objective physiologic abnormalities are generally not noted, NSBRI can be extremely unpleasant and an important cause of disability and lost work time. This project will (1) identify and classify NSBRI cases using several different case definitions of NSBRI, (2) determine associations between the different case definitions and the various outcome variables, (3) characterize the natural history of NSBRI following diagnosis, (4) determine which host factors (i.e., age, marital status, initial symptoms) and workplace factors (i.e., job stress, work environment) are associated with disease progression and severity, (5) determine the effect of NSBRI on socioeconomic outcomes (i.e., work-disability, employment status, financial status), and (6) determine which host factors and workplace factors are associated with more adverse socioeconomic outcomes. The overall study design will be a retrospective longitudinal follow-up study of 75 patients diagnosed with NSBRI from 1994 to 1999. A similar group of 75 musculoskeletal patients matched on age, sex, and year of diagnosis will be used as controls for the socioeconomic analysis. Phone interviews will assess symptoms, general health, functional status, disability, stress, and socioeconomic status since diagnosis of NSBRI. This study should identify diagnostic criteria, increase our understanding of the natural history and socioeconomic consequences of NSBRI, and identify risk factors. This information is critical for developing of interventions to prevent and/or ameliorate the adverse consequences of NSBRI.

An Indoor Environment Design Tool for Entire Buildings

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Keywords/Phrase: Ventilation, indoor air quality, models

Purpose:
To develop an integrated design tool to analyze combined problems of indoor air quality and thermal comfort for an entire building.

Abstract:
Indoor environment is important to a worker's health and welfare because more than half of the U.S. workforce is employed indoors, and up to 90% of a typical worker's time is spent indoors. Also, worker's productivity is related to factors in the indoor environment, such as the indoor air quality and thermal comfort. Poor indoor environment design has cost billions of dollars as a result of the lost productivity of the working American. The integrated design tool for this study will consist of three major components: building models; a heating, ventilating, and air-conditioning (HVAC) model; and mass and heat source/sink models. The building models will use a simplified computational-fluid-dynamics model to calculate indoor air quality (IAQ) and thermal comfort in a single zone and multi-zone model to link the heat and mass transfer between zones for an entire building. The HVAC model will use modules that can be easily used to form different HVAC systems. The mass and heat source/sink models will use the coupled program of the simplified computational-fluid-dynamics and an energy analysis program as well as various dispersion models. The integrated design tool will be validated by experimental data of IAQ and thermal comfort obtained in a building. The integrated design tool can be used to evaluate IAQ and thermal comfort in terms of contaminant concentrations, the mean age of air, ventilation effectiveness, airflow pattern, air velocity, air velocity fluctuation, air temperature, relative humidity, percentage of dissatisfied people due to draft, and percentage of predicted dissatisfied people in an entire building.

• Infectious Diseases •

A Case-Crossover Study of Sharps-Related Injuries

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Keywords/Phrases: Risk factors, sharps-related injury, case-crossover study

Purpose:
To conduct a case-crossover study of 1,000 health care workers who sustain a sharps-related injury in one of six hospitals in Boston and Baltimore.

Abstract:
The investigators will evaluate risk factors in the following domains: (1) worker-related factors, such as rushing, fatigue, distraction and feelings of anger; (2) procedure-related factors such as uncommon, unusual, or emergency procedures; (3) workplace-related factors such as

working short-staffed, overtime, or while on call; and (4) device-related factors such as use of an unusual or malfunctioning device. They will also evaluate differences in the risks between workers with differing characteristics such as age, sex, profession, and history of prior sharps-related injuries. The effect of risk factors in continuous exposure settings such as operating rooms and intermittent exposure settings such as inpatient units and outpatient clinics will be evaluated. Injuries caused by sharp medical devices are common, with an estimated 400,000 to 800,000 American health care workers injured each year. Injured health care workers are at risk for bloodborne viral illnesses, including hepatitis B and C, HIV infection, and other less common diseases. Despite the recent adoption of safer medical devices, the risk of sharps-related injury remains unacceptably high. Relatively little is known about potentially preventable transient etiologic factors that immediately precede these injuries. In a pilot study, 90 health care workers were interviewed by telephone. Forty were nurses and 28 were trainees. Twenty were injured while scrubbing in an operating room or procedure suite and 15 had known exposures to HIV or hepatitis C. Among the preliminary findings, an increased risk of sharps-related injury was associated with rushing (RR 5.1, 95% CI=3.0–8.7), anger (RR 4.7, 95% CI=1.9–12.2), distraction (RR 8.6, 95% CI=4.3–17.2), and multiple passes (RR 3.1, 95% CI=1.6–3.5). There were trends toward higher risk while working short-staffed and among surgeons working in a bloody operative field. Trends toward lower risk were seen with emergency procedures and while being taught. Successful completion of this study may identify modifiable risk factors for hospital-acquired sharps-related injuries. This knowledge may lead to individual and systems-level risk reduction interventions.

Body Substance Exposures: Risk Factors and Psychological Impact

Investigator: Hilary Babcock, M.D.
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Telephone: (314) 454–7947
Keywords/Phrases: Needlestick injuries, psychological impact, risk factors

Purpose:
To determine the psychological impact in health care workers of body substance exposures.

Abstract:
Working conditions affect the risk of body substance exposures among diverse populations of health care workers, including shift assignment, continuous hours of work, hours awake, and degree of job experience. Proposed work will use validated psychiatric assessment tools to determine the psychological impact of body substance exposures in health care workers. Body substance exposures pose a significant risk to health care workers of bloodborne pathogen transmission. Prevention efforts have focused on barrier precautions and more recently on safety devices, whose efficacy may vary and whose cost-effectiveness is unclear. Other risks such as organizational factors at work are still being explored. The psychological impact of sustaining an exposure is poorly documented. The primary aim is to determine the effect of three safety devices (a needleless intravenous system, "safety" peripheral intravenous catheter, and "safety" butterfly) on needlestick injury rates and their cost-effectiveness in a large multihospital system. This health care system has a large, computerized occupational health database to which large and small, urban and rural, teaching and community hospitals report exposures using a common reporting form. The second aim addresses organizational factors that can affect the risk of body substance exposures. A large survey of work schedules and practices of exposed workers at nine hospitals will be performed, and a nested case-control study will be conducted at the largest hospital. The third aim is to use validated psychiatric assessment tools to assess the psychological impact of sustaining an exposure. These effects will be studied immediately after the event and at 1- and 6-month intervals. These interventions will help improve the occupational safety and health of health care workers.

• Intervention Effectiveness Research Methods •

Effectiveness of a Machine Guarding Intervention

Investigator: David Parker, M.D.
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Telephone: (612) 676–5220
Keywords/Phrases: Injury prevention, small business, intervention

Purpose:
To (1) evaluate small machining and metal stamping shops with regard to the availability, functionality, and use of machine guarding, (2) identify critical factors for implementing and conducting effective machine guarding programs, including the identification and elimina-

tion of barriers to program success, and (3) implement and assess the effectiveness of an intervention that uses a combination of control technology, regulatory guidelines, and worker/owner training in a randomized controlled trial.

Abstract:
Amputations, a serious form of work-related trauma, affect between 15,000 and 20,000 Americans each year. Minnesota Sentinel Event Notification System for Occupational Risk (MN SENSOR) data indicate that primary and fabricated metal industries have the fourth highest rate of work-related amputations. The number of potentially affected workers in these industries is several fold greater than other high-risk industries. In addition, amputations represent only a fraction of the cases of upper extremity trauma.

In spite of the fact that many companies provide services to assist in the development of work-related safety programs, their effectiveness has not been evaluated in a controlled intervention study. In addition, little research has been conducted on o hazard control within small industrial establishments (4–50 employees). The intervention will be designed using a health promotion model. The investigators will work with an advisory board of industry leaders and workers throughout the proposed research study. A randomized controlled trial consisting of two groups will be conducted. These groups will consist of a control group (minimal intervention) and intervention. A technical and peer-based intervention will be conducted by peer educators. Shops in both groups will be evaluated at the time they are enrolled and 1 year after their initial evaluation (post intervention). Two measurements will be developed for this purpose: (1) self-administered worker and owner surveys grounded in health promotion models and (2) an evaluation by industrial hygienists of machine guarding availability, functionality and use, and frequency of machine use. The primary outcome is a change in shop score that measures machine use and machine guarding availability and functionality.

Active Control of Workplace Noise Exposure

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Telephone: (604) 822–3073
Keywords/Phrases: Evaluate, noise control, workplace

Purpose:
To determine the feasibility and cost effectiveness of applying active noise control to reduce workplace noise exposure.

Abstract:
Excessive noise exposure is probably the most prevalent of occupational exposures. Work-related hearing loss is the greatest source of occupational disease claims. Noise exposure can be controlled by the use of hearing protection and by administrative and engineering measures. Engineering control traditionally involves "passive" methods, which are not cost-effective at low frequency. Recently, a new technique of noise control called active noise control (ANC) was developed. This technique involves using noise to cancel existing noise and is particularly effective at low frequencies. Industries with workers exposed to significant low-frequency noise have been identified and have agreed to support the project. These industries work in fuel production, electrical power generation, and sea transportation (ship engine rooms). For active noise control to be feasible and effective, the noise workers are exposed to particular characteristics. Measurements will be made of the relevant characteristics of the noise in the target workplaces. These will be analyzed to determine to what extent they have the required characteristics. Using computer models, workrooms in the target sites will be modeled, and possible ANC implementations will be evaluated. Lab-based experiments will be performed to confirm and fine-tune the optimum configurations. A number of workplaces (three to five) will be chosen as validation projects for on-site testing in actual workplaces. In each, an optimized ANC system will be implemented, and the resulting noise and noise-exposure reductions and the system cost effectiveness will be evaluated. The results of the research will be generalized to produce guidelines for reducing noise exposure using ANC and to estimate the expected associated noise reductions and costs (and thus the system cost effectiveness) to be evaluated in other workplaces.

Effectiveness of Computer-Based Hearing Test and Training

Investigator: Oi Hong, Ph.D.
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Telephone: (734) 936–8902
Keywords/Phrases: Construction, intervention, hearing, training

Purpose:
To test the effectiveness of an intervention to increase the use of hearing protection devices (HPDs) by operating

engineers and construction workers who operate heavy equipment.

Abstract:
Four aims will be addressed in this study: (1) design and test the effectiveness of an innovative intervention for operating engineers to increase their use of HPDs, (2) determine prevalence of hearing loss in operating engineers, (3) demonstrate the feasibility of providing computer-based, self-administrated audiometric screening tests (SAAST) and hearing protection interventions at a construction worker training center, and (4) test and refine the Predictors of Use of Hearing Protection Model (HPD), a causal model designed to explain the use of protective devices by operating engineers. This study will deliver the intervention in an innovative format, building on recent research findings regarding the effectiveness of individually tailored interventions. Furthermore, this proposed project will assess the feasibility of providing computer-based SAAST at a training center. Results from the proposed project will provide a model for future intervention research in the occupational safety and health area and will aid in reducing a serious, preventable impairment—noise-induced hearing loss.

Effectiveness of Computer-Based Training: cTRAIN

Investigator: Kent Anger, Ph.D.
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Keywords/Phrases: Training, computer-based, evaluation

Purpose:
To evaluate the effectiveness of cTRAIN (computer-based training) program for workers.

Abstract:
This project identifies more than 100 Occupational Safety and Health Administration (OSHA) workplace standards that require training to minimize the risk of disease or injury. Health and safety specialists have few tools to inexpensively produce effective and customized training that can be readily revised and ensure competency at completion. To fill this gap, the investigators have developed cTRAIN, a computer-based training program developed using behavioral training principles. STRAW consists of both the computer-based training program to teach the information and a "screenbuilder" development environment for entering content to create new programs. It features intuitive navigation and operation, automatic (computer-generated) spoken English or Spanish as continuously available on/off options for all text (entered in the appropriate language), plus a voice recording option (allowing other languages), self-pacing, immediate feedback on quiz items, and a post-test with a simple report on performance. Complementing the training program is a durable "9BUTTON" response input unit that does not put off the poorly educated (as do computer keyboards); a keyboard option is also included. A systematic evaluation of cTRAIN's effectiveness as an intervention technique will assess in majority and minority (Latino) workers the basic training principles that are built into the training program (e.g, specific versus generic feedback, and computer-generated versus recorded natural speech). Coincident with these experiments, new cTRAIN programs (hazard communication, sharps disposal, laboratory safety, eye safety, and tractor safety) will be developed by content experts and reviewed for both educational effectiveness (consistency with established behavioral training principles) and appropriate content. The new programs will then be presented to volunteer Caucasian and Latino employees in education, construction, hospitals, and agricultural nurseries. Learned knowledge (competency) after training will be measured. Three months later, the subjects will be assessed with the post-test (to assess retention) as compared with the pretest. The effectiveness of the training will also be evaluated by measuring behavioral change after training compared with the same behaviors measured before training. In addition, feedback will be elicited from content experts to evaluate the potential for adoption of the computer-based training program and the "screenbuilder" environment.

Effects of an Ergonomic Intervention for Computer Work

Investigator: David Rempel, M.D.
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Keywords/Phrases: Musculoskeletal disorders, intervention, ergonomics

Purpose:
To determine whether an ergonomic intervention package applied to computer-based customer service operators is associated with decreased risk of upper extremity/neck musculoskeletal disorder, arm or neck pain days, hand function, and lost time and productivity.

Abstract:
No well designed, controlled studies have demonstrated the value of "best practice" ergonomic interventions to reduce the risk of musculoskeletal disorders and impairment among computer operators. The primary aim of this randomized controlled trial is to determine over a 12-month period whether a state-of-the-art ergonomic inter-

vention package applied to 175 computer-based customer service operators is associated with a decreased risk of upper extremity/neck musculoskeletal disorder, arm or neck pain days, hand function, and lost time and productivity. A control group consisted of 175 subjects. Historical co-variates will be assessed with a baseline questionnaire, and stability of co-variates will be verified with an exit questionnaire. The intervention will include an alternative geometry keyboard and mouse, large wraparound forearm rest, monitor location adjustment, vision check, chair adjustment, and training. The control group will receive a new conventional geometry keyboard and training. Upper extremity and neck pain severity, hand function, and lost time will be followed with a weekly questionnaire administered via the Internet. If a predetermined pain threshold is exceeded, then a physical examination will be performed to determine whether or not a musculoskeletal disorder is present. Multivariate linear regression and logistic regression models will be applied to examine main effects and to control for significant co-variates. The study is designed to detect a reduction of musculoskeletal incidence by half or a medium effect size of the pain severity week score. The total cost of implementing the intervention will be estimated. Findings and recommendations will be disseminated statewide in cooperation with the California Department of Health Services.

Effects of Physical Conditioning on Lifting Biomechanics

Investigator: Kevin Granata, Ph.D.
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Keywords/Phrases: Low back disorders, conditioning, biomechanics

Purpose:
To quantify how exercise and physical conditioning modify the biomechanics of lifting in manual materials handling and lifting tasks.

Abstract:
Occupationally related low back disorders (LBDs) are the leading cause of lost workdays and the most costly occupational safety and health problem facing industry today. Epidemiologic surveys demonstrate that exercise and physical conditioning may act as a prophylaxis to reduce the incidence of occupational LBDs. Low-back injuries have been attributed to spinal load and spinal stability during lifting and manual materials handling tasks. Factors that contribute to spinal load and stability include lifting technique, spinal kinematic coordination, trunk muscle recruitment and co-contraction, and design of the lifting task (weight, distance, etc.). It is proposed that exercise can modify lifting, spinal kinematics, and muscle recruitment patterns, thereby influencing biomechanical risk associated with spinal load and stability. The research team intends to investigate factors that might contribute to improved spinal stability and reduced spinal load during simulated manual materials-handling tasks. Subjects will participate in an 8-week exercise program in one of four protocols, including either aerobic exercise, strengthening, dynamic spine stabilization, or control (no exercise). Spinal load and spinal stability during simulated manual materials-handling lifting tasks will be quantified before beginning the exercise program, midway through, immediately upon completion of the 8-week exercise program, and 4 weeks after termination of the exercise protocols. It is hypothesized that the exercise programs will change the muscle recruitment patterns and spinal kinematics of lifting, thereby modifying spinal load and stability. This effort represents the first randomized-control study of the effects of exercise and physical conditioning on lifting biomechanics and associated risk factors for LBD.

Designing Ergonomic Interventions for Fire Service

Investigator: Karen Conrad, Ph.D.
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Telephone: (312) 996–7974
Keywords/Phrases: Ergonomic, interventions, fire service workers

Purpose:
To develop and evaluate ergonomic interventions for workers in the fire service providing emergency medical and rescue operation.

Abstract:
The fire service remains one of the most hazardous industries in this country, with its work-related injury rates and total annual costs exceeding those for most other occupations. Consistently over the years, musculoskeletal injuries are the major type of firefighter injury, particularly in emergency medical service (EMS) operations, which are much more frequent than fire suppression. The tasks performed during EMS runs contain many of the same risk factors associated with musculoskeletal injury (and specifically back injury) in other occupations, including lifting, bending, pulling, twisting, awkward postures, and heavy workloads. Unfortunately, few studies have analyzed the biomechanical issues during emergency rescue operations. In a previous study funded by NIOSH, the investigators identified and quantified the biomechanical and postural risk factors associ-

ated with emergency rescue tasks in the fire service. The investigators are now in a position to design, develop, and evaluate targeted ergonomic interventions for this population of workers. The research will develop and evaluate up to 10 ergonomic interventions that reduce biomechanical loads and are considered worthy of adoption for use by the workers who perform emergency medical/rescue (EMS) operations. The investigators will be using a participatory ergonomic process much like what has been advocated by NIOSH and others. The aims of the proposed research are to do the following: (1) in conjunction with fire service personnel, design specific equipment and work method interventions that address ergonomic concerns during EMS operations; (2) develop and build equipment and refine work methods based on the design process; (3) test equipment and refined work method interventions in a laboratory setting using simulated EMS tasks; (4) refine and retest equipment and methods as necessary based on participant feedback and biomechanical results; and (5) implement and evaluate the interventions in the field to obtain usability and acceptability feedback from end users performing EMS operations. The final product will be a set of up to 10 successful interventions that are biomechanically validated and superior to their existing counterparts and are judged to be worthy of adoption for use in the field by the end-user firefighter/paramedics.

Innovative Health Care Worker Training: Infectious Disease Risk

Investigator: Robyn Gershon, Dr.P.H.
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Keywords/Phrases: Infectious disease, intervention, simulation training

Purpose:
To develop, implement, and evaluate novel computerized simulation training programs for the reduction of infectious disease risk in registered nurses.

Abstract:
Health care workers, including nurses, are at risk for a wide range of occupational health hazards, including the risk from infectious diseases such as bloodborne pathogens and tuberculosis. To reduce morbidity and mortality associated with occupationally acquired infections, a number of risk management strategies have been developed. Although safety training programs are acknowledged as an important part of an overall risk management strategy, there are a number of challenges to effective health and safety training, especially in the health care work setting. To address this problem, a multidisciplinary team of researchers has partnered with two large medical centers and a professional nurses' association to evaluate an innovative approach to safety training for nurses. Simulation exercises, shown to be an effective safety training method in other occupational settings, will be developed using a participatory action research format. The exercises, which target bloodborne pathogens and tuberculosis, will be formatted into a computerized, interactive Web-based program and administered to 5,000 volunteer registered nurses who will be recruited with assistance from our partner collaborators. Participants will receive CEU credits as an incentive for participation. The exercises will be evaluated by multiple measurements using a risk behavior, theory-driven questionnaire. Exercises and questionnaires will be completed online at the study's Web site. Baseline measures of employee knowledge, perceptions, attitudes, behavioral intentions, current safety practices, and recent past history of exposures will be collected from participants and followed by 3-month and 6-month followup questionnaires. Analyses will be directed toward change in pre- and post-risk behavior determinants as well as nurses' satisfaction with simulation exercises and with computer-based training formats. The results of this study may have important implications for effective safety and health training for nurses.

Intervention Research on Work Organization Factors and Health

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Keywords/Phrases: Interventions, work organization factors, health impacts

Purpose:
To evaluate the benefits of interventions aimed at reducing adverse work organization factors and their health impact.

Abstract:
The organization of work is considered a strong contributor to the development of musculoskeletal disorders. Few studies have been conducted to date to evaluate the impact of interventions aimed at concretely reducing adverse work organization factors and the comprehensive range of their health impact. The objective of the study is to evaluate the benefits of interventions aimed at reducing adverse work organization factors (high psychological demands, low control, poor social support, and effort-reward imbalance) and their health impact as measured by ambulatory blood pressure, musculoskeletal disorders, mental health problems, and certified sick

leave. The study has the following specific aims: (1) to produce knowledge that will foster the development of well-adapted interventions designed to concretely reduce adverse work organization factors, (2) to systematically document how the intervention is carried out (intervention refers to organizational changes implemented to concretely reduce the four targeted adverse work organization factors), and (3) to measure the extent to which the intervention reduced the prevalence of adverse work organization factors and the level of health outcomes. This study will provide solid new findings that could be used to prevent cardiovascular disease, musculoskeletal disorders, and mental health problems—the most frequent, costly, and debilitating health problems in the working-age population.

Effectiveness of Intervention on Health

Investigator: Lisa Brosseau, Sc.D.
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Telephone: (612) 624–3143
Keywords/Phrases: Written materials, small business, workplace safety and health

Purpose:
To develop tailored written materials and test whether they enhance small business owners' beliefs about outcomes that result from efforts to improve workplace safety and health.

Abstract:
This research project will develop written materials to emphasize those belief outcomes most highly associated with high-intentioned owners, using written formats and styles shown to be most attractive to small business owners. The research will take place in two phases over 2 years. In the first phase, a wide variety of written materials in various formats (newsletters, magazines, newspapers, brochures, etc.) and styles (case studies, personal stories from owners and workers, cartoons, etc.) will be developed and tested using a series of focus groups with small business owners. Results will be used to determine which styles and formats are ranked most highly by owners in attractiveness, readability, and effectiveness in delivering various safety and health messages. Six to twelve separate written pieces will be developed incorporating the focus group results. In the second phase, the effectiveness of written materials will be tested in a randomized, controlled trial with 120 owners of small businesses. Owners in control and intervention groups (60 owners in each group) will complete a baseline survey of intentions, attitudes and outcome beliefs toward improving safety and health. Owners in the control group will receive monthly or bimonthly mailings of a trade newsletter or journal. Owners in the intervention group will receive the same materials along with tailored written materials aimed at safety and health outcome beliefs. At the end of the year, owners in both groups will be asked to complete a followup survey measuring their intentions, attitudes, and outcome beliefs. Owners in the intervention group will also be asked for their opinions about the materials they received. The difference in mean pre- and post-study outcome beliefs (and perhaps intentions and attitudes) is expected to be greater in the intervention group than in the control group.

Evaluating Preassembly of Roof Structural Components

Investigator: Pamela Kidd, Ph.D.
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Telephone: (480) 965–3948
Keywords/Phrases: Roof structural components, effectiveness, impact

Purpose:
To examine the effectiveness of using preassembled roof structural components in reducing injuries, reports of pain and close calls, lost time, and costs compared with conventional roof building methods.

Abstract:
In 1999, 21 per 10,000 construction workers in Arizona sustained multiple injuries, and of these, 32% missed 31 days or more from work as a result of a fall to a lower level. This study will examine the effectiveness of preassembly of roof structural components in reducing costs and lost work time related to injuries and pain. A quasi-experimental design will be used to compare two methods of roof assembly—one from the ground (treatment) and the other from an elevation (traditional/control). Hypotheses are as follows: (1) Workers who participate in the treatment group will experience less strain and pain, fewer injuries, and fewer lost workdays; they will also submit fewer worker compensation insurance claims than those who participate in the control group; (2) workers who participate in the treatment group will have fewer close calls than those who participate in the control group; and (3) costs associated with the treatment group will be less than costs associated with the control group. The training intervention effectiveness research (TIER) model will provide the evaluation framework for the study. Three framing trade companies (two treatment and one control) will participate in the study. The evaluation will include both a company-level and a worker-level analysis. Eligible crews will be selected by the company chief officer. Within the crew, full-time, native English- or Spanish-speaking workers are eligible to participate.

Data will be collected using (1) biweekly interviews of less than five minutes (2) observation in person and through photography, (3) document review, and (4) visual analog and numerical rating of pain scales. The modification of the roof assembly process, if proved effective, may serve as a form of safety intervention and may be better accepted by both employer and worker than other existing safety interventions (e.g., fall protection).

Evaluation of Farm Safety 4 Just Kids Day Camps

Investigator: Deborah Reed, Ph.D.
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Telephone: (859) 275–9636
Keywords/Phrases: Child agriculture, parental attitudes, children's knowledge

Purpose:
To evaluate the effectiveness of farm safety day camps organized and executed through five Farm Safety 4 Just Kids (FS4JK) Chapters in different regions of the Nation with a variety of agricultural commodities and farm compositions.

Abstract:
This research will evaluate whether the farm safety day camps positively influence (1) children's knowledge about farm safety and health, their safety attitudes, and subsequent safety behaviors, and (2) parents' attitudes and behavior toward children's farm safety behavior. In addition, the effect of the camps on the local community will be assessed. A multilevel, mixed-method evaluation strategy that combines both quantitative and qualitative data collection methods will be used to examine the long-term effects of the day camps on children, their families, and their communities. The design of the study is a quasi-experimental, no-control-group, pre- and post-test design with repeated measures that will be collected over 18 months following children's camp experience. The partnership of local FS4JK Chapters, the North American Farm Safety 4 Just Kids organization, and the University of Kentucky provides a unique approach to examining the effectiveness of FS4JK day camps. The evaluation results can be used to help FS4JK with refinements of future programs and will assist camp leaders in articulating their theoretical framework, goals, and objectives for the day camps.

Effectiveness of Farm Safety Day Camps for Children

Investigator: Debra McCallum, Ph.D.
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Telephone: (205) 348–3820
Keywords/Phrases: Child agriculture, evaluation, day camp

Purpose:
To evaluate the "Progressive Farmer" Farm Safety Day Camp Program.

Abstract:
Farm safety day camps are offered in hundreds of communities across the country as a format for teaching children safe methods of play and age-appropriate work on farms and ranches. Little research has evaluated the effectiveness of these 1-day, community-initiated events. To help meet this need, the "Progressive Farmer" Farm Safety Day Camp program began in 1995 to provide nationwide support for interested individuals and groups. The program was designed to meet the needs of local community members who want to help children in their area stay safe. It provides training, resources, support, and networking opportunities needed to conduct a camp that provides age-appropriate, effective lessons in topics related to farm safety. Although providing such support on a nationwide scale, the program is designed to be community-based, as each camp is planned and conducted at the local level, pairing the support and materials provided by "Progressive Farmer" with support provided by local individuals and organizations. Camp process evaluation will consist of surveys completed by the camp coordinators and volunteers reporting data for their camp, (including attendance, curriculum components used, assessments of success, and suggestions for improvements). The process evaluation will involve all camps offered from March 2002 through October 2002. From the camp coordinators, an Evaluation Advisory Group will be formed to assist with plans for conducting the evaluation and with plans for dissemination of the results back to the communities that participate. Outcomes will be evaluated using a sample of 30 camps and their surrounding communities. Pre- and post-test surveys as well as 3-month follow-up and 1-year follow-up surveys will be administered to assess knowledge, beliefs, attitudes, and behaviors of (1) children aged 8 to 13 who attend "Progressive Farmer" day camps, and (2) a comparison group of children in the same communities who do not attend camp. Impact of the camps will also be evaluated by asking about farm-related injuries in the pretest, 3-month, and 1-year followup surveys. In addition to testing for changes among campers across time and testing for differences between campers and noncampers, a com-

parison will be made between community-wide day camps and school-based day camps or programs.

• Low-Back Disorders •

Ergonomic Assessment of Vineyard Systems

Investigator: John Miles, Ph.D.
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Keywords/Phrases: Ergonomics, musculoskeletal disorders, agriculture

Purpose:
To assess vineyard systems that may cause ergonomic injuries.

Abstract:
This project will take advantage of the coincidence of important observations from a prior wine-grape vineyards study and a time-limited opportunity to initiate a long-term intervention in exposures to risk factors for wine-grape vineyard musculoskeletal disorders. During the conduct of an existing study, it became apparent that differing trellis systems involve disparate ergonomics risk factors. Trellis systems serve as a major element in what could be considered the vineyard worker's work station. This research seeks to (1) identify and develop detailed ergonomics measurements of risk factors for musculoskeletal disorders and estimates of worker health outcomes for each of the most commonly used wine grape trellis systems; (2) facilitate use of information about risk factors for musculoskeletal disorders associated with most commonly used wine-grape trellis systems in trellis decision-making; (3) develop practice and design parameters for reducing ergonomics risk factors associated with most used trellis systems; and (4) add to research knowledge about the association of specific agricultural workplace ergonomics risk factors and musculoskeletal disorders and their symptoms.

Spine Loading and Muscle Overexertion During Repetitive Lifting

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Keywords/Phrases: Lifting equations, low-back disorders, load monitoring, biomechanical risk

Purpose:
To assess how exposure to different frequencies of lift over time can result in unacceptable biomechanical risk of low back disorders.

Abstract:
Although assessments have successfully evaluated occupationally related low-back disorders (LBD) risk during a single exertion, none have been able to effectively assess how risk changes during repetitive lifting at various lifting frequencies throughout a workday. Preliminary studies point to two mechanisms of biomechanical risk. First, different lift frequencies affect lifting kinematics and the subsequent muscle recruitment patterns. These changes alter the nature (direction) and magnitude of spinal loading, thereby exceeding spine tolerance limits. Second, exposure to a repetitive lift throughout the workday can also result in muscle recruitment pattern changes over the work period, thereby increasing the spinal loading throughout the day. Thus, a lift frequency that is acceptable early in the workday may exceed biomechanical tolerance limits as the workday progresses. This study will explore the changes in muscle recruitment and spinal loading when workers lift one of three weights (corresponding to the range of industrial exposures) at six different lift rates over extended workdays. The frequency and duration of lift will be judged risky and unacceptable when the spinal loads exceed documented spine tolerance limits. These findings will result in an understanding of the portion of the population at risk for spine structure (disc) injury as a function of load magnitude, lifting frequency, and lift period duration. They will provide quantitative guidance for the mediation of work-related LBDs for the millions of workers performing materials handling tasks in manufacturing and distribution center environments.

Biomechanical Psychosocial Risks for Low Back Disorders

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Keywords/Phrases: Low-back disorders, manual materials handling, workers

Purpose:
To investigate the role of biomechanical job demands and psychosocial work characteristics in increasing the risk of low-back disorders (LBDs) among employees in manual materials handling jobs.

Abstract:
The etiology of LBDs is complex and poorly understood. Although a wealth of knowledge is associated with each of the risk factors, a dearth of studies have rigorously investigated both categories of risk factors in the same work environment. Therefore, it is difficult to estimate the contribution of each of these risk categories to the overall risk for occupationally related LBDs. It is hypothesized that risk factors make independent contributions to the risk of LBDs and that psychosocial work characteristics are more likely to increase risk for LBD when biomechanical job demands are moderate to low rather than high. The proposed study uses a prospective cohort design. It significantly increases the standard of scientific rigor of investigations in this area through (1) reliable, valid, state-of-the art measures of both psychosocial work characteristics and biomechanical job demands, (2) assessments of exposure variables at multiple points in time, (3) the use of an array of outcome measures for LBD, including a validated, highly quantifiable clinical assessment of low-back functional status, and (4) adequate power to formally assess both additive and potential interactive effects of the two categories of risk factors. With adequate quantification of exposures, the investigators will be able to accurately estimate the extent to which exposures (both psychosocial and biomechanical) need to be decreased to reduce LBD risk. The researchers will also be able to discern when and under what conditions an intervention to improve the psychosocial work environment will be likely to reduce the incidence of LBD and its associated morbidity among manual materials handling employees.

Lift Aid Use in Reducing Injuries in Nursing Personnel

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Keywords/Phrases: Ergonomic intervention, mechanical lift devices, nursing personnel

Purpose:
To utilize a pre-post comprehensive ergonomic intervention study designed to increase use of mechanical lift devices by nursing personnel and assess the benefits of intervention.

Abstract:
The most prominent risks for injuries among health care workers are associated with the physically demanding tasks of lifting and transferring patients. The use of mechanical lifts can lower the physical demands, but nursing personnel do not regularly use the devices even when they are available. This pre-post intervention study will focus on training acute care nursing personnel to recognize the need for using the devices and to use them correctly. Following 6 months of baseline data collection, the intervention will be implemented. The intervention will consist of training sessions, periodic educational reminders, and encouragement by management to use the lift devices. The study will evaluate the effectiveness of the intervention using primary outcomes of symptom prevalence and severity, job satisfaction, reported psychosocial stressors, and reported and actual lift usage. In addition, administrative records (workers' compensation records and OSHA logs) will be evaluated as secondary outcome measures. The study will also prospectively identify personal and work organization factors that predict musculoskeletal injury and that limit the use of lift devices by nursing personnel. Pre-intervention data collection will include baseline musculoskeletal symptom and job satisfaction survey, interviews to determine lift usage, and actual lift usage from counting devices on the lifts. Followup surveys will be used to collect symptom and job satisfaction information approximately 12 months following completion of the training. Collection of data for reported and actual lift usage will be ongoing throughout the study period.

Reducing Low-Back Disorders Using a New Sitting Design

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Keywords/Phrases: Chairs, biomechanical and neuromuscular responses, lower back pain

Purpose:
To quantitatively compare the biomechanical and neuromuscular responses of subjects with lower back pain (LBP) as they are exposed to chairs that incrementally alter support to the ischial tuberosities in order to evaluate possible benefits to subjects with LBP.

Abstract:
Work-related low-back musculoskeletal disorders are common and affect a large portion of the workforce. Occupational risk factors for LBP include sustained static muscle load and inappropriate curvature of the spine and pelvis. Sitting may cause backward rotation of the pelvis, reduction in lumbar lordosis, changes in muscle activities and disc pressure, excessive pressure over the ischium and coccyx, and certainly the associated LBP.

This project will investigate a new seat design in which the back part of seat (BPS) can be dynamically tilted

down and up with respect to the front part of the seat (FPS), providing adjustment of thigh and ischial support; the seat is also equipped with back support that is adjustable in height and volume. It was found in the pilot study that sitting with lowered BPS and adjustment of low-back support resulted in more evenly distributed contact pressure, reduced peak pressure under the ischia, increased total and segmental lumbar lordosis, a forwardly rotated pelvis, and increased lumbar intervertebral heights. The investigators believe that the functional relations of the seat and backrest need to be further investigated to prevent flattening of the lumbar spine and to reduce the ischial load in long-term sitting, which are related to LBP. They propose to study the biomechanical and neuromuscular effects of the new sitting concept and to evaluate quantitatively the benefits in the LBP patients for using appropriate lumbar support that increases lordosis and decreases the sitting pressure and load carried by the ischial tuberosities.

Hypothesis 1: When the BPS is tilted down, load on the ischial tubercles and lumbar spine will be reduced and shifted to the thighs and the thoracic spine, respectively. Low-back muscle activities will also be reduced. The primary aim is to evaluate (1) contact pressure distributions between the buttock-thighs and seat and between the back and backrest, and (2) load carried at the seat and back will be evaluated with and without ischial support, combined with flat or adjusted back support. The muscular activities involved in stabilizing the trunk under these conditions will be investigated.

Hypothesis 2: Increase in lumbar lordosis, forward rotation of the pelvis, and larger intervertebral heights will be observed when the BPS is tilted down to reduce ischial support. The second aim is to measure and compare the total and segmental lumbar lordosis, pelvis inclination, and intervertebral spaces of the lumbar spine under the different sitting conditions.

Hypothesis 3: Sitting alternately between the postures with the BPS at level and tilted-down positions will reduce the discomfort and pain associated with sitting. As a result, patients with LBP will better tolerate prolonged sitting. The third aim is to evaluate the subjective evaluation and impressions gained from the use of such a sitting design for a period of 4 months with the use of a questionnaire in two groups of chronic LBP patients with pain history and symptoms.

Neuro-Fuzzy Prediction of Spine Loads in Response to Risk Factors

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Keywords/Phrases: Spine loading assessment, trunk muscle response, multiple risk dimensions

Purpose:
To develop a spine loading assessment system that has the capacity to assess trunk muscle activation patterns and subsequent spine loading in response to multiple risk dimensions (physical/task-dependent, individual, and psychosocial).

Abstract:
Occupationally related low-back disorders (LBDs) continue to be the leading cause of lost workdays and the most costly occupational safety and health problem facing industry today. It has been well established that most occupationally related LBD risk is associated with manual materials handling activities as well as psychosocial influences in the workplace (National Academy of Sciences, 2001). In addition, individual factors can influence risk; however, the ability to characterize risk associated with these various dimensions of LBD risk has been rather poorly understood. Recent literature indicates that a common link within each of these risk dimensions involves increases in trunk muscle coactivation that can lead to increased spine loading and subsequent LBD. Electromyographic (EMG)-assisted models provide the only means to accurately assess and quantify the effect of changes in trunk muscle coactivation on spinal loading; however, the collection of EMG under most industrial conditions is impractical. The objective of this work is to develop a Spine Loading Assessment System (SLAS) that has the capacity to assess trunk muscle coactivation patterns and subsequent spine loading in response to multiple risk dimensions. This system would permit one to accurately estimate spine loading as a result of physical workplace factors, psychosocial factors, and individual factors but it would not require the use of EMG. This objective will be achieved through the development of a hybrid neuro-fuzzy engine (HNFE). This engine would act as a system artificial "brain" able to synthesize information about the workplace and assess how the trunk musculature would behave. The engine will interface with a well developed, biologically driven, dynamic biomechanical model of the trunk. In this manner, the investigators will be able to accurately predict spine loading in the workplace in response to various risk factor dimensions without the need to collect EMG data in the workplace. Collectively, the SLAS will have several benefits. First, it can be used to assess the risk of spine

structure damage believed to contribute to low-back pain as a function of work dimensions commonly associated with the workplace. Hence, this model will have immediate applications to workplace designs. Second, the system will provide insights as to how the various dimensions of risk synergistically impact the musculoskeletal system. Finally, it will facilitate further investigations regarding stability and coactivity.

Low-Back Pain in Cyclic and Prolonged Occupational Activities

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Keywords/Phrases: Spinal ligaments, low back pain, occupational activities

Purpose:
To investigate the role of spinal ligaments in causing spinal instability, injury and low-back pain in two types of occupational activities.

Abstract:
It is hypothesized that which mechanoreceptors in the spinal ligaments are deformed as a result of loading, they initiate sustained reflex activity in the paraspinal muscles. As creep sets in the ligaments, over time, they are desensitized and the reflexive muscular activity is lost, rendering the spine exposed to instability, injury, and low-back pain. This research may provide an insight for a wide range of low-back pain types, ranging from idiopathic pain due to ligament strain, to that resulting from the chain reaction of injury, disc herniation, and nerve damage due to lack of musculature support. This 3-year experimental research program will use a feline model to systematically explore the relationship between the electrophysiological and mechanical properties of spinal ligaments in vivo and the activity of motor units of the paraspinal and abdominal muscles in cyclic and stationary loading conditions when the ligaments are subjected to creep as well as their recovery pattern with rest. Results of this research will (1) provide insight into the neurophysiology of low-back pain in common occupational activities, (2) provide an insight to the cause of lost muscle strength and coordination and prolongation of low back pain, and (3) delineate occupational conditions that result in low-back pain and other occupational conditions that may prevent it.

• Mixed Exposures •

Complex Mixture Modeling of Organophosphate Pesticides

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Work Settings: Agriculture
Keywords/Phrases: Organophosphate pesticide, mixed exposures

Purpose:
To evaluate the potential health implications resulting from exposure to complex mixtures of organophosphate insecticides.

Abstract:
Organophosphate pesticides insecticides are widely used in a variety of applications, and the potential exists for significant occupational exposure. The health implications of mixed chemical exposures are currently poorly understood, since the toxicological characterization of such complex mixtures is not practical because of the numerous potential combinations. To address this chemical mixture issue, an integrated approach is proposed involving the application of physiologically based pharmacokinetic/pharmacodynamic (PBPK/PD) modeling in conjunction with focused in vivo/in vitro studies. The goal of this project is to provide a quantitative understanding of complex chemical interactions within biological systems, estimate tissue dosimetry, and quantitate pharmacodynamic response (i.e., esterase inhibition). This approach represents a reasonable application of limited resources to generate data that can be used to evaluate human health risk from occupational exposure to important agricultural chemicals. This research will (1) develop a PBPK/PD model for diazinon in the rat, (2) conduct focused in vitro experiments in rats to quantify critical metabolic interactions for mixtures of chlorpyrifos and diazinon that can readily be incorporated into a binary mixture PBPK/PD model, (3) conduct in vivo evaluations of the PBPK/PD model interactions for mixtures of chlorpyrifos and diazinon in the rat, and (4) conduct focused in vitro experiments with human tissues to quantify critical metabolic interactions and develop a human diazinon and binary organophosphate pesticide mixture PBPK/PD model.

Microbiological Air Contamination from Machining Fluids

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Telephone: (513) 558–0571
Keywords/Phrases: Bioaerosols, aerosolization, metalworking fluid, respiratory and skin disease

Purpose:
To study the aerosolization of mist and microorganisms from metalworking fluids (MWFs) using new techniques for the aerosolization and measurement of bioaerosols.

Abstract:
Workers exposed to machining fluid aerosols may have an increased risk of developing a variety of respiratory and skin diseases. About 1.2 million workers in the United States are occupationally exposed to MWFs. Recent studies have suggested that microorganisms dispersed from MWFs can cause severe respiratory diseases in workers. In this study of aerosolization of mist and microorganisms from MWFs, a key instrument in this two-year study is a newly developed Biosampler, designed for long-term sampling of bioaerosols. Experiments will first be performed in the laboratory under controlled conditions by simulating several different machining conditions. A laboratory-scale mist generator will be adopted and modified for this study and will be used with MWFs representing different viscosity and surface tension. The aerosolization of mist will be tested first with clean fluids, with fluids inoculated with known concentrations of test microorganisms, and finally with used fluids collected from field test sites. The last phase is a field study. Comparison of the field data with the laboratory data will allow investigators to interpret the dispersion of mist and microorganisms in MWF environments and assess the potential microbial exposure of workers. Both are needed developing engineering control strategies. The field study will also help create an initial database on the concentrations of airborne microorganisms in MWF environments. The findings of this project are expected to contribute to setting or modifying standards for reducing health hazards related to MWF exposure.

Organic Solvent Mixtures and Neuropsychological Outcomes

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Keywords/Phrases: Fishing, solvents, occupational injury

Purpose:
To study emissions from fuel and fuel exhaust in exposed workers in the commercial fishing industry.

Abstract:
Although the commercial fishing industry is reported to have among the highest occupational injury morbidity and mortality rates in the United States little scientific data exists about the occupational illness hazards facing workers in this industry. Fishermen are exposed on a daily basis to evaporative emissions from fuel and fuel exhaust (diesel and gasoline) generated by their boats and to a variety of organic solvents used during maintenance activities. Results from this study will benefit not only the fishing industry but a variety of occupational groups with this common exposure.

Silica Exposure and Silicosis: Effect of Mixed Exposures

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Work Settings: Mining
Keywords/Phrases: Silica, dose-response, silicosis

Purpose:
To determine the quantitative dose-response relationship between crystalline silica and silicosis.

Abstract:
The quantitative relationship between exposure to crystalline silica and development of silicosis is uncertain despite a number of studies. The uncertainty is due to the fact that exposure reconstructions are typically based on sparse data with significant uncertainty, and dose reconstructions that obtain the cumulative lung burden of the worker do not account for simultaneous exposures to less toxic dusts categorized as particles not otherwise classified (PNOC). For this research, a novel Bayesian methodology that synthesizes expert judgment, exposure models, and historical measurements will be used for exposure reconstruction. Pharmacokinetic modeling will be used to estimate the cumulative lung dose of silica and PNOC and the time to macrophage overload in this mixed exposure scenario. A case-control study will be conducted to compare silicotics and disease free referents and test the following hypotheses: (1) a cumulative exposure metric that includes both silica and PNOC is more related to the development of silicosis than cumulative silica exposure alone, (2) the time to macrophage overload is shorter among cases than non-cases employed in the dusty trades, and (3) the time to macrophage overload, due to exposures

to mixtures of silica and PNOC, is related to the time from first exposure to disease among silicosis cases.

Experimental and Computational Methods for Quantitating the Absorption of Complex Chemical Mixtures Through Skin

Investigator: Jim Riviere, D.V.M., Ph.D.
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Telephone: (919) 513–6305
Keywords/Phrases: Mixed exposures, skin absorption, interactions

Purpose:
To define and characterize chemical mixture interactions that affect percutaneous absorption.

Abstract:
Chemical exposure in most environmental and occupational settings is to complex chemical mixtures rather than individual chemicals. Estimating exposure for risk assessment purposes under this scenario is difficult, as most research studies only assess single chemical exposure. Previous research has studied the nature of chemical interactions within a mixture that could modulate absorption across the skin. The present research will evaluate interactions of 12 chemicals selected on the basis of their physical chemical properties in three model systems of increasing biological complexity: inert silastic, in vitro porcine skin diffusion cells, and ex vivo isolated perfused porcine skin flaps (IPPSF). Mathematical models of dermal absorption will then be developed that can provide efficient parameters to serve as experimental endpoints, yet are sensitive to the interactions.

• Musculoskeletal Disorders of the Upper Extremities •

Musculoskeletal Stress in Repetitive Precision Task

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Telephone: (716) 645–2357
Keywords/Phrases: Precision, fatigue and recovery, light tasks

Purpose:
To provide information about the impact that precision has on fatigue and recovery in light repetitive tasks.

Abstract:
Evidence exists that precision work is associated with musculoskeletal disorders of the upper extremities, particularly the shoulders. A logical series of factorial experiments will show whether precision acts alone or interactively with other task factors to elicit musculoskeletal stress. Modifying the precision demands of industrial work may not be possible; however, understanding how more controllable factors, such as task layout or organizational factors, interact with precision will provide pointers as to which ergonomic interventions would best mitigate the impact of precision. The study will also provide simultaneous information about movement time and musculoskeletal stress. Several indices of musculoskeletal stress will be used, including muscle activation patterns, discomfort ratings, postural measures, and counts of the number of non-task- related postural shifts. Indices of movement time will be determined from the coefficients found from fitting data on the time it takes to make movements to an equation that breaks movement time into the time required to move particular distances and the time required to close in on precision targets. Such information will show whether musculoskeletal stress and movement time are correlated and whether they coexist or whether one precedes the other in time. Information about the association of movement time with stress would give agronomists another tool to assess somatic fatigue or stress. The repeated measures experiments will last one to two hours and will provide information about whether the deleterious effects of precision accumulate with task duration, and whether those effects are different for different combinations of precision and task layout. In the early experiments, this would give predictors for when work should stop and when it should begin. In the later experiments, that information would provide a means to evaluate the effectiveness of work/rest cycles.

Computer Use and Musculoskeletal Disorders

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Telephone: (404) 727–3370
Keywords/Phrases: Postural risk factors, musculoskeletal symptoms and disorders, computer users

Purpose:
To identify postural risk factors and associated risk magnitudes for musculoskeletal symptoms and disorders that are specific to men and women computer users.

Abstract:
The overall goal of the proposal is to add to knowledge of the factors affecting survival time to upper extremity musculoskeletal symptoms and disorders (MSDs) among computer users keying at least 15 hours per week. To achieve this goal, additional statistical analyses of existing data previously collected in a major prospective study of factors affecting the onset of upper extremity MSDs among computer users are proposed. The specific aims are to (1) develop an index of postures and work-space dimensions among computer users and determine its ability to predict upper extremity MSDs, (2) examine the assumption of linear relationships between keying hours and upper extremity MSDs by comparing the ability of linear models, threshold models, and other statistical models to describe these associations, and (3) describe gender-specific postural and work-space risk factors for upper extremity MSDs among computer users. Successful completion of the first aim will result in the quantification of the ways that separate postural measurements and/or office work-space dimensions work in combination to increase or decrease risk of upper extremity MSDs. Successful completion of the second aim will advance knowledge of the nature of the association between hours keying and onset of upper extremity MSDs. Successful completion of the third aim will advance knowledge of the causes of observed gender differences in the reporting of upper extremity MSDs among computer users.

Prevention of Musculoskeletal Disorders in Plant Nursery Work

Investigator: John Miles, Ph.D.
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Keywords/Phrases: Engineering interventions, plant cutting jobs, upper musculoskeletal disorders

Purpose:
To evaluate interventions in plant nursery work.

Abstract:
The investigators propose to work cooperatively with owner/operators and workers to evaluate the efficacy of engineering interventions in the plant cuttings job (including adaptation of Airshirz and ergonomics workstation improvements) in significantly improving prevention of upper extremity musculoskeletal disorders (MSDs). This is a subpopulation of farmworkers who have documented history of diagnosed MSDs (specifically carpal tunnel syndrome). In addition, information about MSDs, MSD risk factors, and controls will be disseminated to workers and to grower groups. Project aims are to (1) develop detailed ergonomic descriptions (biomechanical, metabolic, and postural) of targeted risk factors for MSDs involved in making plant cuttings for propagation, (2) estimate the incidence of MSDs and related symptoms among participating plant propagation workers, (3) adapt the proved Airshirz cutting tool to the requirements of the plant cuttings job, (4) assemble and train worker/supervisor ergonomics teams who will interact with researchers to identify and prioritize potential workstation and task improvements, (5) implement the adapted Airshirz cutting tool and other workstation and work processes, (6) evaluate the efficacy of interventions to reduce targeted ergonomics risk factors and reduce upper extremity MSDs and related symptomatology among participating plant propagation workers for potential technology transfer across the nursery industry, (7) communicate project findings to nursery and other agricultural industry groups, workers, and community interests, and (8) report project findings in appropriate research and professional publications.

Ergonomic Interventions for Garment Work

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Telephone: (310) 206–5487
Keywords/Phrases: Ergonomic intervention, sewing machine operators, garment shops

Purpose:
To test an ergonomic intervention for sewing machine operators.

Abstract:
Nearly 40% of the industries with the highest reported incidence rates of injuries and illnesses from repetitive motion in the United States are in apparel manufacturing. Thus the investigators propose to conduct a randomized trial of a newly developed ergonomic intervention applied to sewing machine operators working in Los Angeles garment shops. These interventions were previously tested for acceptance by workers in Northern California. The proposed ergonomic intervention package includes changes in workstation design, such as (1) tilting the sewing machine table to decrease neck and trunk flexion, (2) seating improvements, such as adding sitting wedges to existing chairs or providing highly adjustable chairs

appropriately selected for work at a sewing machine, (3) installing a table extension on the left side of the sewing machine table to decrease awkward arm postures and pinch forces, and (4) providing support for the left foot with a simple block of wood or extending the foot pedals so that both feet are well supported or activate the control. In addition to equipment changes, the investigators will train all employees in how to perform work tasks more safely and suggest improvements in the work procedures (e.g., redesign of the work flow, rest breaks, enhanced variety in tasks to reduce repetitive strain). The research team will examine whether interventions implemented at 150 sewing workstations can reduce rates of upper extremity, neck, and lower back musculoskeletal disorders, severity of pain and impairment, and lost time compared with 150 "placebo" (control) interventions. Secondary purposes include (1) determining the effect of the intervention on body postures and work practices, (2) identifying the characteristics of employees who benefit from the intervention, (3) estimating the effects of the intervention on productivity, and (4) estimating the cost of the intervention. The long-term objectives of this research are to determine to what extent ergonomic and some work organizational changes (for sewing machine operators in garment shops) can prevent upper extremity, neck, and low back musculoskeletal impairment, disorders, and disability. This study will provide employers, employees, and public agencies with evidence of the effectiveness of ergonomic interventions to guide health and safety policy.

Biomechanical Effects of Industrial Eccentric Exertions

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Keywords/Phrases: Hand tool operation, repetitive exertions, musculoskeletal disorders

Purpose:

To study repetitive eccentric exertions of industrial powered hand tool operation on the biomechanical properties of muscle and tendon.

Abstract:

This research will improve the understanding of the etiology and prevention of work-related musculoskeletal disorders. Increased power tool reaction force and buildup time are hypothesized to correspond with greater changes in the dymanic characteristics of the upper limb. A laboratory-based experiment will define the short-term relationship between repetitive eccentric exertions (i.e., reaction force magnitude and buildup time) and upper limb properties (i.e., stiffness, viscous damping, and inertial mass). Preliminary data reveal significant stiffness and inertial mass changes during eccentric exercising at similar intensity levels. Biochemical measures of blood creatine kinase (CK) and anatomical measures using T2 changes in an MRI of the forearms will be compared with biomechanical parameters before and following repetitive eccentric exertions for a random subset of the subjects. Subjective discomfort will be assessed using a visual analog scale, and forearm edema and strength will also be measured. The second experiment will assess similar upper limb biomechanical properties for industrial workers who regularly perform repetitive eccentric exertions of varying intensity, buildup time, and repetition rate in selected industrial jobs. Subjects will be recruited from tool operation jobs on a local automobile assembly line. This research can lead to better ergonomic interventions through quantitative power hand tool design guidelines and work practices based on understanding the damaging effects of exposure to specific levels of reaction force, buildup time, and repetition and provide new outcome measures for epidemiological studies.

Musculoskeletal Disorder Follow-up in Automobile Manufacturing

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Keywords/Phrases: Ergonomics, upper extremities

Purpose:

To expand knowledge of upper extremity disorders with occupational stressors.

Abstract:

In the current study, followup data on MSD morbidity and exposure have been collected about 6 years after the baseline survey. The overall objective is to confirm and expand the previous associations of upper extremity disorders with occupational ergonomic stressors. All eligible workers from the baseline study are being sought for interviews and examinations at the workplace, both the actively employed and retired workers at home. Morbidity information is obtained by standardized interview, screening physical examination, grip and pinch strength, vibrometry, and pressure pain threshold testing. The interviews also inquire about changes in work history, medical and injury history, smoking, recreational activities, and other nonoccupational covariates since the baseline interview. Exposure data on subjects' current jobs are collected by interview and observation and by direct measurement for comparison in a subset of work-

ers. The key substantive areas of investigation are (1) determine changes in previously assessed exposures in the study jobs, (2) estimate prevalence and cumulative incidence of new upper extremity MSDs as a function of ergonomic exposures assessed at baseline (and at the one-year followup for some workers) and in this survey, (3) estimate the persistence of previously identified disorders, again as a function of prior and current ergonomic exposures, and (4) examine work and health factors related to leaving employment and estimate the magnitude of the "healthy worker" selection effect operating in this population. In addition, methodological issues include the validity of psychophysical ratings of ergonomic exposures, short and long-term reproducibility of workers' recall of occupational exposures, and reproducibility of sensitivity of other signs.

Force-Repetition Interaction in a Rat Injury Model of Cumulative Trauma Disorder

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Telephone: (215) 707–3628
Keywords/Phrases: Cumulative trauma disorders, repetitive strain injury, carpal tunnel syndrome

Purpose:
To gain a better understanding of task repetition rate and force level in the development of carpal tunnel syndrome.

Abstract:
The long-term goals of this research are to use a rat injury model of cumulative trauma disorder (CTD) to examine the interaction between multiple risk factors that contribute to the development of CTD and to investigate interventions to prevent and reverse work-related musculoskeletal disorders. In this 5-year study, the protocol includes three aims: (1) to determine the effects of a voluntary low-force task performed at low-, medium-, and high-repetition rates on motor behavior and pathophysiological outcomes of forelimb and central nervous system tissues, (2) to determine the effects of a voluntary low-repetition task performed at low-, medium-, and high-force levels of exertion on motor behavior and pathophysiological outcomes of forelimb and central nervous system tissues, and (3) to determine the effects of voluntary task regimes performed at a range of repetition rate and force level combinations on motor behavior and pathophysiological outcomes of forelimb and central nervous system tissues. The objectives for each aim are to determine (1) whether voluntary task regimens cause direct mechanical injury to musculoskeletal, peripheral nerve, and surrounding connective tissues, (2) the extent to which the task regimens stimulate inflammatory cells and inflammatory processes locally and systemically, (3) the extent to which the task regimens result in neuroplasticity in the spinal cord and nucleus cuneatus of the brainstem, and (4) the extent to which the task regimes cause motor performance and movement pattern changes and their chronological relationship to the peripheral and central tissue changes. Many questions remain about the interaction of task repetition rate and force level in the development of CTD. A more precise understanding of these effects will help to guide therapeutic strategies for preventive and early care of affected individuals, rehabilitation approaches for subacute and chronic cases, and prevention of chronic disability.

A Model for Wrist and Elbow Musculoskeletal Disorders

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Telephone: (510) 231–5720
Keywords/Phrases: Repetitive strain injury, cumulative trauma disorders, musculoskeletal disorders

Purpose:
To use a rabbit animal model to evaluate repetitive activities that might be related to disorders such as carpal tunnel syndrome.

Abstract:
Debate exists regarding the relative role of various biomechanical factors (i.e., force, repetition, acceleration, etc.) during repetitive work in the causation of upper extremity musculoskeletal disorders. Most of these factors can be altered in the design of work. The investigators will use the rabbit finger flexor model to investigate the role of these factors in causing entrapment neuropathy of the median nerve at the wrist and tendonitis at the epicondyle. In addition, the study will identify early cellular and biochemical changes in matrix proteins and cytokines. This study has the potential to identify the characteristics of biomechanical loading which may cause injuries. This information will be valuable to occupational health practitioners in adding specificity to ergonomic guidelines for repetitive work, has the potential to identify the biochemical pathways and timeframes of disease progression, that may cause injuries, and will lead to new strategies for treating and preventing entrapment neuropathies and tendon disorders related to work.

Effects of Repetitive Work on Fatigue of Long Duration

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Keywords/Phrases: Muscle fatigue, repetitive work

Purpose:
To develop a physiologic marker that indicates a level of collective change in the muscle due to exposure.

Abstract:
Musculoskeletal disorders of the upper extremity associated with repetitive work may be caused by cumulative exposure. Muscle fatigue of long duration, also known as low-frequency fatigue, increases with exposure and can persist for more than 24 hours into the next workday. The investigators will conduct a series of hypothesis-driven laboratory-based experiments, which will simulate repetitive wrist flexion work tasks for 8-hour workdays. These experiments will determine a relationship between parameters describing exposure to repetitive work with changes in a physiological response or the level of muscle fatigue. Traditional isometric muscle stimulation techniques will provide objective measurements of fatigue of long duration created by the wrist flexion task throughout the workday and into the next morning. Since fatigue of long duration can persist into the next morning, the first set of experiments will test whether muscle fatigue accumulates over consecutive workdays and whether accumulated fatigue is equivalent to fatigue from a single bout of work. The second set of experiments will test which quantitative measure of exposure to repetitive work dominates the physiological response: is it cumulative activation, force, or work? The third set of experiments will determine the effects of several proposed job task interventions, including training, mini-breaks, and different repetition rates, on the level of fatigue. Ultimately, this study will link aspects of exposure to repetitive work with changes in muscle physiology, an important step in the etiology of work-related musculoskeletal disorders, and will aid in the redesign of repetitive working tasks.

• Organization of Work •

The Impact of Total Workload on Maternal Postpartum Health and Quality of Life

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Keywords/Phrases: Work organization, women's health, stress

Purpose:
To determine how total workload (i.e., hours of paid and unpaid work), use of family medical leave, job stress, and work-family conflict relate to maternal health after childbirth.

Abstract:
The effects of stress and role conflict from total workload on women's postpartum health are not well established, yet mothers of infants represent one of the fastest growing segments in the U.S. labor market. The current study employs a prospective design with panel data collection at 6 weeks, 3 months, 6 months, 12 months and 18 months after childbirth. Selected intervals reflect critical times in women's postpartum recovery and employment patterns that have implications for maternal workload and well-being. Potential subjects will be recruited from selected hospitals and screened for eligibility. Upon hospital discharge following childbirth, 782 women will be surveyed at intervals described above using both telephone and mailed administration of survey instruments depending on the timing of data collection. Results from the study will provide important information about maternal health and quality of life at a vulnerable time in the life cycle of women and their families. The study findings will identify workplace and job characteristics and family and personal choices that support women's health and quality of life. Knowledge of these factors will facilitate the design and testing of policy and programmatic interventions relevant to employers, policy makers, and occupational health providers.

Difficult Work Conditions and Youths' Mental Health

Investigator: Elizabeth Smailes
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Keywords/Phrases: Stress, mental illness, working conditions

Purpose:

To study the impact of difficult working conditions on the mental health of young workers.

Abstract:

The positive association between difficult work conditions and mental illness may reflect the fact that difficult work conditions cause mental disorders (the causation hypothesis) or that people with prior mental illness select or are selected into difficult work conditions (the selection hypothesis). In this study the classical, competing hypotheses of selection and causation and others are assessed with a rarely studied, albeit important group: youths who have recently entered the workforce. Causation and selection effects will be examined prospectively using a longitudinal community sample of 615 youths from upstate New York. The sample was first interviewed in 1975 when the cohort was between the ages of 1 and 10. In 1984 and 1992, mental health and family environment data were collected, and information about work conditions was collected in the latter wave. Mental illness is conceptualized in terms of anxiety, depression, and alcohol abuse disorders—disorders that are the most prevalent among workers. Work conditions are measured in terms of excessive job demands, lack of decision latitude, and conflicted work relationships. In addition, structural equation models will be used to estimate indirect and direct causal effects. Controls for prior mental illness, gender, race, family income, and external social support (family, friends not in the workplace) will be included in all models. Finally, the present study will investigate any specificity that might exist between the type of workplace condition and type of mental illness, and separate models will be run for women, men, and youth from low- and high-income families.

Management Practices as a Factor in Workplace Violence

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Keywords/Phrases: Management practices, male social workers, workplace violence

Purpose:

To investigate the influence of management practices in contributing to the increased exposure of male social workers to workplace violence.

Abstract:

This project will test the effect of decision-making practices, as they relate to informal risk management efforts, regarding the task assignment of clients in the workplace. Examining the assignment practices of volatile (or high-risk) mental health clients may provide additional understanding of contributors to gender disparity in occupational health hazards for social workers. This experimental study will solicit a national random sample of 1,000 National Association of Social Workers (NASW) members for analysis. The sample inclusion criteria are current membership in NASW, mental health as the primary service setting, and supervision as the primary practice function. This research addresses the following questions: (1) Does a mental health client's behavioral history significantly increase the client's likelihood of assignment to a male social worker? (2) Do a mental health client's behavioral history and a social work supervisor's gender role perception interact to significantly increase the client's likelihood of case assignment to a male social worker? (3) Do a mental health client's behavioral history and the male gender of the client interact to significantly increase the client's likelihood of case assignment to a male social worker? (4) Do a mental health client's behavioral history and gender of supervisor interact to significantly increase the client's likelihood of case assignment to a male social worker? (5) Do a mental health client's behavioral history and an organization's policy practices interact to significantly increase the client's likelihood of case assignment to a male social worker? In general, this research will help the scientific community to understand mechanisms that may contribute to gender disparities in occupational health hazards within an occupation. More specifically, these findings will increase our knowledge of gender disparities in client-related violence, risk exposure of an at-risk population, supervisory practices, and organizational policy practices in mental health service settings across the nation.

Work Organization and Health Among Homecare Workers

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Keywords/Phrases: Stress, home care workers, work organization

Purpose:

To assess the relationship between the organization of work, major depression, and musculoskeletal disorders among homecare workers.

Abstract:

Work organization is an important determinant of employee psychological and physical well-being. This

research program will conduct a cross-sectional study of 1,520 home care workers drawn from a large and diverse population in Los Angeles County, California. This research will be the first study in the United States to examine work organization factors in the home care industry in relation to the prevalence of depression and musculoskeletal disorders among home care workers. This study will also make important methodological contributions to the field of occupational health. Home care workers are a "hard-to-reach" special population at risk (with a high proportion of poor, minorities, immigrants, and women), so the investigators will use computer-assisted telephone interviewing to minimize respondent effort in participating. In addition, work organization will be measured among home care workers under standard and nonstandard (part-time, on-call work arrangements) situations. The research will employ a newly developed screening instrument for depression with improved content validity and domain representativeness compared to other nonclinical instruments for this outcome. The results of this study will have implications for workplace policies in home care agencies across the United States that have the potential to provide new information to reduce depression, musculoskeletal disorders, and the associated loss of productivity from these disorders among home care workers.

Extended Work Schedules and Workplace Injury in Nurses

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Keywords/Phrases: Healthcare workers, work organization

Purpose:
To determine the relationship of extended work schedules among nurses in a variety of settings to the occurrence of musculoskeletal disorders and needlestick injuries.

Abstract:
Few industries in the United States have undergone more sweeping changes over the past decade than the health care industry. These changes have primarily come from a desire to reduce or control costs. One of the major cost-cutting strategies has been to reduce the size of the nursing workforce. To compensate, nurses are often required to work extended schedules, including >8-hour days, >40-hour workweeks, mandatory overtime, double shifts, and other inflexible scheduling demands. Nurses face many occupational hazards; among the most common are musculoskeletal disorders (MSDs) and the transmission of bloodborne pathogens, such as HIV and Hepatitis C, through needlestick injuries. Extended work schedules increase the length of workplace exposure to hazards that lead to such injuries. To address the problem of extended work and its health impact on nurses, the investigators will accomplish the following aims: (1) examine the nature and prevalence of extended work schedules (hours/day, hours/week, mandatory and voluntary overtime, breaks) among nurses in a variety of settings, (2) determine the relationship of extended work schedules to musculoskeletal pain/disorders (MSDs), measured longitudinally, and (3) determine the relationship between extended work schedules and needlestick injuries, measured longitudinally. Survey data will be collected from a probability sample of 3,500 actively licensed RNs in two states and analyzed. This study of nurses, who are experiencing a multitude of extended work hour arrangements, will provide a comprehensive examination of the impact of such work arrangements on the health of nurses. Identifying organizational variables related to nurses' health that, if modified, could reduce the likelihood of worker injury is key to maximizing the quality of health care while maintaining a healthy workforce.

Extended Work Schedules and Health Outcomes in the United States

Investigator: Fabio Barbone, M.D., Ph.D.
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Keywords/Phrases: Work organization, schedules, injuries and diseases

Purpose:
To determine whether extended work hours are related to health outcomes among workers and their nonworking spouse and children.

Abstract:
Fundamental issues in the current and future organization of work, particularly extended work schedules, embrace directly or indirectly all American workers and may be related to a number of health outcomes through several intermediate steps. The main component of this research project will be a series of case-control studies and case-crossover studies nested within the historical dynamic cohort of U.S. workers identified among the participants in the Household Component of the Medical Expenditure Panel Survey (MEPS HC). MEPS is a continuous, multipurpose, multi-panel survey of the U.S. civilian noninstitutionalized population drawn from respondents to the National Health Interview Survey (NHIS). The secondary component of this research project will be a series of case-control studies and case-

crossover studies nested within the historical dynamic cohort of nonworking spouses and children of U.S. workers identified among the participants in MEPS HC. Studies within this secondary component will estimate the relation between extended work schedules of the working spouse or parents and health events or health status measured at the level of the nonworking spouse and children. Exposure information in both components of the study will include industry and occupation code, hours worked per week, hours worked per day, start and end times during the day, shiftwork, rotating shift, size of business, and self-employment. Health outcomes will be self-reported events that have been validated by information about health care use from the care provider. Analyses will be adjusted for a number of possible confounders and effect modifier obtained from MEPS and NHIS, including socio-demographic factors, family descriptors, and lifestyle factors.

Effects of Extended Work Hours on Intern Health and Safety

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Keywords/Phrases: Work organization, hospital interns

Purpose:
To determine whether extended work schedules of medical students and interns result in increased risk of medical errors and transportation-related injuries and whether an intervention of a 10-hour protected sleep interval will reduce this risk.

Abstract:
This research plans to test the hypotheses that (1) extended workdays/long workweeks in interns are associated with increased risk of actual and near-miss motor vehicle crashes, falling asleep at the wheel, falling asleep while working, and a reduction in quality of life measures; (2) provision of 10 hours protected time for sleep will substantially increase sleep obtained during ICU on-call nights, and (3) physicians provided with 10 hours of protected time for sleep while on-call will exhibit improved performance, enhanced alertness, and fewer microsleep episodes while on duty. A prospective questionnaire study of all U.S. physicians and dentists in their first postgraduate year is proposed to compare the occurrence of adverse events in physicians who are required to work extended workdays (more than 30 consecutive hours) and long workweeks (more than 80 hours per week) with dentists who are not required to work such extended workdays or long workweeks in their first postgraduate year. A second intervention study is proposed to evaluate the efficacy of providing 10 hour of protected time for sleep in improving alertness and performance and reducing the safety hazards associated with 36-hour on-call shifts. This proposed study could have important public policy implications related to graduate medical education and training in the United States and the safety and health of the 100,000 medical and surgical residents who are the principal providers of medical care in academic medical centers across America.

Work Organizational Factors and Psychological Distress

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Keywords/Phrases: Psychological distress, organizational culture, stress and work productivity

Purpose:
To determine the impact of organizational culture on workers' psychological distress, job-related stress, and work productivity and to explore the relationship between organizational culture and provision of workplace crisis intervention programs to employees in the aftermath of the World Trade Center (WTC) disaster.

Abstract:
This study is intended to obtain preliminary estimates of the effect of organizational culture on whether organizations implement crisis intervention programs, employees' psychological distress and job-related stress, and self-reported work productivity. The preliminary data obtained will enable investigators to plan a larger, more comprehensive study. A sample of 10 organizations and 500 employees will be recruited from within a 10-mile radius of WTC for this study. Human resource managers (or equivalent) will complete surveys to characterize disaster-related workplace programs offered to employees. Employees will complete questionnaires that assess psychological distress (Profile of Mood States), job-related stress (Job Content Questionnaire), other life stressors (PERI Life Event Scale), self-rated work productivity (Endicott Work Productivity Scale), and the perceived cultures of their respective organizations (Organizational Culture Inventory [OCI]) at 12 and 24 months after the disaster. Organizations will be classified as having positive (constructive) or negative (aggressive/defensive and passive defensive) cultures based on the OCI study hypotheses: Organizations with positive (constructive) cultures are more likely provide disaster-related crisis

intervention programs and have lower employee psychological distress and job-related stress compared with organizations with negative cultures. Employees of organizations with positive cultures are more likely to have higher self-reported work productivity and show a reduction in psychological distress between 12 and 24 months after the WTC disaster compared with their counterparts in organizations with negative cultures. It is recognized that the sample size for this study may not be large enough to find statistical significance; however, one of the purposes of this exploratory study is to ensure that there is enough variability in the measures of interest to warrant further investigation. The preliminary data obtained will enable investigators to plan a larger, more comprehensive study.

Impacts of Demanding Work Schedules: National Survey Findings

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Keywords/Phrases: Work organization, work schedules

Purpose:
To determine the impact of the number of hours worked, the type of shift, and sociodemographic factors on the occurrence and type of injuries and their associated economic impacts.

Abstract:
The National Longitudinal Survey of Youth (NLSY) contains extensive information about worker's employment history, job experiences, occupational injuries and illnesses, and a variety of social, economic, vocational, and disability outcomes. Using these data, investigators will be able to categorize work schedules according to the type of shiftwork performed (day, evening, night, split, or rotating), overtime work, extended hours per week (60+), and extended hours per day (12+). The longitudinal nature of the NLSY will allow investigators to retrospectively track individual work experiences over a 13-year observation period (1987–2000). Analysis will answer the following questions: (1) Do shift work and irregular schedules increase the likelihood of suffering occupational injuries and illnesses? (2) Do overtime and extended work hours increase the likelihood of suffering occupational injuries and illnesses? (3) What types of shiftwork, overtime, and extended hours schedules are most hazardous? and (4) Does working on one of these "demanding work schedules" increase the severity of the social, economic, vocational, and disability consequences of occupational injuries and illnesses? This study has several important design features that will significantly advance scientific understanding of work organization, including large sample sizes, a wide range of industries covered, a relatively long period of observation to examine the time dependencies between events, the ability to control for important covariates, and an extremely large array of significant outcome measures. It will result in policy-relevant publications and reports that include research-based recommendations for practical interventions to prevent or minimize risk from these exposures.

Work Hours, Musculoskeletal Disorders, and Cardiovascular Disease Risk

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Keywords/Phrases: Work organization, cardiovascular disease

Purpose:
To evaluate the relationship between work schedules and development of musculoskeletal disorders or cardiovascular disease.

Abstract:
Stressful features of work organization, including long work hours, have recently been identified as risk factors for blood pressure elevation and cardiovascular disease (CVD) and have been suggested as risk factors for work-related musculoskeletal disorders (WMSDs).

The two primary aims of the proposed study are to determine (1) associations between extended work hours, ergonomic risk factors, other psychosocial job stressors, and WMSDs and (2) associations between extended work hours, other psychosocial job stressors (including job strain, effort-reward imbalance, and shift work), blood pressure elevation, and CVD risk. The study population includes white-collar and blue-collar men and women from the health care, transportation, and manufacturing industries, many of whom currently use overtime extensively. The study is also designed to examine the effect of characteristics of overtime, to assess how overtime interacts with other stressful features of work organization, ergonomic stressors, or demographic measures, and to investigate the impact of recent changes in the organization of work on work hours, psychosocial job stressors, ergonomic risk factors, and work climate. Initial efforts will include analyses of available employer records on work hours and WMSDs in the transportation and manufacturing industries, and secondary analysis of existing medical data bases in the health care industry. A population-based case-control

study of incident cases of WMSDs will be conducted among health care workers. Two hundred cases and 200 healthy incidence-density-matched controls will be interviewed in person. Ergonomic observation of an employee representing each job title held by study participants will be conducted. Forty job-matched controls will also be selected from workers in the same job titles as cases to assess information bias. A cross-sectional study of a random sample of 400 employees, stratified by overtime use, from participating employers in various industries, will be conducted to investigate risk factors for blood pressure elevation and CVD. Participants will have their blood pressure measured while working using an innovative method (worksite point estimates) to obtain a valid estimate of mean workday blood pressure. A subsample of 100 employees will be followed over 2 years and have their blood pressure measured during periods of high versus low overtime.

• Risk Assessment Methods •

Physiologically Based Pharmacolinetic / Clonal Growth Modeling: Predicting Cancer Potential of Chemical Mixtures

Investigator: Raymond Yang, Ph.D.
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Keywords/Phrases: Mixed exposures, cancer, modeling

Purpose:
To develop a biologically based modeling approach for predicting the cancer potential of chemical mixtures.

Abstract:
This research will develop a biologically based modeling approach for predicting the cancer potential of chemical mixtures. This will be accomplished by integrating a time-course hepatocarcinogenesis assay at the tissue, cellular, and molecular levels with physiologically based pharmacokinetic (PBPK) and clonal growth modeling. The investigators hypothesize that the carcinogenic potential of chemical mixtures can be predicted on the basis of an integrated approach involving PBPK/clonal growth modeling of time-course glutathione-S-transferase p positive (GST-P) foci development and its temporal cellular and molecular indicators. The intended research is important because, without such a predictive approach, it is impossible to assess the almost infinite number of chemical mixtures in the environment by conventional experimentation. The research approach will integrate computer modeling, bioengineering concepts, a whole animal bioassay system, and state-of-the-science cellular and molecular biology for the prediction of carcinogenic potential. The research team has already implemented the PBPK/clonal growth model to describe the time-course development of GST-P foci in a series of chlorobenzene isomers. Further, the investigators have studied hexachlorobenzene (HCB), 3,3', 4,4', 5 pentachlorobiphenyls (PCB126), and arsenic (As), the three chemicals proposed for this project, using the Ito medium-term liver foci bioassay and have accumulated extensive background data. Overall, the investigators anticipate that PBPK/clonal growth modeling will effectively integrate data from molecular levels (gene expression profiles) to cell kinetics (division/death rates) to organ/tissues levels (GST-P foci development and liver physiology). Further, they anticipate that this model will successfully predict carcinogenic potential of the binary and ternary chemical mixtures of HCB, PCB 126, and As.

• Social and Economic Consequences of Workplace Illness and Injury •

Social / Economic Impact of Injury / Illness in Career Roofers

Investigator: Laura Welch, M.D.
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Keywords/Phrases: Socioeconomic, roofers, injury and illness

Purpose:
To determine the effect of occupational injury and illness on construction roofers' rates of leaving the trade and to measure the social and economic impact of these conditions on roofers who leave versus those who continue.

Abstract:
This research will employ well-developed survey instruments and techniques to survey union construction workers as they leave their trade and 1 year later. It will determine the reason for leaving, the nature of injury or illness if present, functional limitations at the time of leaving the trade, and again after one year, and the social and economic consequences of that decision. This study will focus on three groups of roofers: those who leave the trade before retiring at any time in their careers, those who take early retirement, and those who apply for dis-

ability retirement. The investigators will also interview a comparable group of roofers who continue to work for each of these three groups. Specifically, the investigators will (1) determine what proportion of roofers leave the union before retirement age, retire early, or apply for disability retirement because of work-related injury, work-related disease, or a chronic medical condition; (2) determine what proportion of roofers who continue to work in the trade have chronic symptoms from a work-related injury, have a work-related disease, or have a chronic medical condition; (3) describe the social and economic impact of work-related injury and illness or premature retirement due to a medical condition for each of these groups; (4) evaluate change in measures of social and economic impact over time in the roofers who drop out of the union and those who retire early or on disability; and (5) assess and describe the impact of work-related conditions and aging on the ability of roofers to remain employed in their trade.

Occupational Fatality Trends: A Contextual Analysis

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Keywords/Phrases: Traumatic injuries, surveillance, fatalities

Purpose:

To study the relationship of long-term trends in fatal occupational injury to economic and labor-force injury rates.

Abstract

The investigators propose an epidemiologic study of national and regional levels. Specifically, the research seeks to answer the following research questions: (1) What was the average annual change in the rate of fatal occupational injury from 1980 to 1994 for the Nation, for its principal geographic regions, and for specific sectors of industry, major occupational groups, and worker groups defined by sex, age, and race? (2) Do characteristics of States and regions predict differences in occupational fatality trends that occurred between 1980 and 1994 (compensation levels, population mobility, proportion of women and minorities in the labor force, educational attainment, and power of labor relative to capital and regulatory climate)? (3) Was the relative decline in fatal occupational injury rates from 1980 to 1994 equal for potentially vulnerable groups of workers and for other worker groups with greater historical advantages? (4) Would the overall rate of fatal occupational injury observed toward the middle of the 1990s have been the same as the rate in the early 1980s if there had been no restructuring of the labor force? (5) How are trends modified by the interplay of factors on regional, industrial, and individual levels of organization? To address these questions, the investigators will conduct a contextual analysis using data collected by U.S. government agencies. In evaluating regional patterns, the research concentrates on the South because it has led to current trends. The research has the potential both to produce greater knowledge of the relationship of worker safety to larger trends beyond the workplace and to identify steps that can be taken to maintain or improve safety as other conditions of work change.

Unclaimed Injuries and Workers' Compensation Adequacy

Investigator: RAND Corporation
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Keywords/Phrases: Models, workers' compensation, filing

Purpose:

To analyze the National Longitudinal Survey of Youth (NLSY) to develop models of workers' decisions to file for Workers' Compensation and to investigate the impact of non-filing on estimates of the adequacy of wage replacement.

Abstract

The workers' compensation system is designed to provide health care and compensation to all American workers who suffer injuries or illnesses in the workplace without regard to fault. However, preliminary analysis suggests that only half of injured workers file claims. In light of this fact, the investigators propose research with two key goals: (1) to understand the economic, demographic, and policy factors that cause workers with occupational injuries and illnesses not to file claims (2) to reassess the adequacy of workers' compensation wage replacement rates in light of the fact that many workers do not file claims or receive benefits of any kind. Consideration of the first goal reveals the surprising finding that the most vulnerable workers those with the least alternative insurance against workplace injuries and illnesses may be the ones least likely to file for workers' compensation. They may face higher costs of filing workers' compensation claims. To pursue the second goal, the investigators calculate the total wages lost over several years as a result of a workplace injury, which will be compared to the benefits paid by workers' compensation. These calculations will include the zero benefits paid to workers who do not file claims. The investigators will use the NLSY, a public-use database sponsored by the U.S. Department of Labor. Use of the NLSY breaks

new empirical ground in two important ways. First, the NLSY is a nationally representative database, containing extensive information about more than 4,000 workplace injuries; previous analyses of workers' compensation filing have been limited to the use of site-, firm-, or region-specific data. Second, the NLSY has longitudinal data on earnings as well as unclaimed injuries; previous analyses of the adequacy of workers' compensation have been limited to workers who file claims.

Disability Risk in Work-Related Musculoskeletal Injuries

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Keywords/Phrases: Carpal tunnel syndrome, low back disorders

Purpose:
To identify modifiable risk factors for long-term disability following a workers' compensation claim for either low back injury or carpal tunnel syndrome (CTS).

Abstract
The vast majority of cost and lost productivity in workers' compensation is due to work-related musculoskeletal injuries. Among injured workers with these conditions, a small proportion (5%–10%) develops long-term disability and account for most (80%–85%) of the cost and lost work. In the absence of an accurate method to identify workers at risk for long-term disability, secondary prevention efforts cannot be well targeted. This is a 5-year, population-based, prospective study among Washington State workers with back injuries and CTS. The principal aim is to develop an accurate predictive model of risk for long-term disability among five key risk dimensions: employment-related factors, biomedical/health care related factors, socio-demographic factors, administrative/legal factors, and psychosocial factors. To accomplish this aim, a baseline interview among approximately 3,000 eligible workers will be conducted within 2–6 weeks of (workers' compensation) claim allowance. A continuous measure of disability outcome (lost-time compensation) will be determined from a computerized database at 1 year. Additional important outcomes will be determined by a followup interview at 1 year (functional status, work status) and from computerized records (work status, wage status). Multivariate survival analysis within and across risk dimensions will be used to develop the principal risk models, including adjustment for injury severity. A second aim is the reliability of determining severity from medical records. A third aim of this study is to develop a brief risk assessment instrument for both low-back and CTS injuries that would be useful to physicians when first treating injured workers. The main focus of these instruments would be on those risk factors that may be modifiable and that may be amenable to early intervention to prevent disability. Statistical analysis for this aim will focus on sensitivity and specificity of combinations of risk factors. These risk assessment instruments will be pilot tested among physicians participating in an occupational health care quality improvement project. The fourth aim of this project is to determine reinjury rates and predictors of reinjury among the original low-back injury cohort 2 years after the initial injury. The unique study environment in Washington State, including the ability to conduct population-based sampling, timely access to survey injured workers, linkage of medical, claims, and work status databases, and support from the business and labor communities, will substantially contribute to the success of this study.

• Special Populations at Risk •

Occupational Lead Exposure: Risk to the Aging Worker

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Telephone: (412) 624–0762
Keywords/Phrases: Effectiveness research, neurotoxicology, lead

Purpose:
To determine the impact of lead exposure on older workers.

Abstract
Exposure to lead remains a significant issue for occupational and environmental health in part because new research continues to demonstrate adverse effects at concentrations formerly thought to be innocuous. This study will examine the effects of lead in relation to quantitative measures of chronic occupational exposure. Specifically, it will determine whether long-term occupational exposure to lead is associated with risk of neuropsychiatric and cognitive impairment and whether the magnitude of any such impairment is modified by increasing age. Few studies up to this point have been able to examine effects of lead in relation to quantitative measures of chronic occupational exposure. This study will also add to understanding about the effects of lead at older ages, which is important as the working population ages.

Aging Effects on Intermittent Work Capacity

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Keywords/Phrases: Injury mechanisms, ergonomics, overexertion

Purpose:

To determine whether older workers (aged 55–65) have a lower capacity for intermittent work than younger workers (aged 18–24).

Abstract

Projection of population demographics in the United States indicates that a significantly higher percentage of the active civilian labor force will reach the age of 55 over the next 5 to 10 years. Given the well documented evidence of change in the muscular strength and physiology of older adults, it is clear that the ergonomic design of industrial tasks will have to be reevaluated in the face of potential changes in workers' physical capacity. Previous reports of strength decrements in older muscles have been interpreted to imply concurrent reduction in endurance capability. When performing a task identical to that of a younger worker, older workers will likely be required to perform at relatively higher levels of exertion. Some studies, however, have indicated a higher resistance to fatigue in older muscles when relative effort level is controlled. This may result from a shift towards higher relative proportions of slow-twitch, fatigue-resistant fibers. Larger-scale studies have yet to demonstrate the consistency of these observations. Previous investigations have focused on measures of endurance capacity during static exertions, yet typical industrial work is both dynamic and intermittent. The current study will provide much needed quantitative data on potential differences in endurance during dynamics and intermittent exertion. The three projects outlined in the proposed study will use a variety of experimentally measured quantitative and subjectively reported qualitative measures of exertion and fatigue to (1) establish baseline measures of intermittent work capacity in young, healthy workers, (2) compare measures of intermittent work capacity in healthy older workers to those of young adults, and (3) determine the consistency and repeatability of several measures or predictors of work capacity and fatigue. Successful completion of these projects will provide new data for the fundamental characterization of age-related changes in muscle performance and will aid in industrial reevaluation and design of existing age-related changes in muscle performance and will aid in industrial reevaluation and design of existing work-place tasks. The quantification of intermittent work capacity is an important first step towards effective risk assessment, job evaluation, and reduction of economic and medical costs associated with workplace injuries.

Sustained Work Indicators of Older Farmers

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Keywords/Phrases: Aging farmers, work patterns

Purpose:

To characterize the work practices of older family farmers, identify factors that determine whether they continue farming, and assess health and working conditions that increase the risk of illness or injury.

Abstract

This prospective panel study will focus on the most rapidly aging workforce in the United States—the family farmer. This special population is known to suffer one of the highest rates of occupational injury and mortality. Farmers rarely retire from their vocation and work long past usual retirement age. A longitudinal design will be used for this study. The specific aims of this study are to (1) identify factors that influence the sustained work of older farmers, (2) develop health profiles (including physical and mental indicators) of older male and female farmers, (3) develop exposure profiles for tasks related to agricultural work of older farmers, and (4) explore the sociocultural, family, and economic factors that influence the work practices and health of older farmers. This research will utilize a partial sample from the Kentucky Farm Family Health and Hazard Surveillance Study (data collected 1994–1996) and their spouses (n=914) and an oversample of African-American farmers and spouses (n=914) for a total of 1,828 persons enrolled from Kentucky and South Carolina. Measures on sociocultural, health and behavioral, and work environment factors will be collected through 6 waves of mailed surveys over 50 months. Focus groups of male farmers, farm women, and farm couples will address items not conducive to survey research. Attachment to farm life and the land, farm enterprise transfer, and the meaning of work will be explored in 18 focus group sessions. Findings from the study will be used to design occupational counseling appropriate to age, gender, race, and health and safety programs for aging farmers.

Worker Genetic Susceptibility to Mutagenic Risk

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Telephone: (212) 305–3959
Keywords/Phrases: Mechanism, carcinogenic effects, vinyl chloride

Purpose:
To evaluate the biologic mechanism underlying differential sensitivity to the carcinogenic effects of exposure to vinyl chloride (VC).

Abstract
Special populations at risk for workplace-related health effects include workers with genetic susceptibility to the mutagenic effects of occupational exposures due to inherited variants of metabolizing enzymes. The investigators have previously demonstrated that workers exposed to VC experience an increased frequency of biomarkers of mutagenic damage (mutant ras-p21 or mutant p53) in a dose-dependent fashion. At any given dose, however, workers can experience none, one, or both of these biomarkers of mutagenic damage, suggesting that inherited differences may exist in VC-metabolizing enzymes that could account for these differences in effect from presumed similar exposures. In fact, genetic polymorphisms in VC-metabolizing enzymes have recently been related to an increased sister chromatic exchange frequency, a nonspecific indicator of DNA damage, in VC-exposed workers. The purpose of the current study is to see if genetic polymorphisms in VC-metabolizing enzymes are also related to the more specific biomarkers of mutagenic damage (mutant ras-p21 and/or mutant p53) in VC-exposed workers. Restriction fragment length polymorphism techniques will be used to analyze DNA from subgroups of VC-exposed workers with none, one, or both biomarkers of mutagenic damage but with similar demographic and exposure characteristics for genetic polymorphisms in VC-metabolizing enzymes. Prevalences of the polymorphisms will be compared among the subgroups. Workers with the polymorphisms are anticipated to be more likely to have the biomarkers of mutagenic damage than similarly exposed workers without the polymorphisms and thus will be more likely to suffer from the subsequent carcinogenic and other health effects of VC exposure. If this proves to be correct, then such special populations at risk could be targeted for more stringent interventions to help prevent the occurrence of VC-related occupational diseases.

Evaluation of North American Guidelines for Children's Agricultural Tasks (NAGCAT) Using Case Series of Injuries

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Telephone: (715) 389–3021
Keywords/Phrases: Surveillance, child agriculture, injury prevention

Purpose:
To analyze a case series of injuries and fatalities in order to evaluate the North American Guidelines for Children's Agricultural Tasks (NAGCAT).

Abstract
NAGCAT was developed to help parents and others assign appropriate and safe jobs to children 7 to 16 years who are living and/or working on farms across North America. The proposed research aims to build on the NAGCAT project by providing a field test of the Guidelines for relevance, applicability, and effectiveness. The purpose of the proposed study is to systematically apply NAGCAT to case descriptions of fatal and nonfatal farm injuries experienced by children to determine whether their application may have prevented the injury occurrence. Specifically, the investigators propose to assemble a large case series of traumatic childhood farm fatalities and injuries in the United States and Canada using existing surveillance data, coroner/medical examiner records, case investigation reports, and national survey data. Once this unique database on childhood farm injuries has been assembled, NAGCAT will be systematically applied to these case descriptions. The use of real life childhood farm injury cases will provide some evidence of the extent to which application of NAGCAT may have reduced the occurrence of these injuries and also highlight common injury mechanisms/circumstances that may not be covered by NAGCAT.

Using the Agricultural Safety and Health Best Management Practices (ASHBMP) Manual as a Tool to Reduce Farm Hazards

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Telephone: (814) 865–7151
Keywords/Phrases: Intervention, child agriculture, work practices

Purpose:
To develop and evaluate a youth-oriented version of the Agricultural Safety and Health Best Management Practices (ASHBMP) manual.

Abstract
This project will include working with two audiences: youth and their parents. Both work on farms and both are exposed to the same farm hazards. It is postulated that youth may influence their parents in reducing farm hazards. This project will allow an evaluation of this postulate. A previous study, the adult ASHBMP study, showed the original adult ASHBMP manual to be effective in reducing hazards when used by adult farmers. This study will investigate the use of the concept of the ASHBMP Manual by 12- to 15-year-old farm resident youth to reduce farm hazards. The adult ASHBMP manual has a reading level of Grade 11. A youth ASHBMP manual will be developed that will have a reading level of Grade 6. The research objectives for this developmental project are to (1) determine the effect of the adult and youth ASHBMP manuals and youth-parent interaction about safety topics in modifying safety behaviors on the farm, (2) determine the effects of using the visually-oriented ASHBMP as a hazard audit tool for reducing hazards on farms, (3) determine the relative effectiveness of youth use of the adult ASHBMP manual compared with adults, and (4) evaluate inter-rater reliability and internal consistency of the adult and youth ASHBMP manuals as an auditing tool for use by youth. Before the evaluative process can be accomplished, the youth ASHBMP manual must be developed. Also, in this study safety fact sheets are used for the control measure. These fact sheets are the ones used in the adult ASHBMP study. Youth-oriented fact sheets will be developed, as a second control measure, and used in the evaluation of the youth ASHBMP manual. The last objective of this study is to develop the youth ASHBMP manual into a CD-ROM.

Adapting North American Guidelines for Children's Agriculture Tasks NAGCAT for Ethnic Communities: A Research Model

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Affiliation: University of Minnesota
St. Paul, Minnesota
Telephone: (612) 626–1250
Keywords/Phrases: Evaluation, child agriculture, intervention

Purpose:
To adapt the North American Guidelines for Childhood Agricultural Tasks (NAGCAT) to farm families from ethnic minority communities in the United States.

Abstract
This research will (1) develop a set of evaluation criteria by which the cultural appropriateness and the effectiveness of the existing NAGCAT guidelines when used with a cultural minority group can be measured and (2) describe a process for the adaptation of future guidelines that are tailored to the needs of ethnic communities.

The five specific aims are to (1) examine the extent and nature of child agricultural labor in farm families of Hmong origin in the upper midwest (the Hmong, refugees from Laos in the 1970s and 1980s, constitute the second largest ethnic minority in Minnesota), (2) investigate culture-specific health behavior patterns and culturally appropriate health promotion methods for farm families of Hmong origin, (3) evaluate the NAGCAT for applicability and appropriateness for farm families of Hmong origin, (4) produce recommendations for adapting the guidelines to be more culturally appropriate to Hmong farm families, and (5) design a health education vehicle that presents at least three of the NAGCAT guidelines through messages and in media tailored specifically for Hmong audiences. The research design for this nonexperimental evaluation study combines quantitative and qualitative research methods.

Teaching Kids Safety on the Farm: What Works

Investigator: Anne Gadomski, M.D.
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Telephone: (607) 547–3169
Keywords/Phrases: Injury prevention, evaluation, child agriculture

Purpose:
To evaluate the effectiveness of the North American Guidelines for Children's Agricultural Tasks (NAGCAT) in preventing childhood agricultural injuries.

Abstract
The Teaching Kids Safety on the Farm: What Works study will determine the impact of the active dissemination of the NAGCAT to farm families on the rates of childhood agricultural injury. These guidelines were developed to help parents select age-appropriate farm tasks for their children and promote farm safety for children through increased awareness, simple behavioral changes, and increased adult supervision. This research will use a population-based design. Nine hundred farm households with child residents or employing children will be randomized to a NAGCAT intervention group or to a control group. Outreach educators will visit each intervention farm household to explain, review, and

leave a copy of the NAGCAT guidelines with the parent or adult employer. Two months later, parents or adult employers will receive a NAGCAT knowledge, attitudes, and behavioral intention survey (NAGCAT KAB) and will begin a 2-year period of injury surveillance. Telephone surveillance will be conducted every two months for both intervention and control farms. Seven counties in the northern Appalachia region of New York State will be included in this study. The Training Intervention Effectiveness Model (TIER) will be used to organize the large number of modifying, intervening, or confounding variables that may affect the dependent variables (i.e., change in NAGCAT KAB and incidence of childhood agricultural injury potentially attributable to the independent variables) receipt of NAGCAT training at home.

Evaluation of a School-Based Agricultural Health and Safety Curriculum

Investigator: Allen Williams, M.D.

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Telephone: (612) 676–5105

Keywords/Phrases: Evaluation, curriculum, farm safety

Purpose:

To evaluate the Work Safe Work Smart health and safety curriculum in rural schools.

Abstract

Agriculture is one of the most hazardous occupations in the United States, and rural adolescents are at significant risk of agricultural injury. According to U.S. Census Bureau estimates, approximately 100,000 adolescents between 14- and 18-years old reside in rural Minnesota counties. The purpose of this proposed study is to evaluate the Work Safe Work Smart health and safety curriculum in rural Minnesota schools. The aims are to (1) evaluate changes in students' knowledge, attitudes, and beliefs regarding agricultural/work-related safety behaviors due to the inclusion of the Work Safe Work Smart curriculum into existing school curricula, (2) identify factors critical to incorporating agricultural/work health and safety training (i.e., Work Safe Work Smart) into school curricula, and (3) establish ongoing statewide support for incorporating agricultural/work health and safety curricula within rural schools. To assist in meeting these aims, an advisory group consisting of professionals in public health, agricultural education, health education, and school administration will develop the recruitment and implementation strategies. Using a group-randomized, nesting cohort design, a sample of rural schools will be recruited and randomly assigned to the intervention (Work Safe Work Smart curriculum) or control group (standard curriculum). The impact of the curriculum will be measured using data collected from questionnaires administered to all 9th grade students in both intervention and control groups before the intervention, 2 weeks after the intervention, and again 6 months later. Process evaluation throughout the study will help to clarify the successes and impediments in recruitment, intervention, and evaluation.

Evaluating Teen Farmworker Education

Investigator: Robin Baker

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Telephone: (510) 642–5507

Keywords/Phrases: Intervention, education, child agriculture

Purpose:

To evaluate the effect of teaching teen farmworkers about agricultural health and safety through school-based English as a Second Language (ESL) class.

Abstract

Using a pretest and posttest quasi-experimental design, this study will evaluate whether exposure to an existing school-based curriculum increases agricultural safety and health knowledge and skills among young farmworkers and whether community-based educational activities provided in addition to the curriculum increase these outcomes further. Data from pretests and posttests collected from students in the intervention and comparison regions will be analyzed to assess differences between these two groups of students. The intervention regions will be split in two, one that will receive only the school-based program and the other that will also receive a community education component. Differences in knowledge, attitudes, and behaviors between the two intervention groups will be compared. A followup survey of students in the intervention and comparison communities administered 4 months following delivery of the curriculum in the intervention communities will also determine whether there has been a change in the number of students who report work-related injury, illness, or near misses during their summer work experience. At the end of the third year, all ESL teachers within the three study regions will be offered support and an opportunity to integrate the curricula into their ESL classes.

An Evaluation of the North American Guidelines for Children's Agricultural Tasks

Investigator: Sue Wright, Ph.D.
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Telephone: (509) 359–4817
Keywords/Phrases: Intervention, child agriculture, evaluation

Purpose:
To analyze and modify the existing North American Guidelines for Children's Agriculture Tasks (NAGCAT) based on investigating the decision making processes of parents who are choosing what age is appropriate to involve their children in agriculture tasks.

Abstract
To help reduce agricultural injuries and fatalities on family farms, the National Center for Rural Agricultural Health and Safety has developed age guidelines as a significant tool to help parents make appropriate choices regarding engaging children in farm tasks. However, a significant discrepancy continues between the guidelines and parents' actual practices concerning the age-appropriate engagement of children in farm tasks. By determining what variables besides age enter into parents' decision making processes to first involve their children in farm tasks and by providing information about parents; training, supervision practices, and role modeling behavior, the investigators can begin to evaluate why or why not the NAGCAT might be effective. Quantitative and qualitative approaches will be combined to analyze data collected on parents' attitudes toward the NAGCAT and parents' practices and attitudes in regard to the employment, training, and supervision of their children in farm tasks. Role modeling and gender issues will especially be evaluated as factors. Interventions will be designed based on research findings, at the center of which will be a proposed demonstration project designed to modify and expand the language and presentation of the NAGCAT with the purpose of increasing their effectiveness in preventing injuries and fatalities to farm children.

Biomechanics of Human Reactions to Slip Events

Investigator: Cham Dit Tham Rakle, Ph.D.
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Telephone: (412) 647–8050
Keywords/Phrases: Falls, older workers, biomechanics

Purpose:
To reduce slip-precipitated falls in the workplace, especially among older workers.

Abstract
Slips and falls accidents have been recognized to be of major importance in occupational health. Epidemiological studies have reported this problem being even more serious among older workers, especially female workers. In light of the aging dynamics of the labor force, the long-term goal of this proposed study is directed at reducing slip-precipitated falls among older adults. Specific aims are (1) investigate the differences in gait biomechanics relevant to recovery responses following a slipping perturbation between young/older and male/female adults and (2) examine the effect of slippery surfaces warnings on slip-fall potential and biomechanics of recovery responses. Sixty subjects equally divided by gender and into two age groups will be recruited in this study:

Biomechanics of Slips in Older Adults

Investigator: Cham Dit Tham Rakle, Ph.D.
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Keywords/Phrases: Slip/falls, biomechanical recovery, risk factors

Purpose:
To assess the effects of age, gender, low extremity strength, and postural stability on the biomechanical recovery profiles of people during slip/fall events.

Abstract
Slips and falls are among the leading generators of injuries in the workplace, especially among older adults and even more seriously in the female labor force. The aging dynamics of the workforce and increasing participation rate of female workers have motivated the long-term goal of this proposed study, that is to reduce slip-precipitated falls among older adults, including older female workers. The aims are (1) compare the differences in the biomechanics of human reactions between slip-recovery and slip-fall trials, (2) investigate the impact of age/gender on recovery biomechanics following a slip, (3) examine the effect of slippery surfaces warnings on slip potential and biomechanics of recovery responses, and (4) investigate the effect of postural stability and lower-extremity physical strength capabilities on recovery biomechanics. Sixty subjects equally divided by sex and into two age groups will be recruited in this study.

Pilot Study of Agriculture-Related Injuries Impacting Amish Community

Investigator: William Field, Ed.D.
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Keywords/Phrases: Farm injuries, interventions, Amish

Purpose:

To gain knowledge regarding the nature of farm injuries and interventions among Old Order Anabaptist groups.

Abstract

Old Order Anabaptist groups, such as the Amish and Old Order Mennonites, are a rapidly expanding agricultural minority with a long-standing presence in the U.S. farming community. However, few consolidated efforts have been identified that document the nature and extent of farm work-related injuries among these groups or address the best injury prevention strategies to impact these communities. This absence of information is particularly problematic because the unique farming practices and socioreligious customs of Old Order groups render many conventional farm safety efforts ineffective. An additional concern that is raised by preliminary studies by the principal investigator indicates a much higher than average percentage of Old Order Anabaptist farm fatalities involving children. The purpose of this exploratory project is to expand the knowledge base regarding the nature of farm injuries and best-practice interventions among Old Order Anabaptist groups. To achieve this, the project team will enlarge Purdue's existing database of farm fatalities among the target population through the use of conventional surveillance methods and a nationwide surveillance of Old Order weekly publications. Purdue will subcontract with Messiah College (Grantham, PA), a leading institution for Anabaptist studies, to review weekly Anabaptist publications that frequently contain farm-related injury reports and to profile the types of agricultural technologies being used in Amish communities. Once sufficient data have been gathered, the project team will construct statistical models and conduct a comparative analysis between farm injuries among the target population and those among the overall farming population. The project team will use the database, comparative analysis, and input from the project's consultant committee, comprised of individuals with extensive experience working with Old Order Anabaptist groups, to identify technological and socioreligious factors that contribute to farm injuries, especially to children. As a means of identifying best-practice intervention strategies, the project will again use the consultant committee and will facilitate a national symposium on injuries in Old Order communities. Outcomes, in addition to baseline injury data and potential intervention strategies, will include injury prevention information with application to the growing cottage industry within these communities.

Childhood Agricultural Trauma Evaluation System

Investigator: Debora Boyle, Ph.D.
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Keywords/Phrases: Child agriculture, asthma, injuries

Purpose:

To develop new surveillance methods that will facilitate identification and evaluation of agricultural injuries and asthma among high school students.

Abstract

Agriculture is one of the most hazardous occupations in the United States, and rural adolescents are at significant risk of agricultural-related and work-related injury and asthma. The aims of this study are to (1) determine the magnitude and scope of agricultural injuries and asthma among 9th to 12th-grade students in four different agricultural regions in Minnesota, (2) describe the change in rural work exposures in these adolescents in terms of total work hours and hours worked between agribusiness, traditional family farming, and non-farm work, (3) evaluate the reliability of adolescent self-reported information about agricultural and work exposures and injury experiences, and (4) use a cohort analysis to calculate risk factors for injuries and to facilitate planning for future prevention activities. An advisory group consisting of professionals in public health, agricultural education, school administration, and others will assist in meeting these aims. Using a stratified cluster design with agricultural region as strata and schools as the cluster, a sample of 32 rural schools will be selected and recruited to participate in this study. Data on demographics, work hours and hazards, and injury risk factors will be collected from the entire student body through a self-completed questionnaire administered to each student a total of four times over a 2-year period. Injury incidence and asthma prevalence rates will be calculated to determine the degree of variability on both a seasonal and yearly basis. Information will also be collected to determine the number and type of agricultural and work-related injuries that occur to rural adolescents across a spectrum of farming activities. Data will be used to analyze this open (dynamic) cohort for potential risk factors.

Health Disparities Among Health Workers

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Keywords/Phrases: Injuries, socioeconomic, health care workers

Purpose:
To determine how job-related physical and psychosocial factors combine to produce disparity in occupationally related musculoskeletal injuries and illnesses between races and socioeconomic classes.

Abstract
Socioeconomic position (class, sex, and ethnicity) is inversely associated with risk of morbidity and mortality due to various conditions. Some of these are not immediately life threatening but have a major impact on health quality of life, affecting the physical and social functional capacity of a substantial proportion of the population. These include musculoskeletal disorders, various types of acute injury (both intentional and unintentional), and mental health conditions. All three of these have been associated with environmental conditions in the workplace, which themselves show a marked socioeconomic gradient because of widespread occupational segregation. The investigators propose to examine the work environment as a primary mediator of the effect of socioeconomic position on population health. The study will involve a combination of quantitative and qualitative data and will support a contextual analysis, set within a broader ecological and political theoretical framework. Multiple data sources will be used to evaluate job features, such as physical load (e.g., heavy lifting), shiftwork, high psychological job demands coupled with low decision autonomy, and threat of interpersonal violence. Facility-wide characteristics, such as adequacy of staffing, management commitment to occupational safety and health programs, and policies concerning sex and racial discrimination and sexual harassment will be assessed. Morbidity will be assessed by survey instrument as well as from facility records of absenteeism, work-related injury and illness, and compensation claims. In a series of three panel surveys, the investigators will seek to maximize the number of subjects responding more than once to permit longitudinal analysis. An outcomes sub-study will sample employees reporting health problems at baseline. Additional information about their health and employment status will be sought about two years later. By conducting the study in multiple facilities and job groups, it will be possible to compare the effects of job- and worker-specific exposures as well as the effect of different management policies and workplace climates. These have the potential to determine the magnitude and impact of hazardous exposures. The study will be conducted within the health care industry, which employs a large proportion of the working population in Massachusetts (and nationally) and is an increasingly important employer of minority workers. This workforce has substantial variability in socioeconomic status, sex, and ethnicity and is exposed to a variety of known health and safety hazards at work. This setting should provide an adequate multidimensional range of facts to permit a meaningful examination of physical and social/behavioral risks and the complex pathways that produce disparities in population health status.

Effects of Aging on the Biomechanics of Slips and Falls

Investigator: Thurmon Lockhart, Ph.D.
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Blacksburg, Virginia
Telephone: (540) 231–9088
Keywords/Phrases: Falls, special populations

Purpose:
To investigate changes in walking and the ability to recover from slips associated with increasing age.

Abstract
Injuries associated with slips and falls pose a significant problem to industry, both in terms of human suffering and economic losses. An experiment is proposed to measure how deterioration of lower extremity muscular strength/activation rate and sensory functions among older individuals affect several biomechanical parameters under normal and abnormal conditions. Independent variables for the experiment include age groups (18–35 years, 40–60 years, and 65 years or older) and floor surfaces (oily vinyl tiles and outdoor carpet). Biomechanical parameters include hamstrings muscle activation rate, horizontal heel contact velocity, friction demands, slip distances, and the joint reactive moments (ankle, knee, and hip). Before the experiment, a sensory organization test (SOT) and muscle control test (MCT) will be performed on all subjects to obtain information concerning the proprioceptive, visual, and vestibular functions and muscle control (reaction) times. Isometric and isokinetic tests will be performed to evaluate leg strength. Older adults' musculoskeletal and sensory degradation is hypothesized to constrain the counterbalancing joint reactive moments to reduce segmental motion during recovery from slips and falls and expose older persons to a higher likelihood of slips and falls. This information will allow engineers to design better work environments and jobs to reduce the incidence of

slips and falls for an aging workforce. Additionally, it will provide information about possible intervention strategies (muscle strengthening and balance exercises) for improving dynamic equilibrium in older workers.

Aging Effects on Intermittent Work Capacity

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Telephone: (540) 231–6053
Keywords/Phrases: Injury mechanisms, ergonomics, overexertion

Purpose:
To investigate changes in walking and the ability to recover from slips associated with increasing age.

Abstract
Injuries associated with slips and falls pose a significant problem to industry, both in terms of human suffering and economic losses. Existing evidence has identified several aging effects related to slips and falls, yet has not explained determining causes of older persons' higher likelihood of slips and falls. In this proposal, intrinsic changes associated with aging, such as gait adaptation, musculoskeletal and sensory degradation, and its effect on the initiation, detection, and recovery processes of slips and falls will be evaluated. These assessments will answer the question of why older adults are exposed to a higher likelihood of slip-induced falls. An experiment is proposed to measure how deterioration of lower extremity muscular strength/activation rate, and sensory functions among older individuals affect several biomechanical parameters under normal and abnormal conditions. Independent variables for the experiment will include age groups (3 levels: 18–35 years, 40–60 years, and 65 years or older) and floor surfaces (2 levels: oily vinyl tiles and outdoor carpet). Biomechanical parameters measured will include hamstrings muscle activation rate, horizontal heel contact velocity, friction demands, slip distances, and the joint reactive moments (ankle, knee, and hip). Before the experiment, a sensory organization test and muscle control test will be performed on all subjects to obtain information concerning the proprioceptive, visual, and vestibular functions as well as muscle control (reaction) times. Isometric and isokinetic tests will be performed to evaluate leg strength. Older adults' musculoskeletal and sensory degradation are hypothesized to constrain the counterbalancing joint reactive moments to reduce segmental motion during recovery from slips and falls and expose older persons to a higher likelihood of slips and falls. This information will allow engineers to design better work environments and jobs to reduce the incidence of slips and falls for an aging workforce. Additionally, it will provide information on possible intervention strategies (muscle strengthening and balance exercises) for improving dynamic equilibrium in older workers.

Casa a Campo: Pesticide Safety for Farmworkers' Families

Investigator: Thomas Arcury, Ph.D.
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Telephone: (336) 716–9438
Keywords/Phrases: Pesticides, farm families, education

Purpose:
To develop culturally and linguistically appropriate educational materials and programs that will promote ways to prevent or reduce exposure among farmworker families.

Abstract
An estimated 4.2 million seasonal and migrant farmworkers and their dependents work across most of the United States. This population is largely minority (90% Hispanic), medically underserved, and at risk for a variety of environmental health problems. Casa a Campo builds on a community-university partnership that has worked to reduce one environmental health risk—pesticide exposure—among farmworkers in North Carolina. The activities proposed here will expand the scope of work to include members of farmworker families and enlarge the partnership to include providers of health care to farmworker families and farmworker advocacy and educational organizations. The Casa a Campo partnership will address four aims: (1) conduct research to document knowledge and beliefs about pesticide exposure, document exposure of young children, and document other environmental health concerns of farmworker families; (2) develop culturally appropriate materials and programs to reduce pesticide exposure among these families; (3) develop materials and programs to better prepare health care providers to recognize, treat, and prevent pesticide exposure of farmworker families; and (4) increase the capacity of community-based organizations to involve the community in the identification, assessment, and reduction of environmental health risks in their own communities. These efforts will be structured by a multimode, multidomain model of community participation developed previously by this group. The model is proactive, designed to encourage and develop community participation in different domains (consultation, strategic planning, implementation) through different modes (partnership Junta Directiva, advisory committee,

community forums, research, training of community members, and educating college students from farmworker families).

• Surveillance Research Methods •

Worker and Worksite Factors in Denver International Airport Construction Injury

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Keywords/Phrases: Surveillance, injuries, construction

Purpose:
To identify causes of work-related injury and focus prevention on costly risk factors.

Abstract
Construction workers not only have high rates of work-related injuries but they are also among the most likely workers to experience serious occupational injuries. For this study, the combination of information from injury reports with an administrative database containing claims, demographic information, and hours worked will provide a rich source of information for describing injuries and the factors contributing to them. The utility of these data will then be evaluated to test hypotheses about factors differentially associated with different types of injury and different levels of injury severity. The data will also be used to determine direct costs of injury for high-risk groups of workers and factors contributing to injury. Together, these outputs are designed to identify causes of work-related injury and focus prevention efforts on more costly risk factors. Study aims will be accomplished by coding and analyzing data from standardized First Reports of Injury (FRI) and Accident Investigation Reports (AIRs), linked with an administrative database for the Denver International Airport construction project containing information about more than 4,600 workers' compensation claims, payroll and demographic data on 32,081 workers who worked more than 31 million hours on the project, and company characteristics for 769 contractors. The results should provide information that will be useful in focusing prevention efforts for construction, but the methods developed will have applicability to data for other occupational groups.

Evaluation of a Surveillance Radiograph Standards Set

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Keywords/Phrases: X-ray, pneumoconiosis, surveillance

Purpose:
To validate a screening tool for pneumoconioses as part of an existing surveillance program.

Abstract
Pneumoconiosis due to coal, silica, and asbestos exposure remains a substantial threat to public health worldwide. Rates of pneumoconiosis have dropped in the industrialized world but remain high in the industrializing world. This research aims to develop a tool that can overcome limitations of the existing tool used for pneumoconiosis surveillance. If validated, this tool could be used for population-based analyses and for identifying persons at risk for progression of disease. Surveillance for pneumoconiosis requires a test with reasonable sensitivity and specificity coupled with preventive interventions for the individual worker as well as the workplace in general. The current system requires the use of 22 films, for which access is limited because of the cost of reproduction, distribution, and the complexity of the system, which requires investments in training and application. Increasingly, the industrialized and industrializing world needs a simple, easy-to-use, cost-effective tool to classify radiographs for pneumoconiosis. This investigation aims to validate the use of a simple set of seven radiographs as a Surveillance Radiograph Standards Set (SRSS) to classify small opacity profusion, size, and shape. Because this is a tool for pneumoconiosis surveillance, the validation will be not just for classifying radiographs but also to test the field application of the SRSS as part of surveillance exercise. The investigation also seeks to develop and validate a model training curriculum and examination to develop and test the knowledge, skills, and competencies of physicians using the surveillance test set. Ultimately, improved surveillance methods will help reduce morbidity and mortality due to pneumoconiosis.

Surveillance Methods for Healthcare and Related Workers

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Keywords/Phrases: Surveillance, healthcare workers

Purpose:
To develop a model surveillance system that uses population-based and case-based methods to monitor health, injury, and hazards among health care workers.

Abstract
NIOSH has identified health care workers as a special population at high risk of occupational disease and injury. The Bureau of Labor Statistics estimates that more than eight million workers are employed in United States health care industries. Health care workers are involved in very diverse functions and duties that may expose them to many hazards, such as toxic chemicals, infectious agents (e.g., bloodborne and body substance exposures to bacteria, viruses, fungi, and parasites), latex, ergonomic hazards, workplace violence, work-related stress, and physical agents. Relatively little injury and disease surveillance data exists on health care workers. The major objective of this research is to develop a comprehensive system for health, injury, and hazard surveillance of health care workers. This will be accomplished through the combination of population-based and case-based data. A job-exposure matrix will be developed for hazard surveillance and for estimation of individual exposures through linkage with each worker's job history. The surveillance system will use analytical tools for cohort data to study the incidence and causes of work-related injuries and health conditions, the identification of high risk populations, and appropriate prevention measures. These data will be supplemented by the use of case-based data, allowing more detailed followup of a group of sentinel health events of concern for health care workers. Conditions to be addressed by case-based surveillance will include patient lifting and handling injuries, other noninfectious occupational injuries, latex allergy, occupational asthma, and work-related stress. The surveillance system will be implemented for 5 years using a cohort of more than 10,000 health care workers employed by Duke University Health Systems, which includes Duke University Medical Center, a large teaching hospital, and Durham Regional Hospital, a community-based hospital. Other components of the health systems include 20 clinics located in eight North Carolina counties, triangle Hospice, and the Duke Infusion Center. Although the investigators will evaluate the utility of the system in this setting, the goal of the project is to define elements and performance characteristics of a model surveillance system that could be used in other health care institutions. Results of the case-based surveillance effort also will have broad application to health care workers.

Partnerships in Surveillance and Prevention

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Keywords/Phrases: Information systems, databases, surveillance

Purpose:
To assess the feasibility and potential utility of workers' compensation claims data from multiple insurers into a common database for monitoring all types of workers' compensation claims.

Abstract
This proposal is based on a collaboration between the Center for Research on Occupational and Environmental Toxicology at Oregon Health Sciences University, the Environmental, Occupational, and Injury Epidemiology Section of the Oregon Health Division, and major insurers for workers' compensation in Oregon. The study will address the disparities in data available in the State-mandated workers' compensation system and those available in the databases held by private insurers and self-insured companies. This common database will provide a broad view across insurers, indicate the need for taxonomy development and standardization to facilitate the merging of data, and provide the mechanism to compare illness and injury claims in relation to key variables. Upon successful merging of data from multiple insurers, this project will determine differences in the disabling and medical-only claims among different insurers according to type of injury/illness, age and sex of claimants, type of industry, and occupation. Comparisons will be made in the profile of occupational injury and illness available in State workers' compensation databases and the profile available in data from insurers. This project will demonstrate the utility of complete insurer databases in monitoring clusters of illness and injury, trends and patterns of claims, and identifying new intervention opportunities as they emerge. The information generated from this surveillance can then be used to communicate to insurers the benefit of the surveillance for their loss prevention and the ultimate goal of improving worker safety and health and decreasing workers' compensation claims costs.

Evaluation of a Statewide Emergency Department Injury Surveillance System for Occupational Injury Surveillance

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Telephone: (617) 624–5621
Keywords/Phrases: Surveillance, feasibility assessment, databases

Purpose:
To evaluate the feasibility of using this comprehensive injury surveillance system for surveillance of occupational injuries.

Abstract
Nonfatal occupational injuries are a significant public health problem in the United States, imposing substantial human and economic costs. Surveillance of these injuries at the State and national levels is essential to set research priorities and to target and evaluate prevention efforts. The study will (1) evaluate the sensitivity, specificity, and predictive value of the indicators of work-related injury in the Emergency Department Surveillance and Coordinated Injury Prevention (ED SCIP) database, (2) assess the extent to which employment information is included in the medical record and electronic data systems of participating hospitals and the feasibility of routinely obtaining this information, (3) evaluate the quality of e-codes for occupational injuries, (4) evaluate two proposed alternative injury coding protocols for occupational injury surveillance, and (5) generate a descriptive epidemiology of occupational injuries treated in emergency departments and compare them with findings from traditional occupational injury data sources in Massachusetts to identify potential biases in these data systems. The first four tasks will be accomplished by comparing information obtained through systematic chart reviews with information contained in the ED SCIP database for a sample of ED SCIP cases and interviews with medical records personnel. Comparison of ED SCIP and traditional data sources will be based on summary findings and focus on patterns of occupational injury by age, sex, cause, nature of injury, and distribution by occupation and industry. Findings will be widely disseminated to data providers and users.

Capture-Recapture Estimates of Workplace Injury Rates

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Keywords/Phrases: Capture-recapture methods, occupational injury and illness, data sources

Purpose:
To use capture-recapture methods to improve estimates of occupational injury and illness using two different sources of data in eight States.

Abstract
This study will use the two most widespread and comprehensive sources of occupational injury and illness reporting to evaluate the completeness of reporting in each and factors that affect differential reporting. These two sources are State workers' compensation data and the Survey of Occupational Injuries and Illnesses (SOII) conducted annually by the Bureau of Labor Statistics. It will also provide improved estimates of the overall annual incidence of occupational injuries and illnesses for eight States. For the selected period, the investigators will compare reported injuries from these two sources matching individual injuries and illnesses in eight states: Oregon, Washington, Wisconsin, New Mexico, Florida, Texas, Minnesota, and West Virginia. The study will account for differential capture by employer, injury, and worker characteristics by using logistic regression. This also will enable the research team to identify factors associated with underreporting. On the basis of findings of the capture-recapture analysis, the investigators will suggest changes in reporting programs that would improve data collection. Finally, they will compare the degree to which the two data systems appear to capture occupational injuries and illnesses in the States studied. If capture is relatively uniform across States, capture rates estimated from the studied States will be applied to States outside the study population to provide improved national estimates of the incidence of injuries and illnesses.

Regional Rural Injury Study (RRIS) II: Agricultural Injury Surveillance

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Keywords/Phrases: Surveillance, injuries, child agriculture

Purpose:
To identify critical risk factors for farm-related injuries to children, as well as the incidence and consequence of injuries.

Abstract
Agricultural operations involve persons of all ages, including children, who are at particular risk for injury. The proposed effort, to strengthen occupational safety and health surveillance, focuses on this high-risk industry and can provide a better understanding of the magnitude and scope of childhood agricultural injuries as well as methods to improve occupational surveillance. To accomplish this, the 1999 Regional Rural Injury Study-II (RRIS-II) will serve as the basis for this surveillance effort. The 1999 RRIS-II was designed to determine the etiology and consequences of agricultural injury in Minnesota, Wisconsin, North Dakota, South Dakota, and Nebraska. These States are characteristic of the major types of agricultural production in the United States and are among the leading producers of crops and livestock in the Nation. The new cohort will be selected in the same manner as the 1999 cohort, using a random sampling procedure from the lists of farm operations in each State, maintained by the United States Department of Agriculture. This new cohort will consist of approximately 17,000 persons and include an estimated 8,600 children age 19 and under. Unique methods will be applied for collecting quality data for both incidence and consequences of agricultural injuries as well as types and amounts of exposures, pertinent to the farming operation and environment. Using a computer-assisted telephone interview (CATI) system and instruments specially designed for the 1999 RRIS-II, a nested case-control design will be used to identify critical risk factors for farming-related injuries to children, as well as the incidence and consequences of injuries. This design, which also allows for the collection of exposure information, provides an efficient and optimal method for identifying risk factors that cannot be accomplished through traditional surveillance efforts. Participants will be contacted every 6 months over a period of 1 year (2001) to identify persons who were injured (cases) in the previous 6-month periods. All cases and controls (approximately 3:1) (identified through an algorithm encoded into the CATI system using the density method of control selection) will be interviewed to obtain relevant exposure data. The analyses, both univariate and multivariate, will be conducted using analytic procedures comparable to those incorporated in the 1999 RRIS-II baseline effort. The ability to identify incidence rates, information pertinent to the injury events, the consequences of injury, and relevant exposures and risk factors, through ongoing surveillance, is critical to provide sound scientific data for developing focused intervention strategies and pertinent evaluation. This is essential to reduce morbidity and mortality from injuries in the agricultural community and can serve as a model for other regions in the Nation.

Linking Occupational Injury and Illness Databases

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Keywords/Phrases: Databases, evaluation, surveillance

Purpose:
To link nine work-related injury and illness surveillance systems to develop more efficient methods for conducting occupational surveillance.

Abstract
The current national surveillance for work-related injuries and illness is an employer-based system. The system is widely acknowledged to provide incomplete estimates for both occupational injuries and illness. The investigators propose to link nine work-related injury and illness surveillance systems for Michigan-related data: U.S. Department of Labor, Bureau of Labor Statistics (BLS) Annual Survey of Occupational Injuries and Illnesses, U.S. Department of Labor Occupational Safety and Health Administration Injury and Illness Survey, First Injury and Illness Reports to the Michigan Bureau of Workers' Disability Compensation (BWDC), Occupational Disease Reports to the Michigan Department of Consumer and Industry Services (MDCIS), Michigan Hospital Inpatient/Outpatient Data Base and Michigan Census of Fatal Occupational Injuries (CFOI), Michigan Adult Blood Lead Epidemiologic Surveillance (ABLES), U.S. Department of Labor Occupational Safety and Health Integrated Management Information System, U.S. Department of Labor Mine Safety, and Health Injury and Illness database. The researchers will assess the degree of overlap. A more comprehensive surveillance system would be useful for better documenting what percent of public health resources should be allocated to occupational safety and health. Also, the data would be useful to prioritize, target, and evaluate both public health and enforcement activity. The research project consists of an interdisciplinary team consisting of an occupational health physician, epidemiologists, a biostatistician, and a computer programmer. The investigators have arranged access to all nine data systems.

Occupational Health Surveillance of Low Income, Minority Populations Through Community Health Centers

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Keywords/Phrases: Surveillance, socioeconomic, special populations

Purpose:
To collect and evaluate occupational health information from low-income minority workers attending community health clinics and to promote clinic-based intervention activities.

Abstract
Little is known about the occupational health experience of low-income minority populations, including where and how much they work, the hazards they face, and the incidence of work-related injuries and illnesses. Information is especially elusive for these populations within the contingent workforce of temporary, part-time, and contract workers who may not have access to traditional workplace interventions that protect workers on the job or to benefits such as workers' compensation. The research will (1) develop a survey instrument and protocol to collect demographic, employment, and occupational health information through patient interviews conducted by community health workers at community health centers in Massachusetts, (2) conduct the survey and analyze data to describe the occupational health and safety experience of low-income minority populations receiving services at community health centers and to evaluate this method of data collection, (3) assess the extent to which information about employment is routinely collected at community health centers to determine if these data can be used or improved to conduct occupational health surveillance at the community level, and (4) provide site-specific feedback and technical assistance to community health centers to increase awareness of the occupational health needs of the communities they serve and promote local prevention activities.

Occupational Surveillance Modules for Prevention

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Keywords/Phrases: Surveillance, model

Purpose:
To demonstrate the application of a comprehensive occupational surveillance program.

Abstract
The Safety and Health Assessment and Research for Prevention (SHARP) program will demonstrate the application of a comprehensive occupational surveillance program that can be adapted by other States. To allow for adaptability, SHARP proposes development of a modular approach that demonstrates several approaches to outcome-based surveillance, hazard-based surveillance, and subsequent prevention activities. The proposed project will address the following aims: (1) conduct a survey of State-based occupational surveillance programs to determine currently employed approaches to surveillance and prevention, program capabilities, and program opinion leaders, (2) demonstrate a modular approach to occupational surveillance that will encompass the use of different data sources for priority conditions selected by an individual program, (3) develop modules for the creation, dissemination, and evaluation of prevention efforts, (4) conduct an employer/employee survey to further identify etiologic agents or practices in one identified industry, (5) develop an Internet-based library of surveillance modules and prevention materials, (6) produce and disseminate three surveillance reports for Washington State priority conditions per year, and (7) produce and disseminate two prevention reports to employers or employees per year. Through the proposed project, SHARP will demonstrate the use of several data sources for the surveillance of occupational diseases and hazards. Further, SHARP will demonstrate the analysis of such data, the creation of simple public health interventions using surveillance data, the implementation of interventions, and the evaluation of interventions using surveillance data. Finally, SHARP will produce a Web-accessible library of materials detailing the methodology of the various components of the surveillance program, including prevention materials that may be modified and disseminated in other States.

Core Occupational Health Surveillance in Massachusetts

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Keywords/Phrases: Occupational health surveillance, prevention, model

Purpose:
To develop, implement, and evaluate a core occupational health surveillance program to promote prevention at the State and local levels that can serve as a model for other States.

Abstract
Work-related injuries and illnesses are a significant public health problem in the United States, imposing substantial human and economic costs. Surveillance of work-related illnesses, injuries, and hazards is essential to establish research priorities and to target, design, and evaluate prevention efforts. Surveillance is needed at the State and local as well as national levels. The core program will include surveillance of multiple occupational health/hazard endpoints. The aims of the proposed project are as follows:

Sentinel event surveillance:
(1) refine the list of high priority occupational health conditions that should be placed under sentinel case surveillance in all States, (2) develop surveillance protocols for high-priority conditions and implement surveillance in Massachusetts, (3) evaluate prevention impact of sentinel event surveillance activities, and revise model core program.

Population-based surveillance:
(1) describe existing population-based sources of data on health conditions, hazards, and the worker populations-at-risk that may be used for occupational health surveillance at the State and local levels, (2) conduct analyses of priority data sets; prepare and disseminate surveillance reports, (3) assess the relative utility of these different population-based approaches to surveillance and propose schedule of core population-based surveillance activities.

Intervention and prevention:
(1) continue and expand working relationships with prevention partners to promote use of surveillance findings for public health action at the State and local levels and (2) develop mechanisms to improve dissemination and use of surveillance findings.

Regional collaboration:
work with other States in the Northeast to obtain their input in defining core occupational health surveillance functions and to promote the development of State occupational health surveillance capacity and (2) produce a set of written "surveillance tools" that can be used or adapted by other States working to build core programs.

MDPH will work with NIOSH State Occupational Surveillance Consortium in developing a final report and set of consensus recommendations regarding core occupational health surveillance activities in the States.

Improving Data Quality in Pesticide Illness Surveillance

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Telephone: (360) 236–3361
Keywords/Phrases: Pesticide illness surveillance, intervention, investigation

Purpose:
To increase the value of the information generated by the pesticide illness surveillance system.

Abstract
Washington State has required investigation of all reported suspected pesticide-related illnesses since 1970. While Washington has successfully initiated several effective interventions based on this data, the usefulness of the data for developing such interventions has been limited because of weaknesses of the data and of the data management system. Increasing the value of the information produced by Washington's occupational pesticide illness surveillance system must be based on a systematic evaluation and enhancement of data quality, data collection procedures, and data analysis and interpretation. The aim of this project is to increase the value of the information generated by the pesticide illness surveillance system to formulate and evaluate more effective intervention efforts to protect workers from pesticide exposures and illnesses. This project will (1) evaluate and improve the quality of data collected by the surveillance system by assessing the quality of data produced by each of its components data sources, investigating the degree and determinants of underreporting through focus groups and a review of outpatient records, and developing a system for incorporating incident data into a Geographic Information System, (2) improve the functionality and compatibility of the database management system by incorporating functions to analyze and export data using NIOSH variable definitions, coding, and format, and (3) enhance the analysis of the surveillance data and expand the dissemination of program and policy-relevant information derived from surveillance data by gathering input from stakeholders about questions that need to be addressed, developing short, focused reports about these topics, evaluating the usefulness of these reports, and institutionalizing those analyses and reports that generate information that directly helps to develop and evaluate intervention policies and programs.

The Youth Employment Training Pilot Program

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Keywords/Phrases: Model, youth, injury surveillance

Purpose:

To develop and implement a new model for youth occupational injury surveillance.

Abstract

The new model developed through this research will link injury surveillance with the Wisconsin youth work permit system. Within the next 2 to 3 years, the Wisconsin Department of Workforce Development plans to computerize the current child work permit system. The initial computerization planning process is an opportune time to develop a surveillance component that can be incorporated into the work permit application system. Upon successful completion, the proposed pilot study could affect the statewide implementation of the Department of Workforce Development program and expand the linked injury surveillance and the work permit application system to all of the public high schools in Wisconsin. No youth suveys have been conducted to determine the incidence of occupational injuries in Wisconsin. Existing data comes from workers' compensation claims. Currently, no comprehensive occupational safety training program exists for working Wisconsin youth, nor is there easy youth access to safety information or a mechanism for getting questions answered. The project will (1) develop a computerized youth work permit application, (2) develop and maintain a computerized work permit database to make sure that jobs are not prohibited by State or Federal rules or that persons whose permits have been revoked do not receive another, (3) develop a computerized safety training program for working minors, (4) develop a computerized survey for working minors that can be administered during school, and create a Web site/hotline to address student work safety concerns. Data from the anonymous school-based surveys will be used to determine whether youth who have obtained a work permit are less likely to experience a work-related injury.

Connecticut Occupational Disease Surveillance Enhancement Project

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Keywords/Phrases: Surveillance, event reporting, occupational disease

Purpose:

To improve occupational disease event reporting.

Abstract

The primary objective of the Connecticut Occupational Disease Surveillance Enhancement Project is to improve the overall completeness, timeliness, and continuity of occupational disease event reporting in the State. This enhancement in surveillance capacity will allow for the development of improved interventions targeted at the primary prevention of occupational diseases in Connecticut workplaces. This primary objective will be achieved through activities focused on addressing the aims of the proposed research, which are to (1) assess the completeness of reporting for occupational asthma, burns, and skin disease within the State through comparison with existing data sources, (2) assess the knowledge, attitudes, and practices of primary care physicians and selected specialists, as they relate to occupational diseases and reporting requirements and to target interventions to stimulate more complete reporting of occupational diseases from primary care physicians to the Connecticut Department of Public Health, (3) assess internal and external capacity for future development and implementation of a NEDSS-compliant electronic reporting system for occupational diseases, (4) identify factors that influence the continuity of disease reporting from occupational health clinics to the Department of Public Health and develop interventions aimed at ensuring continuity of reporting from individual clinics, and (5) enhance processes for disseminating occupational disease information to appropriate clinicians and public/private sector decision makers and identify and address ongoing and emerging occupational health issues affecting the State through formation of an interagency communications committee and the Connecticut Occupational Health Advisory Board.

In general, activities to address these aims will involve comparison of existing Department of Public Health occupational health data with existing data from other sources (i.e., hospital discharge, workers' compensation, Connecticut Department of Labor) to identify barriers to complete and timely reporting of occupational disease events. The proposed activities will also involve collect-

ing new data in the form of surveys to assess physicians' knowledge, attitudes, and practices related to occupational diseases and their willingness to report complete and timely data. Subsequently, interventions incorporating outreach and training will be developed and tested to target factors identified as adversely affecting timely, complete and continuous reporting. Qualitative and quantitative methods of evaluation will be used to identify significant factors affecting reporting and to assess the effectiveness of interventions. Intervention activities will focus initially on smaller areas, with the goal of expanding targeted conditions and effective interventions to larger areas throughout the State toward the end of the study period. In addition, the Connecticut Occupational Health Advisory Board and an interagency communications workgroup will be assembled to identify targets for current and future occupational health surveillance and intervention activities and to implement processes for disseminating occupational disease surveillance data and other information originating from Connecticut Department of Public Health.

• Traumatic Injuries •

Surveillance Research Methods in Construction Injury

Investigator: Judith Glazner, M.S.
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Telephone: (303) 315–7939
Keywords/Phrases: Prospective surveillance, database, construction

Purpose:
To develop a prospective surveillance database on occupational injuries and hazards from a long-term commercial construction site.

Abstract
Construction workers have among the highest rates of occupational injury, yet there are significant challenges in understanding their work exposures and the injuries associated with them for a number of reasons that are closely associated with the way they work. Construction workers are mobile and work for multiple contractors, which makes them difficult to enumerate. Their job sites are constantly changing as are the associated hazards. The work is often done by multiple trade groups on site with different responsibilities, different immediate supervisors, potentially different safety priorities and training requirements, and usually different compensation carriers. Yet the work of one group of workers has great potential to affect the health and safety of other workers. In recent years, the U.S. economy has supported much construction; consequently, the construction trades have attracted Latino workers, presenting new challenges associated with language and cultural differences to the safety and health of workers. The investigators propose to assess occupational injuries and hazards on a long-term commercial construction site in the Denver area with a diverse workforce. The study will take place through collaboration with the University of Colorado's "rolling owner-controlled insurance plan." This arrangement provides a unique opportunity to determine the amount of time workers in various trade groups are exposed to risk and to document their work injuries, the circumstances surrounding those events, and the changing hazards associated with different stages of construction. Data will be collected through a combination of quantitative and qualitative methods that will allow both case-based and rate-based analyses. The result should be improved understanding of the injury experience of workers as well as the context in which injuries occur on complex construction projects, which will be useful for guiding prevention efforts.

Auditory Motion and Pedestrial-Motor Vehicle Collisions

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Telephone: (330) 263–2475
Keywords/Phrases: Vehicle collisions, pedestrians, hearing

Purpose:
To study auditory motion and pedestrian-motor vehicle collisions.

Abstract
This study identifies the specific acoustic conditions that maximize the perceptual bias to hear looming sound sources as closer than actual (the margin of safety effect) and the conditions that allow the earliest possible perception of looming auditory motion (early detection).

Adolescent Farmwork, Fatigue, and Injuries in Colorado

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Keywords/Phrases: Injury, fatigue, farm youth

Purpose:

To study high injury rates in adolescents residing on farms.

Abstract

This study will describe (1) attitudes and behaviors among adolescents 13–18 years of age related to work practices, (2) sleep patterns among adolescents, (3) the injury patterns of 600 adolescents, and (4) the relationship between injuries and adolescent attitude, behaviors, work practices, and fatigue among adolescents residing on Colorado farms. Fatal and nonfatal injuries among adolescents have been reported to be higher on farms than in other environments. Reasons for higher injury rates among adolescents residing on farms are multifaceted and often unclear. Recent research has focused on identifying parental attitudes and behaviors, which place children and adolescents on farms at high risk of injury. Parents directly influence farmwork practices among children and adolescents, and studies to understand parental motivation are important in designing effective educational programs to reduce injuries among adolescents on farms. Further work is needed to address the issue of adolescent behaviors and attitudes, which influence the risk of farm injuries. Other factors contributing to increased risk of injuries on farms must also be considered in the design of a comprehensive educational program to reduce injuries. One such area is the relationship between fatigue in adolescents and the risk of injuries. It has been documented that fatigue due to sleep deprivation leads to a diminished capacity to function effectively in adults. One study focusing on sleep loss in adolescents showed that sleep deprivation in adolescents was also related to the decline in performance. Despite obvious implications such observations may have on farm-related injuries in adolescents, very little work has been done to assess levels of fatigue in adolescents residing on farms.

Workplace Violence Risk in Home Health Workplace

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Keywords/Phrases: Violence, home health care, risk factors

Purpose:

To study the risk of violence in the home health workplace.

Abstract

Workplace violence is recognized as a significant occupational hazard in the health care sector, however, little is known about the magnitude of the problem and effective prevention strategies in the home health care workplace. Home health care workers are exposed to many of the same hazards associated with workplace violence as their counterparts in the hospital environment, but they face additional risk related to the nature of their work. Their work is often highly unpredictable and they have little or no control of the physical work environment. Also, the differing social role of caregiver and client (family or domestic partners) when in the client's home may place these workers at increased risk of assault-related injury. The overall objective of this exploratory research project is to collect pilot data to inform study design, sampling strategy, and measurement of workplace violence in the home health workplace. The pilot project will develop measures for risk factors, threats, and assaults. This pilot project will provide a conceptual and methodological blueprint for a large-scale investigation of workplace violence in home health care via the following aims: (1) develop valid and reliable measures of risk factors for workplace violence in the home health workplaces with a focus on organization of work factors, (2) ascertain empirical sampling parameters of the relevant dependent variables, threats, and assaults to calculate sample size and power estimates for future study examining the association of identified risk factors and assault in home health care, (3) describe the frequency and severity of threats and assault in a sample of Maryland home health workplaces, and (4) develop measures to assess current violence prevention strategies in home health care and their relationship to OSHA guidelines for a comprehensive violence prevention program. Valid and reliable measures of workplace violence in home health care workplaces will be developed through the use of focus groups and a self-administered survey of direct-care providers and administrators from two Maryland home health agencies. Focus group notes and transcripts will be analyzed for the purpose of developing survey questions. Content validity of the instrument will be established by convening a panel of violence experts to rate items for adequacy and relevancy. The survey will then be piloted with a sample of direct-care providers from the two agencies. Survey results will be analyzed to measure the validity and reliability of measures of risk factors for threats and assaults. In addition, the validity of these measures in the home health worker population will be ascertained to develop an empirical sampling strategy for future work. Focus groups will assess the type of preventive strategies in use in home health care. Measurement items based on the framework for OSHA' s 1996 violence prevention guidance for community health workers employers will be developed. Strategies for contacting and conducting

future research among a larger population of home health care workers will be explored.

Risks for Workplace Violence in Long-Haul Truckers

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Telephone: (859) 257–3410

Keywords/Phrases: Risk factors, violence, truckers

Purpose:

To identify risk factors associated with workplace violence among long-haul truckers.

Abstract

The research will investigate the incidence and distribution of workplace violence among female and male long-haul truck drivers and the effects of violence on their mental health. Homicide is the leading cause of death among U.S. women in the workplace and depending on the geographic area, the first, second, or third leading cause of death among all workers. Sixteen percent of workplace homicides are perpetrated by an intimate partner [NIOSH 2001]. The aims of this project are to (1) identify the types of violence that women and men experience while working as a long-haul truck driver, (2) identify risk factors that contribute to violence against truckers and between truckers, (3) differentiate the risks of work-related stress among distinct sociodemographic groups of truckers as they relate to exposure experiences by long-haul truck drivers, (4) determine the prevalence of domestic violence experienced by long-haul truck drivers when their driving partner is their intimate partner, and (5) identify work environment factors that place truck drivers' safety at risk. The project focuses on risk factors related to workplace violence in the long-haul trucking profession. A cross-sectional, nonintervention design using both quantitative and qualitative methods will be used to collect data. A quantitative survey will be conducted on violence-related variables (e.g., harassment, weapons, assault, rape, robbery, worksite security, fatigue, psychological strain, and substance abuse). Qualitative data on violence at the worksite will be collected via 60 phone questions about workplace violence. The findings will assist in the development of interventions to decrease the risk of exposure to violence in the long haul trucking industry. A sequential and staged approach to the analysis of the data will be used.

Evaluation of California Initiatives to Reduce Violence in Healthcare Settings

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Keywords/Phrases: Workplace, violence, health care

Purpose:

To evaluate two initiatives to decrease the workplace violence in health care facilities.

Abstract

In response to a growing awareness of violence against health care workers, the State of California implemented two initiatives to reduce violence in health care facilities. The first initiative was Cal/OSHA's 1993 release of Guidelines for Security and Safety of Health Care and Community Service Workers. These Guidelines describe elements of a comprehensive security program for the health care setting. The second initiative was the California Hospital Safety and Security Act (Assembly Bill 508), which required licensed acute care and psychiatric facilities to implement a comprehensive security program by July 1995. The combination of these two initiatives is unique among States, and no formal evaluation of either of these initiatives has been conducted. The overall goal of this proposed research is to apply a quasi-experimental study design to evaluate the simultaneous effects of these two initiatives. The first objective is to conduct an impact evaluation to determine whether the initiatives led to improve security programs in California hospitals. The second objective is to conduct an outcome evaluation to determine the effects of the two initiatives on incidence rates of violent events in hospitals. Psychiatric and Acute Care Hospitals in California will constitute the intervention population and those in New Jersey will constitute the comparison population. New Jersey was chosen as the comparison state because they follow Federal OSHA guidelines and have no State-based initiatives regarding hospital security programs. At least 150 intervention and 50 comparison hospitals will be sampled using a stratified random sampling method to represent urban safety program material and interviews with the nurse mangers, risk mangers and an average of three staff members within each unit. The security assessment will evaluate environmental modifications, work practice changes, policies and practices implemented, training, security services, management commitment, use of risk assessment, and violent event surveillance. Incident rates of violent events in participating facilities will be the main outcome measure. An interrupted time-series analysis will be used to determine whether the initiatives led to decreases in rats when compared with the comparison hospitals. The relationship between different

components of the security programs and violent event rates will also be examined. This proposal is a unique opportunity to examine the impact of State-based prevention initiatives and to identify the most effective components of hospital security programs.

Organizational Factors Affecting Police Victimization

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Telephone: (202) 454–8318
Keywords/Phrases: Violence, police, prevention strategies

Purpose:
To assess lethal and nonlethal violence sustained by police and recommend relevant prevention strategies.

Abstract
Law enforcement officers are second only to taxicab drivers in terms of the rates at which they are murdered on the job. Their rate of nonfatal violent victimizations exceeds that of taxi drivers and all other occupational groups. Despite the seriousness and importance of the problem of violence against the police and despite considerable changes within agencies over recent years geared toward improving officer safety, surprisingly little is known about the impact of various law enforcement agency initiatives on the level of violence against their personnel. The Police Executive Research Forum (PERF) proposes a project to identify law enforcement agency policies, practices, and training that reduce the incidence of assaults and murders of on-duty police officers. The project will produce policy relevant information for law enforcement agencies that can be used to safeguard police on the streets. The investigators will use multivariate statistical analyses to identify the factors both internal and external to law enforcement agencies that impact on the rate at which police are assaulted/murdered. The dependent variable will be the rates at which officers are assaulted/murdered. The two sets of independent variables will represent (1) factors internal to the agency that might impact officer safety (e.g., training, policies, practices, equipment) and (2) factors external to the agency that might impact the rate at which officers are assaulted/killed (e.g., violent crime rate, poverty level). The second set of variables (external variables), selected based on prior research, are necessary control variables that will enable the investigators to effectively identify the impact of the organizational variables. In addition to a technical report for the funding agency, the investigators will produce a practical guide for law enforcement officers and executives summarizing the findings and outlining recommendations based on the results that can promote the safety of officers on the streets.

Spokane Workplace Domestic Violence Initiative

Investigator: Christopher Blodgett, Ph.D.
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Spokane, Washington
Telephone: (509) 358–7679
Keywords/Phrases: Domestic violence, workplace

Purpose:
To identify and reduce domestic violence in the workplace.

Abstract
Domestic violence is a leading cause of preventable injury and death. Workplace domestic violence is under identified, and programs in the workplace are needed to identify and intervene in domestic violence. This proposal will (1) increase the identification of domestic violence in the workplace, (2) increase the capacity of organizations to prevent workplace violence incidents through preventive policies and early intervention practices, and (3) increase the effectiveness of responses to workplace domestic violence through a coordinated community response to improve the quality of business response, victim supports, and law enforcement intervention. The proposed initiative uses employee and management education, business policy development, the creation of incident reporting strategies to increase the identification of domestic violence in the workplace and a continuing relationship with the intervention team to improve programs over time. A second principal objective of this initiative is to develop the organizational development strategies, management and employee skills, and followup strategies to assure that policies result in effective practices in the workplace. In this initiative, the investigators propose a coordinated community response to assess and reduce the emerging threat, protect the persons at risk, reduce the risk of re-victimization, and reduce the disruption to the mission of the affected business. Key to this coordinated response is the melding of victim support and safety and law enforcement response with businesses' obligations to aid their employees and pursue their mission as organizations. The research team will conduct a longitudinal, randomized outcomes study of the effectiveness of a domestic violence in the workplace intervention that integrates these educational, organizational development, and crisis response components.

Evaluation of Workplace Violence Prevention Intervention

Investigator: Jane Lipscomb, Ph.D.
Affiliation: University of Maryland
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Telephone: (410) 706–7647
Keywords/Phrases: Violence, social service workplace, prevention programs

Purpose:
To conduct a comprehensive assessment of risk factors for violence and occurrences of violence in social service workplaces and to develop and implement a comprehensive violence prevention program in these workplaces.

Abstract
Workplace violence is pervasive in the social service and health care setting. Washington State workers' compensation assault injury data for 1995–2000 ranks Social Services as the highest risk major industry (142.0 per 10,000 workers) followed by Health Services (74.6 per 10,000 workers). Within Social Services, Residential Care ranked second among industries with a rate of 301 per 10,000 workers. The program will be developed in concert with Federal OSHA guidelines for violence prevention. Management commitment and employee involvement are inherent in the design of the proposed study and include the formation and work of joint labor-management advisory groups. A worksite analysis will include focus groups, a pre-intervention survey, and walk-through evaluations. Hazard prevention and control will be accomplished by implementing recommendations from the walk-through survey and focus groups. The advisory groups in consultation with project staff will review and make recommendations for necessary changes to policies and procedures. Training and education will take place in year three of the study. Formative evaluation of the project will be ongoing. The impact of the intervention on staff assault experience will be evaluated one year following implementation of the program. The aims of the proposed five-year project are as follows: (1) describe environmental, organizational, and behavior/interpersonal risk factors for workplace violence present in the social service workplace, (2) assess the assault experience of staff in these workplaces, (3) examine the relationship between organizational factors and staff assaults in this sample of workplaces, (4) design and implement a violence prevention intervention within these workplaces, and (5) conduct a process and outcome evaluation of the intervention in sample workplaces one year following program implementation.

Work-Related Motor Vehicle Crashes: Reducing the Burden

Investigator: Pamela Peele, Ph.D.
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Keywords/Phrases: Database, record linking, employees, motor vehicle crashes

Purpose:
To extend analyses of cost and frequency of work-related injuries and illnesses data for motor vehicle crashes among Philadelphia city employees.

Abstract
Motor vehicle crashes are the single major occupational cause of death for American workers. A great deal has been learned about preventing motor vehicle crashes in the general public. However, little is known about the underlying causes and effective preventive strategies for work-related motor vehicle crashes. This project proposes to (1) create a comprehensive database of municipal employees and their work-related motor vehicle crashes suitable for risk factor analysis. Existing data on municipal workers in the city of Philadelphia will be used, including a broad range of information about all city drivers and vehicles that focuses on the morbidity and economic impacts of crashes and provides the foundation for an ongoing crash surveillance system, (2) develop predictive models to define the determinants of work-related motor vehicle crashes by examining risk factors related to driver characteristics, vehicle factors, and crash factors using retrospectively collected data on the city's workforce and vehicles, and (3) test and validate predictive models of work-related motor vehicle crashes by using prospectively collected data on the city's workforce and vehicles.

Trucking Firm Characteristics, Driver Injury, and Outcome

Investigator: Arthur Oleinick, M.D.
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Telephone: (734) 764–3238
Keywords/Phrases: Traumatic injuries, truck driving

Purpose:
To identify factors associated with the incidence of lost time occupational injuries and illnesses in the trucking industry.

Abstract
Truck drivers had the highest number of occupational injuries and illnesses causing time away from work from

1992 to 1997 and the third highest rates. Except for back injuries, almost no information is available about risk factors for such injuries. Neither the role of personal factors nor that of motor carrier (trucking firm) operating characteristics and vehicle features is understood. This study will (1) calculate incidence rates by motor carrier operating characteristics, fleet size, and truck configuration, (2) estimate medical care use in different medical care settings by social-demographic, truck firm, and medical diagnosis and models using logistic or Poisson regression, (3) model outcomes measured by lost work time using logistic, Poisson, and Cox models, and (4) calculate the predictive value of the resulting models by appropriate methodology. The compensation information will be obtained from a major industrialized State workers' compensation bureau. The study population will consist of about 12,000 workers who had work-related injuries or illnesses occurring from 1996 to 1998. Motor carrier operating characteristics and vehicle features will be obtained from federal or state regulatory agencies. Truck crash information will also be obtained from Federal or State sources.

Occupational Injuries Among Commercial Fishers

Investigator: Dana Loomis, Ph.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
Telephone: (919) 966–2251

Keywords/Phrases: Injury prevention, fishing, injuries

Purpose:

To identify the injuries, musculoskeletal disorders, and risk factors that could reduce injury to workers in the fishing industry.

Abstract

This is a prospective cohort study of occupational injuries among commercial fishers that seeks to (1) measure the incidence of nonfatal occupational traumatic injuries and musculoskeletal disorders, (2) characterize the types and severity of occupational traumatic injuries and musculoskeletal disorders, (3) describe and characterize the work processes, equipment, and environmental conditions, and (4) identify risk factors that could be modified to reduce the risk or severity of injury. The study will be carried out via an intensive 2-year prospective followup of a cohort of commercial fishers in eastern North Carolina. The cohort will be characterized in detail by clinical evaluations conducted at the beginning and every 6 months thereafter. Incident injuries will be ascertained prospectively by telephone interviews conducted weekly during the fishing season. This followup strategy will ascertain injury occurrence in a population that is ordinarily hard to study because of its geographic dispersal and irregular work schedules of participants.

A New Method for Yield Pillar Design to Control Coal Bumps

Investigator: Syd Peng, Ph.D.
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Telephone: (304) 293–7680

Keywords/Phrases: Mining, hazards, engineering

Purpose:

To study the various factors and mechanisms that could induce cascading pillar failures in underground mines and to develop and promulgate guidelines for mine design and operations that prevent cascading pillar failure.

Abstract

In underground room and pillar mines extracting tabular mineral deposits, blocks of mineral deposit called pillars are left to support the required spaces for a safe and healthful working environment for the miners. However, numerous cases of rapid and often violent failure of pillars in a large area with very little or no apparent precursory warnings have been reported in underground evaporate, coal, and metal mines worldwide. This type of pillar failure is termed cascading pillar failure (CPF) often accompanied with devastating effects, such as air blasts, inrush of harmful gases, seismic events, etc. Though a CPF event often has catastrophic effects on the mine structures and production, it poses even greater safety and health risks to the miners. Reported CPF events in the United States so far have not resulted in serious injuries or death. However, CPF events still occur. Therefore, a proactive approach should be adopted to reduce the occurrence of such CPF events and their safety and health consequences. In the development of such a proactive approach, it is necessary for the researchers to understand the mechanism involved in the creation of favorable conditions for, and the initiation and propagation process of, the reported CPF events. The geological, geomechanical and mining factors leading to these types of events should be identified. Once these factors are identified and understood, guidelines for designing the mine layout and mining operation can be developed and promulgated.

Evaluation of Traumatic Injuries in Healthcare Workers During Surgery

Investigator: Denise Korniewicz, D.N.Sc.
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Telephone: (410) 706–7250

Keywords/Phrases: Health care workers, AIDS, hazards

Purpose:
To investigate the factors associated with needlestick/sharps injury during a surgical episode.

Abstract
Twenty two percent of all needlestick injuries have been reported by surgical personnel. Thirty-three percent of the injuries occur in the surgical field and 25% occur at the surgical site. Fifty-nine percent occur with the non-dominant hand. An alternating block design (four

6-month blocks) is proposed to (1) investigate the factors associated with needlestick/sharps injury during a surgical episode and (2) evaluate surgical factors (length of surgery, surgical instrumentation, handedness, use of indicator gloves for needlestick/sharps injury, sequence of surgical cases) that impact on the rate of traumatic (needlestick/sharps) injury among health care workers during surgery. During a 24-month data collection period, all operating room personnel involved in the study will be trained to use an indicator glove and medical devices (blunt suture needles and retractable scalpels) engineered to reduce the rate of needlestick/sharps injuries. Data will be collected by circulating room nurses for type of surgery health care worker identification, role of health care worker, surgical instruments used during a surgical episode, and numbers of glove changes during the episode. Following the surgical event, all gloves will be collected, visually inspected for defects, cuts, and holes, and tested for barrier integrity via the standardized FDA waterleak test method (1000cc/2 min).

A Strong Construction Injury Prevention Intervention at the Subcontractor Level

Investigator: Pete Stafford, M.S.
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Keywords/Phrases: Intervention, construction, injuries

Purpose:
To develop and evaluate a method that can be used to lower injury rates in the construction industry.

Abstract
The goal of this proposal is to lower injuries in construction, using methods that are easily applicable to the entire construction industry. The proposal aim is to show that introducing strong injury prevention methods similar to those used at industry-leading companies (at the level of the subcontractor) can improve safety practice and lower injuries. The methods to be used to achieve this goal are (1) collect best practice safety programs and develop the intervention safety program, (2) recruit 40 medium to large contractors from four geographic areas (more than 50 full-time equivalent construction workers) who are willing to institute a strong safety program but do not currently have one, (3) develop and implement the program at each of the 40 contractors, (4) perform a safety visit to a worksite for each company every 2 months to ensure that the company is following its safety policy, (5) perform control safety visits to matched sites—similar in size, trade and craft, work type, and location to contractors not in the study, to determine the present state of safety practice throughout the length of the study period, and (6) gather injury data (OSHA 200 logs and construction work hours) and calculate injury rate and lost-time injury rate for the study group. Control group injury data will be sought from OSHA logs and worker hours of the companies seen at control sites. The expectation is that the 40 companies will significantly improve their safety practice over the background safety practice and will lower their injury rates.

Wisconsin Dairy Traumatic Occupational Injury Intervention

Investigator: Larry Chapman, Ph.D.
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Telephone: (608) 262–7408

Keywords/Phrases: Agriculture, traumatic injuries, intervention

Purpose:
To implement and evaluate the effectiveness of an intervention in agriculture intended to prevent and reduce traumatic agricultural injuries.

Abstract
The investigators plan to build on ongoing intervention among the 21,000 dairy operations in Wisconsin that constitute 20% of the Nation's operations and employ more than 73,500 workers. Since no effective workplace safety regulation exists for most of this industry, this intervention strategy focuses on encouraging the adoption of production practices that are more profitable as well as safer. The principal outcome measures are those that monitor the intervention's success at the population

level (i.e., what percent has adopted each innovation, what percent is aware). In this application, the researchers plan to accomplish three aims: (1) Continue, for 3 additional years, a community-based, information-dissemination intervention among Wisconsin dairy producers that will reduce traumatic injuries by persuading operation managers to adopt safer and more efficient work methods. The investigators will reduce hazards (and thereby injuries) by improving information flow to dairy operation managers to persuade them to adopt production methods that are both safer and more profitable. The research will continue the intervention in the first year of this application when other funding ends. (2) Conduct annual, large-sample, questionnaire evaluations by mail of the information dissemination intervention that include both process and outcome measures. The investigators intend to determine whether (a) our materials are reaching the target audience and which intervention aspects are most effective, (b) dairy producer adoption and awareness of each production method have increased, and (c) dairy farmer perceptions of each hazard-reducing production method's relative safety or profit advantages are improving. (3) Add one or two traumatic injury-reducing production methods to the intervention in each of the 3 additional intervention years. The researchers will seek out reports from farmers and others about emerging production methods that could improve both safety and profits and add one or more of the new production methods to the intervention to promote statewide at the start of year 6, year 7, and year 8.

Purpose:
To develop, institute, and validate a program for hospital-based occupational latex allergy diagnosis, monitoring, and prevention that can also be used by other health care facilities.

Abstract
The hypothesis of this proposal is that substitution of powdered latex gloves is sufficient to protect unsensitized but predisposed employees from becoming sensitized and to prevent allergic symptom induction in health care workers who have already become sensitized to natural rubber latex allergens. Using state-of-the-art serology, skin testing, and glove provocation testing the investigators propose to (1) determine the initial prevalence of type I latex sensitization in high risk operating room health care workers all exposed to latex aeroallergen except in one group of workers who have instituted personal avoidance of latex exposure by substituting nonlatex examination gloves compared with another group who continue to use sterile powdered natural rubber latex gloves, (2) assess the effectiveness of the avoidance intervention to convert the hospital to a latex-safe workplace with longitudinal measurements in latex-sensitized workers and assessment of occupational latex exposure in the operating rooms by measuring the extractable and airborne latex allergen concentrations in natural rubber latex gloves used by the surgeons and nurses, (3) identify potential genetic markers for latex allergy, and (4) develop a generic protocol to facilitate conversion of any hospital to a latex-safe environment. The investigators believe that this project of validating a program for hospital-based occupational latex allergy diagnosis, monitoring, and prevention will provide a framework for hospitals throughout the United States to help them convert to a latex-safe environment.

2 Cooperative Agreements

• Allergic and Irritant Dermatitis •

Assessing Latex Avoidance on Occupational Sensitization

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Keywords/Phrases: Diagnosis, latex allergy, hospital-based

• Infectious Diseases •

Surveillance of Bloodborne Pathogens

Project Director: Janice Huy
Division: DSHEFS
Telephone: (513) 841–4245
Project ID: 9277298
Keywords/Phrases: Health care workers, human immunodeficiency virus (HIV), surveillance
Purpose:
To collect and analyze data on health care worker exposure to bloodborne pathogens.

Abstract
This project will collect data related to exposure to bloodborne pathogens among health care workers employed in nonhospital settings through two cooperative agreements, an analysis of bloodborne pathogen exposure data collected through CDC's NaSH surveillance system and the development and implementation of CDC's NaSH-lite surveillance system. The expected outcome is the identification of the major risk factors and potentially identifying factors for future intervention activities to reduce bloodborne pathogen exposures.

• Intervention Effectiveness Research Methods •

Effectiveness of Interventions for Customer Service Work

Investigator: Robert Spear, Ph.D.
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Telephone: (510) 642–0761
Keywords/Phrases: Arm and hand pain, ergonomic interventions, computer-based customer service

Purpose:
To determine whether ergonomic and work organizational interventions can reduce arm and hand pain, reduce lost time, and improve hand function in computer-based customer service work.

Abstract
Computer-based customer service work (e.g., call centers) is one of the most rapidly expanding occupations in the service sector, in health care, banking, retail trades, and finance. The work ranges from telephone and computer-based nursing advice to health insurance inquiries to billing collection services. According to industry figures, there are 60,000 call centers in the United States. Musculoskeletal discomfort and disorders of the neck, shoulder, arm, wrist, and hand are the most common occupational health problems reported in these occupations and account for the majority of work-related lost time. This is a 12-month, group-randomized intervention study with three treatment arms: (1) ergonomic workstation modifications, (2) work organizational intervention to increase job control, and (3) a combination of (1) and (2). A total of 255 subjects will be recruited to the study. The outcome measures are monthly: upper extremity pain severity, hand function scores, lost time, and productivity. In addition, intervention costs will be assessed. A baseline questionnaire will assess possible co-variates (e.g., gender, age, home activities, etc.); the role of significant covariates will be assessed in the data analysis. The study has the potential to identify workplace interventions that can improve the health of workers performing computer-based customer service work.

Evaluation of Exposure Control in the Autobody Industry

Investigator: Sue Ann Sarpy, Ph.D.
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Telephone: (504) 584–1774
Keywords/Phrases: Exposure control matrix, risk decrease, automotive body shops

Purpose:
To assess the efficacy and effectiveness of the exposure control matrix in risk reduction in automotive body shops.

Abstract
In 1995, the Environmental Protection Agency (EPA), the Occupational Health and Safety Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), and members of the automotive refinishing industry formed the Voluntary Product Stewardship Partnership. The primary objective of the efforts was to pursue feasible and effective approaches to reducing the risk to the environment and to the safety and health of workers during automotive refinishing operations. On the basis of the problems identified, NIOSH developed recommendations for the automotive refinishing industry involving respiratory protection, engineering controls, and types of spray equipment use for controlling worker exposure to air contaminants in the facilities. NIOSH concluded the auto refinishing industry was at a high level for health, safety, and environmental concerns. In conducting this research program, a systematic evaluation of the exposure control matrix will be conducted by (1) describing and developing a baseline of current recommended exposure reduction work practices in the New Orleans metropolitan area for painters in automotive body shops and (2) implementing the exposure control matrix recommendations in selected large and small automotive body shops in the New Orleans metropolitan area and assessing the effectiveness and efficacy of the exposure control matrix intervention in reducing health risks and enhancing painter safety.

• Low-Back Disorders •

Home Health Care: Identifying and Reducing Work

Project Director: Traci Galinsky
Division: DART
Telephone: (513) 533–8150
Project ID: 9278030
Keywords/Phrases: Health care workers, research, ergonomics

Purpose:
To quantify the frequency of the occurrence and the severity of resultant illness and injuries caused by home health care work hazards.

Abstract
This research will evaluate interventions to reduce home health care hazards, focusing on reducing musculoskeletal strain during patient lifting. Existing interventions such as gait belts and transfer boards will be evaluated, and a new intervention comprising a mechanical patient lift customized for home health care workers will be developed and evaluated. Data will be obtained from thousands of home health care workers across the United States. Data sources will include (1) worker compensation records, (2) workers' reports of hazards, injuries, and illnesses, and (3) worksite job analyses and safety assessments conducted by safety and health experts. Results will provide information regarding the usefulness of existing and new interventions and suggest directions for future research.

• Mixed Exposures •

Initial Respiratory Responses in Welding Apprentices

Project Director: Nancy Bollinger
Division: HELD
Telephone: (304) 285–6121
Project ID: C9277103
Keywords/Phrases: Mixed exposures, chronic pulmonary obstructive disease, infections disease

Purpose:
To provide new epidemiologic evidence of the association between exposures to welding fumes and acute respiratory disease.

Abstract
Despite some inconsistencies in study results, evidence of an association between welding fume exposure and occupational asthma has been growing over the past 15 years. Most of the earlier epidemiological studies concerning welding exposures and respiratory effects have been limited by their cross-sectional study design, the selection of study populations with extensive welding experience, and limited information on the timing and nature of exposures to welding fumes. The investigators propose a study of 200 welding apprentices in which airway reactivity and acute respiratory responses will be measured early in the apprentices' careers, within 6 months of their first welding exposure. Since welders who experience respiratory problems due to welding are less likely to stay in the welding field longterm, a study of welding apprentices who are just entering the field has the advantage of including workers who experience respiratory problems early on. The study design focuses on short-term changes in pulmonary function parameters with simultaneous extensive exposure assessment that will include real time measurements of particulates, and (on a subsample) NOx. Average exposure concentrations during the training session will be provided for these variables and for fluoride. Recent evidence suggests an acute respiratory response 15 minutes after first daily exposure to welding, so pulmonary function and respiratory symptoms will be measured before the start of a welding training session, 15 minutes after the first weld, and at hourly intervals throughout the welding session. The real time personal exposure measurements will be used to identify peak concentrations and all measures will contribute to measuring average exposures in the specified time intervals above. These exposure variables will be examined in relation to respiratory responses, and airway reactivity will be measured by response to methacholine before and after apprentices have learned to weld. In addition, determinants of welding exposures will be identified by considering factors such as ventilation, type of welding work, and worker habits. This study will provide insights into the nature of the association between welding exposures and acute respiratory responses. Recommendations will be made for the most effective respiratory and exposure variables to use in epidemiological assessments.

Assessment of determinants of exposure will also be useful for consideration of exposure control options.

• Musculoskeletal Disorders of the Upper Extremities •

Exposure Response Relationship in Hand Arm Vibration

Project Director: Martin Cherniack
Division: HELD
Telephone: (860) 679–4916
Project ID: C9277083
Keywords/ Phrases: Vibration, musculoskeletal disorders, exposure assessment

Purpose:
To study four cohorts of workers exposed to vibration in their jobs in Europe and North America to characterize exposures and identify hand-arm vibration as one of three foci of the Musculoskeletal Disease Consortium.

Abstract
Exposure to vibrating tools produces several characteristic disorders affecting tissues of the upper extremity, which collectively are termed the hand-arm vibration syndrome. NIOSH has recognized the importance of exposure and response relationships in hand-arm vibration by identification as one of three foci of the Musculoskeletal Disease Consortium. This proposal represents the combined plan of investigators from Canada, Finland, Sweden and the United States to study four vibration exposed cohorts in Europe and North America. These cohorts include the Suomossalmi forest worker cohort in Finland, the Volvo truck cab assembly workforce in Umea, the Electric Boat shipyard workforce in Connecticut, and Connecticut dental hygienists exposed to high frequency vibration. Dental hygienists appear to experience rapid onset injuries to mechanoreceptors in the fingers. The three industrial cohorts have been studied. Their restudy reflects the intent to use existing exposure data, and to assure cohort participation where health effects have been quantified and where there are usable prior studies. The latter point is important because the proposed study period may be too brief to appreciate intra-subject change. Worksite selection reflects exposure variation and inclusion of impact (Volvo) and high frequency vibration (dental hygienists). Medical tests (laser Doppler, cold challenge plethysmograpy, multifrequency vibrometry, and fractionated digital nerve conduction) are sophisticated and reflect physiologic understanding. Exposure assessment is the most complex component of this study. It includes vibratory and biomechanical assessment of cohort representatives and individual monitoring of daily work routines using individualized data loggers and sensor gloves. This level of detail, which has not been previously applied, reflects the necessity of assessing daily real-time exposure corrected for biomechanical variables.

Program for the Prevention of Work-Related Musculoskeletal Disorders

Project Director: Susan Burt
Division: DSHEFS
Telephone: (513) 841–4594
Project ID: 9277328
Keywords/Phrases: Musculoskeletal disorders, epidemiology, ergonomics

Purpose:
To describe exposure-response relationships between physical job stressors and the prevalence and incidence of upper limb and low-back musculoskeletal disorders, and to further develop practical exposure assessment methods including the NIOSH lifting index.

Abstract
Strong evidence exists of causal relationships between combined job physical stressors and musculoskeletal disorders (MSDs), but more quantitative information to describe exposure-response relationships would be helpful. The predictive power of the lifting index will be further evaluated and data will be used to further describe the shape of the exposure-response curve. Further, development of methods to evaluate upper limb exposures will be beneficial to promote the use of standard, practical, and valid tools for identifying and prioritizing jobs for intervention and for assessing the effectiveness of interventions to reduce physical job demands. The anticipated impact of this project is that practitioners in occupational health fields will be able to use these methods to easily and accurately discriminate job tasks that represent low, moderate, and high risk for upper limb and low back MSDs, resulting in more effective job design changes or interventions in existing jobs to prevent these disorders.

A two-year prospective cohort study of 4000 employees in approximately 40 workplaces in the service and manufacturing industries will evaluate exposure-response relationships between physical job stressors and work-related musculoskeletal disorders. Four projects comprise this program: The first focuses on carpal tunnel syndrome (CTS), hand-wrist tendinitis, and epicondylitis. The second project focuses on hand-arm vibration syndrome. The third project focuses on low back pain. The fourth project will evaluate the effectiveness of engineering interventions in a subset of jobs included in the exposure-response studies. Data from some participants may be utilized for more than one of these projects. Health outcomes will be defined based on physical

examinations including nerve conduction studies, a battery of sensorineural, circulatory, and neurobehavioral tests for hand-arm vibration syndrome; and questionnaires. Exposure assessment includes videotape analysis of each participant's job tasks, calculation of the NIOSH lifting index, and measurement of hand-transmitted vibration. State-of-the-art exposure assessment methods will be used to assess hand activity level, forceful exertion, and other upper limb stressors. FY01 accomplishments include: (1) Obtained OMB approval of study proposal. (2) Completed exposure and health assessment protocols and obtained Human Subjects Review Board approval for them. (3) Completed pilot studies testing these protocols. (4) Finalized protocols accordingly. (5) Recruited and selected companies that meet study criteria to participate in the study. (6) Conducted baseline data collection at 4–8 sites. Expected accomplishments include continue recruiting and selecting companies into the study; continue site visits to conduct initial job evaluations to determine whether jobs are suitable for the study; and conduct baseline data collection at 16 sites.

• Surveillance Research Methods •

Occupational Surveillance Modules for Prevention

Investigator: David Bonauto, M.D., M.P.H.

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Olympia, Washington

Telephone: (360) 902–5664

Keywords/Phrases: Surveillance model, occupational conditions

Purpose:
To develop and implement a comprehensive model occupational surveillance program for priority conditions including work-related asthma, adult blood-lead poisoning, upper extremity musculoskeletal disorders, low-back disorders, dermatitis, hospitalized burns, traumatic head and brain injuries, and assaults.

Abstract
Through surveillance of several NORA, Healthy People, and Washington State Department of Labor and Industries priority conditions including occupational asthma, adult lead poisoning, musculoskeletal disorders of the upper extremity, low-back disorders, dermatitis, hospitalized burns, traumatic head and brain injuries, and assaults, the Safety and Health Assessment and Research for Prevention (SHARP) program will demonstrate the application of a comprehensive occupational surveillance program. Through demonstration of the proposed surveillance program, SHARP will create a systematic model for adoption by other States. To allow for adaptability, SHARP proposes development of a modular approach that demonstrates several approaches to outcome-based surveillance, hazard-based surveillance, and subsequent prevention activities. The proposed project will address the following aims: (1) conduct a survey of State-based occupational surveillance programs to determine currently employed approaches to surveillance and prevention, program capabilities, and program opinion leaders, (2) demonstrate a modular approach to occupational surveillance that will encompass the use of different data sources for priority conditions selected by an individual program, (3) develop modules for the creation, dissemination, and evaluation of prevention efforts, (4) conduct an employer/employee survey to further identify etiologic agents or practices in one identified industry, (5) develop an Internet-based library of surveillance modules and prevention materials, (6) produce and disseminate three surveillance reports for WA State priority conditions per year, and (7) produce and disseminate two prevention reports to employers or employees per year. Through the proposed project, SHARP will demonstrate the use of several data sources for the surveillance of occupational diseases and hazards. Further, SHARP will demonstrate the analysis of such data, the creation of simple public health interventions using surveillance data, the implementation of interventions, and the evaluation of interventions using surveillance data. Finally, SHARP will produce a Web-accessible library of materials detailing the methodology of the various components of the surveillance program, including prevention materials that may be modified and disseminated in other States.

Improving Data Quality in Pesticide Illness Surveillance

Investigator: Lynden Baum

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Telephone: (360) 236–3361

Keywords/Phrases: Pesticide illnesses, quality of data, surveillance

Purpose:
To enhance the utility and linkages to prevention of the pesticide illness surveillance system in Washington State.

Abstract
Washington State has required investigation of all reported suspected pesticide-related illnesses since 1970. Although Washington has successfully initiated several

effective interventions on the basis of this data, the usefulness of the data for developing such interventions has been limited because of weaknesses of the data and of the data management system. Increasing the value of the information produced by Washington's occupational pesticide illness surveillance system must be based on a systematic evaluation and enhancement of data quality, data collection procedures, and data analysis and interpretation. The aim of this project is to increase the value of the information generated by the pesticide illness surveillance system as a means of formulating and evaluating more effective intervention efforts to protect workers from pesticide exposures and illnesses. This project will (1) evaluate and improve the quality of data collected by the surveillance system by assessing the quality of data produced by each of its components data sources through investigation of the degree and determinants of underreporting through focus groups and a review of outpatient record, and development of a system for incorporating incident data into a geographic information system, (2) improve the functionality and compatibility of the database management system by incorporating functions to analyze and export data using NIOSH variable definitions, coding, and format, and (3) enhance the analysis of the surveillance data and expand the dissemination of program and policy relevant information derived from surveillance data. This will be accomplished by gathering input from stakeholders on questions that need to be addressed, developing short-focused reports on these topics, evaluating the usefulness of these reports, and institutionalizing those analyses and reports that generate information that directly helps to develop and evaluate intervention policies and programs.

The Youth Employment Training Pilot Program

Investigator: Henry Anderson, M.D.
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Madison, Wisconsin
Telephone: (608) 266–1253
Keywords/Phrases: Youth occupational injury, surveillance, computerized

Purpose:
To develop and implement a new occupational surveillance model for targeting youth injuries.

Abstract
Despite decades of protective legislation and enforcement, working children continue to be exposed to injury on the job. No youth surveys have been conducted to determine the incidence of occupational injuries in Wisconsin. Existing data comes from workers' compensation claims. This project will develop and implement a new model for youth occupational injury surveillance in Wisconsin. This model will link injury surveillance with the Wisconsin youth work permit system. Within the next two to three years, the Wisconsin Department of Workforce Development plans to computerize the current child work permit system. Now, during the initial computerization planning process, is an opportune time to develop a surveillance component that can be incorporated into the work permit application system. Upon successful completion, the proposed pilot study could affect the statewide implementation of the Department of Workforce Development program and expand the linked injury surveillance and the work permit application system to all of the public high schools in Wisconsin. Currently, no comprehensive occupational safety training program exists for working Wisconsin youth nor is there easy youth access to safety information or a mechanism for getting questions answered. The project will (1) develop a computerized youth work permit application, (2) develop and maintain a computerized work permit database to make sure that jobs are not prohibited by State or Federal rules, or that persons whose permits have been revoked do not receive another, (3) develop a computerized safety training program for working minors, (4) develop a computerized survey for minors who are working that can be administered during school, and (5) create a Web site/hotline to address student work safety concerns.

Core Occupational Health Surveillance in Massachusetts

Investigator: Letitia Davis, Sc.D.
Affiliation: Massachusetts Department of Public Health
Boston, Massachusetts
Telephone: (617) 624–5621
Keywords/Phrases: Surveillance, prevention, occupational endpoints

Purpose:
To develop, implement, and evaluate a core occupational health surveillance program to promote prevention at the State and local levels that can serve as a model for other States.

Abstract
Work-related injuries and illnesses are a significant public health problem in the United States, imposing substantial human and economic costs. Surveillance of work-related illnesses, injuries, and hazards is essential to establish research priorities and to target, design, and evaluate prevention efforts. Surveillance is needed at the state and local as well as national levels. This core program will include surveillance of multiple occupational

health/hazard endpoints. The aims of the proposed project are as follows, falling into four major categories:

Sentinel event surveillance:
(1) refine the list of high priority occupational health conditions that should be placed under sentinel case surveillance in all States, (2) develop surveillance protocols for high priority conditions and implement surveillance in Massachusetts, and (3) evaluate prevention impact of sentinel event surveillance activities, and revise model core program.

Population-based surveillance:
(1) describe existing population-based sources of data on health conditions, hazards, and the worker populations at risk that may be used for occupational health surveillance at the State and local levels, (2) conduct analyses of priority data sets; prepare and disseminate surveillance reports, (3) assess the relative utility of these different population-based approaches to surveillance and propose schedule of core population-based surveillance activities.

Intervention and prevention:
(1) continue and expand working relationships with prevention partners to promote the use of surveillance findings for public health action at the State and local levels and (2) develop mechanisms to improve dissemination and use of surveillance findings.

Regional collaboration:
work with other States in the Northeast to obtain their input in defining core occupational health surveillance functions and to promote the development of State occupational health surveillance capacity and (2) produce a set of written "surveillance tools" that can be used/adapted by other States working to build core programs.

The Massachusetts Department of Public Health will work with the NIOSH State Occupational Surveillance Consortium in developing a final report and set of consensus recommendations regarding core occupational health surveillance activities in the states.

Connecticut: Occupational Disease Surveillance Enhancement Project

Investigator: Mary Lou Fleissner, Dr.P.H.
Affiliation: State of Connecticut Department of Public Health
Hartford, Connecticut
Telephone: (860) 509–7740
Keywords/Phrases: Occupational disease, event reporting, intervention

Purpose:
To improve the overall completeness, timeliness, and continuity of occupational disease event reporting.

Abstract
Enhancement in surveillance capacity will allow for the development of improved interventions targeted at the primary prevention of occupational diseases in Connecticut's workplaces. The primary objective of this project will be achieved through activities focused on addressing the aims of the proposed research, which are to (1) assess the completeness of reporting for occupational asthma, burns, and skin disease within the state, through comparison with existing data sources, (2) assess the knowledge, attitudes, and practices of primary care physicians and selected specialists as they relate to occupational diseases and reporting requirements and to target interventions to stimulate more complete reporting of occupational diseases from primary care physicians to the Connecticut Department of Public Health, (3) assess internal and external capacity for future development and implementation of a NEDSS-compliant electronic reporting system for occupational diseases, (4) identify factors that influence the continuity of disease reporting from occupational health clinics to the Connecticut Department of Public Health and develop interventions aimed at ensuring continuity of reporting from individual clinics, and (5) enhance processes for dissemination of occupational disease information to appropriate clinicians and public/private-sector decision makers and to identify and address ongoing and emerging occupational health issues affecting the state, through formation of an interagency communications committee and the Connecticut Occupational Health Advisory Board.

In general, activities to address these specific aims will involve comparison of existing occupational health data with existing data from other sources (i.e., hospital discharge, workers' compensation, Connecticut Department of Labor) to identify barriers to complete and timely reporting of occupational disease events. The proposed activities will also involve collection of new data in the form of surveys to assess physicians' knowledge, attitudes, and practices related to occupational diseases and their willingness to report complete, and timely data. Subsequently, interventions incorporating outreach and training will be developed and tested to target factors identified as adversely affecting timely, complete and continuous reporting. Qualitative and quantitative methods of evaluation will be used to identify significant factors affecting reporting and to assess the effectiveness of individual interventions. Specific intervention activities will focus initially on smaller areas, with the goal of expanding targeted conditions and effective interventions to larger areas throughout the state toward the end of the study period. In addition, the Connecticut Occupational Health Advisory Board and an interagency communications work group will be assembled to identify targets for current and future occupational health sur-

veillance and intervention activities and to implement processes for disseminating occupational disease surveillance data and other information originating from Connecticut Department of Public Health.

3 Intramural Projects

• Allergic and Irritant Dermatitis •

Hazard Identification Core

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277361
Keywords/Phrases: Latex, allergies, immunotoxicology
Purpose:
To provide a centralized core to the NORA project Developing Dermal Policy Based on Lab and Field Studies that will yield data to the program investigators on the potential for a chemical/mixture to induce irritant dermatitis or allergic sensitization in workers.

Abstract:
This project will use validated and other published assays to provide hazard identification and dose response data on the potential for a chemical/mixture to cause irritant dermatitis or allergic sensitization. To accomplish this, the chemicals/mixtures will be applied topically to the rodent ear, and ear swelling will be measured as an indicator of irritation; the proliferation of draining lymph node cells will serve as an indication of chemical sensitization potential, and the type of cells in the draining lymph node will provide information to differentiate contact sensitizers from IgE producing sensitizers. This core data will provide basic information necessary for the development of dermal policy.

The Role of Dextran Powder in Latex Hypersensitivity

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278984
Keywords/Phrases: Latex, allergies, immunotoxicology
Purpose:
To investigate the role of dextran powder found in latex gloves in developing latex allergy.

Abstract:
Studies to date have evaluated the mitogenicity of dextran glove powder and determined that although naive dextran does not induce a proliferative response from naive splenocytes, powder removed from the inside of latex gloves does demonstrate mitogenic activity. Glove powder is contaminated with endotoxin, and this has been shown to have an immunomodulatory effect on the production of latex-specific IgE by inducing a class switch to IgG2a. Studies are currently evaluating the cytokine modulation induced by endotoxin to determine the mechanism of this effect. A new inhalation exposure chamber for exposure to dextran powder has been designed and manufactured by members of the Engineering Control Technology Branch (ECTB). Because of the limited amount of latex proteins available, a surrogate protein, ovalbumin, has been chosen to conduct preliminary studies on the potential adjuvancy of dextran glove powder. Once the model is established, including the concentrations of powder to be used, a single study will be conducted with latex proteins and glove powder.

The Role of the Route of Exposure in the Development of Latex Hypersensitivity

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278985
Keywords/Phrases: Models, mechanisms, latex allergy
Purpose:
To develop animal models of latex allergy, to investigate mechanisms underlying latex sensitization, and to provide models for testing intervention strategies.

Abstract:
Models will be developed to reproduce the hypothesized conditions by which health care workers (topical and respiratory) and spina bifida patients (subcutaneous to represent surgical exposure) are exposed to natural rubber latex (NRL) proteins. Animal models will be used to determine levels of NRL proteins required for sensitization (development of total and latex-specific IgE) following different routes of exposure, and pulmonary reactivity will be evaluated in these animals following respiratory challenge.

Can One Assay Identify Potential Allergies and Irritants and Distinguish Type 1

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telehone: (304) 285-6121
Project ID: 9278986
Keywords/Phrases: Allergies, immunotoxicology, hazards

Purpose:
To develop methods for the identification and differentiation of chemicals with the capacity to elicit irritation, IgE mediated, or T cell mediated hypersensitivity responses.

Abstract:
This research will combine the parameters of an ear swelling assay for irritation with phenotypic analysis of the lymph nodes draining the sites of chemical exposure using flow cytometry; these methods have the potential to significantly reduce the number of animals used and time and expense required for chemical testing. As part of an international effort, these assays are being modified to evaluate the potential for chemicals/drugs to induce systemic immune responses. Gene array analysis and RT-PCR are being used to identify candidate genes that are differentially expressed following different chemical treatments and can be used as an alternative endpoint for differentiating chemicals with irritancy or sensitizing potentials. This data may also provide new insights into mechanisms of chemical-induced hypersensitivity. Although developed for use in hazard identification, with refinement these methods may prove useful in risk assessments for occupational hazards.

The Percutaneous Absorption of Latex Proteins

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278989
Keywords/Phrases: Latex, skin, health, services

Purpose:
To investigate the role of the skin in the development of latex allergy.

Abstract:
The researchers have developed an in vitro percutaneous penetration model to conduct this research. Studies with human surgical tissue and hairless guinea pig skin have demonstrated that hairless guinea pig skin is a good surrogate for human skin. Latex proteins have been shown to penetrate the skin with approximately 1% penetrating intact skin and up to 30% penetration seen when the skin is abraded. Investigations are currently under way to determine the correlation between individual protein penetration and the differential serum recognition among various exposure groups. Studies are also under way to evaluate the effects of contaminants found in the health care environment on the skin barrier and the way this affects latex protein penetration. Information gained from in vitro and in vivo penetration experiments will be useful in developing intervention strategies to prevent latex sensitization.

Effect of Mixed Dusts on Asthma and Pulmonary Infectivity

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278181
Keywords/Phrases: Mixed dusts, immune-suppresive effects, infection

Purpose:
To evaluate the immune-suppressive effects of three mixed dusts (welding fume, diesel exhaust particles, and boiler bottom ash).

Abstract:
The hypotheses to be tested is that mixed dusts contain components (organic compounds and metals) that lead to immune suppression and enhanced susceptibility to infection. The aims of this project include the following: (1) determine the potential effects of mixed dusts on innate immunity by measuring the number and function of natural killer cells in the spleen and blood, (2) evaluate cell-mediated immune status by measuring the number and function of T lymphocytes using flow cytometry and the mixed lymphocyte response in the spleen and blood, (3) evaluate humoral immunity by measuring the number and function of B lymphocytes using flow cytometry and the IgM antibody response to the T dependent antigen sheep erythrocytes, (4) for any given alteration in the immune system, perform a reversibility study by assessing the same parameters after a 2-week period without exposure, and (5) determine the effects of mixed dusts on the in vitro IgM antibody response using a metabolic activation system. If data derived from this in vitro system is consistent with the results from the in vivo studies, the assay can be used on fractionation studies to rapidly determine the active chemical component(s). For the in vitro test system, the Mishell-Dutton assay will be used to assess the immune response in the presence of asphalt fumes' condensate or condensate

fractions. The results will significantly advance the understanding of mixed dust exposures from a mechanistic and dosimetric perspective.

Developing an Engineering Control Knowledge Base

Project Director: Ronald Mickelson, B.S.Ch.E, M.S., P.E.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278164
Keywords/Phrases: Skin, dermatitis, intervention
Purpose:
To provide engineering assistance for current and emerging dermal absorption problems.

Abstract:
This project will evaluate work processes in a holistic fashion to determine whether chemical substitution, process modification, work practice modification, or engineering controls can reduce skin exposure. The investigators will make recommendations based on evaluations of which control scenario will best fit the process in question. The investigators will also implement and evaluate the effectiveness of the control scenario. This process will be conducted at four to five sites to demonstrate the significance and applicability of this control approach. Reports for each site will be completed and peer-reviewed papers will be submitted for publication. NIOSH policy will be developed regarding engineering controls for these dermal hazards.

NORA DERM: Development of Decision-Making Procedures and Documents

Project Director: Heinz Ahlers, J.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278009
Keywords/Phrases: Dermatitis, hazard recognition, exposure assessment
Purpose:
To develop a series of documents to inform workers and employers and to set forth NIOSH recommendations for classifying substances as contact or allergic dermatitis agents or systemic toxins due to dermal exposure.

Abstract:
The documents developed through this project will set forth NIOSH recommendations for classifying substances as contact or allergic dermatitis agents or systemic toxins due to dermal exposure. Methods for hazard recognition and exposure assessment and the effectiveness of potential exposure-reduction approaches also will be discussed. NIOSH will convene conferences in support of the program. In FY01, the investigators developed scientific journal publications and have completed a draft NIOSH-numbered publication on the identifications and control of dermal hazards. In FY02, an international conference on occupational dermal hazards was convened in Washington, DC. A series of NIOSH-numbered publications on the identification and control of the dermal hazards is being developed. Publications will be completed on skin decontamination, and identifying dermal hazards has been completed. A contract for collecting data on compounds with NIOSH "skin" notation was completed. In FY03, the NIOSH skin notation will be updated.

Developing Healthy and Dermatitis Skin Absorption Models

Project Director: Sidney Soderholm, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277084
Keywords/Phrases: Skin, exposure assessment
Purpose:
To develop and evaluate two skin model systems (healthy and dermatitis skin) at their in vivo and in vitro levels and use the models to investigate the disposition of 11 chemicals in the body.

Abstract:
This laboratory-based dermal project will investigate the behavior of skin surface penetrants. Skin penetration, tissue distribution, skin metabolism, dermal absorption, and systemic disposition will be fully characterized. Full mass balance studies will ensure data reliability and relevant application in occupational risk assessment. Advanced skin bioengineering, analytical chemistry, cellular biology/immunohistology, and computerized physiologically based toxicokinetic modeling will be used. The result will be a uniquely valuable set of data that will guide the development of recommendations for avoiding skin overexposures and harm in the work place.

Quantitative Structure-Activity Relationship Modeling

Project Director: Eugene Demchuk, Ph.D.
Division: HELD
Telephone: (304) 285-6121

Project ID: 9277095

Keywords/Phrases: Dermatitis, skin, computer

Purpose:

To develop quantitative structure-activity relationships (QSARs) for occupational dermal exposures.

Abstract:

The project will improve existing QSARs for absorption of chemicals across healthy skin, new QSARs for diseased skin, and QSARs for allergic contact dermatitis. These goals are achieved by using standard QSAR methods augmented by original and innovative nonlinear and nonparametric techniques. The project makes intense use of internal and external data and provides a deeper understanding of the mechanisms by which chemicals penetrate the skin or trigger dermatitis. This capability will allow predictions to be made of the biological activities of chemicals that have not been dermally tested.

Developing Dermal Policy Based on Lab and Field Studies

Project Director: Sidney Soderholm, Ph.D.

Division: HELD

Telephone: (304) 285-6121

Project ID: 9277096

Keywords/Phrases: Dermatitis, skin, industrial hygiene

Purpose:

To coordinate and communicate information concerning dermal exposure research to researchers, external partners, and stakeholders.

Abstract:

Many workers in the United States are potentially exposed to chemicals that can be absorbed through the skin. Dermal exposure can lead to dermatitis or systemic toxicity; however, NIOSH has few recommendations for identifying and controlling occupational overexposures and disease of the skin. In response to this situation, NIOSH established a research program to develop scientifically based dermal policy based on laboratory and field studies. This Coordinating Core project is intended to provide a focal point for communication and coordination among program researchers and for communication with external partners and stakeholders. The intended result is an effective research program, adoption of improved policies by NIOSH, and successful tracking of the program's impact on employers, workers, regulatory agencies, and others.

Mechanisms of Toxicity of Redox Reactive Intermediates in Skin

Project Director: Choudari Kommineni, Ph.D., D.V.M.

Division: HELD

Telephone: (304) 285-6121

Project ID: 9278092

Keywords/Phrases: Dermal toxicology, oxidants, skin cancer

Purpose:

To study mechanisms of toxicity of redox reactive intermediates during enzymatic metabolism of phenols and organic hydroperoxides to elucidate involvement of free radical pathways in cutaneous toxicity and skin disorders.

Abstract:

Although phenolic compounds are known to cause several types of dermatitis, leukoderma, and cancer promotion, the underlying mechanisms of these toxic effects are unknown. The enzymic oxidation of phenols is an effective metabolic pathway that will be studied in this project.

Results from these studies will provide mechanistic information that can be used in risk assessment.

Chemical Activation of Innate Immunity in Contact Dermatitis

Project Director: Sally Tinkle, Ph.D.

Division: HELD

Telephone: (304) 285-6121

Project ID: 9278100

Keywords/Phrases: Dermatitis, skin, immunotoxicology

Purpose:

To undertand the chemical-cellular interactions of workplace toxicants and the skin.

Abstract:

Elucidating chemical-induced skin irritation and the relationship between cutaneous innate and specific immunity in the development of irritant and allergic dermatitis will improve the evaluation of the irritant and sensitizing potential of new chemicals and set protective workplace exposure concentrations. It is hypothesized that the innate immune response provides information about dose and type of antigen to the immune response and is involved in initiation of the inflammatory/irritant response to occupational chemicals. An understanding of the mechanism through which chemicals induce irritant and allergic dermatitis will provide critical information necessary to develop improved strategies for prevention and treatment of disease.

Develop and Demonstrate the Use of Colorimetric Indicators

Project Director: Evanly Vo, Ph.D.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP13
Keywords/Phrases: Chemicals, exposure, prevention

Purpose:
To develop colorimetric indicators to provide a method for field validation testing for chemical protective gloves and clothing to protect against skin exposure to aldehydes and glycol ethers.

Abstract:
Colorimetric indicator pads will be created to provide a method for conducting field validation testing of chemical protective gloves and clothing that protect against skin exposure to aldehydes (formaldehyde and glutaraldehyde) and glycol ethers (2-butoxyethanol). Aldehyde, ether, and alcohol pads will be fabricated and tested in this project. The results of this research will be useful in allowing workers to determine when their protective gloves have been compromised so that they would be better able to protect themselves from chemical skin exposures. The use of colorimetric indicator pads in conjunction with existing dermal exposure prevention techniques is expected to further reduce the number and severity of chemical dermal injuries.

• Asthma and Chronic Obstructive Pulmonary Disease •

The Occupational Burden of Chronic Obstructive Pulmonary Disease

Project Director: Eva Hnizdo, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277415
Keywords/Phrases: COPD, cooperative agreement, epidemiology

Purpose:
To support the development of pilot projects related to chronic obstructive pulmonary disease (COPD) in addition to supporting the development of cooperative agreements to conduct studies to estimate the population attributable risk percent due to occupational factors in COPD and to explore and assess various methodologies for utilizing longitudinal spirometry data for epidemiological and screening applications.

Abstract:
COPD is a common and costly chronic medical condition and a major contributor to mortality and morbidity. Occupational factors associated with COPD have been understudied and methodologies for the assessment of longitudinal changes in pulmonary function in exposed workers have not been well developed. Further research is required to improve the understanding of the contribution of work exposures to the overall population burden of COPD, as well as to better understand the types, severity, and distribution of occupational exposures that accelerate lung function loss. This project will consist of several components. The first component will support the development of cooperative agreements to estimate the population attributable risk percent due to occupational factors in COPD, focusing on occupational exposures not yet well studied, especially relating to mixed exposures and exposures falling within the rubric of particles not otherwise regulated or classified. The second component is to explore and assess various methodologies to evaluate accelerated lung function loss for longitudinal spirometry data in epidemiological and screening applications. For this purpose the investigators will locate and purchase a comprehensive industry-based screening dataset, as well as employ some existing in-house datasets. The third component is to support the development of new pilot research projects related to COPD. This project supports research funded under a cooperative agreement between the CDC Public Health Practice Program Office and the Association of American Medical College with research conducted at the University of California, Los Angeles, and Tulane University School of Medicine.

Medical Monitoring for Workers Using Isocyanate

Project Director: Edward Petsonk, M.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277079
Keywords/Phrases: Asthma, isocyanate, screening methods

Purpose:
To describe the optimal science-based program for medical screening during working with diisocyanates.

Abstract:
This project builds on an established dialogue among worker representatives, academic occupational health personnel, and representatives of industries that produce

and use diisocyanates to describe an optimal science-based program for medical screening during work with diisocyanates. Descriptors of existing health screening data from diisocyanate workers will be obtained and the feasibility of assessing current medical screening practices determined. If feasible, current screening practices and program effectiveness will be assessed, and a model program described for medical screening during work with diisocyanates. The model program will be pilot tested, evaluated, and ultimately discussed at a workshop, with the goal of describing an optimal science-based medical screening program. Such a program would represent an important advance in strategies for prevention of occupational asthma due to diisocyanates.

Research for Occupational Asthma Reduction / Coordination Core

Project Director: Janet Hale, B.S.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277074
Keywords/Phrases: Asthma, indoor air quality, isocyanate

Purpose:
To provide guidance for all occupational asthma investigations at NIOSH.

Abstract:
The Coordination Core of the Research for Occupational Asthma Reduction (ROAR) program provides the ongoing coordination, oversight, reporting, data entry support, and continuing evaluation needed to assure an integrated high-quality program able to respond to both challenges and opportunities that arise in the course of conducting any of the projects. This Core will assure ongoing communication among all asthma investigators in NIOSH and will serve as an incubator for idea development and formative/feasibility research.

Workplace Exacerbation of Asthma

Project Director: Paul Henneberger, Sc.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277077
Keywords/Phrases: Asthma, epidemiology spirometry

Purpose:
To investigate the frequency, causes, and consequences of the increase in asthma in the workplace.

Abstract:
Workplace exacerbation of asthma can have serious consequences. This has been ignored by researchers in the United States. Given the diversity of workplace agents and processes associated with asthma, a population-based rather than industry-based approach will be used to investigate the frequency, causes, and consequences of workplace exacerbation of asthma. The findings of this study could be used by regulatory agencies to set new standards for exposures to asthmatic agents that would provide greater protection to susceptible persons.

Work-Related Asthma in School and Office Buildings

Project Director: Kathleen Kreiss, M.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277078
Keywords/Phrases: Asthma, indoor air quality, exposure assessment

Purpose:
To acquire information and to test hypotheses related to the identification and prevention of work-related asthma and other respiratory-related outcomes in offices and school buildings.

Abstract:
The study will be conducted using requests to the NIOSH, Health Hazard Evaluation and Technical Assistance (HETA) program. The principal aim is to identify risk factors for work-related asthma and to quantify exposure-response relationships between work-related asthma and indices of exposure, including moisture and bioaerosols. Subsidiary aims are directed towards developing and testing environmental and medical methods having application to indoor air quality and lung disease.

Longitudinal Follow-Up of Food Flavoring Exposed Workers

Project Director: Greg Kullman, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278117
Keywords/Phrases: Respiratory diseases, Chronic Obstructive Pulmonary Disease, exposure assessment

Purpose:
To investigate an outbreak of bronchiolitis obliterans in a popcorn plant.

Abstract:
In May 2000, an occupational medicine physician in Kansas City contacted the Missouri Health Department to report that he had seen medical records of 9 former workers at a small popcorn plant who had severe lung disease. Four of these workers were awaiting lung transplant. This outbreak was determined to be bronchiolitis obliterans, a particularly severe form of chronic obstructive pulmonary disease (COPD) in which fixed airways obstruction arises, sometimes within weeks. This project supports the following activities: (1) animal studies of suspected agents (organic gases from the flavorings), (2) longitudinal followup of the workers in the microwave popcorn plant to describe the natural history of the occupational bronchiolitis and the effectiveness of engineering and respiratory protection interventions now being put in place, and (3) determination of the extent of similar exposures and disease occurrence in both the microwave popcorn industry and in the related food flavorings industry through the survey of additional popcorn and flavorings facilities.

Feasibility Study of Occupational Asthma Incidence

Project Director: Paul Henneberger, Sc.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278207
Keywords/Phrases: Asthma, epidemiology, cooperative agreement

Purpose:
To estimate the frequency of both work-related exacerbation of asthma and new-onset occupational asthma (OA).

Abstract:
This project has two parts. In Part A, the estimate of work-related exacerbation of asthma will be accomplished by analyzing data collected during surveys. A second goal of Part A is to estimate the frequency of asthma among workers exposed to particulates not otherwise classified and irritant gases in the pulp and paper industry. This part of the project is internal to NIOSH. In Part B, the estimate of the incidence of new-onset OA will be accomplished by providing assistance to two cooperative agreement recipients. The outcomes of this project will be estimates of the frequency of OA that are virtually nonexistent in the United States. The findings will help inform future research and intervention activities.

Occupational Asthma Identification Methods

Project Director: Edward Petsonk, M.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278213
Keywords/Phrases: Asthma, allergies, isocyanates

Purpose:
To examine the different asthma screening approaches as surveillance tools for workers at risk and to characterize the occurrence of, and risk factors for, occupational asthma (OA)in various high-risk settings.

Abstract:
OA has emerged as the most prevalent occupational respiratory disease. This project addresses important knowledge gaps relevant to prevention of OA. The results should be useful in improving tools for recognition, monitoring, and surveillance of OA. In addition, risk factors for OA will be further delineated, which will assist in targeting OA prevention strategies for agricultural and other workers.

Lab Core for the Research of Occupational Asthma Reduction Program

Project Director: Daniel Lewis, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277082
Keywords/Phrases: Asthma, indoor air quality, analytical methods

Purpose:
To provide laboratory support to the Research of Occupational Asthma Reduction (ROAR) Program research programs.

Abstract:
This core laboratory program will ensure that laboratory data are collected in a valid, reproducible manner for the entire course of the ROAR study. The core laboratory program will also evaluate the utility of new technologies in the performance of epidemiological studies. This program will work closely with other NIOSH investigators to conduct systematic evaluations of work environments in which occupational asthma is occurring with emphasis on the nonindustrial workplace, such as office buildings and schools.

Epithelial Trandsduction in Airway Hyperreactivity

Project Director: Jeffrey Fedan, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277265
Keywords/Phrases: Asthma, respiratory disease, toxicology

Purpose:
To understand the mechanisms leading to airway inflammation and hyperreactivity.

Abstract:
This project will develop new techniques for characterizing cellular transduction pathways, in particular kinase cascades and ion channels, in respiratory epithelium that are associated with the production and effects of epithelium-derived relaxing factor (EpDRF) and evaluate changes occurring in animal models of occupational asthma (OA). EpDRF is thought to play a role in the development of airway hyperreactivity in OA because its effects are altered in animal models of OA. Through the use of inhalation exposure of animals to agents such as toluene diisocyanate, cell culture of airway epithelial cells, measurement of bioelectric/ion channel events in epithelium, and characterization of related kinase pathways, the investigators will gain understanding of the molecular mechanisms of action of inhaled asthmagens and the mechanisms by which they induce airway hyperreactivity.

Gene Environment Interaction in Occupational Diseases

Project Director: Ainsley Weston, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277388
Keywords/Phrases: Biomarkers, genetics, cancer

Purpose:
To identify and evaluate biomarkers of susceptibility and biomarkers of exposure that signal altered risk of occupational disease.

Abstract:
This program project seeks to further identify occupational disease risk factors, understand their biological basis, and provide a foundation for improved prevention and intervention strategies as well as genome-based occupational risk assessment. Many of the fundamental tools have been assembled and include worker cohorts, normal human epithelial cell strains, and new analytic methods. Three interrelated core projects form the nucleus of this environmental and genetic research program. They include chemical carcinogenesis, chronic beryllium disease, and occupational asthma. To understand gene-environment interactions as they pertain to the occupational disease process, molecular epidemiology and complementary basic biological models are being investigated in concert.

Noninvasive Measures of Small Animal Response to Inhalation Exposure

Project Director: Jeffrey Reynolds, B.S.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278073
Keywords/Phrases: Method development, exposure assessment, asthma

Purpose:
To develop noninvasive methods to measure the physiological response of small laboratory animals exposed to airborne toxins and workplace dusts known to cause asthma.

Abstract:
Methods to be developed for this research project include estimates of airway resistance, analysis of breathing pattern from the whole body plethysmograph, analysis of cough sounds of small animals exposed to asthma-causing agents, and improved direct calorimetry for laboratory animals. The techniques developed and the information obtained from this project will be implemented in many of the laboratory animal studies of possible airborne toxins encountered in the workplace. This project will enhance the general research capability to address occupational health issues associated with the exposure of workers to airborne pathogens.

Identification of Occupational Allergens

Project Director: Daniel Lewis, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278147
Keywords/Phrases: Allergy, asthma, exposure assessment

Purpose:
To address concerns about the role of immunologic hypersensitivity reactions through the development of techniques that detects immune reactions before clinical outcomes and identifies occupational allergens.

Abstract:
Exposure to substances that can cause immunologic hypersensitivity reactions is recognized as an important hazard in certain work environments and is thought to

play a role in some forms of occupational lung diseases, such as asthma and allergic alveolitis. This project is intended to assess these concerns through the development of improved techniques for the detection of such immune reactions before adverse clinical outcomes occur and the development of improved techniques for the detection and identification of occupational allergens. The project will involve the analyses of clinical samples, environmental bulk samples, and environmental aerosol samples. Successful completion of these investigations should lead to the development of effective prevention strategies for occupational allergies and asthma.

Cough Sounds and Aerosols as a Predictor of Respiratory Disease

Project Director: David Frazer, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278981
Keywords/Phrases: Respiratory disease, chronic obstructive lung disease, asthma

Purpose:
To develop a new, noninvasive method for detecting lung disease in workers based on voluntary cough sound analysis.

Abstract:
In this research project, workers will voluntarily cough through a mouthpiece and concatenated tube system. The cough signal is decomposed into two parts representing the sound generation process within the lungs and the change in sound with respect to time as it travels through the respiratory system. Initial studies indicate that obstructive lung diseases can be distinguished by characteristic alterations in the generation of a cough sound and its sound transmission path. Restrictive diseases also show distinct differences in cough sound composition. The development of an easily administered early detection technique for identifying obstructive and restrictive lung disease in workers will enhance occupational health by enabling earlier implementation of primary and secondary prevention.

• Cancer Research Methods •

A Cytogenetic Study of Markers of Cosmic Radiation Exposure and Effects Among Pilots

Project Director: Lee Yong, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277129
Keywords/Phrases: Aviation, radiation, biomarkers

Purpose:
To assess genetic biomarkers and possible damage to flight attendants exposed to radiation.

Abstract:
This study will measure chromosomal aberrations as markers of cosmic radiation exposure and damage in flight attendants, estimated to have high cosmic radiation exposure based on flight histories, and referents with little flying history. Fluorescent in situ hybridization (FISH) will be used to estimate cumulative radiation exposure damage in this study. FISH detects stable (symmetrical) aberrations, which are transferred to daughter cells in cell division. Chromosomal aberrations have been shown to be associated with the subsequent development of cancer. The findings of this project will be used to determine (1) whether flight crews are at increased risk of cytogenetic damage and cancer, (2) the need for future cytogenetic marker studies in flight crews, and (3) the need for intervention on flight crew exposures.

Molecular Mechanisms of Ultraviolet-Induced Carcinogenesis

Project Director: Min Ding, Ph.D., M.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277385
Keywords/Phrases: UV, transcription factors, skin cancer

Purpose:
To conduct research that will clarify the molecular mechanisms of ultraviolet (UV)-induced carcinogenesis.

Abstract:
This research is concerned with workers in agriculture, construction, and other sectors that work outdoors and are exposed to sunlight. It will conduct laboratory studies to understand the molecular mechanisms of UV-induced carcinogenesis. The mechanistic investigations (gene mutation, activation of transcription factors, ROS

generation) will explain the events of UV-induced tumor initiation, promotion, and progression. Determining the mechanisms involved in UV-induced carcinogenesis in parallel with the manipulation of target signaling could provide insights for the development of possible prevention strategies for UV-induced diseases. Such information would be used to develop early diagnostic tests for UV-induced skin diseases and help the Occupational Safety and Health Administration set exposure standards.

Potential Occupational Etiology of Breast Cancer

Project Director: Ainsley Weston, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277387
Keywords/Phrases: Organochlorines, cancer, genetics
Purpose:
To investigate agricultural exposures and the potential genetic interactions that may influence the development of breast cancer.

Abstract:
Agricultural chemicals have been implicated in breast cancer. This is a study of gene-environment interactions with respect to cell cycle control, agricultural exposures, and risk of breast cancer through (1) in vitro studies using normal human cells to examine the immediate/early effects of occupational chemical exposures in relation to genotypes will provide a basis to evaluate chemicals in current and future use and (2) two breast cancer case-control studies (n=510 and 1,052) will evaluate the role of genetic polymorphisms in cell cycle control genes, occupational exposures, and their interaction. Measures of blood pesticides, DNA-adducts, and other work exposures are being collected. An understanding of gene-environment interaction at a basic level will provide a broad base for development of strategies for breast cancer prevention that may benefit working women.

Molecular Mechanisms of Cadmium Carcinogenesis

Project Director: Tong Man Ong, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278102
Keywords/Phrases: Cancer, early detection, biomarkers
Purpose:
To determine the factors responsible for cadmium carcinogenesis and changes in cancer-related genes that can be useful biomarkers in epidemiology studies.

Abstract:
Approximately 20,000 cancer deaths each year are attributed to occupational exposure in the United States. The goal of this project is to test the hypotheses that overexpression of the two novel genes, translation initiation factor (TIF), and eukaryotic translation elongation factor 1 delta sub-unit (TEF) are responsible for Cd carcinogenesis and that changes in the methylation patterns of cancer-related genes, including p16, are potentially useful as a biomarker for molecular epidemiology studies. Using cellular and molecular analyses, the nature of overexpression of TIF and TEF and changes in methylation patterns of cancer-related genes will be characterized. This project will provide important information regarding mechanism(s) of cadmium carcinogenesis and the usefulness of DNA methylation as a potential biomarker for molecular epidemiology studies and early detection of occupational cancer.

• Control Technology and Personal Protective Equipment •

Personal Dust Monitor

Project Director: Jon C Volkwein, M.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: G921AO13
Keywords/Phrases: Mining, dust, aerosol, assessment
Purpose:
To investigate dust measurement technologies for application in mining.

Abstract:
Assessment of particulate in mines is currently time consuming and expensive. The personal dust monitor (PDM) is a near real time quantitative and qualitative mass based sensor for cal mine use that offers an improved approach to monitoring respirable dust and which provides workers' with timely feedback of dust exposures, thus enabling action to protect worker health. This work is being conducted in partnership with labor, industry, and academia. The successful outcome of the work will result in several new tools and approaches to particulate monitoring in mining to protect worker health.

Control of Disease Transmission in Commerical Aircraft Cabins

Project Director: Jennifer Topmiller, M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277306D
Keywords/Phrases: Engineering controls, infectious disease, ventilation

Purpose:
To address the problem of in-flight disease transmission on commercial aircraft.

Abstract:
In this project, the ventilation conditions in aircraft cabins will be assessed to determine factors that affect the potential for disease transmission. Studies to investigate cabin air quality have been conducted to determine concentrations of air contaminants present in aircraft cabins. Limited research has been done in the area of disease transmission in aircraft.

The Federal Aviation Administration (FAA) and NIOSH are collaborating to study this issue. Because a direct epidemiological approach was not feasible, an engineering study was planned to indirectly address this issue. The primary objective of this study is to understand the dispersal and removal of aerosols in the aircraft environment.

Demonstration of Quality Control and MaintenancePrograms for Environmental Cabs

Project Director: William Heitbrink, Ph.D., B.S.Ch., M.S., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277403
Keywords/Phrases: Agriculture, tractors, control technology

Purpose:
To demonstrate that low-cost optical particle counters can be used in quality control and maintenance programs for environmental enclosures.

Abstract:
Environmental enclosures are used to protect workers from pesticide spray mists, dusts generated during other agricultural activities, and silica exposures during surface mining activities involving drilling and earth moving. To ensure that all workers using these vehicles continue to receive exposure reduction, manufacturers and users need to operate quality control and maintenance programs. This project will be conducted in collaboration with a custom pesticide applicator and a manufacturer of environmental enclosures. These programs are needed to ensure that all workers who use these enclosures receive adequate protection from pesticide exposures. The investigators will incorporate the measurement of aerosol penetration into the manufacturer's quality control plan and user's maintenance plan. The optical particle counter will measure the concentration of ambient aerosol inside and outside the enclosure. The ratio of concentration inside to that outside is the aerosol penetration into the enclosure. These enclosures are expected to provide at least a 50-fold reduction in exposure (i.e., penetration under 0.02).

Engineering Development Research for Occupational Health

Project Director: John Sheehy, Ph.D., P.E., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278165
Keywords/Phrases: Control technology, research, ventilation

Purpose:
To develop and evaluate engineering controls to be used in the workplace.

Abstract:
This project incorporates a number of short-term medium-size occupational health engineering development research studies.This project will focus on the following four areas: (1) perchloroethylene vapor degreasers, (2) Immigration and Naturalization Service and custom agents exposures to vehicle emissions, (3) health care worker exposures to pharmaceuticals, and (4) advanced ventilation techniques, (e.g., fluctuating flow). It will include both laboratory and field research. The latter three research efforts will incorporate computation fluid dynamics (CFD) modeling. In addition, new real-time/video monitoring and telemetry technology will be developed. Technical support, equipment maintenance, calibration, and repair for EPHB field and laboratory studies will be conducted.

Control Technology in Small Business

Project Director: Keith Crouch, Ph.D., A.B.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278167
Keywords/Phrases: Small business, engineering controls, airborne contaminants

Purpose:
To identify small business sectors requiring assistance in controlling occupational safety and health exposures.

Abstract:
This project will identify small business sectors that require assistance with the control of occupational safety and health issues. Small businesses often do not have the resources to commit to occupational safety and health programs nor do they have access to a trained professional to take care of these needs. In conducting this research, industries will be chosen based on the number of workers exposed and establishments involved, the severity of worker exposure, and the likelihood that a feasible intervention could be implemented. Following the selection of industries to be studied, representative establishments will be contacted for potential site visits. During the site visits, safety and health hazards will be assessed. After surveys at a number of businesses, appropriate engineering and administrative controls will be designed for industry processes. Follow-up surveys will be conducted to implement the controls and test their effectiveness. Recommendations will be disseminated to the small business owners on ways to reduce employee exposures, and they will be given contacts that can assist them.

Reduction of Silica Exposures in Construction

Project Director: Michael Gressel, Ph.D., C.S.P.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278169
Keywords/Phrases: Silica, control technology, construction

Purpose:
To develop cost-effective engineering controls to reduce silica exposure.

Abstract:
Although research has been conducted in the construction industry, silica exposures remain a major occupational health problem. Samples collected in a recent study found 43% of the silica samples from the construction industries exceeded the NIOSH recommended exposure limit (REL). This project seeks to develop cost-effective engineering controls for the reduction of silica exposures in the construction industries. Four main areas of work include development of cost-effective dust collectors, research on fundamental control strategies, research to control silica exposures in specific construction processes, and promotion and dissemination of research findings. The overall goal of the project is to reduce and eliminate silica exposures in the construction.

Permeation Study for Hazardous Drugs

Project Director: Guy Burroughs, Ph.D., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278175
Keywords/Phrases: Protective equipment, control technology, health care workers

Purpose:
To measure the permeability of glove and gown materials in the health care sector, which will help control occupational exposure to hazardous drugs.

Abstract:
The testing procedures selected for measuring permeability of protective clothing materials are established by the American Society for Testing and Materials. This project will ensure consideration of the control hierarchy—engineering and administrative controls and personal protective equipment (PPE)—and relates to a NIOSH goal for the evaluation of PPE. Dermal exposure has been reported by several studies and is considered by one to be the most significant routes of exposure in the health care setting. To evaluate the effectiveness of PPE, a determination of the permeability of various glove and gown material to hazardous drugs will be conducted under contract. All of the common antineoplastic pharmaceuticals as well as drugs defined as hazardous by the American Society of Healthcare Pharmacists will be evaluated in this testing. The results from this project should inform selection of the most protective PPE for pharmacy and nursing staff to prevent dermal exposure.

New Methods for Assessing Exposure to Radiofrequency Communication

Project Director: Gregory Lotz, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278320
Keywords/Phrases: Control technology, radiofrequency, RF, telecommunication towers

Purpose:
To develop new exposure assessment methods and determine the effectiveness of control strategies and personal protective equipment for workers exposed near radiofrequency (RF) communication sources.

Abstract:
This project will compare existing and new equipment for measuring exposures to workers who are exposed to near RF radiation-emitting communication sources. In addition, the effectiveness of RF protective suits and personal exposure monitors to reduce exposure from RF

communication sources will be determined. NIOSH field testing will determine whether the new equipment and techniques are effective and will help regulatory agencies, workers, and occupational health specialists to evaluate, regulate, and reduce hazardous RF exposures.

Noise Reduction Characterization of Nonlinear Hearing Protection Devices

Project Director: William Murphy, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278339
Keywords/Phrases: Hearing, protective equipment, method development

Purpose:
To develop instrumentation and methods necessary to assess and rate the protection provided by nonlinear hearing protectors (NLHPs).

Abstract:
In certain occupational settings, traditional hearing protectors block noise that might be necessary for job safety and proficiency (i.e., alarms or tool noise). Newer hearing protection devices, which modify the noise getting through to the wearer while protecting the ear, are called NLHPs. In this project, the performance characteristics of the major types of NLHPs will be determined, and these characteristics will be correlated with the hearing needs of specific jobs. The new information about the protectors' performance will allow consumers to make an informed choice of NLHPs to achieve the best mix of hearing protection and ability to understand speech and warning signals in a noisy environment. These new laboratory methods will be published to provide information for NLHP manufacturers, workers testing laboratories, and relevant standard setting groups.

Field Hearing Protector Testing Methods and Rating

Project Director: John Franks, Ph.D., M.A., B.A.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278344D
Keywords/Phrases: Hearing, protective equipment, rating

Purpose:
To develop instrumentation and methods necessary to assess and rate the protection provided by hearing protection devices, both in the laboratory and at the work-site.

Abstract:
Key parameters will be determined for both laboratory and work-site test methods that allow accurate characterization of the attenuation of hearing protectors. It is anticipated that rating adjustment factors may be necessary to make the two methods equivalent and that these rating adjustment factors may need to be applied to laboratory data for each class of hearing protector or even for each hearing protector. Thus, it should be possible to select an appropriate protector based on the new laboratory data or based on the work-site test.

Control of Exposures During Construction

Project Director: Leo Blade, B.S.Ch.E., M.S.E.E., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278389
Keywords/Phrases: Asphalt, engineering controls, construction

Purpose:
To investigate the availability of engineering controls for construction processes that will reduce occupational exposures.

Abstract:
The use of engineering controls within the construction industry is dramatically inadequate. This project responds to identified construction processes that will benefit from the application of engineering controls to reduce occupational exposures. Where existing controls are not commercially available, this project designs and assists equipment manufacturers in the design of engineering solutions to reduce occupational exposures. Since inception, this project has applied engineering controls research toward drywall sanding, rebar tying, asphalt paving equipment, asphalt-roofing kettles, and coal tar construction products.

Computational Fluid Dynamics in Control Technology

Project Director: James Bennett, Ph.D., B.S.E., M.S.P.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278404
Keywords/Phrases: Control, control exposure, fluid mechanics

Purpose:
To validate computational fluid dynamics (CFD) model results through laboratory and field studies.

Abstract:
Exposure to potentially hazardous airborne material is one of the major problems in the workplace. Fluid transport phenomena fully determine the fate of airborne contaminants in the (occupational) environment. CFD provides a powerful, new, analytical tool to understand the factors that lead to exposure and to design appropriate controls for airborne contamination. It also provides insight regarding exposure assessment and accuracy of measurement devices or simple exposure models. NIOSH will continue to use CFD in parametric studies to evaluate ventilation effectiveness and exposure measurement accuracy. CFD will be applied to the control of exposure to silica, welding fume, bioaerosols, and gas phase contaminants. Five journal articles or technical reports are expected to be published this year.

Control of Refractory Ceramic Fibers

Project Director: Kevin Dunn, B.M.E., M.S.E.E., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278406
Keywords/Phrases: Control technology, cancer, fibers

Purpose:
To evaluate the effectiveness of current engineering control strategies to limit exposure to refractory ceramic fibers (RCFs).

Abstract:
This ongoing project has evaluated the effectiveness of engineering control strategies to limit exposures to RCFs. Additional surveys planned for FY 2002 will evaluate engineering controls in manufacturing, primarily in end-user factories for job categories shown to have the highest exposures—such as sanding, grinding, sawing, and drilling. One engineering control evaluation conducted at the NIOSH Pittsburgh Research Laboratory on engineering controls for belt and disc sanding resulted in reduced personal airborne fiber concentrations of greater than 99%. In addition to a presentation at the 2000 American Industrial Hygiene Conference and Exposition and scientific journal articles, NIOSH and the Refractory Ceramic Fiber Coalition (RCFC) will jointly develop hazard control documents based on workplace sample data collected over a 5-year period.

Generation and Control of Aerosol Emissions from Arc Welding

Project Director: Anthony Zimmer, Ph.D., P.E., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278442
Keywords/Phrases: Welding, control technology, respiratory disease

Purpose:
To determine factors that influence the particle-size distribution in a typical arc welding process, determine how efficiently particles can be deposited within the lungs, and determine the efficiency of low-cost engineering control techniques to remove aerosols.

Abstract:
For this study, the fume generation/aerosol sampling chamber has already been designed, built, and validated. Experiments were performed to evaluate the role of various welding parameters on the formation of welding aerosols. Additionally, experiments have been conducted to determine the efficacy of a commercially available air-cleaning device in removing welding aerosols from the gas stream. Several peer review manuscripts have been written and are in different stages of publication.

Assessment of Asphalt Fume Exposure from Roofing Kettles

Project Director: David Marlow, B.S.Ch.E.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278492
Keywords/Phrases: Asphalt, engineering controls, small business

Purpose:
To evaluate existing engineering controls to reduce worker exposures to asphalt fumes during roofing operations.

Abstract:
In conducting this research, the control systems to be evaluated include an air filtering system, an afterburner and safety loading door system, and low-fuming asphalt. Results and recommendations will be disseminated to this widely dispersed industry, and the impact will be measured in subsequent years.

Environmental Tractor Cab System Integrity

Project Director: Ernest Moyer, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278113
Keywords/Phrases: Agriculture, tractor cabs, silica
Purpose:
To develop and incorporate aerosol test methods for evaluating all phases of cab manufacturing/design, auditing, and routine maintenance.

Abstract:
Environmental cab enclosures are used to protect agricultural workers during pesticide spray operation and agricultural, heavy construction, and mining operations in which dust generating operations such as drilling and earth-moving operations are routine. This project will provide a critical link in the process of determining the cause(s) of hazardous exposure within enclosed environmental tractor cabs. Testing methodology that has been used to evaluate particulate filter efficiency and aerosol particle counter to identify leak sites and evaluate total cab integrity will be used. Equipment manufacturers, custom pesticide applicator's and NIOSH researchers will collaborate to incorporate the measurement of aerosol penetration into environmental enclosures. All phases from manufacturing and design through audits to routine maintenance applicability will be evaluated and appropriate aerosol test methodology incorporated to provide for total/cab performance program.

Industrial Ventilation Systems Research

Project Director: Steve Martin, M.S.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278116
Keywords/Phrases: Ventilation, engineering controls, research
Purpose:
To determine the efficacy of industrial ventilation filters and sorbent materials against various aerosol and/or vapor exposure scenarios.

Abstract:
This research will assess the overall performance and efficacy of these environmental ventilation systems against particulates and organic vapors, as well as look at aerosol/vapor interactions that could affect overall ventilation system performance. Field evaluations will be conducted to study the efficacy of entire ventilation systems over time, focusing on the use, care, and maintenance of the system, the sorbent and filter replacement schedules, and the performance of the old system filters and sorbent beds in targeted industries, such as agriculture, construction and food processing and flavoring. Models of the performance of industrial ventilation filters and sorbent materials and models for predicting filter/sorbent breakthrough and establishing more reliable replacement schedules will be developed.

New Technology to Increase Rollover Protective Structures Used on Tractors

Project Director: John Etherton, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277178
Keywords/Phrases: Injury prevention, rollover protectors, tractors
Purpose:
To increase the number of tractors equipped with rollover protective devices.

Abstract:
This safety engineering project will organize similar technical skills and instrumentation to work on a common injury prevention problem: too many tractors still do not have rollover protective structures (ROPS). More than 60% of tractors in use do not have ROPS installed. Targets of the research are a simpler, more economical ROPS design for retrofitting older tractors, field tests of a structure that deploys when overhead clearance is restricted, field tests of a sensor that detects an imminent rollover and can initiate deployment of a self-raising structure, and analysis of composite materials to reduce the weight of adjustable structures and improve the corrosion resistance of ROPS in general. As a result of this project, U.S. industry and tractor owners will be provided with capabilities to equip significantly more tractors with ROPS.

Radio Frequency Safety System to Protect Workers from Caught-In Injury

Project Director: John Powers, Jr., B.S.E.E.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277241
Keywords/Phrases: Agriculture, traumatic injuries, control technology
Purpose:
To design a radio frequency-based safety system that protects workers from machinery-related caught-in incidents.

Abstract:
The detection system for this study consists of a small worker-worn low-power radio frequency (RF) transmitter to transmit a modulated RF signal throughout the worker's body and an RF receiver with two proximity sensing antennas mounted in parallel around a wood chipper's feed chute. By analyzing the relative strength of the RF signals from the antennas, the receiver recognizes the worker's proximity to the chute and initiates the alarm shutdown or feed-roll reversal. The system also provides redundant lockout protection during repair and maintenance. This low cost (less than $100) proximity protection system could be easily applied to various grinding, chopping, stamping, and press-type machines to effectively reduce machinery-related caught-in traumatic injuries.

Footwear for Improved Balance Control in Construction Work

Project Director: Peter Simeonov, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278066
Keywords/Phrases: Falls, construction, traumatic injuries

Purpose:
To study the effects of different shoe types and shoe characteristics on workers' balance control and potential for fall initiation.

Abstract:
Standing and walking balance will be assessed in simulated work conditions, including narrow and sloped surfaces and reduced visual cues. The information from the project will provide the scientific basis for optimal selection and design of safety footwear to improve balance control in construction work. The study results will directly benefit construction workers by reducing the risk of traumatic injury associated with falls due to loss of balance incidents.

Evaluation of Head Reactions to Objects Directed to Eyes

Project Director: Douglas Ammons, B.S.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278068
Keywords/Phrases: Eye injury, computer, method development

Purpose:
To use virtual reality technology to determine how foreign particles get around protective eyewear.

Abstract:
Test subjects will take part in a computer-simulated work environment in which they will be performing a work task such as hammering, grinding, or sawing. During the time they are working on the task, a small piece of virtual debris will be propelled toward their eyes. This event will simulate what occurs during an eye injury. During the simulated traumatic event, researchers will measure movement of the subject and the virtual particle to determine whether the eye was struck by the simulated particle. This study will help researchers determine whether an eye injury could have been prevented by using a different type of eyewear, and the results will be provided to eyewear makers to improve protective eyewear design.

Improved Equipment Design through Applied Anthropometry

Project Director: Janes Spahr, M.P.H.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278110
Keywords/Phrases: Protective equipment, method development, traumatic injuries

Purpose:
To improve fit assessments and the design of personal protective equipment (PPE) and work environments for reducing the occurrence of traumatic injuries in the workplace.

Abstract:
Methods for assessing fit for designing better fitting protective gloves will be developed and techniques to evaluate coverage provided by safety eyewear will be recommended from this research effort. The third portion of this project will examine the protective volume required around an operator in the event of tractor rollover. This will help designers of rollover protectors determine the size and degree of inflexibility required in these structures. The researchers will work with trade groups and standards organizations to ensure that the results of this research are appropriately disseminated.

Anthropometry of Construction and Agriculture Populations

Project Director: Hongwei Hsiao, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278933
Keywords/Phrases: Construction, agriculture, protective equipment

Purpose:
To study the 3-D human form of construction and agriculture workers for evaluating the interaction of workers with their personal protective equipment, machinery, and workplaces.

Abstract:
The three major efforts for this study are (1) developing methodologies for quantifying 3-D shapes and sizing information for personal protective equipment design applications, (2) establishing a sizing system for the design of fall-protection harnesses and formulating an anthropometric guide to aid users in the selection of the appropriately sized fall-protection harness for their work, and (3) formulating anthropometric criteria for the design of farm tractors and rollover protective structures to increase safety of farm tractor operators.

Life Support and Survival

Project Director: John Kovac, M.B.A., M.S., M.A.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP30
Keywords/Phrases: Underground mining, respirators, emergency responders

Purpose:
To ensure that deployed self-contained self-rescuers (SCSRs) function properly.

Abstract:
This project will develop the technology to increase the chances for escape of miners surviving a mine fire, explosion, gas outburst, or water inundation and to improve the safety and effectiveness of mine rescue, recovery, and fire fighting. The project focuses on improvements on the design and use of a closed-circuit breathing apparatus such as the SCSR.

Performance Test for High Assigned Protection Factor Respirators

Project Director: Ziqing Zhuang, Ph.D.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP07
Keywords/Phrases: Protective equipment, respirators, biological monitoring

Purpose:
To develop a validated respirator performance test for the NIOSH certification program.

Abstract:
This project will validate the six currently available quantitative fit-test methods. Specifically, fit factors obtained using the six quantitative fit-test methods will be compared with an exposure dose of Freon. Full-face pieces, negative pressure respirators and loose-fitting powered air-purifying respirators will be tested on a panel of 30 male and female subjects. Correlation coefficients will be determined between fit factors and challenge vapor exposure dose. Two hypotheses will be tested: (1) that fit factors from each method are significantly correlated with the exposure dose when wearing high assigned protection factor (high-APF) respirators and (2) that one method is the best predictor of exposure when wearing high-APF respirators. The expected outcome will be (1) demonstration of correlation between fit factors and exposure dose and (2) incorporation of performance tests for high APF respirators into the NIOSH certification program.

Development of Computer-Aided Face Fit Evaluation Methods

Project Director: Ziqing Zhuang, Ph.D.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP09
Keywords/Phrases: Respirators, control technology, protective equipment

Purpose:
To establish fit-test panels to be incorporated into the NIOSH certification program.

Abstract:
This project will establish an anthropometric database of about 4,000 workers with traditional measurements and 500 subjects using 3-D scanning technology. Fit-test panels will then be developed to be incorporated into the NIOSH certification program. A new design approach using 3-D data will be developed and compared with the traditional approach using only facial dimensions to see whether it will improve face fit. Shape statistics will also

be used to capture the variability in the actual shape of the faces. Methods for using these statistics for product design will be developed. The expected outcomes of the research will be (1) establishment of new fit-test panels for workers, (2) incorporation of these panels into NIOSH standards, and (3) demonstration of better fit from respirators designed with 3-D data.

Assess Respirator Fit to Improve Protection Against Tuberculosis

Project Director: Christopher Coffey, Ph.D.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP11
Keywords/Phrases: Respirators, tuberculosis, health care workers

Purpose:
To evaluate a new donning procedure and the simulated workplace performance of N95 respirators.

Abstract:
The donning procedure will be evaluated using two sets of 25 people. One set will use the current method and the other will use a mirror and another subject to check the position of the respirator before fit-testing. The number of people in each group passing the fit-test will be compared. The simulated workplace performance (i.e., 95th-percentile of total penetration) will be measured with and without fit-testing for thirty-five respirators on 25 people. The expected outcomes will be a new donning procedure and a listing of respirators with an assessment of their performance characteristics.

Development of Air-Purifying Respirator CO2 Test Using an Automated Breathing Metabolic Simulator

Project Director: Nina Turner, Ph.D.
Division: NPPTL
Telephone: (412) 386-6111
Project ID: 927PP12
Keywords/Phrases: Respirators, control technology, regulatory activities

Purpose:
To develop an automated breathing and metabolic simulator(ABMS)-based test for measuring average inhaled carbon dioxide concentrations for all classes of respirators.

Abstract:
This study will design ABMS test protocols, which are valid and relevant for each respirator class and test representative respirators to characterize their performance (carbon dioxide [CO2] concentrations). The computer-controlled ABMS produces CO2 at fixed rates, minute ventilation, and tidal volumes to simulate human metabolic processes. The anticipated outcomes are a valid CO2 test performed on the ABMS, which can be incorporated into the certification process and a characterization of average inhaled CO2 concentrations in currently available NIOSH-approved air-purifying respirators. The test procedure will be written in draft rule/standard language and format for future incorporation into the rule making process.

Investigation of Technology for Hearing Loss Prevention

Project Director: David Byrne, B.A.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P008
Keywords/Phrases: Hearing, mining, protective equipment

Purpose:
To identify methods to improve the audibility of hazard/warning signals in the mining environment while minimizing the risk of developing a noise-induced hearing loss.

Abstract:
It is well known that noise attenuation provided by hearing protectors as they are worn during everyday use is usually quite different (i.e., worse) than when tested under laboratory conditions. The availability of optimally selected hearing protectors will provide a degree of protection and safety beyond what is currently attained in most mining environments. This investigation will develop practical health communication messages/products that contain clear statements about the ability to hear warnings while using hearing protective devices. Further, recommendations can then be offered to the mining community regarding correct earplug/earmuff usage that maximizes recognition of hazard/warning sounds while adequately protecting the miners' hearing.

Dust Control in Surface Coal Mining

Project Director: Jeffrey Listak, B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P014
Keywords/Phrases: Control technology, dust, mining

Purpose:
To provide a broad-based approach toward the reduction of silica exposure in surface mining operations through identification of dust sources, evaluation of current control technologies, and development of new control technologies.

Abstract:
The Mine Safety and Health Administration dust exposure data show that highwall drill operator is the occupation at surface coal mines that most frequently exceeds the permissible exposure limit (PEL) for respirable dust. NIOSH field studies have shown that many surface drills have dust containment and capture problems at the shrouded drill table above the hole. For this project, laboratory and mine-site development work for improving the highwall drill's primary dust collection system and investigations into improving quality control methods to ensure the integrity of enclosed environmental cabs are planned. Additional efforts will focus on interactions between drilling parameters and overburden lithology and how this interaction affects respirable dust generation. This research will identify effective dust control technologies for surface coal mining operations to improve coal miners' health protection from silica dust exposure.

Silica Dust Control in Metal / Nonmetal MIning

Project Director: Andrew Cecala, M.B.A., B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P017
Keywords/Phrases: Mining, silica, control technology
Purpose:
To reduce silica dust exposure of workers at both underground and surface metal/nonmetal mining operations.

Abstract:
Although the health hazards from silica dust have been documented for many years, the problem of overexposure still persists for a number of job occupations in both underground and surface metal/nonmetal mining operations. Several occupations havebeen identified as being chronically exposed to excessive quantities of dust. Dust surveys will be conducted in both underground and surface mining operations to identify sources of dust generation and exposure for high-risk occupations. Research will be performed to develop effective control technologies that can be implemented toreduce the exposure of these workers to excessive concentrations of silica dust.

Reducing Injuries from Jolting / Jarring on Mobile Equipment

Project Director: Dean Ambrose, B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P031
Keywords/Phrases: Mining, agricultural, ergonomics
Purpose:
To reduce workers' risks from exposure to mining, construction, and agricultural machinery.

Abstract:
Ultimately, this project will reduce injuries to the workforce related to human interaction with machinery, through the application of human factors design considerations and engineering interventions. The research will use a multifaceted approach. The methodology being employed includes human factors design considerations, computer modeling and simulation, collaboration with equipment manufacturers, and field and laboratory tests to validate engineered interventions. The primary equipment to be investigated by PRL includes mine shuttle car haulage vehicles and farm tractors (SRL will investigate construction equipment). Expected outputs are the field validation of several improved seat designs and suspension systems. Outcomes of the project are recommendations and findings to assist in the reduction of back injuries and musculoskeltal disorders of the upper extremities from operating mobile equipment used in mining, construction, and agricultural industries.

Overhead Power Line Contact Alarm for Mobile Equipment

Project Director: James Cawley, M.B.A., B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P125
Keywords/Phrases: Control technology, mining, vehicles
Purpose:
To develop and test alarm technology to warn vehicle operators and nearby workers whenever high reaching mobile equipment accidentally contacts an overhead power line.

Abstract:
In conducting this research, measuring current across a single-plane pivoting joint via a shunt connected sensor cable has proven reliable on four vehicles tested to date. The remainder of the test program will establish the performance limits on this technique and produce a prototype device. An electrostatic means of overhead power

line contact detection has been found worthy of further investigation as a supplemental means of protection. Two private sector firms have expressed interest in commercializing such a device when it is completed. Successful implementation of this concept could reduce electrocutions involving high-reaching, mobile equipment by up to 50% in mining and 20% in construction.

Select and Evaluate Diesel Emission Controls on Mine Equipment

Project Director: George Schnakenberg, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P135
Keywords/Phrases: Mining, diesel, airborne contaminants

Purpose:
To make selection, bench test, and field evaluation of diesel emission control technology suitable for deployment in underground mines and usable without alteration on diesel powered surface mining and construction equipment.

Abstract:
In doing this project a transportable engine and dynamometer will be employed to provide a test bench for evaluating the effectiveness of the technology through tailpipe and ambient measurements. The technology of choice is the combination of a reduced emission engine, ultra-low sulfur fuel, a diesel oxidation catalyst, and a particle filter with a fuel additive to promote auto-regeneration of the filter, but other combinations are possible. The coal partnership will be providing suitable field sites and vehicles to field test for effectiveness and robustness as well as integration into the mine operations. This project will also develop instrumentation or methods to determine the effectiveness of the control technology in the field as a part of a routine maintenance procedure. It is hoped that, once the technology is proven effective, mines will adopt it for use on all vehicles in outby coal mine locations as well as all underground metal/nonmetal mines. Significant reductions in current worker exposures to diesel exhaust (especially particulate matter) are expected. Control technology, for inby coal mine diesels, is not being addressed in this project.

Dust Control for Longwall Mining

Project Director: Jay Colinet, M.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P082
Keywords/Phrases: Underground mining, coal mine dust, control technology

Purpose:
To reduce respirable dust exposure of mine workers at longwall mining operations.

Abstract:
A multitasked research program is being conducted using laboratory testing to evaluate optimum operating levels for existing control technologies, respirable dust entrainment in high-velocity airstreams, and the feasibility of implementing advanced control techniques on longwalls. Mine site evaluations of control technologies will be conducted as technology is developed and cooperating longwalls are secured. Research results will allow longwall operators to select control technologies that are most appropriate for their operating conditions and offer alternatives to traditional control techniques.

Control of Silica Dust Exposures in Underground Coal Mining

Project Director: Gerrit Goodman, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P120
Keywords/Phrases: Silica, coal mine dust, mining

Purpose:
To develop and/or improve control technology to reduce worker exposure to high concentrations of silica.

Abstract:
Exposure data collected by Federal mine inspectors in 1999 showed that more than 25% of their samples at roof bolting and mining machine occupations exceeded the Mine Safety and Health Administration limit for respirable silica of 100 µg/m3. Excessive occupational exposure to respirable silica continues in the underground coal mining industry. To control silica exposures at roof bolting occupations, a smaller-sized air tube is being evaluated, as well as various means of cleaning the dust box on the machine. Other work will include assessments of various spray system designs for controlling respirable dust and face methane concentrations at continuous mining machines. Research will also be conducted to characterize silica liberation from rock surrounding the coal seam. Control technology developments will be reported to the mining industry through appropriate publications and presentations.

Extended-Cut Air Deliver Systems

Project Director: Charles Taylor, B.A.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P121
Keywords/Phrases: Prevention, exposure assessment, underground mining

Purpose:
To prevent dangerous accumulations of methane at the mining face and monitor methane concentrations at the face to assure control measures are working properly and regulatory standards for methane concentrations are not exceeded.

Abstract:
In this research, the effects of redirecting scrubber flow toward the face will be evaluated as a technique for further improving the dilution of methane at the face to improve face airflow for methane control while reducing turbulence that can increase airborne dust concentrations due to roll back. Methane concentrations will be monitored at the face and at locations on the model mining machine to establish guidelines for using machine-mounted methane monitors to predict face methane concentrations. A three-axis sonic anemometer will be installed in the full-scale test gallery to generate airflow patterns (velocity profiles) for a variety of mining methods and equipment. The effects of repeated exposures to dust and moisture on catalytic sensor response time will be measured, and recommendations will be made for routine maintenance and field testing.

Enhanced Spray Dust Capture for Improved Dust

Project Director: John Organiscak, M.B.A., B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P124
Keywords/Phrases: Control technology, dust, mining

Purpose:
To develop enhanced spray dust capture principles for improving water droplet collection efficiency of respirable silica dust.

Abstract:
Water application is one of the primary means used in mining to control dust generation and liberation. The initial laboratory phase of the project will measure spray droplet characteristics of various spray nozzle types, study geometric spray nozzle layout enhancements for improving water droplet to air induction performance, and measure airborne dust capture or removal rates of these particular geometric spray nozzle layouts and dust particle interaction. The second phase will further develop the application of these enhanced spray technologies and principles into existing mining systems for improving silica dust suppression from mining, crushing, screening, and milling processes.

New Technology to Increase Rollover Protective Structures

Project Director: Timothy Lutz, B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P137
Keywords/Phrases: Injury prevention, rollover protective structures, tractors

Purpose:
To increase the use of rollover protective structures (ROPs) on tractors that originally did not have ROPs installed from the factory.

Abstract:
This safety-engineering project will organize similar technical skills (mechanical, electrical, and safety engineers) and instrumentation to work on a common injury prevention problem relating to tractors that do not have ROPs installed. More than 60% of tractors in use do not have ROPs installed. Targets of the research include (1) a simpler, more economical ROPs design for retrofitting older tractors, (2) field tests of a structure that deploys during a roll that is of benefit for work in which overhead clearance is restricted, (3) field tests of a sensor that detects an imminent rollover and can initiate deployment of a self-raising structure, and (4) analysis of several composite materials to reduce the weight of adjustable structures and improve the corrosion resistance of ROPS. The expected outcome of this project is improved ROPs technology for U.S. industry and tractor owners that will allow significantly more tractors to be equipped with ROPs.

Improving Ventilation Technology in Large Opening Mines

Project Director: Roy Grau, B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P140
Keywords/Phrases: Underground mining, ventilation, diesel

Purpose:
To develop effective, practical methods to improve ventilation in the large, low-velocity airways common to the

working areas of metal/nonmetal mines (underground stone mines).

Abstract:
Underground stone mining operations create airborne contaminants that are distributed throughout the mine in the ventilation airflow. Improving ventilation will reduce worker exposure to these harmful substances. The exposure time of the contaminants in the ventilation airflow before exiting the mine is dependent on the travel distance and ventilation practices and characteristics. Currently, the underground stone industry relies on intuition and trial-and-error methods to address ventilation problems. The ventilation strategies developed as part of this research effort will be disseminated to industry to improve the workplace environment for underground miners.

Preventing Injuries from Falling Rock in Underground Coal Mines

Project Director: Christopher Mark, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P142
Keywords/Phrases: Underground mining, roof support systems, ground control

Purpose:
To reduce the risk of injury from minor rock and rib falls in underground coal mines by removing the barriers that limit the use of surface control technology.

Abstract:
Minor roof and rib falls that result in more than 800 injuries a year occur from the surface of the mine opening, and therefore the protection systems are called surface control. Surface controls can be in the form of installed support systems or incorporated into equipment design. If surface control technology is more widely adapted by the mining industry, potentially up to 80% of all ground fall injuries could be eliminated.

Lockout / Tagout, Jammed and Moving Machinery Controls

Project Director: Gary Mowrey, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P148
Keywords/Phrases: Engineering controls, injury prevention, mining

Purpose:
To develop low-cost, practical monitoring, warning, and interlock devices that industry can license and further develop into commercially available safety products for conveyor, baler, and compactor equipment.

Abstract:
This safety engineering project will design devices to warn employees of their proximity to a potentially hazardous work area and, if necessary, shut down the equipment. The research team will ensure that any interested stakeholders become aware of the capability of this new technology through Open Industry Briefings, training workshops, and publications in peer-reviewed journals. Licensing agreements and cooperating product development efforts will be vigorously pursued with appropriate vendors. Both fatalities and nonfatalities from workers becoming caught in moving conveyors are expected to decline in industries in which this technology is successfully implemented.

Surface Blasting Safety and Health

Project Director: Marcia Harris, B.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P158
Keywords/Phrases: Blasting, explosives, mining

Purpose:
To investigate flyrock related fatalities over the last 10 years.

Abstract:
Since 1988, 11 incidents occurred in which it is suspected that blast-generated CO migrated through the ground, resulting in CO poisoning. In 10 of these cases, the blasting was part of a construction project at a strip mine. In all, 23 people were hospitalized and treated for CO poisoning, with one fatality. Blasters need to know how to protect against CO poisoning. Every blast is associated with fragmentation and often the projection of rocks. Flyrock and blast area security dominate blasting-related accidents in surface mining. The objectives of this task are to (1) determine the causes of flyrock-related fatalities in the construction industry during the past decade, (2) publish the results of the mining and construction industry studies, and (3) approach the International Society of Explosives Engineers and the Institute of Makers of Explosions about jointly producing a training video to enhance the reduction of flyrock fatalities.

Mobile Mining Equipment Warning Systems

Project Director: John Owens, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S352
Keywords/Phrases: Mining, rollover, control technology
Purpose:
To reduce the number of injuries and deaths of workers who operate or work near forklift trucks at mining operations.

Abstract:
A common danger in the mining industry occurs when mobile mining equipment is unknowingly operated in unstable configurations and dangerous conditions. Such instabilities can be initiated through both operator error and changing terrain and can result in equipment rollovers and deaths of workers. Despite the fact that forklift trucks have evolved into very safe vehicles over the last 50 years, provided they are operated within their specialized design limitations, many accidents continue to occur. About 100 workers die each year in forklift truck accidents in the United States and 34,000 workers are injured. More than 650 forklift truck accidents occurred at mining operations during 1995-1999. A sensor-based monitoring system will be developed to monitor continuously the critical operating parameters (i.e., pitch, roll, yaw, lift weight, and height) of forklift trucks to (1) alert the operator when the vehicle is being operated unsafely and (2) be used as a training tool to evaluate and improve the operating competency of forklift truck drivers. Some of the benefits of installing a sensor-based monitoring system on forklift trucks include reduced forklift truck accidents and fatalities, improved driving habits, enhanced compliance with Mine Safety and Health Administration safety standards, reduced forklift truck maintenance costs, reduced storage rack and product damage, safer and more productive workplace, and ongoing forklift truck training to keep operators at the peak of their abilities.

Reducing Diesel Particulate Exposures in Western Mines

Project Director: David Denton, B.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S380
Keywords/Phrases: Mining, diesel, airborne contaminants
Purpose:
To reduce current exposure of workers in western mines to potentially dangerous concentrations of exhaust from diesel engines.

Abstract:
Products from this research include information and tools that the mining industry can use to help meet Federal mandates and reduce worker exposures. The research will identify various interventions and rigorously evaluate the technical and financial feasibility of each. The program hopes to significantly reduce current exposure to diesel particulates.

Identification and Control of Rock Burst Hazards

Project Director: Jeffrey Whyatt, Ph.D.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S917
Keywords/Phrases: Underground mining, ground control, rock bursts
Purpose:
To examine adverse geologic conditions that create increased rock burst hazards in mines, study methods for identifying these conditions, develop analytical methods for assessing their impact on workplace safety, and develop alternative methods for evaluating alternative measures.

Abstract:
Miners are subjected to widely varying incidences of rock bursts. Highly hazardous areas are often created by adverse geologic conditions. The presence of these conditions in portions of mines in one district have been associated with a rate of rock burst fatalities in the district that is eight times greater than the industry average for all causes of death. The main hypothesis of this project is that rock burst hazards are controlled by localized deviations from average, expected conditions. Experienced personnel have become quite adept at anticipating and responding to average conditions. However, the location and characteristics of unusual conditions that may be encountered in the course of mining often lie outside the realm of their experience and are more difficult to incorporate in a ground-control plan. The goal of this project is to demonstrate this hypothesis and develop methods for assessing rock burst hazards. This project will examine the types of adverse geologic conditions that create pockets of increased rock burst hazards within mines, study methods for identifying these conditions, develop analytical methods for assessing their impact on workplace safety, and develop analytical methods for evaluating alternative measures.

• Emerging Technologies •

Smart Fire Sensors

Project Director: John Edwards, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P058
Keywords/Phrases: Fires, mining

Purpose:
To investigate the development of sensors that will detect fire in mines.

Abstract:
To protect miners in the workplace from hazardous smoke and combustion gases associated with mine fires, improved mine fire detection technologies are to be investigated in this research project. These technologies result in the development of smart mine fire sensors capable of discriminating between a mine fire and diesel emissions, determining the stage of fire growth, and determining the fire combustion source. There is an increased need for early and discriminating mine fire detection as advanced mining technology rapidly increases the underground mine region occupied by miners to be monitored. This project uses the unique research expertise and mine facilities at NIOSH. During FY01 mine fire detection experiments with fuel sources of coal and conveyor belt in the presence of diesel emissions were conducted. Additional experiments will be conducted to provide a database for a neural network analysis of fires in the presence of nuisance alarms from diesels and welding and cutting operations. The effect of multiple type in-mine fire sensors for mine fire detection and discrimination will be examined. An in-mine evaluation of mine fire discrimination technology at a battery charging station will be conducted at an operating mine. The quantitative results of this research will be provided to the Mine Safety and Health Administration (MSHA) and will assist the implementation of underground mine fire sensor deployment strategies.

• Exposure Assessment Methods Development •

NIOSH Manual of Analytical Methods Cooperative Research

Project Director: Paul Schlecht, B.S., M.B.A.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277066
Keywords/Phrases: Analytical methods, sampling methods, method development

Purpose:
To develop new analytical methods to be published in the NIOSH Manual of Analytical Methods (NMAN).

Abstract:
Collaborating laboratories having expertise not currently available within NIOSH will be given financial and technical assistance to develop methods for the determination of hazardous substances in the workplace. These collaborators will thoroughly evaluate methods already in use in their laboratories. The methods will be added to NMAM, when the methods have been shown to meet NIOSH evaluation criteria. NMAM is used by industrial hygiene and environmental laboratories, universities, State and Federal agencies, libraries, and the private sector to assess hazard evaluations, industry studies, and the effectiveness of engineering controls. Each year, one or more new monitoring methods developed by cooperating laboratories will be added to NMAM. The priority of new methods will be determined from a survey of industrial hygiene laboratories.

Screening Methods for Airborne Metals in Construction

Project Director: Kevin Ashley, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277331
Keywords/Phrases: Construction, screening methods, method development

Purpose:
To develop methods for screening metals in the workplace.

Abstract:
Because of the hazardous nature of exposures to toxic metals, methods are needed that can rapidly provide information about worker exposures in the construction industry. This project will provide field-evaluated methods for on-site screening of metals in workplace samples

to allow the assessment of worker exposure and effectiveness of control measures. This project will entail (1) the development and evaluation of new methods for metal species not previously investigated, (2) field evaluations of metals screening methods, and (3) technology transfer efforts to commercialize and publicize new field screening methods for metals monitoring in the construction industry.

Development of the Fine Particle Characterization and Monitoring Methods

Project Director: Andrew Maynard, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277399
Keywords/Phrases: Aerosols, exposure assessment, sampling methods

Purpose:
To develop electron and scanning probe methods to fully characterize ultrafine aerosols produced in workplaces and also methods to monitor exposure to quantities, such as particle number and surface area.

Abstract:
There is evidence that the toxicity of very fine workplace-related particles may be more closely associated with number or surface area than their mass. Validation of this hypothesis is limited by a lack of suitable characterization and monitoring methods. The problem is particularly acute for particles below 100 nm in diameter (ultrafine particles) in which aerosol characteristics are dominated by surface area and particle number. The two approaches combined together will provide the tools to enable a greater understanding of toxicologically-relevant particle characteristics to be developed and will allow exposure monitoring against relevant metrics.

Health Assessment of Workers Exposed to Bromopropane

Project Director: Dennis Lynch, B.A., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277400
Keywords/Phrases: 1-bromopropane, biomarkers, solvents

Purpose:
To conduct a multifaceted biomarker study of workers exposed to 1-bromopropane (1-BP; n-propyl bromide).

Abstract:
1-BP is a widely used industrial solvent, yet human toxicological data are lacking and no occupational exposure guidelines currently exist. Significantly, several Health Hazard Evaluations conducted by NIOSH have revealed that workers are being exposed to 1-BP at concentrations known to cause adverse effects in laboratory animals. In this research, biomarkers of exposure, effect of exposure, and susceptibility will be evaluated using blood, urine, and semen obtained from workers. Workplace and personal breathing zone concentrations of 1-BP will be measured. Study results should serve as a basis for the development of an occupational exposure limit for 1-BP and may identify opportunities to reduce worker exposures through implementation of engineering controls and/or improved work practices.

Use of Liquid Chromatography / Mass Spectrometry to Identify Isocyanate Exposure Hazards

Project Director: Robert Streicher, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277402
Keywords/Phrases: Analytical methods, exposure assessment, isocyanate

Purpose:
To develop a liquid chromatography/mass spectrometry (LC/MS) method for the analysis of complex mixtures of isocyanates generated in workplace environments by thermal breakdown of polyurethane or other precursor materials.

Abstract:
An analytical method previously developed by the investigators will be modified for this project to be made compatible with MS detection. If successful, a collaborative effort between laboratory and field researchers could investigate workplaces in which concentrations of isocyanates formed by thermal breakdown are expected to be high. Expected products of this project are a publication in a peer-reviewed journal and a working method to analyze complex mixtures of isocyanates.

Antineoplastic Drug Exposure: Effectiveness of Guidelines

Project Director: Thomas Connor, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277449

Keywords/Phrases: Health care workers, biomarkers, exposure assessment

Purpose:

To evaluate the exposure of nurses and pharmacists to antineoplastic drugs to determine whether these health care workers are being exposed.

Abstract:

For the proposed project, air and surface concentrations of antineoplastic drugs will be measured with a number of internal biological measurements. The intent is to determine whether chronic low-level exposure to antineoplastic agents may cause health effects and if biological markers would be useful as early indicators of effect to aid in intervention efforts.

Biomarker Development for Human Exposure Assessment

Project Director: Debra Debord, Ph.D.

Division: DART

Telephone: (513) 533-8462

Project ID: 9278005

Keywords/Phrases: Biomarkers, genetics, exposure assessment

Purpose:

To develop and apply biomarker methods for occupational toxicants to assess exposure, effect of exposure, and susceptibility.

Abstract:

Biomarkers have been developed and used in field studies to assess worker exposure and effects of exposure host susceptibility factors to the following compounds: roofing asphalt, perchloroethylene, JP-8 jet fuel, nitrosamines. These biomarkers would have application for human field studies. For epidemiological and health hazard studies, it is imperative that biomarkers for internal dose, biologically effective dose and early effects be evaluated so that exposure and effects of exposure can be more accurately determined. It also addresses a need to relate exposure markers to markers of early effects and to determine which markers may best reflect exposure or disease. Studies continue to evaluate biomarker use in determining exposure and effect of exposure of occupational agents, such as secondhand cigarette smoke, JP-8 jet fuel, and roofing asphalt. This is the fifth year of this project. Because of the development of two biomarkers for DNA damage for asphalt fumes, this project provided a springboard for the initiation of a project to evaluate exposure, early DNA damage, and gene environment factors in roofing asphalt workers. In the past, this project received additional funds from the Construction Steering Committee when a feasibility study to assess genotoxicity of asphalt fumes was integrated into this project. This past year, one book chapter, one manuscript, and three poster presentations were published from the results of this project.

Biomonitoring Analyses for Studies of Dermal Exposures

Project Director: Kenneth Cheever, M.S.

Division: DART

Telephone: (513) 533-8462

Project ID: 9278034

Keywords/Phrases: Biological monitoring, analytical methods, exposure assessment

Purpose:

To develop and apply biomarker methods for occupational toxicants to assess exposure, exposure effect, and susceptibility.

Abstract:

Biomarkers have been developed and used in field studies to assess worker exposure, effects of exposure host susceptibility factors to the following compounds: roofing asphalt, perchloroethylene, JP-8 jet fuel, nitrosamines. Studies continue to evaluate biomarker use in determining exposure and effect of exposure of occupational agents, such as second-hand cigarette smoke, JP-8 jet fuel, and roofing asphalt.

Aerosol Measurement Research

Project Director: Paul Baron, Ph.D.

Division: DART

Telephone: (513) 533-8462

Project ID: 9278155

Keywords/Phrases: Aerosols, exposure assessment, fibers

Purpose:

To investigate the air velocities and flow patterns near the nose and mouth of a breathing manikin and compare these results with similar flows near a human subject.

Abstract:

This project will address several issues in aerosol sampler accuracy. Inhalable sampler performance will be tested in relation to human aerosol inhalation. Compared with current practice, sampler performance will be measured more directly through a particle imaging velocimeter (PIV) system. Techniques for evaluating new sampler performance will be developed. Investigation into current techniques for testing thoracic and respirable aerosol samplers will result in more accurate and comparable results from these devices. A generation and fiber-length

classification system for fibers will be evaluated and improved to perform nose-only inhalation studies.

Development of Analytical Methods for Metalworking Fluids

Project Director: Robert Glaser, B.S., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278157
Keywords/Phrases: Analytical methods, aerosols, metalworking fluids

Purpose:
To refine and extend the applications of a method for metalworking fluids (MWF).

Abstract:
This project will continue to refine and extend the applications of a NIOSH/American Society for Testing and Materials (ASTM) method for MWF. It is imperative that the method be fully evaluated and refined to improve data collection used in other research situations? epidemiological surveys, for example.

Measurement of Group-Based Log KOWs for Solvent Mixture Components

Project Director: Robert Glaser, B.S., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278158
Keywords/Phrases: Analytical methods, feasibility assessment, solvents

Purpose:
To assess whether the dermal absorption of one solvent is affected by the presence of other solvents.

Abstract:
Because octanol-water partition coefficients (KOW) provide an indication of the dermal uptake of a given solvent, the octanol-water partition coefficient will be computed for neat solvents and then blends of the same solvents in this research project. Evidence of increased dermal uptake of mixture components will be apparent if the computed values of KOW in the mixture are substantially greater than comparable measurements for the neat matrix.

Pesticides by Gas Chromatography Atomic Emission Detection

Project Director: Mary Birch, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278159
Keywords/Phrases: Analytical methods, pesticides, child agriculture

Purpose:
To provide screening and quantitative methods for pesticides.

Abstract:
Screening and quantitative analytical methods for a broad range of pesticides in different matrices (e.g., air, dust, wipes, clothing) will be developed. Pesticide use is widespread and are hundreds are being used, some illegally. This project will employ a specialized analytical technique that is not routinely available. The technique is particularly useful for pesticide analysis because it can detect a wide variety of pesticides and has the high selectivity required for complex samples. New methods for extraction of pesticides from different matrices will be investigated. The analytical methods developed will support epidemiological studies, surveillance activities, evaluation of mitigation measures, and confirmation of pesticide-related illness.

Technical Support for NIOSH Manual of Analytical Methods 5040

Project Director: Mary Birch, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278160
Keywords/Phrases: Analytical methods, diesel, particulates

Purpose:
To provide quality assurance data and technical support for a recently developed, analytical method (NIOSH Manual of Analytical Methods [NMAM] 5040) for diesel particulate matter.

Abstract:
Quality assurance results from samples collected during previous field surveys will be submitted for journal publication. Preparation techniques for an analytical reference material and other measurement issues will be examined. NMAM 5040 is being used for environmental and occupational monitoring, and new air standards recently have been proposed by the American Conference of Government Industrial Hygienists, the

Mine Safety and Health Administration, and the U.S. Environmental Protection Agency.

Screening of Metalworking Fluids Using Liquid Chromatography / Mass Spectrometry

Project Director: Jack Pretty, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278161
Keywords/Phrases: Analytical methods, mixed exposures, metalworking fluids

Purpose:
To screen metalworking fluids for hazardous species content.

Abstract:
This project will use syringe-pump infusion or liquid chromatography with mass spectrometric detection to assess metalworking fluids for hazardous species content. The presence of suspected sample constituents may be confirmed by comparing data parameters, such as chromatographic retention time, isotope ratios, and molecular fragmentation patterns, with values obtained for standards of the known compounds. Information about the molecular formulae and molecular structures of unknown species in metalworking fluids is also provided by mass spectrometric detection, providing support for identification of these unknowns. Screening methods that result from this research will allow more complete understanding of metalworking fluid content and in-house methods for identification of hazardous components and semiquantitative measurement of their concentrations.

Control Technology and Exposure Assessment for Sub-Micrometer Beryllium Particle

Project Director: Alan Echt, B.S., M.P.H, C.I.H
Division: DART
Telephone: (513) 533-8462
Project ID: 9278166
Keywords/Phrases: Beryllium, control technology, small business

Purpose:
To identify industries in which sub-micrometer beryllium particle control is an issue, to characterize exposure within these industries and assess applied control methods, and to evaluate the gaps in current control methods to reduce exposure.

Abstract:
This research will begin by identifying industries in which beryllium particles are generated or used. An Occupational Safety and Health Administration (OSHA) database will be used to identify those industries in which sampling for beryllium was conducted by OSHA compliance officers and consultants to target appropriate industry segments (by four digit Standard Industrial Classification [SIC]code) in which beryllium exposures occur. Although the IMIS data will be slanted toward industry segments thought to be problematic in terms of exposure, this data is one comprehensive source of information in which beryllium is used. Next, a series of walkthroughs will be performed. Among the facilities selected for walkthroughs will be those in which process equipment has been designed to control exposures to sub-micrometer and larger beryllium particles. The identification of design concepts and control strategies that can be applied to other similar processes will be emphasized. In-depth exposure characterization will then be conducted at approximately 20 sites over the course of the project to collect indicative measurements of exposure to particle number, surface area, mass, and particle size distribution in relevant industries and to determine the control parameters and their effectiveness in reducing exposures. Side-by-side measurements will be performed that consist of traditional air sampling, particle size measurement, and advanced sampling techniques that are being developed in a related beryllium project. The reports from these in-depth studies will be used as a basis for making control recommendations in NIOSH policy documents and to prepare technical reports and journal articles on the effective control of sub-micrometer particles. This information will be available to health professionals, equipment manufacturers, and others to facilitate the development of effective control measures in the workplace.

A Method for Simultaneous Analysis of Multiple Pesticides

Project Director: Raymond Biagini, Ph.D., D.A.B.T.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278314
Keywords/Phrases: Biological monitoring, biomarkers, exposure assessment

Purpose:
To develop a new urinary biological monitoring technology called fluorescence microbead immunosorbent assays.

Abstract:
The new urinary biological monitoring technology, fluorescence microbead immunosorbent assays, developed through this project will measure concentrations of several pesticides simultaneously in urine. Professional pesticide applicators apply many different types of pesticides during a typical work week. Urinary biological monitoring is an essential exposure assessment tool for these workers since skin absorption is a common route of exposure. Typically, an accurate estimate of total pesticide exposure for these workers requires separate, costly, and time-consuming analyses for each individual pesticide. Successful application of this multi-analyte technology will allow for a more complete and cost-effective characterization of workplace exposures, which, in turn, should allow for enhanced intervention measures to prevent future exposures.

Exposure Assessment Methods for Evaluating Electric and Magnetic Field Health Effects

Project Director: Joseph Bowman, Ph.D., C.I.H.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278342
Keywords/Phrases: Electric and magnetic field, EMF, cancer, cardiovascular disease
Purpose:
To conduct research on new methods for assessing exposure and risk from occupational electric and magnetic fields (EMF).

Abstract:
This project will conduct measurements of worker exposures to biologically based magnetic field metrics with the Multiwave III, a new personal waveform monitor. This instrument will be used in an epidemiologic study of the diseases previously associated with EMF exposures in electric utility workers (brain cancer, leukemia, and Alzheimer's disease). In FY2002, the investigators will be conducting pilot measurements with the Multiwave III at electric utilities and developing the protocol for the full exposure assessment and risk analysis of EMF-related diseases in a population in which health outcomes have already been determined.

Validation Studies in Occupational Immunotoxicology

Project Director: Raymond Biagini, Ph.D., D.A.B.T.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278345D
Keywords/Phrases: Latex, allergies, hypersensitivity
Purpose:
To assess exposure to latex proteins and fungus S. chartarum.

Abstract:
This occupational immunotoxicology project focuses on worker exposure to latex proteins and the fungus S. chartarum. In this "real-world"' problem, persons who are sensitive to latex will be exposed to latex proteins by puncture skin tests to determine which proteins are most important for the production and elicitation of latex allergy. Successful identification of the proteins will make it possible to develop better in vitro tests, identify which proteins should be removed from latex gloves, give insight into therapeutic intervention (desensitization injections), and allow for enhanced intervention measures to significantly lower the incidence of latex allergy. Finally, a major new effort will evaluate bakers for asthma and hypersensitivity (an underreported disease), as well as evaluate genetically modified grain as an occupational allergen (a newly emerging risk).

Biomonitoring Methods for Agricultural Exposures

Project Director: Cynthia Striley, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278351
Keywords/Phrases: Biological monitoring, agriculture, pesticides
Purpose:
To develop new enzyme-linked immunosorbant assays to analyze pesticides.

Abstract:
Millions of pounds of pesticides are applied each year, putting a large number of workers at risk for exposure to potentially toxic chemicals. NIOSH currently has several studies investigating exposures to organophosphate insecticides and the herbicide metolachlor. These surveillance and intervention studies require sensitive and accurate methods to assess exposure of workers. Since much of their exposure is through the skin, biological monitoring is needed to complement sampling of air, clothing, etc. Because conventional biomonitoring meth-

ods are relatively slow and expensive, new biomonitoring methods enzyme-linked immunosorbant assays (ELISAs) for pesticides azinphosmethyl, phosmet, and piperalin are being developed and will be used to analyze specimens collected in the NIOSH studies. These new methods will be cheaper and easier to use than conventional assays, thereby allowing for quicker identification and correction of exposure risks.

Biological Monitoring Research and Support

Project Director: John Snawder, Ph.D., D.A.B.T
Division: DART
Telephone: (513) 533-8462
Project ID: 9278378
Keywords/Phrases: Biological monitoring, analytical methods, herbicides

Purpose:
To develop new biological-monitoring analytical methods and provide biological-monitoring analyses for NIOSH field investigations.

Abstract:
Currently, the in-house effort regarding this research focuses on development of (1) an improved method for determining a urinary biomarker of exposure to the pesticide diazinon and (2) a method for biological monitoring for exposure to the herbicides alachlor, metolachlor, acetochlor, atrazine, and cyanazine via urinalysis for their mercapturic acid conjugates. Biological monitoring results are used to demonstrate (1) the existence of an exposure problem so that it can be corrected and (2) the adequacy of control technologies and intervention strategies.

Physical Characterization of Ultrafine Particles

Project Director: Andrew Maynard, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278417
Keywords/Phrases: Aerosols, exposure assessment, particulates

Purpose:
To develop and evaluate novel methods for characterizing and quantifying workplace ultrafine particulate exposures in terms of aerosol surface-area.

Abstract:
There is growing evidence that current occupational exposure limits may not adequately protect all workers exposed to low-solubility particles typically smaller than 100 nm in diameter (ultrafine particles). Surface-area is implicated as an important exposure metric in a number of studies; however, no validated methods for measuring aerosol surface-area exposure in the workplace exist currently. New and existing exposure measurement methods will be evaluated. Research will also examine the behavior of ultrafine particles in the workplace and following lung deposition, further explore the relevance of alternative exposure metrics. The proposed research will provide a basis for re-evaluating current exposure standards and monitoring methods.

Beryllium Disease Surveillance Research

Project Director: Kathleen Kreiss, M.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278208
Keywords/Phrases: Beryllium, genetics, exposure assessment

Purpose:
To extend a well-characterized beryllium-exposed cohort for cumulative incidence of beryllium disease, genetic and other risk factors, and exposure-response relations using new measurement techniques.

Abstract:
NIOSH researchers conduct exposure assessment and analyze questionnaire interviews, screening blood tests for beryllium allergy and clinical diagnostic information from a beryllium company with genetic analyses and exposure reconstruction from NIOSH divisions. Understanding the level of beryllium exposure that results in disease among workers with increased genetic susceptibility can guide prevention efforts.

Applied Monitoring Studies

Project Director: David Bartley, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278456
Keywords/Phrases: Respiratory disease, sampling methods, screening methods

Purpose:
To conduct a targeted program of research for monitoring worker and workplace exposures to toxic substances and develop fast, inexpensive, sampling and analytical methods to detect fungi in soil and bird and bat droppings.

Abstract:
The methods developed for this research must have sufficient sensitivity to detect small numbers of fungi. State-of-the-art molecular bioanalytical techniques will be used to identify pathogenic fungi from construction and agricultural workplaces. This research will provide the occupational safety and health community with information, training, and the capacity through instrumentation to prevent occupational diseases. This project will result in valuable information about monitoring, which would otherwise be unavailable to Federal agencies and to safety and health practitioners.

Methods Development for Field Research

Project Director: Donald Dollberg, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278484
Keywords/Phrases: Sampling method, analytical methods, method development

Purpose:
To develop sampling and analytical methods in support of NIOSH projects, which require the assessment of workplace exposures to new chemicals.

Abstract:
Short-term sampling and analytical methods will be developed in support of NIOSH researchers upon request and is an integral part of a project that involves exposure assessment or control technology evaluation. Methods are developed that follow established protocols contained in the NIOSH Guidelines for Air Sampling and Analytical Method Development and Evaluation. The short-term method development process consists of a literature review, sampling system selection, instrumental optimization, establishment of limits of detection and quantitation, and determination of analyte recovery and stability. These methods are used to monitor exposures to new chemicals found in the workplace atmosphere and are published in the NIOSH Manual of Analytical Methods and scientific literature.

Analysis of Silica Polymorphs

Project Director: Rosa Key-Schwartz, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278497
Keywords/Phrases: Aerosols, silicosis, sampling and analytical methods

Purpose:
To improve analytical methods and standardize laboratory practices for measurement of crystalline silica.

Abstract:
Research into improvement of analytical methods and standardization of laboratory practices for measurement of crystalline silica will provide better accuracy and precision in the assessment of occupational exposure to crystalline silica and a step towards the elimination of silicosis. A detailed survey of lab practices for laboratories participating in the Proficiency Testing Program (PAT) for crystalline silica showed that in addition to standard lab practices, an important factor in accuracy and precision of crystalline silica measurement was calibration, which is the use of a certified Standard Reference Material (SRM) and the availability of working standards on filters. Research into the deposition of crystalline silica SRM onto filters will be conducted with a goal of availability of several levels of working standards, which will provide PAT silica laboratories with additional standards for routine calibration. Demonstration of the improvement in the precision of crystalline silica analyses will be accomplished by monitoring PAT results after standard laboratory practices, improved methods, and required calibration standards have been put into place.

Summary of Blood Lead Monitoring Evaluation Project

Project Director: Lauralynn Taylor, M.P.H.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278572
Keywords/Phrases: Lead, biomarkers, exposure assessment

Purpose:
To field validate an anodic stripping voltammetry field instrument that rapidly analyzes capillary and venous blood lead levels.

Abstract:
The anodic stripping voltammetry field instrument has only been used with children whose blood lead levels are significantly lower than in occupationally exposed adults. The instrument's expeditious analysis makes it potentially valuable to occupational health professionals during on-site investigations. To conduct the instrument evaluation, the investigators propose to evaluate this instrument in at least two highly exposed adult populations at low and high altitudes and to compare these results to split samples analyzed according to a reference graphite furnace atomic absorption spectrometry method. This sam-

pling and analytical technique is less invasive and can provide quicker results than current methods, rapidly guiding efforts to reduce lead exposures.

Pesticide Exposures of Greenhouse Workers

Project Director: Wayne Sanderson, Ph.D., C.I.H.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278578
Keywords/Phrases: Pesticides, organophosphate pesticide, agriculture

Purpose:
To evaluate pesticide exposures of workers while applying pesticides and harvesting roses.

Abstract:
Greenhouse workers are exposed to a variety of pesticides with a broad range of health effects, including dermatitis, respiratory irritation, neurologic dysfunction, increased cancer risk, and death caused by acute poisoning. In the initial phase of this study, workers' exposure to selected pesticides, use of personal protective equipment, and the effectiveness of training techniques were evaluated. Based on the results of these cross-sectional evaluations, interventions will be designed and implemented. Follow-up evaluations will determine the effectiveness of the interventions to reduce workers' pesticide exposures and potential health effects.

Immunologic Methods for the Assessment of Workplace Exposure to Natural Rubber Latex

Project Director: David Weissman, M.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277049
Keywords/Phrases: Latex, exposure assessment, allergies

Purpose:
To develop standardized approaches to measure natural rubber latex (NRL) allergens in the environment.

Abstract:
NRL allergy has become a major occupational illness of health care workers and a significant problem for heavily exposed patient populations such as children with spina bifida. The disease can have significant consequences for affected persons. Fortunately, the potential exists to prevent this disease by limiting exposure to NRL allergens. To set recommended exposure limits and monitor the effectiveness of measures to prevent exposure, it is necessary to have a standard, reproducible way to measure exposure. Thus, the main purpose of this project is to develop NRL allergen measurements suitable for environmental monitoring. In addition, these measurements will be used to assess the potential usefulness of decontamination procedures.

Portable Analysis of Multiple Airborne Metals (Mining)

Project Director: Nicholas Lawryk, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277100
Keywords/Phrases: Exposure assessment, emerging technology, airborne contaminants

Purpose:
To develop new standard methods for analyses of multiple airborne metals using portable technologies that are user-friendly, rugged, and relatively inexpensive.

Abstract:
The methods developed through this research will be most useful in workplaces in which airborne metals pose health hazards. Workers in mining, construction, welding, refining, and related industries are potentially exposed to airborne contaminants such as silver, lead, nickel, manganese, chromium, and zinc, which can cause health problems ranging from metal fume fever and asthma to cancer and parkinsonism. Recently, field-portable screening methods for measuring airborne metals have been developed. Unfortunately, they are not widely used because of their expense, complexity, and relative inaccuracy. Refinement and extensive field testing of existing portable methods combined with method development for emerging technology can lead to rugged, more accurate, and relatively inexpensive instruments that can quickly screen numerous airborne metals in the workplace. Such instruments will permit rapid exposure assessment and evaluation of engineering controls and interventions, thereby reducing airborne metal exposures and possible illnesses.

Evaluation of New Technologies for Bioaerosol Screening

Project Director: Teh-Hsun Chen, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277249
Keywords/Phrases: Bioaerosols, exposure assessment, indoor air quality

Purpose:
To examine the applicability of emerging technologies for detection and quantitation of total and airborne microorganisms at worksites in which bioaerosols are a health hazard.

Abstract:
The number of reported indoor air quality problems is rapidly increasing and includes such problems as irritation and immunologic and infectious diseases. There is a need to develop real-time monitors that identify airborne microorganisms in workplaces. Airborne microorganisms are suspected of causing illness in "sick" buildings, worksites using contaminated metal working fluids, some agricultural exposure situations, and health care patient rooms. This project will examine the applicability of each of several emerging technologies as an exposure assessment screening tool for identifying airborne microorganisms in workplaces by applying technologies being developed by the Department of Defense to detect bioaerosols. The main focus has been on polymerase chain reactions (PCR) techniques. Success in this project will lead to production of transportable devices to be used for identifying problematic airborne microorganisms in workplaces.

Gas and Vapor Monitoring

Project Director: Chun-Sing Orr, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277251
Keywords/Phrases: Airborne contaminants, exposure assessment, industrial hygiene

Purpose:
To evaluate and develop a portable sensor for monitoring nitrous oxide in dental offices.

Abstract:
The sensor developed in this project will allow dental personnel to make real-time measurements of nitrous oxide in the ambient air inside the dental office. This will allow dental personnel to make immediate corrections to situations in which overexposure to nitrous oxide is occurring. Because of its significant effects in the medical, industrial, agricultural, and environmental areas, the results of this project will be valuable to industrial hygienists or safety and health personnel to improve the safety and health of workers in other occupations. The technology developed will also be applicable to other gas or vapor types. Commercialization of sensor design and technological approaches is likely.

Computational Fluid Dynamics Simulations

Project Director: Aaron Bird, M.S.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277376
Keywords/Phrases: Aerosols, exposure assessment, computer

Purpose:
To examine the feasibility of using computational fluid dynamics (CFD) simulations to model airflow around workers and evaluate computational simulations of air sample collection efficiency of worker-mounted samples.

Abstract:
Evaluation of the accuracy and precision of computational simulations for monitoring airborne exposures is essential before the results of such simulations can be used. Previously, research on air sampling devices has usually been conducted in wind tunnels or calm-air chambers. However, recent advances in computational power and modeling capabilities make it possible to simulate flow fields and shed more light on the physical phenomena associated with air sampling. This project has demonstrated that computational models of the flow fields around the human torso are possible and will evaluate the accuracy and precision of simulations of air sampling devices mounted on manikins as well as the ability to model aerosol capture by the sampling device. If successful, improved sampler designs will be possible in the future based on simulation results and limited experimental evaluation.

Predicting Skin Penetration: Model and Experiments

Project Director: H. Frederick Frasch, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278075
Keywords/Phrases: Skin, exposure assessment, dermatitis

Purpose:
To improve the ability of mathematical/computer modeling to predict both steady- and nonsteady-state penetration of chemicals through human skin.

Abstract:
The underlying hypothesis is that dermal penetration can most appropriately be predicted using a random walk approach to account for the heterogeneous structural properties of stratum corneum (SC) that govern skin per-

meation. In vitro penetration and diffusion studies will be performed using excised human cadaver skin. The proposed research involves a novel application of a mathematical description of the diffusion process at its most basic level to realistic anatomic skin structures based on microscopic analysis. The model will be validated with data from in vitro dermal diffusion studies. Expected outcomes are peer-reviewed publications and incorporation of the mathematical model into NIOSH's dermal evaluation procedures. The investigators expect the model to become the sine qua non for the estimation of dermal exposure from workplace chemicals. Such a tool will be vital to NIOSH in the area of quantitative risk assessment of dermal exposure.

Particle Surface Program: Dust Characterization

Project Director: William Chisholm, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278077
Keywords/Phrases: Particulates, analytical methods, pneumoconiosis

Purpose:
To determine the surface elemental composition and structure of respirable particles involved in hazardous occupational exposures.

Abstract:
Surface analysis methods are being developed that use NIOSH-invented modifications of scanning electron microscopy—X-ray spectroscopy in combination with complementary scanning, auger spectroscopy for detailed surface elemental and structural analysis of selected individual respirable particles, and other novel or unique laboratory analyses for a wide variety of parameters on a particle-by-particle basis. These are developed and tested for use to identify heretofore unrecognized or difficult to detect properties of respirable dusts that are controlling toxicity and may be predictive of disease risk. Field samples from workplaces in which there are anomalies in disease risk assessment based on conventional industrial hygiene exposure characterizations will be analyzed.

Particle Surface Program: Chemistry Characterization

Project Director: David Murray, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278079
Keywords/Phrases: Particulates, chemistry, silicosis

Purpose:
To develop and apply spectroscopic and other analytical methods to identify insoluble respirable particle surface chemical functional groups that control the expression of toxicity and that predict the risk that particle exposures pose for occupational respiratory disease.

Abstract:
Knowledge of the mechanisms by which inhaled, insoluble particles cause lung disease will increase the ability to assess the hazard of breathing a variety of dusts. This project will develop and apply modern spectroscopic and other surface chemistry research methods to model dust-lung interactions at the biochemical and molecular levels. The initial focus will be on pulmonary surfactant interactions with both strongly pathogenic (quartz) and non-strongly pathogenic (kaolin) dusts to model surface chemistry interactions controlling the initial expression of insoluble mineral particle toxicity in the lung. Methods and information developed will be applied to other respirable particulate materials and biological interactions. Identification of surface properties controlling toxicity will provide a basis for more complete characterization of workplace dust exposures for improved pneumoconiosis risk assessment.

Imaging and Grading Occupational Disease or Injury

Project Director: William Wallace, Jr. , Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278090
Keywords/Phrases: Pneumoconiosis, musculoskeletal disorders, neurotoxicology

Purpose:
To develop advanced spectroscopy-based imaging methods for noninvasive detection and measurement of biological responses to occupational exposures.

Abstract:
Initial methods under study for this project are positron emission tomography (PET)-scanning and magnetic resonance imaging (MRI) applied to animal models of pulmonary response to fibrogenic dusts and to models of musculoskeletal response to repetitive motion and vibration exposures. Applications to neurotoxicology research will be explored. Initial results of studies have been encouraging. Success would provide bases for field and clinical methods to complement industrial hygiene measures of occupational exposures for improved medical surveillance and epidemiological identification of occupational health hazards, and for more rapid evaluation of

prevention measures and medical management for manifest disease or injury.

Field Testing and Refinement of Local Positioning System

Project Director: Jennifer Hornsby-Myers, M.S.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278091
Keywords/Phrases: Industrial hygiene, exposure assessment, engineering
Purpose:
To field test the effectiveness of the outdoor prototype personal location units to identify occupational safety and health hazards.

Abstract
This research will field test the new outdoor prototype personal location units in conjunction with environmental sensors in outdoor workplaces to elucidate occupational safety and health hazards. Software will be written that allows the safety and health professional to easily determine when, where, and how much a worker is exposed to a hazard if a portable real-time sensor is available for that hazard. This will be particularly useful in identifying locations with high exposures, assigning average exposures to tasks that are performed in a defined area, and assessing exposure variability. The indoor prototype will be developed, field tested, and refined. The expected outcome of this project is a technology transfer of the indoor and outdoor personal location devices to the general public.

Dermal Particle Exposure and Granulomatous Lung Disease

Project Director: Sally Tinkle, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278111
Keywords/Phrases: Particulates, beryllium, genetics
Purpose:
To investigate the role of skin exposure in the development of pulmonary granulomatous disease.

Abstract:
Chronic beryllium disease is a debilitating occupational lung disease. The metal and its alloys are indispensable in the nuclear, aerospace, ceramics, and telecommunications industries, and its use has expanded to include the manufacture of fire fighting tools, dental implants, specialty golf clubs, and bicycle frames. Workers who manufacture any of these products are at risk. Successful completion of these studies will provide biological support for the development of skin-specific engineering control strategies in work environments with elevated particulates. The physical characteristics of particles that affect penetration into the skin will be determined and particle toxicity confirmed in human skin cell lines and murine skin exposure. The data will also assist OSHA in its reevaluation of the beryllium worker exposure limit.

Diesel Engine Emissions Measurement Analysis

Project Director: George Schnakenberg, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P016
Keywords/Phrases: Mining, diesel, sampling methods
Purpose:
To focus on the application of NIOSH Method 5040 for determining the workplace concentrations of diesel particulate matter (DPM) in metal and nonmetal mines.

Abstract:
The Mine Safety and Health Administration recommends NIOSH NMAM 5040 for curtailing diesel particulate matter (DPM), but industry has presented evidence (May 1999) that mine atmospheres present overwhelming interferences. This project addresses these issues by a systematic investigation of the effects of nondiesel mine aerosols on the determination of diesel exhaust particulate matter when NIOSH NMAM 5040 is used. NIOSH NMAM 5040 determines the organic and elemental carbon fractions of a workplace aerosol sample collected on a filter. Ore dusts containing carbonate oil mists cause positive interference in the organic carbon, and graphite and other carbon containing dusts cause positive interference in elemental carbon. Acidification of the sample can reduce or eliminate the carbonate interference. Size-selective sampling, which limits the aerosol collected on the filter to 0.8 micrometer size or smaller, can effectively eliminate both carbonate and elemental carbon interferences owing to the size difference between diesel and ore dusts. This research will investigate the validity of these techniques or develop alternative approaches to mitigate interferences.

Assessment of Personal Particulate Exposure

Project Director: Jon Volkwein, M.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P019
Keywords/Phrases: Mining, dust, silica
Purpose:
To investigate fundamental dust measurement technologies for application in mining.

Abstract:
Assessment of particulate in mines is currently time-consuming and expensive. New tools and approaches for monitoring respirable dust are required to provide timely feedback of dust exposures to workers to protect worker health. This project is developing near real-time quantitative and qualitative mass and pressure-based sensors for coal mine use. Basic research tasks will investigate diesel particulate matter measurements based on light scattering angular ratios, ion trap, and differential pressure technologies. Much of this work is being conducted in partnership with industry and academia. The successful outcome of the work will result in several new tools and approaches to particulate monitoring in mining to protect worker health.

Portable Monitors for Airborne Metals at Mining Sites

Project Director: Pamela Drake, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 2927S346
Keywords/Phrases: Mining, exposure assessment, engineering controls
Purpose:
To use existing and emerging technologies and methods for rapid measurement of multiple airborne metals at mining and processing sites.

Abstract:
This project will use existing and emerging technologies and methods for rapid measurement of multiple airborne metals at mining and processing sites to design and implement engineering controls to reduce exposures and possible illnesses. The outcome of this project will be the acceptance and use of field-portable instruments and methods by the mining industry to measure airborne metal concentrations and subsequently implement control measures to reduce exposures.

Longitudinal Surveillance / Beryllium

Project Director: Christine Schuler, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278423
Keywords/Phrases: Beryllium, surveillance, exposure assessment
Purpose:
To understand the key risk factors predicting beryllium-related health outcomes so that preventive strategies can be implemented and evaluated.

Abstract:
This project will establish a way of measuring worker exposure to beryllium that alerts workers and companies to hazards of beryllium disease, determine whether keeping beryllium off the skin prevents development of an immune reaction to beryllium, ascertain safe concentrations of beryllium exposure for those persons with inherited genes that predispose them to contract beryllium disease, and see whether workers are better off if they leave beryllium employment. The research relates beryllium sensitivity and disease occurrence to new measures of exposure, skin protection, genetic analyses, and leaving beryllium work. This work contributes to prevention of beryllium disease by showing which beryllium work environments are hazardous, what preventive measures work, and how to prevent beryllium disease in all workers, regardless of genetic characteristics.

• Fertility and Pregnancy Abnormalities •

Identification of Workers Cohorts Exposed to Reproductive Toxicants

Project Director: William Moorman, M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277401
Keywords/Phrases: Reproductive hazards, feasibility assessment, fertility
Purpose:
To initiate worksite studies to characterize exposure and health effects of chemical hazards identified through the National Toxicology Program (NTP) testing and subsequently prioritized through a tripartite process.

Abstract:
This research requires the identification of exposed workers, gaining industry cooperation to evaluate health effects, and communicating the findings. This project is establishing methods to initiate worksite reproductive studies. Using the hazard identification information provided by NTP and the U.S. Environmental Protection Agency (EPA), the workers exposed to reproductive toxicants that have not been investigated are located. Additionally, the investigators have expanded our prioritization process to include pesticides and have met with EPA to obtain their pesticide toxicity database.

Methods Assessing Male Reproductive Toxicity

Project Director: Steven Schrader, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278278
Keywords/Phrases: Reproduction, sexual dysfunction, genetics

Purpose:
To implement new technologies and clinical methods for assessing physiological sites to measure toxic effects found in occupational field studies.

Abstract:
Male reproductive hazards have been shown to attack at least one of four major sites (endocrine system, the testes, the accessory glands, and sexual function). This project will implement new technologies and clinical methods for assessing these sites to measure toxic effects found in occupational field studies. Validated, state-of-the-art methods are required to accurately assess workers and provide the regulatory agencies accurate and objective reproductive assessment data.

Field Application of Male Reproductive Health Biomarkers

Project Director: Steven Schrader, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278281D
Keywords/Phrases: Reproduction, sexual dysfunction, endocrine

Purpose:
To assess the reproductive health of men exposed to potential occupational hazards.

Abstract:
The project will continue to provide important data on workers' reproductive health in various exposure scenarios. Equally important, this research also provides much needed data on the versatility and utility of the male reproductive health profile to a spectrum of suspected reproductive hazards. These field investigations are being conducted with an external partner to study the reproductive effects of nickel exposure. The reproductive health of bicycling policemen is also being studied. State-of-the-art research methods in assessing male reproductive function are being implemented in these occupational field studies.

Methods to Evaluate Reproductive Potential of Women

Project Director: James Kesner, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278287D
Keywords/Phrases: Biological monitoring, reproductive hazards, women's health

Purpose:
To develop specific and sensitized methods to identify female reproductive toxicants in population studies.

Abstract:
This project addresses women's reproductive health by developing methods to biologically monitor the reproductive health of women exposed to chemicals, radiation, physical exertion, stress, and other forms of occupational hazards. Results from this research will help identify workplace hazards, isolate the hazards from potential victims, and reduce the social, economic, and personal cost imposed by reproductive disorders.

Risk for Adverse Reproductive Outcomes Among Nurses

Project Director: Christina Lawson, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277460
Keywords/Phrases: Health care workers, reproductive hazards, work organization

Purpose:
To better understand the impact of shift work and physical demands on female nurses with regard to reproductive health, especially spontaneous abortion, preterm delivery, and infant birth weight.

Abstract:
Female nurses may be at increased risk of adverse reproductive outcomes through exposure to a wide variety of known and potential reproductive hazards. The study population will be the ongoing Harvard Nurses' Health Study (NHS), which has collected very little occupational information from participants to date. An occupational supplement will be mailed to a subset of the NHS cohort who have reported at least one recent pregnancy. Data collection will be conducted in FY2001–2002. Analysis will begin in FY2003, and results will be reported in scientific journals.

Exposure Screening and Identification of a Cohort for a Reproductive Health Study

Project Director: Cynthia Hines, C.I.H., M.S.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278427
Keywords/Phrases: Phthalate exposures, human reproduction, developmental effects

Purpose:
To measure phthalate exposures among workers in a variety of industries to identify populations for epidemiologic research on the possible effects of phthalate exposure on human reproduction and developmental effects.

Abstract:
Exposures to certain phthalate diesters are associated with reproductive and developmental effects in animals. Phtalates are also suspected endocrine disruptors. NIOSH and the National Toxicology Program have identified research on possible human health effects due to phthalate exposure as a high priority. Phthalates are used as plasticizers and solvents in a wide range of consumer and industrial products. Virtually no published data are available on the extent of phthalate exposures among working populations who use or are exposed to these chemicals. Estimates of the number of workers exposed to phthalates is unknown; however, given the widespread use of phthalates in commercial and consumer products, tens to hundreds of thousands of workers may be exposed. Until recently, phthalate exposures have been difficult to determine accurately since phythalate diesters are ubiquitous in the environment. A novel method has been developed to measure phthalate monoesters in urine, thereby minimizing problems due to environmental contamination. This research will ascertain exposures to the phthalates di(2-ethylhexyl)phthalate, di-n-dibutyl phthalate, and diethyl phthalate to identify possible occupational populations for epidemiologic research, to examine the glucuronidation of the monoesters across a range of exposures, and to provide phthalate exposure information to a NIOSH study on birth defect and parental exposures. A 3-year screening study of 300 workers (100 workers per phthalate) in a variety of phthalate-exposed jobs is planned for this research project. Biomonitoring will be conducted for the phthalate monoesters in urine. Descriptive data will also be collected on the monitored jobs.

Birth Defects and Parental Occupational Exposures

Project Director: Christina Lawson, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278428
Keywords/Phrases: Exposure assessment, birth defects, occupational exposures

Purpose:
To provide detailed exposure assessment data for the National Birth Defects Prevention Study (NBDPS) that will allow for examination of the link between occupational exposures and birth defects.

Abstract:
The ongoing NBDPS, which began collecting data in 1997, is a population-based case-control study that covers an annual birth population of 482,000 and includes cases identified from birth defect surveillance registries in eight States (or Centers). We are proposing to collaborate with the Centers to conduct a detailed exposure assessment of maternal and paternal occupational exposure data, providing a unique and timely opportunity to analyze much needed data on occupational exposures and birth defects. The study will (1) identify candidate exposures of interest, (2) use industrial hygiene expertise to assess exposure to chemicals from occupation, industry, and job description data, and (3) examine the link between parental occupation and risk of specific birth defects. The Centers comprise some of the Nation's leading birth defects researchers. In addition, investigators from NIOSH will provide expertise in occupational reproductive epidemiology. The results of this project will be used to generate multiple papers on various etiologic hypotheses, such as exposure to solvents, metals, and pesticides with several defect groups and exposure to phthalates and risk of male reproductive tract defects. The exposure assessment component of the project will be completed within 3 years, with data analyses and manuscript development beginning at the end of the third year.

Reproductive Hazards in the Workplace

Project Director: Christina Lawson, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278528
Keywords/Phrases: Reproductive hazards, chemicals, dioxin

Purpose:
To provide much needed data on potential reproductive hazards in the workplace.

Abstract:
The epidemiological studies included in this project focus on exposure of workers to reproductive hazards. Although more than 1,000 workplace chemicals have shown reproductive effects in animals, most have not been studied in humans. In addition, most of the 4 million chemical mixtures in commercial use remain untested. The inadequacy of current knowledge coupled with the growing number of chemical and physical workplace exposures pose a potentially serious public health problem. We are conducting three studies: (1) a study to examine the birth defects among offspring of men exposed to dioxin, (2) a birth defects cluster investigation among steel workers, and (3) exposure assessment for phlalates. Results of these studies may be used by Federal agencies to regulate occupational and population exposures to reproductive toxicants.

Reproductive Health Study of Female Flight Attendants

Project Director: Elizabeth Whelan, Ph.D.

Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278626D
Keywords/Phrases: Radiation, reproduction, aviation

Purpose:
To evaluate the reproductive health effects of female flight attendants.

Abstract:
Workplace exposures that may contribute to adverse reproductive outcomes include cosmic ionizing radiation and alterations of circadian rhythm. Two studies are under way: (1) a questionnaire study to examine past reproductive outcomes (7,000 women) and (2) a feasibility study of ovulatory function among flight attendants. Teachers are serving as a comparison population for both studies. With the support of Federal Aviation Administration funding, data collection for a biomonitoring feasibility study was conducted and data analysis is in progress. These studies will provide useful health information to the 142,000 flight crew members, as well as frequent fliers, shift workers, and workers exposed to ionizing radiation.

Reproductive State, Xenoestrogens, and Work

Project Director: Linda Huffman, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277262
Keywords/Phrases: Women's health, endocrine disruption, inhalation toxicology

Purpose:
To study endocrine factors that may alter inflammatory/immune responses of workers following exposures to workplace hazards and to elucidate mechanisms underlying these effects.

Abstract:
The foci of this proposal are (1) female reproductive hormones such as estrogen, progesterone, and prolactin and (2) chemicals that can mimic the action of estrogen (i.e., xenoestrogens). The proposed research will expand the knowledge and clarify relationships between reproductive hormone status and inflammatory/immune responses to occupational hazards. This research could potentially be used to improve the identification of conditions or situations that may pose a substantial risk to worker health.

Testicular Toxicity of Occupational Chemicals

Project Director: Eisuke Murono, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277264
Keywords/Phrases: Endocrine, fertility, reproduction

Purpose:
To assess chemicals reported to have an adverse effect on testicular functioning in reproduction.

Abstract:
This project will evaluate the effects of various agricultural or industrial chemicals (including pesticides and surfactant additives to detergents), which have been reported to disrupt reproductive (endocrine) functions in humans and various wildlife species on testicular functions. The test chemicals will be administered in whole animals to determine whether the in vitro observations will be duplicated following in vivo exposure. Specific

mechanism(s) of action of each chemical using cultured Sertoli and Leydig cells from rat testes of different ages will also be identified. It is anticipated that the results of these studies will identify occupational chemicals that have the potential to adversely affect reproduction in humans (leading to reduced fertility and/or developmental abnormalities) and determine whether this sensitivity is influenced by reproductive age.

• Hearing Loss •

Hearing Loss Intervention for Carpenters

Project Director: Mark Stephenson, Ph.D., CCC-A
Division: DART
Telephone: (513) 533-8462
Project ID: 9277325D
Keywords/Phrases: Hearing loss, training, intervention

Purpose:
To determine the effectiveness of a hearing loss prevention program (HLPP) to promote carpenters' worksite hearing health behaviors.

Abstract:
The comprehensive HLPP for carpenters, designed to cultivate behaviors to reduce the incidence of occupational hearing loss, will field-test HLPP and collect survey and observational data to assess the program's effectiveness in promoting carpenters' worksite hearing health behaviors. Measures to be evaluated include factors related to cost-effectiveness and feasibility of the program, as well as knowledge gained by participants through training, behavioral intentions of participants, and correlations with workplace behaviors. The results of this effort will contribute directly to a reduction in noise-induced hearing loss among construction workers. The model approach used in this program may also be applicable to a wide range of occupationally noise-exposed workers.

Hearing Loss Prevention Strategies Program Coordination

Project Director: Mary Lynn Woebkenberg, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277448
Keywords/Phrases: Noise, hearing loss, control technology

Purpose:
To provide the core coordination for the NIOSH program to identify effective hearing loss prevention strategies.

Abstract:
This noise program expands NIOSH research studies that develop gap filling information for standards and regulators groups. It also augments the NIOSH noise program by adding research information about noise control to improve and disseminate information about hearing loss prevention program strategies and management. The program will focus on assessing the status of noise exposure and hearing loss (cross-sectional and longitudinal surveillance) and noise exposure control technology (including hearing protection) primarily in the construction and mining sectors. The effectiveness of strategies (personal protection, engineering controls, etc.) for preventing hearing loss will be noted as part of the assessment/surveillance activities.

National Surveillance of Noise Exposure and Hearing Loss

Project Director: John Franks, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277450
Keywords/Phrases: Noise, hearing, exposure

Purpose:
To develop methods for the collection of hearing and noise information that will support NIOSH surveys and other noise and hearing projects.

Abstract:
Although the present infrastructure available at NIOSH can support the National Hazards Survey (NHS), there has been no optimization for the efficient collection and analysis of data. Thus, the tools of Signalator and HearSaf 2000 have not yet been used to full fruition. In addition, since the NHS will add an interview with workers, something which both the National Occupational Hazard Survey of the 1970s and the National Occupational Exposure Survey of the 1980s lacked, it is critical to make sure that interview information is collected in a manner consistent with HearSaf 2000 or that HearSaf 2000 be adapted to manage the interview information.

Accommodation of Noise-Exposed, Hearing-Impaired Workers

Project Director: Thais Morata, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277451
Keywords/Phrases: Hearing loss, noise, intervention
Purpose:
To develop an assessment protocol that will allow hearing conservation professionals to recommend appropriate accommodations for noise-exposed, hearing-impaired workers.

Abstract:
This project proposes to develop standard evaluation and intervention procedures to be recommended for the accommodation of noise-exposed, hearing-impaired workers. This will allow these workers to continue to perform their jobs safely and prevent additional hearing loss. Workers with hearing impairment face special problems, especially when working in hazardous noise environments. Standard hearing conservation practices do not take into account the special problems encountered by noise-exposed, hearing-impaired workers. Initial research efforts will be directed toward investigating the factors that affect a hearing impaired worker in noisy environments. Subsequently, intervention strategies for the hearing health community will be developed and evaluated.

Definition and Assessment of Engineering Noise Controls

Project Director: Charles Hayden, B.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277452
Keywords/Phrases: Engineering, noise, construction
Purpose:
To conduct a survey of the use of engineering noise controls in the mining and construction industries.

Abstract:
Over 3.3 million miners and construction workers are exposed to noise that is harmful to hearing. Studies of coal miners, metal/nonmetal miners, and carpenters have shown that hearing loss begins early, by age 50, in their working careers, and 90% of the coal miners and 50% of the carpenters have hearing impairment. Because noise control is the best way to prevent noise-induced hearing loss, this project will conduct a survey of the availability and effectiveness of engineering noise controls to be found in mines and on construction sites, assess the lack of noise controls, develop a noise-control prioritization for mining and construction, develop best practice workshops, and prepare publications for dissemination in print and electronically. As a result of this project, it should be more feasible to deploy engineering noise control in mining and construction, thus reducing the present noise burden carried by miners and construction workers.

Audiometric Assessment in NHANES IV

Project Director: Christa Themann, M.A.
Division: DART
Telephone: (513) 533-8462
Project Id: 9278346
Keywords/Phrases: Hearing loss, noise, epidemiology
Purpose:
To assess risk and monitor progress in prevention.

Abstract:
This project seeks to develop sound baseline data on hearing and balance through support of audiometric and balance testing in the National Health and Nutrition Examination Survey (NHANES). NHANES collects nationally representative data on the health and nutritional status of U.S. residents through interviews and physical examinations. To date, hearing and balance data have been collected on more than 2,000 survey participants. All audiometric data is reviewed, technician training is monitored and maintained, and other technical assistance is provided. In FY02, an analysis plan will be developed, based on data collected so far; actual analysis and publication of results will begin after 3 years of data collection have been completed and the samples can be considered nationally representative.

Noise Sampling Strategies and Exposure Response Models

Project Director: Mary Prince, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277101
Keywords/Phrases: Noise, exposure assessment, sampling methods
Purpose:
To develop an exposure-response model to evaluate the synergistic effects of impulsive noise and continuous noise in predicting hearing loss.

Abstract:
Evidence exists that impulsive noise may affect hearing loss more than continuous noise exposure at the same 8-

hour time-weighted average (TWA). This project will improve on existing noise and hearing loss exposure-response analyses by determining the most accurate way of estimating the TWA and incorporating the combined effect of impulsive and continuous noise. Two main approaches to estimating TWA noise exposure will be compared: (1) task-based assessment (noise levels associated with each task in a given job, combined with time-at-task) and (2) dosimetry (full-shift personal monitoring). Additionally, repeated measures of noise over several points in time on persons and jobs will permit an evaluation of how the precision of the exposure assessment approach affects the exposure-response analysis (manufacturing only). The study will collect noise exposure data at the study sites, obtain updated audiometric and noise survey data from the plants, begin analysis on impulsive noise data, and data previously collected at the mining and auto plant sites.

Factors Affecting Hearing Conservation Program

Project Director: Mary Prince, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278613
Keywords/Phrases: Effectiveness research, noise, hearing loss

Purpose:
To develop methods for evaluating hearing conservation programs.

Abstract:
This study will develop methods for program evaluation and will identify factors having the most impact on the effectiveness of hearing conservation programs (HCPs). Noise-induced hearing loss (NIHL) can be prevented when good hearing conservation practices are adhered to in the workplace; however objective, systematic measures of the effectiveness of HCPs must be developed to track whether prevention of NIHL is successful. This project involves three studies in which HCP evaluation methods are tested in populations, which vary in the extent and level of data available for identifying components with the greatest impact on effectiveness. The results will be used to develop criteria for evaluation of HCPs and identify program components most likely to be associated with an effective prevention program. An evaluation of impact/impulse noise will also be examined for two plant sites.

Noise-Control: Web-Based Outreach to Construction and Mining

Project Director: Carol Stephenson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277076
Keywords/Phrases: Information systems, hearing loss, Web site

Purpose:
To develop and maintain information systems dedicated to translating research findings from the NORA noise program of research into usable recommendations for the construction and mining industries.

Abstract:
Through this project, NIOSH will work with noise team scientists to synthesize their peer-reviewed publications and research results into both technical and lay documents packaged for Web distribution. Writers, editors, Web experts from the NORA noise program, graphic artists, and other NIOSH staff will collaborate to produce a constant stream of dynamic and timely Web documents that will educate and inform interested stakeholders regarding noise control and hearing loss prevention. Effectiveness and impact of the Web site will be assessed by tracking use of the site, user satisfaction with the Web site and the information provided, and targeted queries examining workplace changes implemented as a result of information dissemination. Formative research was evaluated with small business owners.

Cross-Sectional Survey: Noise Patterns / Sources Exposure

Project Director: Eric Bauer, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P081
Keywords/Phrases: Hearing loss, research, exposure assessment

Purpose:
To establish representative noise exposure profiles for the various mining occupations that will be used to develop appropriate engineering control measures.

Abstract:
This is a comprehensive study combining the efforts of past research studies incorporating worker noise exposure characterization studies and equipment/activity-related noise data. The resultant database will be an up-to-date, comprehensive profile of noise exposures to the mining population as a function of equipment and activity-specific measures. This study is a crucial component

in the NIOSH effort to develop engineering noise controls because it will define the sources of miners' dosages and the characteristics of those sources. Once this crucial information is available, efforts can be focused on the development and application of appropriate engineering control measures. Surface and underground coal and metal/nonmetal mines will be included in the study although initial efforts will emphasize underground and surface coal and coal preparation plants.

Coordination of the Engineering Noise-Control Projects

Project Director: Gerald Finfinger, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P145
Keywords/Phrases: Hearing loss, engineering controls, noise

Purpose:
To coordinate the efforts of three NIOSH laboratories in the definition and assessment of engineering noise controls.

Abstract:
Recognizing that noise control is the best way to prevent noise-induced hearing loss, this project will conduct a survey of the availability and effectiveness of noise controls to be found in the mines and on construction sites, assess the lack of noise controls, develop a noise-control prioritization for mining and construction, and develop best practice workshops and publications for dissemination in print and electronically. As a result of this project, it should be more feasible to deploy noise control in mining and construction and reduce the present noise burden carried by miners and construction workers.

Hearing Loss Prevention Strategies Program Coordination

Project Director: Jeffrey Kohler, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P150
Keywords/Phrases: Hearing loss, noise, control technology

Purpose:
To provide for the core coordination of the NIOSH program to identify effective hearing loss prevention strategies.

Abstract:
This noise program expands the current NIOSH noise research studies that develop gap-filling information for standards and regulatory groups and also augments the NIOSH noise program by adding research in noise control to the efforts to improve and disseminate information about hearing loss prevention program strategies and management. This program will focus on assessing the status of noise exposure and hearing loss (cross-sectional and longitudinal surveillance) and noise exposure control technology (including hearing protection) primarily in the construction and mining sectors. The effectiveness of strategies (personal protection, engineering controls, etc.) for preventing hearing loss will be noted as part of the assessment/surveillance activities.

Noise Sampling Strategies and Exposure-Response Models

Project Director: Eric Bauer, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P152
Keywords/Phrases: Noise, exposure assessment, sampling methods

Purpose:
To create an exposure-response model to evaluate the synergistic effects of impulsive noise and continuous noise in predicting hearing loss.

Abstract:
Evidence exists that impulsive noise may affect hearing loss more than continuous noise exposure at the same 8-hour time-weighted average (TWA). This project will improve on existing noise and hearing loss exposure-response analyses by determining the most accurate way of estimating the TWA and incorporating the combined effect of impulsive and continuous noise. Two main approaches to estimating the TWA noise exposure will be compared: (1) task-based assessment (noise levels associated with each task in a given job, combined with time-at-risk) and (2) dosimetry (full shift personal monitoring). Additionally, repeated measures of noise over several points in time on persons and jobs will permit an evaluation of how the precision of the exposure assessment approach affects the exposure-response analysis (manufacturing only). The study will focus on field work instrumentation/methods, data analysis of dosimetry, and task-based observations.

Definition and Assessment of Engineering Noise Controls

Project Director: Patrick Hintz, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S164
Keywords/Phrases: Mining, noise, engineering controls

Purpose:
To conduct a survey of the availability of noise controls at western metal mines.

Abstract:
Researchers at NIOSH will conduct a survey of available noise controls in western metal mines. This work will be done in support of the mining venue of the larger Definition and Assessment of Engineering Noise Controls project. Because of the size of the equipment that is used in metal mining and the environment in which it is operated, mine workers are exposed to noise that is harmful to hearing. Studies of both coal miners and metal/nonmetal miners have shown that hearing loss begins early, by age 50, in their working careers, and 90% of mine workers have hearing impairment. Because noise control is the best way to prevent noise-induced hearing loss, this project will conduct a survey of the availability and effectiveness of noise controls at the mine sites, assess the lack of noise controls through peer-review manuscripts, develop a noise-control prioritization, and develop best practice workshops and publications for dissemination in print and electronically. As a result of this project, it should be more feasible to deploy noise control in the mining industry and reduce the present noise burden carried by mine workers.

• Indoor Environment •

Investigation of Indoor Air Quality Processes,Instrumentation, and Interventions

Project Director: Christopher Coffey, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278114
Keywords/Phrases: Indoor air quality, ventilation, chemicals

Purpose:
To determine the performance of portable direct reading measuring instruments used to measure particulates indoors under varying environmental factors.

Abstract:
The indoor environment has a significant impact on human health. The higher chemical concentrations and the tendencies for people to spend most time indoors combine to increase human exposures to potentially harmful chemicals. NIOSH has identified the characterization and measurement of indoor pollutants as a priority research need. This study will determine indoor environmental quality (IEQ) instrumentation performance and the efficacy of engineering controls. The results of this study will yield data that will improve understanding of the impact of indoor environments on human health, the performance of various instruments used to assess IEQ, develop alternate means of determining IEQ, and develop and evaluate interventions to improve the quality of indoor air of commercial buildings.

Monitoring Bioaerosols in Commercial Aircraft Cabins

Project Director: Lauralynn Taylor, M.P.H.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278178D
Keywords/Phrases: Cabin air quality, bioaerosols, infectious agents

Purpose:
To monitor bioaerosols (bacteria and fungi) during commercial aircraft flights and to explore the utilization of unique exposure assessment techniques (such as polymerase chain reaction) to monitor infectious agents such as *Mycobacterium tuberculosis* or other viral aerosols.

Abstract:
Approximately 142,000 flight personnel, including pilots, flight attendants, and other flight crew members, are potentially exposed to infectious diseases brought into the enclosed aircraft environment by passengers. This research will monitor indoor cabin air contaminants and physical parameters including carbon dioxide, temperature, and relative humidity. This sampling will be initiated before takeoff and terminated at or after landing. Viable biological sampling will be conducted during multiple isolated sampling periods during the flight: boarding, takeoff, midflight, landing, and deboarding. The intention of this biological monitoring is to determine baseline levels for total colony-forming units of bacteria and fungi on Boeing 767 aircraft. Although infectious agents have significant interest and relevance

in cabin air quality, exposure methods are not well developed for airborne viral aerosols. This research also will investigate the utilization of unique exposure assessment techniques (such as polymerase chain reaction) to monitor infectious agents such as *Mycobacterium tuberculosis* or other viral aerosols.

Development of an Immunological Approach for Measuring Fungi in Indoor Environments

Project Director: Detlef Schmechel, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277372
Keywords/Phrases: Indoor air quality, exposure assessment, bioaerosols

Purpose:
To develop an immunometric method to identify and quantify allergenic and toxigenic airborne fungi in indoor environments with molecular detection techniques based on monoclonal antibodies.

Abstract:
Fungal spores are easily aerosolized and are of concern in a number of occupational environments. Allergic and toxic reactions may result from exposure to fungal aerosols, but the significance of these observations to indoor air quality concerns is unclear. The correlation between airborne fungal biomass and adverse health effects has been difficult to determine. Current techniques to estimate fungal biomass in air samples have severe limitations. There is need for sensitive, specific assays that will provide accurate determination of fungal spores in air samples. This project will evaluate sampling techniques matched to the analytical procedure and will evaluate the use of highly specific immunoassays as the analytical procedure. It is hoped that the application of these techniques will permit more accurate determination of the role of fungi in indoor air quality. The results of these studies may have relevance to other occupational environments, such as the agricultural work site, in which adverse health effects from fungal exposures are suspected.

Gas-Phase Chemistry of Indoor Environments

Project Director: John Wells, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278177
Keywords/Phrases: Indoor air quality, airborne contaminants, chemistry

Purpose:
To understand indoor environment chemical processes.

Abstract:
The investigation of the gas phase and indoor surface reactions of volatile organic compounds found in indoor environments will be used to more clearly define the indoor exposure, and provide insight into important chemical and surface structure(s) that influence indoor air quality and highlight potential analytical/sampling needs. The research direction will be influenced by data generated from Health Hazard Evaluations (HHEs) and by other identified gaps in indoor environment research. The research results will also address indoor pollutant characterization and measurement. The research results will technically transition to more accurate exposure assessment, better analytical tools for HHE sampling, and improved engineering control methods to reduce chemical contaminants.

• Infectious Diseases •

Characterization of Tuberculosis Bacillus Aerosols and Implications on Controls

Project Director: Ernest Moyer, Ph.D.
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9277430
Keywords/Phrases: Health care workers, respirators, tuberculosis bacillus, TB

Purpose:
To study research gaps in tuberculosis bacillus (TB) aerosols.

Abstract:
This project addresses three research gaps identified during the NIOSH TB strategic planning process. First, the aerosol size distribution of cough aerosols, which have been characterized in both laboratory and field studies, will be reproduced in the bioaerosol chamber. Second, laboratory studies will be conducted to evaluate the effectiveness of surgical masks in preventing wearers from generating aerosol-containing viable TB bacteria. Third, through laboratory studies, field studies, and computer simulations, the efficacy of using 95% efficient filters in ventilation systems of health care facilities will be evaluated. The results will be used by health care workers, health professionals, the Occupational Safety and Health Administration, the World Health Organization,

correctional facility workers, and others to identify, modify, and implement appropriate preventive measures.

Genetic Variation in Metabolism of AZT

Project Director: Ainsley Weston, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277007R
Keywords/Phrases: Human immunodeficiency virus, HIV, genetics, infectious disease

Purpose:
To determine the correlations between thymidine kinase, thymidylate kinase, pyrimidine nucleoside diphosphate kinase, and UDP-glucuronosyltransferase genotypes and toxic and mutagenic endpoints in 300 AZT treated persons.

Abstract:
In the event of occupational exposure to a source of blood-borne pathogens, caregivers, medical technicians, public safety workers, and others receive chemoprophylaxis for human immunodeficiency virus (HIV) infection in the form of AZT or other antiviral agent. Blood cell DNA AZT levels, chromosomal aberration, hypoxanthine-phosphoribosyl-transferase (hprt) and glycophorin-A (GPA) mutations, AZT glucuronidation, and phosphorylation in persons treated with AZT vary widely. Genetic polymorphisms in thymidine kinase, thymidylate kinase, pyrimidine nucleoside diphosphate kinase, and UDP-glucuronosyltransferase are likely responsible for these variations. This research will try to make correlations between the genotypes and toxic and mutagenic endpoints in 300 AZT-treated persons. This knowledge will help clinicians make more informed risk/benefit decisions about AZT use in prophylaxis and tailor treatment to persons following accidental occupational exposures.

New Approaches to Medical Screening for Latent Tuberculosis Bacillus

Project Director: David Weissman, M.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277014
Keywords/Phrases: Tuberculosis bacillus, TB, health care workers

Purpose:
To evaluate the usefulness of a laboratory test to detect latent tuberculosis infection by measuring cell-mediated immunity to tuberculosis.

Abstract:
Latent tuberculosis bacillus (TB) infection occurs when an infected person has controlled the infection and is asymptomatic but has not eliminated the infection. Without treatment, latent infection can progress to active infection and the ability to infect contacts by cough aerosol. Prophylactic antimicrobial therapy can prevent progression to the active disease. There is considerable need for better ways to screen for latent TB infection in populations at risk. The tuberculin skin test is suboptimal for a variety of reasons. In conducting this research, features of the immune response to TB, mounted by peripheral blood cells in vitro, will be characterized and used in efforts to further improve test performance. In aggregate, these studies will facilitate improved approaches to medical screening and surveillance for latent TB infection that can be used to prevent the occupational transmission of TB.

• Intervention Effectiveness Research Methods •

Work Organization Intervention in IRS Service Centers

Project Director: Paula Grubb, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277044D
Keywords/Phrases: Work organization, intervention, service

Purpose:
To assess the success of an intervention to improve the work climate, employee satisfaction, health, and well-being and suggest preventive measures to decrease personnel stress levels.

Abstract:
NIOSH assisted the Internal Revenue Service (IRS) in developing a survey to measure the extent to which enhanced supervisory practices are being used in customer service call centers and their effects on employee health and well-being. Baseline surveys were administered in FY1999 and FY2000. Three post-intervention surveys will be administered at 6-month intervals after the intervention implementation (6-month, 12-month, and 18-month followups). NIOSH is performing analyses comparing pre-intervention survey data to post-intervention data. Survey data are also being linked to employee performance measures and other job outcome variables provided by IRS at the site level. NIOSH is

reporting the findings to IRS and the National Treasury Employees Union after each round of data collection and is making recommendations for refining and further implementing the enhanced supervisory practices intervention model.

Cross-Cutting Research and Intervention in Hazardous Work Environments

Project Director: Frederick Scharf, Jr. , Ph.D
Division: DART
Telephone: (513) 533-8462
Project ID: 9277060
Keywords/Phrases: Intervention, work organization, work practices

Purpose:
To implement and evaluate safety and health interventions that reduce workload or workplace hazards, reorganize work, or provide new information to change the way workplace hazards are managed.

Abstract:
This project will undertake interventions with cross-cutting potential for the agriculture, construction, and mining industries. As interventions are tested, an interdisciplinary team will monitor the progress, evaluate each intervention for potential improvement, and recommend additional testing as needed. The results from this interdisciplinary effort are expected to lead to (1) interactive tools for workers in the industries under study, (2) improved communication and collaboration among NIOSH scientists and other safety and health professionals working in hazardous environments, and (3) an ongoing exploration of cross-cutting approaches to common problems in these industries.

Hearing Loss Prevention: Putting Theory into Action

Project Director: Thias Morata, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278012
Keywords/Phrases: Hearing loss, noise, intervention

Purpose:
To evaluate the implementation of a model hearing loss prevention program in a manufacturing setting.

Abstract:
This research project has developed a comprehensive program with zero tolerance for occupational noise-induced hearing loss to replace the study site's earlier compliance-driven hearing conservation program. Key features of the model program incorporating newly developed methods and technologies include intensive one-on-one worker education and training to motivate workers and optimize selection and use of appropriate devices. This training will take place during the annual audiometry and fit-testing of hearing protection. When fully implemented and evaluated over the succeeding years, this project will provide a detailed and timely assessment of the real-world barriers to, and the effectiveness of, this approach in a typical industrial setting.

Long-Term Study of Alternative Keyboard Effectiveness

Project Director: Evan Jones, B.S.E.E.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278324
Keywords/Phrases: Computer, musculoskeletal disorders, intervention

Purpose:
To assess the use of alternative keyboards in preventing or reducing musculoskeletal disorders among employees using keyboards.

Abstract:
This project is the first comprehensive, long-term assessment of the efficacy of alternative keyboards in preventing or alleviating musculoskeletal disorders among keyboard users. The project is being conducted in collaboration with an external partner in the insurance industry. Several alternative keyboards will be assessed over a period of 1- to 2-years. Outcome measures include medical assessment of symptoms, job/task and workstation assessments, stress/discomfort/fatigue, worker perceptions of the psychosocial work environment, and a range of physical and physiological indicators of musculoskeletal risk factors (i.e., postural analyses, electromyography [EMG], etc.). The projected outcomes will result in recommendations regarding effective keyboard designs.

Evaluation of a High-Risk Worker Notification of Dry Cleaners Exposed to Perchloroethylene

Project Director: L. Barbara Connally, M.S.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277126D

Keywords/Phrases: Communication, communication research, worker notification

Purpose:

To evaluate the effectiveness of high-risk worker notification about the risk of exposure to dry cleaning solvents.

Abstract:

The worker notification program was initiated in response to concerns by citizen groups, unions, and Congress that workers included in studies of exposure should be informed of the results of the studies (i.e., informed of their risk for cancer or other diseases). There is a dearth of research about the impact and effectiveness of such efforts. Efforts to comply with the ethical responsibility to report what is known must be supported by sound evaluation of the way these communications impact workers. Evaluation of primary or secondary intervention strategies to reduce exposures and mitigate safety and health risks are also goals of this activity.

Evaluation of State-Based Workplace Violence Prevention

Project Director: Eleanor Jenkins, M.A.

Division: DSR

Telephone: (304) 285-5894

Project ID: 9277120

Keywords/Phrases: Violence, effectiveness research, evaluation

Purpose:

To evaluate the effectiveness of State-based approaches to workplace violence prevention, including State-specific occupational safety and health regulations and other regulatory activities that impact workplace violence prevention.

Abstract:

This projects seeks to (1) develop a model for evaluating State-based workplace violence prevention strategies with emphasis on both process and outcome evaluation using California Occupational Safety and Health Administration guidelines for violence prevention in health care settings as the initial effort, (2) compile an inventory of all State-based regulations that impact workplace violence prevention, and (3) conduct evaluations of at least three additional State-based approaches to workplace violence prevention, including at least one that is a "nontraditional" occupational safety and health approach (i.e., Florida regulations for training and environmental and administrative control in convenience stores that are administered through the State Attorney General's office).

Evaluating the Effectiveness of a Logger Safety Training Program

Project Director: Jennifer Bell, Ph.D.

Division: DSR

Telephone: (304) 285-5894

Project ID: 9277123

Keywords/Phrases: Logging, training, injury prevention

Purpose:

To determine the effectiveness of a logger safety training program in reducing logging-related injuries and to determine which types of injuries are most affected after training.

Abstract:

In this research investigation, injury rates from several years preceding training will be compared with post-training injury rates in each company. The injury experience of companies not enrolled in the training program will be evaluated as a reference group, and trends for the industry as a whole will be determined. The expected impact of this proposed evaluation study would be to be able to make a definitive statement about the usefulness of the logging safety-training program in reducing logging injuries.

Evaluating Toolbox Training in Construction / Mining

Project Director: Herbert Linn, M.S.

Division: DSR

Telephone: (304) 285-5894

Project ID: 9277142

Keywords/Phrases: Construction, effectiveness research, training

Purpose:

To evaluate the toolbox talk approach to workplace training.

Abstract:

This project will (1) identify and review existing toolbox/tailgate training materials and programs, (2) prepare new toolbox talks series for high-risk mining and construction sectors based on injury and fatality investigation reports, (3) evaluate the effectiveness of these toolbox talks series, as well as existing toolbox talks materials and programs in small construction and mining companies, (4) using evaluation research results, expand toolbox series and distribute widely to target sectors, and (5) evaluate the impact of toolbox training programs in target sectors. This project will fill gaps in current knowledge regarding the effectiveness of short, on-site workplace training sessions for work crews, and the crit-

ical elements, formats, and approaches of such training sessions that contribute to desired results.

Intervention Strategies for Taxi Cab Drivers

Project Director: James Collins, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277166
Keywords/Phrases: Violence, fatalities, intervention

Purpose:
To evaluate the effectiveness of crime prevention strategies developed to protect taxi cab drivers.

Abstract:
The homicide rate of 22.7 per 100,000 taxi drivers per year is 30 times higher than the homicide rate for all workers. Bullet-resistant partitions between the front and back seat, panic buttons that pinpoint the location of a taxi, and video surveillance cameras mounted near the rear view mirror have been implemented on large fleets of taxis in everal urban areas in the United States. Training programs that teach drivers how to avoid and respond when confronted with a hazardous situation have also been implemented on a large scale basis in several U.S. urban cities. This project will measure the effectiveness of these prevention strategies for reducing the risk of robbery, assault, and homicide to taxi cab drivers.

Evaluating U.S. Adaptation of a European Machinery Risk Reduction Program

Project Director: John Etherton, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278061
Keywords/Phrases: Effectiveness research, injury prevention, risk assessment

Purpose:
To evaluate of the new American National Standards Institute (ANSI) B11-TR3 Machinery Risk Assessment/ Risk Reduction (RA/RR) guideline and training for its use.

Abstract:
In 1995, a U.S. safety standards consensus subcommittee (TR3) was formed under the auspices of the ANSI B11 Machine Tool Safety Standards Committee. The subcommittee has labor, machine builder, machine user, government, and safety consulting representatives. Their purpose was to develop a technical guidance document to bring machine tool risk assessment practice in the United States up to or above the level now required by European standard EN 1050 "Safety of Machinery: Risk Assessment." The European standard mandates that a process be followed that ensures that safety measures are appropriate to the risks in machine operation and servicing tasks. The ANSI B11 TR3 document became available for general use in November 2000. In conducting this research, the TR3 intervention will be introduced into 12 companies on two machinery systems in each company. An active partnership to conduct this evaluation research jointly with a qualified private sector partner will be implemented in FY02. Evaluation measures will include avoided injuries, reduced exposure to machinery hazards, pretest and posttest knowledge demonstration, assessment of group processes following training, correct implementation of the guidelines, and degree to which risk reduction recommendations are implemented. The application of the validated risk assessment methodology will guide machinery designer/user teams to implement effective protective measures appropriate to the risk, with a resultant reduction in machinery-related injury.

Small Business Interventions

Project Director: Richard Niemeier, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277233
Keywords/Phrases: Small business, intervention, hazards

Purpose:
To develop and implement an intervention to reduce morbidity and/or mortality among high-risk small business industries.

Abstract:
In partnership with various trade/industry/labor/insurance groups, this project will develop and implement one or more interventions targeted at reducing hazards identified within a selected high-risk small business industry. The process will include literature searches, site visits, interviews, focus groups, targeted job analyses, intervention designs, and implementation. A key to the success of the project will be the development of interventions in partnership with the industries affected. The solutions will be those that are both acceptable and affordable to small business owners in high-risk industries. As well as more traditional methods of disseminating information, a small business site on the NIOSH Web site will be developed to deliver hazards information, training materials, and solutions (substitution, engineering controls, work practices, etc.) targeted to the high-risk small business segments included in the pilot intervention. The success of the pilot

intervention will be evaluated to determine which components/strategies were most effective in bringing about change in the targeted industries and should be used in further programs targeted at reducing injuries and illnesses among high-risk small business industries.

Evaluation of Model Training Program for Food Service Industry

Project Director: Raymond Sinclair, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277353
Keywords/Phrases: Evaluation, training, injuries

Purpose:
To determine the impact of a new worker safety and health training curriculum.

Abstract:
NIOSH is helping the National Restaurant Association conduct an evaluation of the effectiveness of occupational safety and health training involving three different companies and internal controls. The NIOSH research team is participating in the study by assisting with (1) the design of the study, (2) the design and testing of knowledge and attitude measurement instrument, (3) review of training curriculum, (4) collection of post-training measures of effectiveness, (5) data analysis, and (6) preparation of reports of study results. Data was collected from all stores on employee knowledge, attitudes, and behaviors. Participating companies were asked to provide illness and injury data and other demographic data for all study participants. The study will evaluate the effectiveness of the training in changing employee knowledge, attitudes, and behaviors toward working safely and assessing any reductions in injuries and illnesses. Study results will add to the knowledge base on safety and health intervention effectiveness, training methods, and field study methods.

Impact Evaluation of NIOSH-Numbered Publications

Project Director: Vern Anderson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278008
Keywords/Phrases: Publications, evaluation communication

Purpose:
To determine the value and utility of NIOSH-numbered publications through a survey of health professional organizations.

Abstract:
In collaboration with the respective professional associations, NIOSH will survey members of the American Industrial Hygiene Association, the American Society of Safety and Engineers, the American Association of Occupational Health Nurses, and the American College of Occupational and Environmental Medicine to ascertain their perception of the value and utility of NIOSH-numbered publications. This 36-month effort will generate a report that describes how these occupational safety and health professionals use NIOSH-numbered publications in influencing workplace safety and health practices and policies. In addition, lessons learned from this survey will direct future NIOSH communication efforts aimed at these customers regarding their preferred publication format, design, and delivery systems.

Hearing Loss Intervention for Carpenters

Project Director: Carol Stephenson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278013
Key Words/Phrases: Hearing loss, intervention, effectiveness research

Purpose:
To determine the effectiveness of a Hearing Loss Prevention Program (HLPP) in promoting better worksite hearing health practices in carpenters.

Abstract:
NIOSH has developed a comprehensive hearing loss intervention program for carpenters that is designed to cultivate behaviors that will reduce their incidence of occupational hearing loss. Carpenters are known to develop occupational hearing loss early, becoming substantially impaired by middle age. This project will collect survey and observational data to assess the HLPP's effectiveness in promoting carpenters' worksite hearing health behaviors. It will expand on existing partnerships between NIOSH and labor-management organizations within the construction industry to field-test and evaluate this program. Measures to be evaluated include factors related to the feasibility of program adoption as well as knowledge gained by participants, behavioral intentions of participants, and correlations with actual workplace behaviors. The results of this effectiveness research will contribute directly to a reduction in noise-induced hearing loss among construction workers. The model

approach used in this program may also be applicable to a wide range of occupationally noise-exposed workers.

Evaluating Training Interventions for Small Business

Project Director: Carol Stephenson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278422
Keywords/Phrases: Training, small business, intervention

Purpose:
To develop, deliver, and evaluate training modules (six are planned) targeting hazards selected by external partners as most relevant to injuries occurring among small business workers in Ohio.

Abstract:
This intervention program of research will follow the training intervention effectiveness research (TIER) model to systematically develop and evaluate effective training materials and mediums (i.e., print, electronic, audiovisual). Feedback regarding the new programs will be obtained from small business operators and workers receiving the training. Injury rates for small business companies participating in the new training intervention will be compared with those of companies continuing with their current level of training activity for the selected hazards. Results will be published in peer-reviewed literature, and training products will be made available for widespread distribution.

Effectiveness of Training and Controls in Nursing Homes

Project Director: Robert Park, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278435
Keywords/Phrases: Engineering controls, injury prevention, intervention

Purpose:
To evaluate programs for injury prevention in a sample of nursing homes in the State of Ohio.

Abstract:
This research project, will evaluate engineering controls, training, and information dissemination programs for injury prevention in a sample of nursing homes in the State of Ohio. Injury experience will be derived from workers' compensation claims. The Bureau of Workers' Compensation in Ohio makes available intervention programs for targeted industries, including nursing homes, but lacks resources to evaluate their effectiveness. Workers' compensation, Occupational Safety and Health Administration-related, and other interventions that employers have implemented will be classified and described, as will their workers' compensation claim rates and costs over time. The purpose will be to estimate what effects various intervention programs have had on reducing workers compensation claims and costs.

Evaluation of CD-ROM HAZMAT Refresher Training

Project Director: Carol Stephenson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 927N001
Keywords/Phrases: Training, firefighters, evaluation

Purpose:
To compare classroom instruction by an expert to Federal Emergency Management Agency (FEMA) developed hazardous materials (HAZMAT) computer-based training for firefighters that is supplemented by access to an "expert performer" onsite.

Abstract:
Computer-based or on-line instruction for Occupational Safety and Health Administration (OSHA)-required HAZMAT refresher training was selected as a critical need for firefighters. NIOSH will partner with FEMA to develop and evaluate computer-based HAZMAT training incorporating performance-based measures. The effectiveness of the computer-based training will be compared with that of traditional classroom instruction. The curriculum plan calls for 80 lessons. Evaluation will begin in New York when the first seven instructional units are completed. FEMA and the OSHA Training Institute will collaborate with NIOSH researchers to conduct the evaluation. The International Association of Fire Fighters will assist in securing and tracking the New York firefighters who will participate in the evaluation.

Preventing Latex Allergy Among Non-Health-Care Workers

Project Director: Donald Eggerth, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277254

Keywords/Phrases: Latex, allergies, communication research

Purpose:
To develop a health intervention that (1) effectively communicates the NIOSH recommendations for preventing latex allergy to the appropriate, at-risk non-health-care worker occupations and (2) promotes the use of the recommendations through corresponding attitude and behavior change.

Abstract:
The current study will first determine the level of glove usage and prevalence of atopic, dermatological, and latex allergy symptoms in a sample of workers from five non-health-care occupations. It will then (1) assess the effect of history of atopy or latex allergy/reaction on the receiver's level of message processing and (2) analyze the effectiveness of message framing in developing the most appropriate health intervention message that effectively changes behavior (increased nonlatex glove usage).

Testing Theory-Based Alerts

Project Director: Nancy Bollinger, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277257
Keywords/Phrases: Communication research, effectiveness research, publications

Purpose:
To identify the characteristics of NIOSH Alerts that produce the strongest levels of receiver awareness, comprehension, acceptance, and use.

Abstract:
This project proposes to conduct a systematic, theory-based, long-term series of field experiments with existing NIOSH Alerts targeted with appropriate occupational populations. The project will conduct a systematic, theory-based, long-term series of field experiments with existing NIOSH Alerts targeted with appropriate occupational populations. The research will apply the concepts of the elaboration likelihood model across all studies and use the knowledge created in earlier studies to guide the later study's design and execution. After completion of the research program, investigators expect to be able to have a theory-based and empirically-tested "design template" that can be used in the future to create maximally effective Alerts.

Applying Schema Matching to Latex Allergy Prevention

Project Director: Donald Eggerth, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277377
Keywords/Phrases: Latex, intervention, communication research

Purpose:
To investigate whether application of schema correspondence theory will increase the effectiveness of occupational safety and health information brochures discussing allergy to natural rubber latex.

Abstract:
This project will incorporate occupational group-specific information from the U. S. Department of Labor Occupational Information Network database into existing NIOSH natural rubber latex allergy information brochures. This should increase the relevance of safety and health messages for the targeted audiences, leading to more careful processing of the messages, and to increased persuasion and behavior change. These brochures will be tested on occupational groups representing a broad range of work settings and activities. If proven successful, this approach could be used to increase the effectiveness of NIOSH occupational safety and health communications intended for any of a wide range of occupational groups.

Tailoring NIOSH Messages to Individual Health Construals

Project Director: Jennifer Welbourne, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277378
Keywords/Phrases: Communication research, health care workers, computer

Purpose:
To examine the impact of message tailoring to individual construals via the Web.

Abstract:
First, this project will assess the evaluation processes underlying needlestick safety behaviors for nurses who construe this issue in terms of "maintaining one's health" versus those who construe it as "illness prevention." In a second study, participants will be randomly assigned to a Web communication (based on the NIOSH Alert entitled "Preventing Needlestick Injuries in Health care Settings") that uses gain and loss framed arguments designed to match or mismatch their understanding of

this issue. It is expected that message tailoring on this variable (matching message to construal) will result in enhanced attitude and behavioral compliance with recommendations provided in the NIOSH communication.

A Model Hearing Conservation Program for Coal Miners

Project Director: David Byrne, B.A.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P022
Keywords/Phrases: Hearing loss, underground mining, noise

Purpose:
To develop and implement a hearing conservation program specifically for coal miners that can serve as a model for all other similar mining operations.

Abstract:
This research is being conducted at a working underground coal mine in collaboration with a university partner under a cooperative agreement. The resulting Model Hearing Conservation Program (HCP) will incorporate the best practices of well-run programs in other industries while identifying and overcoming any obstacles present in this particular industry. The effectiveness of the Model HCP will be evaluated over a 5-year period. Toward the end of this project, one or more industry-wide workshops will be conducted in which all coal mine operators are encouraged to adopt and implement an effective HCP at their mine sites.

Ergonomics Interventions in Mining

Project Director: Fred Turin, M.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P107
Keywords/Phrases: Mining, ergonomics, musculoskeletal disorders

Purpose:
To assess mine workers' exposure to risk factors to evaluate the effectiveness of ergonomic interventions.

Abstract:
This research is planned as a two-phase effort. The first phase consisted of exposure assessments at four mine sites. The results of these assessments are being used to establish safety and health baseline data and identify general means to reduce hazard exposures. The second phase will involve development, implementation, and evaluation of ergonomics interventions at one or two cooperating mine sites. The results of this work will demonstrate the effectiveness of ergonomics interventions in reducing mine worker exposure to risk factors and the occurrence of musculoskeletal disorder injuries.

Role of Emotion in Hearing Loss Prevention Among Miners

Project Director: Charles Vaught, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P136
Keywords/Phrases: Communication research, hearing loss, mining

Purpose:
To assess the comparative effectiveness of positive and negative emotion in motivating coal miners to adopt hearing loss prevention behaviors using the Extended Parallel Processing Model.

Abstract:
NIOSH research found that 80% of coal miners have moderate to profound hearing loss by age 64, compared with only 20% of those nonoccupationally exposed to noise. In this research, using the extended parallel processing model, coal miners will be randomized to participate in one of five groups (four treatment and one control) using a 2 x 2 factorial design comparing positive and negative emotion. The expected outcome is that negative and positive messages will be nearly equal in their effectiveness, an important finding when attempting to motivate behavior change among workers in fields with high mortality and morbidity.

Definition and Assessment of Engineering Noise Controls

Project Director: Efrem Reeves, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P147
Keywords/Phrases: Hearing loss, engineering control, noise

Purpose:
To conduct a survey of the availability of noise controls in mining.

Abstract:
Because of the size of the equipment used in mining and the environment in which it is operated, mine workers are exposed to noise that is harmful to hearing. Because noise control is the best way to prevent noise-induced

hearing loss, this project will conduct a survey of the availability and effectiveness of noise controls to be found at the mines sites, assess the lack of noise controls, develop a noise-control prioritization as well as develop best practice workshops, and publications for dissemination in print and electronically. As a result of this project, it should be more feasible to deploy noise control in the mining industry and thus reduce the present noise burden carried by mine workers.

Evaluating Roadway Construction Work Zone Intervention

Project Director: Todd Ruff, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S163
Keywords/Phrases: Construction, injury prevention, effectiveness research

Purpose:
To evaluate interventions that will decrease injuries involving equipment at roadway construction sites.

Abstract:
This multidisciplinary project involves laboratory and field development, demonstration, and evaluation of selected interventions that construction contractors can use to protect their workers from being struck by construction vehicles and equipment operating inside work spaces of roadway construction projects. Internal traffic control plans and a variety of proximity warning devices are promising yet are unproven interventions for preventing fatalities and injuries associated with construction vehicles and equipment. If proven to be effective, adoption of these interventions throughout the construction industry could substantially reduce exposure of workers to moving construction vehicles and equipment, thus reducing fatalities and injuries related to vehicles and equipment.

Evaluating Toolbox Training in Construction and Mining

Project Director: Christine Boldt, M.S.
Division: SRL
Telephone: (509) 354-8006
Project ID: 927S386
Keywords/Phrases: Mining, construction, training

Purpose:
To evaluate the toolbox talks approach to workplace training.

Abstract:
This project will (1) identify and review existing toolbox/tailgate training materials and programs, (2) prepare toolbox talks series for high-risk mining and construction sectors based on injury and fatality investigation reports, (3) evaluate the effectiveness of these toolbox talks series and existing toolbox talks materials and programs in small construction and mining companies, (4) use evaluation research results, expand toolbox series and distribute widely to target sectors, and (5) evaluate the impact of toolbox training programs in target sectors. This project will fill gaps in current knowledge regarding (1) the effectiveness of short, on-site workplace training sessions for work crews and (2) the critical elements, formats, and approaches of such training sessions that contribute to desired results (increased safety and health awareness, knowledge, behaviors, reduced risk, etc.). The project could ultimately provide an effective, cost-efficient option to help small construction contractors and mining operators meet their safety training needs. This could translate into more attention to safety and health issues in some small companies and reduced risk and injuries. Potentially, the toolbox talks series could be expanded in scope (and NIOSH interdivisional participation) to include other areas related to construction and mining hazards.

• Low-Back Disorders •

Technology Investment Agreement with Advanced Technology Institute

Project Director: Stephen Hudock, C.S.P. , Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278490D
Keywords/Phrases: Ergonomics, intervention, musculoskeletal disorders

Purpose:
To study a variety of construction, repair and recycling processes in the shipyard industries, and work processes within the marine cargo handling industries to assess job risk factors, and devising and implementing cost-effective ergonomic controls.

Abstract:
Because of the number of multifaceted job tasks performed by the various trades in the ship construction, repair, and recycling industries, there is a perception that fitting the job to the worker may not be practical or applicable. Additionally, ergonomic engineering controls

employed in general industry, or even construction or manufacturing sectors, are not unilaterally employable because of the diverse job activities in the shipyard industries. It is imperative that research be undertaken to better understand musculoskeletal disorders and associated job risk factors. Once this association is better understood, effective ergonomic intervention strategies can be developed to prevent such disorders. Dissemination of best practices will be accomplished through NIOSH partners such as the Maritime Advisory Committee on Occupational Safety and Health (MACOSH), Occupational Safety and Health Administration (OSHA), shipyard companies, and labor unions. OSHA has exempted the maritime industries from the proposed Ergonomics Program Standard for general industry while further information specific to these industries can be collected. This project addresses the collection of some of this missing information. This study will be conducted in three phases. The tasks of the first phase, which is near completion, include conducting walk-through surveys of a number of domestic shipyard sites to (1) examine trade or department injury and illness rates for the past 5 years, (2) conduct qualitative job risk factor assessments of the various trades or job processes, and (3) determine if the individual shipyards are willing to cooperate in the collection of the data and the implementation of pilot ergonomic interventions. The objectives of the second phase are (1) to quantify job risk factors by utilizing exposure assessment tools for selected job processes in selected shipyards, (2) to recommend unique ergonomic engineering and administrative controls to reduce the exposure to the risk factors associated with the specific job processes, and (3) to implement pilot ergonomic interventions for the specific job processes. The third phase of the project will take place in the final year of the project. The final year will be used to evaluate the effectiveness of the pilot ergonomic interventions and to disseminate the results of the study to the public. The dissemination will take the form of best practices with respect to ergonomics, a series of workshops to report on the effectiveness of the interventions and in a Web site devoted to ergonomic solutions for job processes within the shipyard industries. The broader application of the developed ergonomic interventions will be used to transfer the lessons learned in the specific shipyards to other shipyards, boatyards, and other industries such as manufacturing and construction.

Manual Lifting and Low-Back Pain: Division of Applied Research and Technology Component

Project Director: Thomas Waters, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277404
Keywords/Phrases: Low-back disorders, lifting equations, ergonomics

Purpose:
To provide epidemiological data to better define the relationship between the physical demands of manual lifting as described by the NIOSH lifting index (LI) and the incidence and severity of lifting-related low-back disorders.

Abstract:
This research will provide additional epidemiological data to better define the relationship between the physical demands of manual lifting as described by the LI obtained from the NIOSH lifting equations and the incidence and severity of lifting-related, low-back disorders. It will also provide information regarding the utility of the NIOSH lifting equation as a practical, yet valid, tool for identifying and prioritizing jobs for interventions. This project is parallel to a project in the Division of Surveillance, Hazard Evaluations, and Field Studies.

Reducing Injury Risk from Jolting / Jarring on Mobile Equipment in Construction

Project Director: Thomas Waters, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277324
Keywords/Phrases: Low-back disorders, interventions, vibrations

Purpose:
To determine the impact of jarring and jolting from operation of heavy mobile equipment on the risk of workers developing low-back disorders.

Abstract:
In conducting this research project, acceleration data obtained from mobile mining, agriculture, and construction equipment will be input into a biomechanical model to determine the kinematic and kinetic responses on the human body. The joint reaction forces and moments will be compared with known human tolerance limits to determine risk of low-back disorders. Interventions will be developed and implemented to reduce jarring and jolting. Post-intervention acceleration data will be collected and compared with the pre-intervention data to deter-

mine the effectiveness of the interventions to reduce the risk of low-back disorders.

Control Technology Assistance for the Construction Industry

Project Director: Cheryl Estill, P.E., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278419
Keywords/Phrases: Control technology, intervention, musculoskeletal disorders

Purpose:
To determine engineering controls that will reduce the incidence of musculoskeletal disorders among construction industry workers.

Abstract:
This research will determine which engineering interventions reduce workers' exposure to physical risk factors for back injuries. The project will involve meeting with affected leaders (companies, unions, and associations) and determining a plan for developing engineering controls for the reduction of back injuries. Ten or more sites will be visited representing many of the construction sectors. The focus will be on documenting engineering controls that are already in use. Jobs with the highest physical risk factors will be identified by the affected leaders and from the initial site visits. Eventually, controls will be developed, applied, and tested for those occupations and tasks identified during the first year as having one of the highest levels of physical risk factors. Quality and production information corresponding to use of the engineering control will also be collected. The final product will be a compendium of engineering control interventions for the construction industry.

• Mixed Exposures •

Effect of Mixed Dusts on Asthma and Pulmonary Infectivity

Project Director: Barbara Meade, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278181
Keywords/Phrases: Welding fume, diesel exhaust particles, boiler bottom ash

Purpose:
To evaluate the immune-suppressive effects of three mixed dusts: welding fume, diesel exhaust particles, and boiler bottom ash.

Abstract:
This project will (1) determine the potential effects of mixed dusts on innate immunity by measuring the number and function of natural killer cells in the spleen and blood, (2) evaluate cell-mediated immune status by measuring the number and function of T lymphocytes using flow cytometry and the mixed lymphocyte response in the spleen and blood, (3) evaluate humoral immunity by measuring the number and function of B lymphocytes using flow cytometry and the IgM antibody response to the T-dependent antigen sheep erythrocytes, (4) for any given alteration in the immune system, perform a reversibility study by assessing the same parameters after a 2-week period without exposure, and (5) determine the effects of mixed dusts on the in vitro IgM antibody response using a metabolic activation system. If data derived from this in vitro system is consistent with the results from the in vivo studies, the assay can be used on fractionation studies to rapidly determine the active chemical component(s). The hypothesis to be tested is that mixed dusts contain components (organic compounds and metals) that lead to immune suppression and enhanced susceptibility to infection.

Asphalt Fume Chemical Characterization and Hazard Identification

Project Director: Larry Olsen, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278467
Keywords/Phrases: Asphalt, hazard identification, analytical methods

Purpose:
To identify compounds or compound classes in asphalt fumes that may cause irritation or genotoxicity.

Abstract:
This research will be integral to sampling and analytical method development that assesses exposures to asphalt fumes and to irritants and genotoxins. It will provide laboratory research that will be useful in the design of better worker exposure protocols, in the identification of biomarkers to assess a worker's true exposure, and in the design of animal studies to evaluate physiological and toxicological effects associated with exposure.

Feasibility Assessment of Cohort Mortality Study Among Asphalt Road Pavers

Project Director: Kevin Hanley, M.S.P.H., C.I.H., R.E.H.S./R.S.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277131
Keywords/Phrases: Asphalt, polycyclic aromatic hydrocarbons, feasibility assessment

Purpose:
To evaluate the feasibility of conducting a cohort mortality study of asphalt paving workers.

Abstract:
In the United States, about 4,000 hot mix asphalt facilities and 7,000 paving contractors employ nearly 300,000 employees. The currently available data from studies on asphalt are too limited to draw conclusions about the carcinogenic hazard for asphalt paving workers. The feasibility study will determine whether it is possible to identify a population of sufficient size, minimal exposure to other carcinogens and adequate work history, and exposure records to conduct a mortality study. If a mortality study is feasible, it will fill an important gap in understanding chronic health effects, including cancer, in this large occupational group.

Environmental Causations of Allergies and Asthma

Project Director: David Weissman, M.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277081
Keywords/Phrases: Mixed exposures, chronic obstructive pulmonary disease, infectious disease

Purpose:
To understand the role of contaminating metals or organic chemicals in the induction of obstructive lung disease or enhancement of susceptibility to pulmonary infection.

Abstract:
Boilermakers, sheetmetal workers, and garage mechanics are cohorts exposed to mixed dusts. A collaborative effort among scientists at NIOSH, an external partner, and the Department of Defense affords unique expertise to allow this problem to be addressed from the molecular (radical generation, transcription, etc.), cellular (production of oxidants and cytokines, phagocytosis, bacterial killing), animal (infectivity, production of antimicrobial agents, biomarkers of injury and inflammation), and human (pulmonary function, susceptibility to infection, biomarkers) levels. Results will provide mechanistic and dosimetric information concerning pulmonary reactions to mixed dusts and be useful for risk assessment

Effects of Dusts on Asthma and Pulmonary Infectivity (mining)

Project Director: Vincent Castranova, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277103
Keywords/Phrases: Mixed exposures, chronic obstructive pulmonary disease, infectious disease

Purpose:
To understand the role of contaminating metals or organic chemicals in the induction of obstructive lung disease or enhancement of susceptibility to pulmonary infection.

Abstract:
Boilermakers, sheetmetal workers, and garage mechanics are cohorts exposed to mixed dusts. A collaborative effort among scientists at NIOSH, academia, and the Department of Defense affords unique expertise to allow this problem to be addressed from the molecular (radical generation, transcription, etc.), cellular (production of oxidants and cytokines, phagocytosis, bacterial killing), animal (infectivity, production of antimicrobial agents, biomarkers of injury and inflammation), and human (pulmonary function, susceptibility to infection, biomarkers) levels. Results will provide mechanistic and dosimetric information concerning pulmonary reactions to mixed dusts and be useful for risk assessment.

Vibration Effects on Pulmonary Responses to Toxic Agents

Project Director: David Frazer, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277247
Keywords/Phrases: Vibration, exposure assessment, respiratory disease

Purpose:
To investigate whole body vibration effects, both direct and indirect, on pulmonary functions of laboratory rats, mice, and guinea pigs exposed to toxic aerosols and gases.

Abstract:
Pulmonary functions under investigation in this project will be breathing patterns, particle deposition, cellular

response, endocrine function, metabolic function, and airway resistance. Vertical vibration will be used to obtain a detailed effects study. The expected results of this multiyear project are recommendations to minimize the risks to workers of whole body vibrations on their pulmonary functions and/or change existing exposure limits for workers who are simultaneously exposed to vibration and toxic aerosols and gases.

Molecular Mechanism of Disease Development with Mixed Dusts

Project Director: Velayudhan Vallyathan, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277261
Keywords/Phrases: Cancer, disease, research

Purpose:
To investigate the effect of different metal ions deposited on crystalline silica during sandblasting of metal ions and the interaction of trace metals with mixed dust in animal models.

Abstract:
The relationship between crystalline silica exposure and lung cancer remains unknown. Epidemiological studies of cancer risk vary considerably in populations exposed to different sources of crystalline silica. It is possible that in some occupations, mixed exposures, particularly one with trace metal contaminants, may be associated with high incidence of lung cancer. Synergistic interactions of trace metals and crystalline silica could be important in enhanced toxicity and carcinogenicity by enhanced generation of reactive oxygen species. This study will investigate the effect of different metal ions deposited on crystalline silica during sandblasting of metal plates, and the study will tease out the independent and synergistic interaction of trace metals associated with mixed dust exposure in vitro and in vivo animal models. Studies on biomarkers associated with these studies may provide some positive identification of high-risk exposure groups.

Particle-Induced Lung Injury in Mixed Exposures

Project Director: Ann Hubbs, Ph.D., D.V.M.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277263
Keywords/Phrases: Mixed exposures, lung cancer, pneumoconiosis

Purpose:
To evaluate human lungs for an association between dust exposures, fibrosis, preneoplastic changes, lung cancer, and CYP1A1 activity and investigate whether coal dust decreases CYP1A1 dependent processes in the lungs of animals.

Abstract:
Some epidemiological studies show a surprising lower than normal risk of lung cancer in coal miners. Interpretation of these studies is complicated by the high percentage of smokers in many mining populations. Additional studies have shown an association between high levels of cytochrome P4501A1 (CYP1A1) and the development of lung cancer in man. Studies indicate that silica dust decreases the chemical induction of CYP1A1 in the lungs of rats. These studies will help explain the epidemiological findings and improve risk assessment for mixed exposures.

Susceptibility to Lung Infection After Mixed Dust Exposure

Project Director: James Antonini, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277383
Keywords/Phrases: Infectious disease, welding, construction, mixed exposures

Purpose:
To determine the mechanisms that make workers who inhale metal-containing particles of mixed composition more susceptible to infection by assessing differences after exposure with infectious agents together with welding fumes or fly ash.

Abstract:
Little is understood about how construction workers who are exposed to metal-containing particles of mixed composition (such as welders) become more susceptible to infectious diseases. Evidence verifying a potential link and an understanding of the mechanisms by which exposed workers could become susceptible to infection is incomplete or absent. This project will develop a database for in vivo studies designed to assess the mechanisms by which particles such as residual oil fly ash and welding fumes increase worker susceptibility to lung infections. In addition, particle-exposed rats will be exposed to bacterial infection, and the antimicrobial capacity of alveolar macrophages, the spread of pulmonary infection, and the general immune status of the exposed animals will be evaluated. An explanation of these mechanisms will enable us to protect and educate workers exposed to these mixed dusts and potentially prevent adverse health effects.

Particle Surface Program: Biological Interactions

Project Director: Michael Keane, M.S.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278088
Keywords/Phrases: Particulates, diesel, toxicology
Purpose:
To determine the characteristics of hazardous dusts as they relate to biological systems and the disease process.

Abstract:
Most pneumoconiosis cases have resulted from exposures to mixed dust for which the toxic properties are unknown. In this project, the characteristics of respirable mineral particles, hardmetal particles, diesel exhaust particles, and fibers that have been characterized for composition, surface nature and composition, and other physical and chemical characteristics will be related to interactions with biological systems (in vitro and in vivo). Toxic particles will be studied, in native form and after interaction with simulated pulmonary surfactant, to closely simulate actual inhalation exposures. These studies will use in vitro cellular and genotoxicity assays to assess the importance of the particle/surfactant interaction in the initiation of disease processes. Successful studies will pinpoint critical characteristics of hazardous dusts that will allow improved exposure assessment and more precise identification of exposures requiring controls.

Pulmonary, Systemic, and Dermal Effects of Welding Fume Inhalation Exposure

Project Director: James Antonini, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278425
Keywords/Phrases: Welding fumes, mixed exposures, pulmonary disease
Purpose:
To design an inhalation welding fume exposure system and characterize particles generated using a toxicological analysis to provide information on welding fume exposure.

Abstract:
Epidemiology studies indicate that large numbers of welders experience adverse health effects. Little information exists about the causality, dose-response, and possible underlying mechanisms of exposure to welding fumes and the health of welders. Moreover, short-term and long-term toxicology studies using animals to assess the effects of welding fumes are incomplete. This project will address the problem from the design of an inhalation welding fume exposure system and characterization of the particles generated to a toxicological analysis from the molecular to whole animal level in multiple organ systems by monitoring adverse effects on airway reactivity, pulmonary infectivity, induction of carcinogenesis, and dermal irritation. Results will provide mechanistic and dosimetric information concerning welding fume exposure and be useful for risk assessment and development of prevention strategies.

Asphalt Fumes: Inflammatory Effects and Pulmonary Injury

Project Director: Jane Ma, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278917
Keywords/Phrases: Asphalt, hazards, mixed exposures
Purpose:
To investigate the effects of asphalt fumes on pulmonary irritation, inflammation, airway reactivity, and lung injury using an animal model.

Abstract:
Exposure to asphalt fumes during road paving operations have been associated with airway irritation and airway hyperreactivity in some pavers. These fumes are complex mixtures that contain both particulate and potentially toxic chemicals. Mixed exposures, such as asphalt fumes, may result in greater pulmonary injury than exposure to a single agent. In this research project, pulmonary injury will be evaluated by measuring oxidant generation, inflammatory cytokine secretion, and metabolic activities in the lung. Airway irritation will be monitored by histological evaluation of the nasal cavity. Airway reactivity will be evaluated by measuring pulmonary function. The results of these studies should aid in better understanding the potential health hazards associated with asphalt fumes exposure.

In the Immune System Targeted by Asphalt Fumes

Project Director: Albert Munson, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278988
Keywords/Phrases: Asphalt, immunotoxicology, hazards
Purpose:
To investigate target organ toxicity of asphalt fumes.

Abstract:
This project is part of a comprehensive laboratory-based toxicological study that will provide an exposure system for asphalt fumes and evaluate noncancer endpoints of target organ toxicity following exposure to asphalt fumes. It will also be used to establish doses of asphalt fumes that will be used by the National Toxicology Program to perform a chronic cancer bioassay. This part of the project addresses the immune system as a target for asphalt fume toxicity. Immunological assays are being used to assess the functions of innate, cell mediated, and humoral immunity in Fischer 344 rats. In vitro assays are being used to determine which fractions of asphalt fumes are responsible for the immune effects. Immune status data can be used to set exposure concentrations and determine the chemicals or fractions that possess immunosuppressive activity. This project will provide hazard identification and dose-response information that can be used in risk assessment.

Initial Respiratory Responses in Welding Apprentices

Project Director: David Wegman
Division: HELD
Telephone: (304) 285-6121
Project ID: C9277103
Keywords/Phrases: Mixed exposures, chronic pulmonary obstructive disease, infections disease

Purpose:
To provide new epidemiologic evidence of the association between exposures to welding fumes and acute respiratory disease.

Abstract:
Despite some inconsistencies in study results, evidence of an association between welding fume exposure and occupational asthma has been growing over the past 15 years. Most of the earlier epidemiological studies concerning welding exposures and respiratory effects have been limited by their cross-sectional study design, the selection of study populations with extensive welding experience, and limited information on the timing and nature of exposures to welding fumes. The investigators propose a study of 200 welding apprentices in which airway reactivity and acute respiratory responses will be measured early in the apprentices' careers, within 6 months of their first welding exposure. Since welders who experience respiratory problems due to welding are less likely to stay in the welding field long-term, a study of welding apprentices who are just entering the field has the advantage of including workers who experience respiratory problems early on.

• Musculoskeletal Disorders of the Upper Extremities •

Ergonomic Exposure Assessment—Observational Accuracy

Project Director: Brian Lowe, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277228
Keywords/Phrases: Exposure assessment, musculoskeletal disorders, repetitive strain injury

Purpose:
To quantify the accuracy of trained ergonomists to estimate levels of work-related musculoskeletal disorder (WMSD) risk factors by observation and develop recommendations for improving observational exposure assessment methods.

Abstract:
In this project, laboratory instrumentation will measure risk factors of posture, repetition, and force exertion during performance of laboratory-simulated industrial jobs. Twenty-five expert ergonomists will watch video recordings of these selected jobs and give exposure estimates. The accuracy of the ergonomists' exposure classifications will be calculated by comparing observational estimates to the instrumentation measurements (the gold standard). The research results will lead to improved recommendations based on the most accurate methods for obtaining observational data to quantify physical work stresses. This research may also improve on the scientific understanding by delineating the limits on visual observation accuracy in measuring physical risk factors.

Interventions for Reducing Work-Related Musculoskeletal Disorders

Project Director: Cheryl Estill, P.E., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277329
Keywords/Phrases: Control technology, intervention, musculoskeletal disorders

Purpose:
To determine if the implementation of engineering interventions reduce workers' exposure to physical risk factors for musculoskeletal disorders (MSDs) (hand/wrist, shoulder, or lower back).

Abstract:
Three different engineering interventions will be implemented, and two control groups, onsite and offsite, will be used for this research project. The facilities will be self-selected from those participating in a larger exposure-response study. Selection of groups will be chosen from those that have at least 25 jobs with physical risk factors for the intervention group. Exposure assessment will be conducted before the intervention is implemented and 6 and 12 months after the intervention is implemented. Quality and the production rate will also be collected. A compendium of engineering control interventions that were successful in reducing employees' physical risk factors to MSDs will be developed.

Evaluation of Tool Design Characteristics for Use in Construction Work

Project Director: Brian Lowe, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278317
Keywords/Phrases: Exposure assessment, musculoskeletal disorders, repetitive strain injury
Purpose:
To identify and evaluate ergonomic design criteria for hand tools in construction.

Abstract:
A checklist for use by construction workers and supervisors to efficiently select the most appropriate tools has been developed for this project. The next step in the development process is to conduct a laboratory study and a field study to validate the checklist. The laboratory portion will involve smaller studies targeting filling the research voids on the topics of tool handle slipperiness, compliability, contour, weight, and cross-sectional shape and their effects on musculoskeletal loading in hand tool use. The field portion will be an intervention study comparing hand tools that score at the low and high ends of the evaluation checklist in terms of the required posture and force and subjective discomfort. The checklist should discriminate tools that minimize biomechanical demands from those that require higher levels of these demands if it is valid. Results of the laboratory and field validation studies will be used to revise the checklist as needed.

Upper Limb Work-Related Musculoskeletal Disorders

Project Director: Susan Burt, Sc.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277133
Keywords/Phrases: Musculoskeletal disorders, epidemiology, ergonomics
Purpose:
To describe exposure-response relationships between physical job stressors and the prevalence and incidence of upper limb muculoskeletal disorders (MSDs) and to develop and test practical exposure assessment methods.

Abstract:
Strong evidence exists of causal relationships between combined job physical stressors and upper limb MSDs. Data from this study will be used to better quantify exposure-response relationships. The anticipated impact of this project is that practitioners in occupational health fields will be able to use these methods to easily and accurately discriminate job tasks that represent low, moderate, and high risk for upper limb MSDs, resulting in more effective job design changes or interventions in existing jobs to prevent these disorders.

Hand-Arm Vibration: Worker Exposures and Health Effects

Project Director: Aaron Schopper, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277083
Keywords/Phrases: Vibration, musculoskeletal disorders, exposure assessment
Purpose:
To develop enhanced hand-arm vibration-related recommendations for guidelines, standards, and improved exposure and health assessment methods.

Abstract:
This project will include measures of vibration exposure, other ergonomic factors (i.e., force, repetition, posture, integrated videotape-based assessments of job demand), hand-arm-vibration-related symptoms, and musculoskeletal-related symptoms obtained from 300 users of powered hand tools at the beginning, middle, and end of a 2-year period. Interim site visits will document job changes and dropouts. The latter will receive telephone follow-up assessments. After data analyses, recommendations for improved exposure guidelines will be formulated, more accurate and reliable means of performing exposure and health assessments will be identified,

enhanced injury prediction models will be developed, and better means for evaluating workplace hazards will be provided.

Vibration Assessments of Powered Hand Tools

Project Director: Renguang Dong, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277143
Keywords/Phrases: Vibration, musculoskeletal disorders, exposure assessment

Purpose:
To investigate the hand-transmitted vibration associated with powered hand tools.

Abstract:
This multiyear, phased project will investigate hand-transmitted vibration associated with powered hand tools to (1) develop new methods and devices for vibration measurement, evaluation, and assessment, (2) characterize the transient or acute effects of vibration on the workers, (3) evaluate engineering-control and vibration mitigating methods such as anti-vibration gloves and handle cushions, and (4) develop biomechanical models to explain various observed phenomena and characterize hand-transmitted vibration.

Cellular Models for the Study of Hand-Arm Vibration Syndrome

Project Director: William Lindsley, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277245
Keywords/Phrases: Vibration, cellular effects, injury mechanisms

Purpose:
To develop a cell culture model to study vascular changes associated with occupational hand-arm vibration syndrome.

Abstract:
Dermal microvascular endothelial and vascular smooth muscle cells will be exposed to vibrations of various frequencies and acceleration levels normally produced by vibrating tools. Changes in the production of vasoactive factors (endothelin-1, prostaglandin E2, and nitric oxide) and coagulation/fibrinolysis factors (von Willebrand factor, thrombomodulin, tissue type plasminogen activator, and plasminogen activator inhibitor-1) as well as expression of genes related to inflammation (intercellular adhesion molecule-1) and intimal hyperplasia (platelet derived growth factor-B) will be monitored to investigate the etiology of vibration-induced injury. This work will provide a better understanding of the injury mechanisms associated with occupational exposure to vibration.

Animal Model for the Study of Hand-Arm Vibration Syndrome

Project Director: William Lindsley, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277246
Keywords/Phrases: Vibration, biomarkers, cumulative trauma disorders

Purpose:
To investigate the physiological and biomechanical factors associated with the development of hand-arm vibration syndrome (HAVS).

Abstract:
HAVS occurs in workers who use vibrating tools such as grinders, jackhammers, and chainsaws. HAVS is characterized by nerve damage, circulatory problems, and loss of strength in the hand and arm. Although the epidemiological evidence for HAVS is well-established, the physiological mechanism by which vibration causes tissue damage is not clear. This lack of understanding has hampered efforts to reduce the incidence of HAVS. This project will provide a better understanding of the physiological and psychophysical changes that occur with vibration exposure and will identify possible biological indicators (biomarkers) that may be used to reliably predict the development of HAVS.

• NORA Implementation •

NORA Implementation

Project Director: Douglas Sharpnack, D.V.M.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278007
Keywords/Phrases: Work organization, hearing loss, exposure assessment

Purpose:
To support the Division of Applied Research and Technology (DART) staff who are on teams developing NORA.

Abstract:
This project supports development of NORA, which is a top NIOSH priority, with the goal of guiding U.S. occupational safety and health research in the next decade. NORA is also a primary vehicle for building partnerships. There are 21 NORA topics, each with a team dedicated to prioritizing the research needs for that topic area. DART staff participate on approximately 13 of the NORA teams. Each team will develop a document that describes the research agenda for their topic and sponsor or participate in workshops and conferences on that research topic.

NORA Exposure Assessment Methods Development Team

Project Director: Mary Woebkenberg, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278139
Keywords/Phrases: Exposure assessment, NORA, method development

Purpose:
To track the activities of the NORA Exposure Assessment Methods Team.

Abstract:
The Exposure Assessment Methods Team works on the development and promotion of a national research agenda addressing research needs in exposure assessment. The team has produced a white paper, presented at meetings, and published proceedings. The team is planning a biomonitoring conference and writing a journal article.

NORA Musculoskeletal Disorders

Project Director: Thomas Waters, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278141
Keywords/Phrases: Ergonomics, musculoskeletal disorders, low-back pain

Purpose:
To evaluate the status and define future research needs in the area of work-related musculoskeletal disorders (MSDs).

Abstract:
This project provides administrative support for holding team meetings and sponsorship of conferences and symposia directed at prevention of work-related MSDs. The primary products of the project will be NIOSH documents and articles describing research issues discussed at the various meetings.

NORA Organization of Work

Project Director: Steven Sauter, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278142
Keywords/Phrases: Organization of work, workshops, expert reports

Purpose:
To develop and promote (via workshops, expert reports, etc.) a national research agenda addressing the changing organization of work and the safety and health of working people.

Abstract:
Organizational practices have changed dramatically in recent years. To compete more effectively, many companies have restructured themselves and downsized their workforces, increased their reliance on nontraditional employment practices that depend on temporary workers and contractor-supplied labor, and adopted more flexible and lean production technologies. These revolutionary changes in the organization of work have far outpaced the understanding of their implications for work life quality and safety and health on the job. Under the present project a multidisplinary team of researchers and representatives from NIOSH, industry, labor, and academia was assembled in 1997 to develop and help implement a research strategy to close these knowledge gaps. Review of the literature and meetings with more than three dozen stakeholder groups resulted in the development of a comprehensive research agenda to investigate and reduce occupational safety and health risks associated with the changing organization of work. This research agenda addresses the need for improved surveillance of changing organizational practices, increased health effects research to better understand the effects of these practices, and increased intervention research examining ways to reorganize work to protect worker safety and health. Future efforts in this project will focus on ways to leverage research addressing these priorities. This project supports efforts by NIOSH and partners in industry, labor, and academia to develop and promote (via workshops, expert reports, etc.) a national research agenda addressing the changing organization of work and the safety and health of working people.

NORA Hearing Loss

Project Director: John Franks, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278143
Keywords/Phrases: Hearing loss, prevention, intervention

Purpose:
To conduct activities related to the prevention of occupational hearing loss.

Abstract:
The NIOSH NORA Hearing Loss Team has members from private sector, academic, union, and government organizations. The team meets at least twice annually, has developed a white paper on research needs for prevention of occupational hearing loss, and has held conferences on best practices for various topics related to the prevention of occupational hearing loss. For FY03, the topic of the conference will be on impulsive noise.

NORA Control Technology and Personal Protective Equipment

Project Director: Laurence Reed, B.S., M.S.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278150
Keywords/Phrases: NORA, control technology, protective equipment

Purpose:
To track activities of the NORA Control Technology/ Personal Protective Equipment (CT/PPE) Team.

Abstract:
The CT/PPE NORA Team works on the development and promotion of a national research agenda addressing research needs in engineering control technology and personal protective equipment. The team has conducted a workshop and produced draft proceedings on a national research agenda. The team also collaborates with the NIOSH Working Group on Safe Handling of Hazardous Drugs, which is developing a NIOSH Alert on occupational exposures to hazardous drugs. The CT/PPE NORA Team will meet once in FY03.

Implementing NORA: The DRDS Contribution

Project Director: Joe Burkhart, M.S.l
Division: DRDS
Telephone: (304) 285-5749
Project ID: 9278089
Keywords/Phrases: Asthma, mixed exposures, NORA

Purpose:
To promote research on asthma, coronary obstructive pulmonary disease (COPD), and mixed exposure.

Abstract:
In support of NORA, developed by NIOSH and its partners, DRDS will bring together leaders from agencies and organizations with an interest in occupational disease research to (1) develop collaborative working groups, (2) develop comprehensive statements of research and prevention needs, and (3) cooperatively assign resources and personnel to effectuate a coordinated research and intervention plan. This project will produce white papers and workshop proceedings that will be used to promote and guide new research initiatives in asthma, COPD, and mixed exposures research.

NORA Research, Development, and Planning

Project Director: Joseph Hurrell, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278591
Keywords/Phrases: Research, communication, technology transfer

Purpose:
This project supports the NORA team activities of the Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS).

Abstract:
The information generated by research in occupational safety and health may also be applied to other public health missions. DSHEFS scientists continuously contribute to the implementation of NORA and to efforts of Federal and non-Federal institutions in the development of standards, documents, and recommendations. DSHEFS scientists will contribute to efforts of implementing the research agenda for several NORA.

Implementation of NORA Priorities

Project Director: Nancy Stout, Ed.D
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278948
Keywords/Phrases: Traumatic injuries, fatalities, prevention

Purpose:
To implement the NORA traumatic injury research priority and other NORA priority areas related to the programs of DSR.

Abstract:
The primary focus of the project is on traumatic injuries for which DSR has the lead. The project also provides a mechanism for DSR staff to contribute to implementation efforts for other NORA priority areas, including control technology and personal protective equipment, intervention effectiveness research, surveillance research methods, risk assessment methods, special populations at risk, and social and economic consequences of workplace illness and injury. The NORA traumatic injuries team will continue working toward implementing recommendations from the Traumatic Occupational Injury Research Needs and Priorities report, developed and disseminated in 1998 to further advance research and prevention efforts on a national level.

NORA Bibliometric Assessment and Technical Support

Project Director: Vernon Anderson, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277057
Keywords/Phrases: NORA, research, databases

Purpose:
To evaluate NORA's impact using bibliometrics.

Abstract:
Bibliometrics is a bibliographical tracking system that provides quantitative data for programmatic decision making. The hypothesis for this project is that NORA is a catalyst for increased research productivity. The net effect of NORA is expected to translate into increased publication productivity and citation rates for NORA topic areas. The product from this project will provide bibliometric data, analysis, and reports to document the impact of NORA. During FY01, two comprehensive bibliometric reports were completed. Bibliometric databases will be compiled for each NORA team to assist in tracking NORA-related research activity. A NORA database will be constructed and available to NORA teams on the NIOSH Intranet.

Intervention Effectiveness Team

Project Director: Raymond Sinclair, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277113
Keywords/Phrases: Interventions, evaluation, research methods

Purpose:
To develop products to be shared with researchers participating in noise programs.

Abstract:
This team has developed or is developing a number of products to be shared with all researchers participating in the noise program of research occupational injury and illness interventions, evaluation or research methods research to guide and focus future dissemination efforts through a targeted Web site. A conceptual paper, manual, and case study exercise are complete. An employer pamphlet is nearly complete. A new initiative with the National Safety Council is being pursued.

NORA Cancer Research Methods Team

Project Director: Paul Schulte, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277176
Keywords/Phrases: Cancer, NORA, exposure

Purpose:
To explore methods and data needs that close the gap between understanding the molecular events leading to cancer and using this information to prevent occupational cancer.

Abstract:
Over the past decades, major advances occurred in understanding the molecular events leading to cancer. The cancer research methods NORA team is focusing on methods and data needs that might close this gap, ranging from current data on industrial production and uses of chemicals to techniques for screening chemicals for potential carcinogenicity to the predictive value of intermediate effect markers in occupational cohorts. An important goal is to be able to recognize potential carcinogens before occupational exposure manifests in excess cancer risk.

NORA Risk Assessment Methodology Team

Project Director: David Dankovic, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277180
Keywords/Phrases: Risk assessment, toxicology, epidemiology

Purpose:
This project represents an ongoing effort to support the work of the NORA risk assessment methodology team.

Abstract:
An interdisciplinary team (i.e., toxicology, epidemiology, and statistic) of scientists from academia, government, labor, and industry has been formed. The team has developed a tentative list of research topics that it believes should be high priority for future research in this arena. This project will facilitate meetings of this team to further define this agenda.

Conference on Future Directions for Risk Assessment Methods

Project Director: David Dankovic, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277182
Keywords/Phrases: Risk assessment, epidemiology, toxicology

Purpose:
To help define the future research agenda for NIOSH risk assessment methodology.

Abstract:
A conference on "Risk Assessment Methods: Current State of the Science and Directions for Future Research" was held in August 2000. The conference brought together prominent scientists in different areas of risk assessment methodology, such as epidemiology, toxicology, and dose-response modeling to present papers on the current state of the science within their areas. Following these presentations, the meeting was divided into working groups that defined areas for future research in improving risk assessment methods. The recommendations will be used to help define the future NIOSH risk assessment methodology agenda and the work of other agencies and organizations involved in risk assessment. The papers and working group reports will be published as proceedings.

NORA Implementation

Project Director: David Weissman, M.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277043
Keywords/Phrases: Emerging technology, NORA, research

Purpose:
To support activities associated with the NORA emerging issues technology team and other NORA-related activities within the HELD.

Abstract:
This project will facilitate collaborative relationships, plan and coordinate meetings and conferences, and promote and guide new research initiatives in emerging technologies.

Mine Safety and Health Technology Assessment

Project Director: Elaine Cullen, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S364
Keywords/Phrases: Mining, communications, technology transfer

Purpose:
To consolidate the communications program at Spokane Research Laboratory (SRL), assess its effectiveness, and develop new ways to meet the needs of the customers it serves.

Abstract:
An active communications program is a vital part of any research organization, particularly one funded by public money. It is critical that all customers, suppliers, and stakeholders have access to information concerning the specific body of knowledge included in the research areas. This project will consolidate the communications program at SRL, assess its effectiveness, and develop new ways to meet the needs of the customers it serves.

Mine Safety and Health Technology Assessment

Project Director: Elaine Cullen, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S364

Keywords/Phrases: Mining, communication, technology transfer

Purpose:
To consolidate the communications program at the Spokane Research Laboratory (SRL), assess its effectiveness, and develop new ways to meet the needs of the customers it serves.

Abstract:
Provision of information is one crucial component of customer service. The communication of information relating to safety and health research is critical to the success of a research program. Private and public researchers, interested government employees, industry representatives, mineral industry workers, manufacturers, academia, consultants, entrepreneurs, and the public in general look to government scientists to provide information and expertise about various aspects of scientific research. All Federal science agencies maintain active public information and technology transfer programs. These programs provide processes in which technical and nontechnical products and information are accessible to customers in a manner that facilitates their use. In many cases, the government is the only source of such information. Technology Transfer is also an intra- and inter-agency process that decreases duplication and increases research efficiency while maximizing the use of each research dollar. This project includes three major communications areas: technology transfer, public information, and public outreach. Individual tasks have been designed to address each of those areas. Task 1, technology transfer focus, comprises three main goals: increasing the level of industry-based participation and feedback in mining safety and health programs, increasing the level of involvement of SRL researchers in actively transferring technology, and accelerating the transfer of technology and knowledge between industry, State, and local government customers. Task 2, public information focus, includes the development of activities and forums for the dissemination of broad-based scientific information to the public. It includes cooperative relationships with outside groups including the mineral industry, related natural resource industries, vendors, academia, other government agencies, professional groups, the media, and elected officials to maintain access to the highest quality information, and to provide it to any of SRL's customers. Task 3, public outreach focus, includes working with targeted groups such as schools, Boy and Girl Scouts, community groups, business and environmental organizations, etc., to help educate the public on the importance of minerals, science, and technology in everyday life.

• Organization of Work •

Work Schedule Designs to Reduce Job Strain: Evaluation of Existing Interventions

Project Director: Thomas Waters, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277045
Keywords/Phrases: Work organization, stress, effectiveness research

Purpose:
To evaluate the effectiveness of changing work schedules to reduce risk of injury or illness due to stress and fatigue.

Abstract:
This research will assess how effectiveness of changing work schedules in reducing safety and health risks is associated with job stress, high workloads, or excessive fatigue. The present project is evaluating prework and postwork schedule designs to determine which designs are most successful in reducing risks of injuries and illnesses. Targeted outcomes being analyzed include safety and health indices (e.g., work absences, visits to health clinics, injury and incident rates, and changes in somatic complaints) and behavioral/psychological indices (e.g., changes in perceived stress, fatigue, recovery, and satisfaction with domestic and other social relations).

Development Studies in Work Organization

Project Director: Naomi Swanson, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277046
Keywords/Phrases: Minority health, work organization, stress

Purpose:
To investigate work organization factors that affect the health and well being of workers.

Abstract:
This developmental project will provide support for the investigation of a broad range of work organization factors affecting worker health and well-being (i.e., socioeconomic factors influencing the way work is organized, work organization factors influencing minority health) through exploration of the literature and data sets.

Work Organization, Cardiovascular Disease, and Depression

Project Director: Paula Grubb, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277052
Keywords/Phrases: Organization of work, cardiovascular disease, mental stress

Purpose:
To investigate the relationships between specific aspects of work organization, health, and depression among men and women in their jobs.

Abstract:
This study will investigate the relationships between specific aspects of work organization (job stressors) and depression among 10,000 men and 10,000 women in a 5-year prospective study. The investigators will identify relationships between 14 potential job stressors (as well as perceived family-related demands and discrimination).

Changing Nature of Work

Project Director: Lawrence Murphy, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277222
Keywords/Phrases: Work organization, psychosocial risk factors, stress

Purpose:
To characterize the nature and extent of changes in work organization in the United States and their safety and health consequences, establish baseline data for tracking trends in work organization factors, and identify targets for intervention to improve worker safety and health.

Abstract:
Outcomes from this project will include national estimates of the nature and scope of changes in the modern workplace and the ways in which these changes influence worker safety and health. These data will represent the best estimates of how work is changing and the effects of such changes on worker safety and health since 1977 and will serve as benchmarks for researchers over the next decade.

Work Organization Predictors of Depression in Women

Project Director: Naomi Swanson, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277453
Keywords/Phrases: Women's health, mental stress, work organization

Purpose:
To examine the relationship between nontraditional work organization, traditional job stressors, and levels of depression in working women.

Abstract:
The relationship between nontraditional job stressors (i.e., work-family conflicts, harassment, discrimination), traditional job stressors (i.e., demands, control), and levels of depression in working women will be studied. Additionally, the moderating effects of specific workplace policies, practices, and procedures that may attenuate the effects of work organization stressors on depression will be investigated. It is anticipated that findings from this study will enhance our knowledge of workplace antecedents of depression among working women and provide a better understanding of which, if any, workplace policies, programs, and procedures might reduce depression prevalence among working women.

Work Organization, Cardiovascular Disease, and Depression in the National Health and Nutrition Examination Survey

Project Director: James Grosch, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277454
Keywords/Phrases: Mental stress, cardiovascular disease, work organization

Purpose:
To link data from the National Health and Nutrition Examination Survey (NHANES III) with a government database containing information about occupations.

Abstract:
Data from NHANES III, a large national health survey, will be linked to the O*NET, a government-sponsored database containing detailed information about a broad spectrum of occupations. Analysis of NHANES III data will examine occupational differences in cardiovascular disease (CVD) and depression that can be compared with findings from previous research. In addition, analysis of the linked database will identify work organization variables from O*NET that are associated with CVD and depression outcomes. These variables are similar to those studied in the work organization literature but are determined independently of the data gathered in NHANES III. Finally, knowledge gained from this analysis will help to develop specific questions about

work organization that can be included in a future version of NHANES III.

Safety and Health Outcomes Related to Work Schedules of Nurses

Project Director: Claire Caruso, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277455
Keywords/Phrases: Health care workers, work organization, hazard identification

Purpose:
To examine associations between work schedules and self-reported safety and health outcomes in registered nurses employed in acute care hospital units.

Abstract:
This 3-1/2-year study will use a cross-sectional design to survey 1,000 nurses who will be randomly selected from 10 hospitals. The independent variables of interest are shift work and overtime. Outcomes will include gastrointestinal and cardiovascular symptoms, mood, sleep problems, automobile crashes, unintentional injury, near misses, musculoskeletal disorders, and needlestick injuries. Other risk factors will be controlled statistically. The study results will contribute empirical data for work schedule design recommendations for nurses in these settings.

Work Organization and Workplace Violence

Project Director: Paula Grubb, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278418
Keywords/Phrases: Workplace violence, organization of work, intervention, evaluation research

Purpose:
To provide data on workplace violence prevention programs and policies in various industries through a nationwide organizations survey.

Abstract:
An expert panel at NIOSH will develop a workplace violence module to be added to the National Organizations Survey (NOS) through an existing Interagency Agreement with the National Science Foundation (NSF). NIOSH will also collaborate on pilot work to develop a workplace violence intervention and evaluation process that could then be used by other organizations as an aid in developing their own workplace violence prevention strategies. NIOSH has longstanding interest and expertise with regard to workplace violence research and prevention. For example, NIOSH first published data in 1988 indicating that homicide was among the leading causes of workplace injury death. More recently, NIOSH funded a workshop sponsored by the University of Iowa (April 2000) that brought together leading researchers, industry and labor representatives, government agencies, and others to identify the most pressing needs in workplace violence prevention research. The recommendations from this workshop were published by the University of Iowa in "Workplace Violence: A Report to the Nation" in February 2001. This report provides a framework on which to build and enhance both extramural and intramural research efforts in this area The investigators are actively pursuing a range of opportunities to enhance knowledge with regard to workplace violence and to engage new partners in this important occupational safety and health research arena.

Work Organization, Cardiovascular Disease, and Depression: National Health and Nutrition Examination Survey

Project Director: Toni Alterman, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277099
Keywords/Phrases: Work organization, heart disease, depression

Purpose:
To analyze data from the third National Health and Nutrition Examination Survey (NHANES III) to determine the prevalence of cardiovascular disease and depression by occupation and industry.

Abstract:
NHANES III was conducted from 1988 to 1994 on a national probability sample of the noninstitutionalized population of the United States. Data from NHANES III will be linked to the O*NET, a government-sponsored database containing detailed information about a broad spectrum of occupations. Analysis of the linked database will identify work organization variables from O*NET that are associated with cardiovascular disease (CVD) and depression outcomes. Knowledge gained from this analysis will help to develop specific questions about work organization that can be included in a future version of the NHANES III or other surveys.

Work Organization, Cardiovascular Disease, and Depression

Project Director: Joseph Hurrell, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277459
Keywords/Phrases: Work organization, depression, cardiovascular disease

Purpose:
To explore the relationship between work organization factors, cardiovascular disease, and depression in men and women.

Abstract:
This 5-year prospective study investigates the relationship between work organization factors (job stressors) cardiovascular disease (CVD), and depression among 10,000 working men and 10,000 working women. It seeks to identify relationships among 14 job stressors, depression, hypertension, angina, and myocardial infarction (heart attack). The study will use employee medical records, blood samples, and questionnaire and worksite assessments of stressful job conditions. The results of the study are expected to be useful in reducing work-related CVD and depression.

Cohort Mortality Study of Airline Workers Experiencing Job Loss

Project Director: Nelson Kyle Steenland, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278536
Keywords/Phrases: Cardiovascular disease, downsizing, unemployment

Purpose:
To compare the mortality of employees who were involuntarily laid off from airlines from 1979–1992 with those who remained employed.

Abstract:
This study will examine the mortality of those involuntarily laid off at an airline from 1979–1992 (when the airline closed) compared with the mortality of those who remained employed. It has been hypothesized that unemployment, as a result of stress, lack of access to insurance, and/or disruption of daily circadian rhythms, might increase mortality. If the investigators show that involuntary unemployment is related to higher subsequent mortality, strategies for prevention might be developed, including increased effort to find employment elsewhere for laid-off employees. Also, the effects of social class and race on heart disease mortality will be investigated. This research will use two databases: one from the American Cancer Society and one from NIOSH. In both data sets the research team will investigate the effects of social class while controlling for race and investigate whether race has an independent effect after controlling for social class. The potential results of this study will quantify the degree to which social class determines heart disease and the degree to which race contributes to heart disease independently of social class.

• Risk Assessment Methods •

Risk Assessment Methods for Particles and Fibers

Project Director: Eileen Kuempel, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9278011
Keywords/Phrases: Risk assessment, particles, fibers, modeling

Purpose:
To develop an improved scientific basis for quantitative risk assessment of occupational exposure to respirable particles and fibers.

Abstract:
This project will be performed using traditional risk assessment methods and the development of biologically based models using existing data in humans, monkeys, and rats. The concordance between the animal- and human-based risk estimates will be evaluated. These findings will provide a framework for predicting disease risk in humans exposed to other types of reparable particles and fibers for which there is rodent bioassay data but insufficient epidemiological data. This project is expected to provide a scientific basis for future NIOSH recommendations on occupational exposures to particles and fibers.

Molecular Genetics of Granulomatous Disease in Beryllium Workers

Project Director: Ainsley Weston, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9278095
Keywords/Phrases: Beryllium, biomarkers, genetics

Purpose:
To study chronic beryllium disease and its relationship to polymorphisms in HLA-genes.

Abstract:
Beryllium (Be) became strategically important because of its use as a trigger in atomic weapons during WWII. It is now indispensable to modern society and is found in a multitude of everyday products from cell phones to sprinklers. However, a chronic and debilitating granulomatous lung disease (chronic beryllium disease [CBD]) afflicts approximately 5% of beryllium workers. Despite more than 50 years of control measures, chronic granulomatous lung disease, precipitated by exposure, continues to be problematic to workers in the beryllium industry. The results of these studies will be to (1) better understand the multigenic nature of CBD, (2) better design positively directed in vivo and in vitro studies of disease mechanism, and (3) develop a basis for genome-based risk-assessment (and attendant improvements to exposure standards that protect all workers). Specifically, the molecular epidemiologic study will address the association of disease and sensitivity with polymorphisms in HLA-genes (e.g., DP, DQ, and DR) as well as TNF-alpha, IL-1alpha and beta. The collaborative nature of this study, involving epidemiologists, industrial hygienists, and toxicologists will facilitate investigations of gene-environment interactions.

Ground Stability Assessment with Seismic Monitoring

Project Director: Peter Swanson, Ph.D.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S331
Keywords/Phrases: Underground mining, ground control, rock bursts

Purpose:
To develop and apply seismic monitoring tools to aid in estimating and forecasting ground control hazards to reduce occupational exposures.

Abstract:
Underground miners are exposed to a variety of different hazards (i.e., ground falls, coal bumps, general overstressing, etc.) resulting from uncontrolled or unplanned deformation of the local ground surrounding underground openings. This project seeks to develop inexpensive automated seismic monitoring tools to aid in estimating and forecasting such ground control hazards to reduce occupational exposures. Results will be transferred to the mining industry through joint development and demonstration projects and information dissemination activities.

Advanced Warning of Ground Stability Hazards

Project Director: Stephen Signer, B.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S392
Keywords/Phrases: Ground control, instrumentation

Purpose:
To develop improved methods for identifying, monitoring, and evaluating ground stability hazards and better techniques for warning underground workers of ground control dangers.

Abstract:
The Mine Safety and Health Administration statistics indicate a dire need to warn underground miners of unexpected ground stability hazards. Over the last 10 years, roof and rib falls have accounted for approximately 44% of the fatalities in underground mines in the United States. Currently, ground control hazards are primarily monitored through visual observations and often go undetected. The long-term objective of this research is to reduce the number of injuries and fatalities associated with unexpected roof and rib falls in underground mines by developing improved methods for identifying, monitoring, and evaluating ground stability hazards and better techniques for warning underground workers of imminent ground control dangers.

• Social and Economic Consequences of Workplace Illness and Injury •

Employers Workers' Compensation Savings from Prevention Measures

Project Director: Tim Bushnell, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277119
Keywords/Phrases: Economic consequence, effectiveness research, method development

Purpose:
To develop methods for estimating the distribution of workers' compensation savings available to firms in particular industries that adopt a preventive measure of known effectiveness.

Abstract:
This project will be accomplished using commercially available insurance pricing formulas and software in conjunction with data on the distribution of industries across states, size classes, insurance policy types, and information about costs per claim-by-claim type. Discretionary adjustments to insurance premiums associated with deregulation of insurance markets and not captured in standard pricing formulas will also be analyzed for their relationship to the claims experience of firms. Results will be disseminated within NIOSH, the Occupational Safety and Health Administration, and industrial hygiene and safety professionals for use in motivating increased prevention activities and identifying situations in which regulatory enforcement is most needed.

Methods and Analysis of Economic Impact of Workplace Injury

Project Director: Elyce Biddle, M.S.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278049
Keywords/Phrases: Economic consequence, fatalities, socioeconomic

Purpose:
To determine the economic consequences of occupational fatal and nonfatal injury on workers, their families, and employers that can be used to improve program planning, intervention evaluation, and policy analysis.

Abstract:
Projects for this research include using and refining a model to measure the burden of occupational injury and fatality on the employer and improving the utility of an existing cost of the fatal occupational injury computer program, assessing economic impact of violence in the workplace, and projecting fatal work injury patterns for women into 2010. Results of these studies will be made available through NIOSH documents, peer-reviewed journal articles, and analytical tools.

Economic and Social Consequences at Sand and Gravel Operations

Project Director: Thomas Camm, Ph.D.
Division: SRL
Telephone: (509) 354-8000
Project ID: 2927S374
Keywords/Phrases: Mining, injuries, engineering controls

Purpose:
To study the economic and social consequences of fatality or injury to safety in sand and gravel operations.

Abstract:
Historically, surface crushed stone and sand and gravel have not been included in traditional mining safety research. However, this segment of mining occurs in every city, town, and construction project in the country. This project will determine the direct and indirect costs of a fatality or injury in an effort to reflect the value of safety on a sand and gravel pit. At present no good information exists about the true costs of a mining injury or fatality. The costs involve more than just the direct costs to the mining company or its insurer. Indirect costs can often exceed the direct costs. Direct costs may include such things as medical and insurance administration costs. Indirect costs include lost earnings, lost home production, lost fringe benefits, employer costs of retraining and restaffing, coworker costs of lost productivity, and time delays. This task will collect available direct costs with assistance from various collaborators. In addition, a protocol will be developed to measure indirect costs associated with a worker injury or fatality. This protocol will include a literature search, enhancement of the existing system of obtaining direct and indirect costs, and collection of associated social and economic impacts through personal and professional interviews. The first year, a pilot study will be done of a benchmark group. The benchmark group is envisioned to be a small sand and gravel operation with six or fewer workers that has not necessarily experienced an accident or fatality. This group will be used to establish the methodology and test the economic model. The benchmark model will determine direct and indirect cost sources of data relevant to a serious accident. The second year, followup case study will gather information to fleshout the benchmark model with actual costs. On completion of the actual case study, the methodology and cost sources will be well established, so subsequent accidents can be analyzed more efficiently. The study group will be another small, independently-owned sand and gravel operation that had experienced a serious injury or fatality.

• Special Populations at Risk •

Workplace Hazards to Children and Adolescents in Agricultural Work Settings

Project Director: Thomas Waters, C.P.E., Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9277047
Keywords/Phrases: Child agriculture, interventions, musculoskeletal disorders

Purpose:
To quantify the risks to farm children resulting from excessive physical work demands and to evaluate and suggest prevention measures to reduce injuries caused by these hazards.

Abstract:
This project will (1) identify a set of jobs, tasks, and activities performed by children and adolescents on farms that have a high risk of musculoskeletal disorders (MSD), (2) perform an onsite job analysis of each of the high risk jobs to quantify the risk factors, and (3) formulate interventions for controlling or eliminating hazards for high-risk jobs. To date, a comprehensive review of the scientific literature on agriculture-related MSDs has been completed, a preliminary list of farm jobs routinely performed by children has been identified through focus groups, and a physician-based surveillance method aimed at identification of farm jobs with high risk for MSD has been developed and pilot tested. In FY2001, the onsite ergonomic evaluation of farm jobs and development of a strength model for children and adolescents was begun. Following the ergonomic assessments, interventions aimed at reducing the physical demands for high risk jobs for children will be formulated..

The Aging U.S. Workforce: Reducing Safety and Health Risks

Project Director: James Grosch, Ph.D.
Division: DART
Telephone: (513) 533-8462
Project ID: 9278387
Keywords/Phrases: Special populations, work organization, psychosocial risk factors

Purpose:
To identify safety ad health risks facing older workers.

Abstract:
Despite an increasingly older U.S. workforce, little is known about the occupational characteristics of older workers and the health problems they may experience. Therefore, this project will examine safety and health risks affecting older workers through (1) analysis of existing national health databases (e.g., Health and Retirement Survey) and (2) collaboration with external partners (e.g., National Institute on Aging), who are currently conducting research on older workers. Analyses will be conducted of the prevalence of diseases, impairments, and work-related disabilities and work organization factors across industry and occupational groups. Gaining this knowledge is essential to a better understanding of the work settings in which older workers are employed and represents an important first step in developing targeted interventions to improve working conditions for older workers.

Reproductive Outcomes in Radiation Technology (RORT)

Project Director: David Utterback, Ph.D., C.I.H.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277108D
Keywords/Phrases: Reproductive hazards, radiation, epidemiology

Purpose:
To assess exposures to ionizing radiation in a group of radiologic technologists employed at medical facilities in the United States.

Abstract:
To carry out this research, a model will be developed that estimates exposure as a function of a number of predictor variables obtained from a set of detailed work history questionnaires. This exposure assessment will be used to evaluate whether exposure to fractionated and protracted doses of ionizing radiation are associated with an increase in cancer incidence. The results may be used to evaluate whether radiation exposure limits, established by the Nuclear Regulatory Commission and the Department of Energy, are set at levels that adequately protect worker health.

Breast Cancer Incidence Among Former Pan American Flight Attendants

Project Director: Lynn Pinkerton, M.D., M.P.H.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277124
Keywords/Phrases: Aviation, radiation, breast cancer

Purpose:
To determine whether female flight attendants are at increased risk of breast and other cancers.

Abstract:
This cancer incidence study will be conducted in approximately 10,000 former Pan American World Airways flight attendants. An increased risk of breast cancer was observed (standardized incidence ratio=1.9; 95% confidence interval 1.2, 2.3) among Finnish flight attendants (Pukkala et al., 1995). Exposures that may affect breast cancer risk in flight attendants include cosmic radiation and circadian rhythm disruption from traveling across multiple time zones. If the findings indicate that health effects result from these exposures, interventions, guidelines, or regulations may be implemented to reduce these exposures.

Environmental and Take-Home Pesticide Exposures—Farm Families

Project Director: Brian Curwin, M.S.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9277421
Keywords/Phrases: Child agriculture, pesticides, take-home toxin

Purpose:
To evaluate the extent of take-home pesticide exposures among farm families, particularly children.

Abstract:
Pesticide exposure to younger children residing on farms is an especially serious concern since younger children may absorb pesticides through contact with contaminated floors and other surfaces and may be more susceptible to the toxic effects. This study will involve field surveys of farm family homes to measure pesticide residue at selected locations around and within the home and pesticide metabolite concentrations in the urine of participants. It is also planned to identify potential behavioral and environmental risk factors influencing these exposures. The study will evaluate the extent of pesticide contamination within the homes of farm families and provide the basis for recommendations to reduce exposure. Data collected may also provide an impetus to pesticide regulators to consider farm family exposures when evaluating the safety of pesticides.

Studies of Breast Cancer Incidence in Occupational Cohorts Exposed to Polychlorinated Biphenyls / Ethylene Oxide

Project Director: Elizabeth Whelan, Ph.D.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278598
Keywords/Phrases: Cancer, epidemiology, endocrine

Purpose:
To determine the incidence of breast cancer in women exposed to polychlorinated biphenyls (PCBs) and ethylene oxide (ETO).

Abstract:
Increasing numbers of women are employed outside the home, yet few studies of breast cancer etiology have addressed occupational and environmental chemical exposures. Many cancer studies of industrial cohorts have excluded women. This project will determine the incidence of breast cancer in 9,929 women exposed to ETO and 13,726 women exposed to PCB compounds, which are suspected breast carcinogens. Breast cancer cases will be ascertained through death certificates and questionnaires administered to living subjects and next-of-kin of deceased subjects. The results will apply to the general population exposed to PCBs and more than 100,000 women who are occupationally exposed to ETO in the United States. If positive, results will be used by the Occupational Safety and Health Administration and/or the U.S. Environmental Protection Agency to formulate guidelines for reducing exposures.

Young Worker Regional Health Education Center

Project Director: Raymond Sinclair, Ph.D.
Division: EID
Telephone: (513) 533-8302
Project ID: 9277059
Keywords/Phrases: Young workers, cooperative agreement, training

Purpose:
To address high rates of occupational injuries among young workers using a community health education framework.

Abstract:
This project uses a community health education framework. It will be conducted in two areas of the country, the west coast and east coast, through a cooperative agreement with NIOSH. Interventions capitalize on lessons learned from previous young worker community

health training intervention projects. Analysis of community health education needs and opportunities will guide community-level efforts to raise the issue of young worker health with a variety of target audiences. Evaluation data will guide further efforts to promote health education around young workers' issues. A model for community health interventions will be developed. Study results will be published.

Parkinsonism, Pesticides, and Markers of Neurotoxic Effect

Project Director: Cecil Burchfiel, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277244
Keywords/Phrases: Parkinsonism, pesticides, neurotoxicology

Purpose:
To examine the interrelations among markers of pesticide exposure, quantifiable brain tissue injury, and clinical and pathological evidence of Parkinsonism and dementias in an established epidemiological study.

Abstract:
This study will integrate and increase the understanding of the issues among the disciplines of epidemiology, clinical neurology, neuropathology, and neurotoxicology. The outcome of this collaboration will establish the existence of more sensitive and precise indicators of neurotoxic damage in humans using methods validated in more than 10 years of animal research that are directly transferable from experimental research to clinical and epidemiological research. The findings will have significant impact on regulating chronic occupational and environmental exposure to organochlorine pesticides.

Disseminating a NIOSH Kids Web Site

Project Director: Donald Eggerth, Ph.D.
Division: HELD
Telephone: (304) 285-6121
Project ID: 9277379
Keywords/Phrases: Child agriculture, communication research, evaluation

Purpose:
To explore methods of effectively providing youth with occupational safety and health information.

Abstract:
Given the increased risk among youth for injury or illness in the workplace and NIOSH research priorities with this special population, NIOSH scientists are proposing a program of projects that will determine how to effectively disseminate information about occupational safety and health to youth. Specifically, developing a multimedia intervention based on a NIOSH Web site for kids and teens is proposed. The objectives of this research are to determine the most effective source, message, channel, and receiver characteristics that will increase exposure, comprehension, attitude, intentions, and behavior of youth in regard to use of the Web site and the NIOSH safety recommendations.

• Surveillance Research Methods •

Developing Nationally Standardized Occupational and Industry Coding Software

Project Director: Suzanne Marsh, B.S.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278819
Keywords/Phrases: Surveillance, epidemiology, traumatic injuries

Purpose:
To encourage coding of narrative occupation and industry information in public health to standardized numeric codes, which will facilitate research on occupational injuries and illnesses.

Abstract:
Standardized occupational and industry coding (SOIC) software uses artificial intelligence to enable the provision of comparable and consistently coded data from occupation and industry narratives. Development and implementation of the software includes input from a national collaborative committee with agency representatives from the National Association for Public Health Statistics and Information Systems, Bureau of Labor Statistics, National Center for Health Statistics, Bureau of the Census, National Center for Chronic Disease Prevention and Health Promotion, and NIOSH. This project seeks to develop standardized occupational and industry (O/I) coding through integration of SOIC into State vital records and other records systems on a national level. This software and resultant coded data will be useful to all State, Federal, and private organizations engaged in occupational safety and health surveillance research.

NORA Surveillance Research Methods, Communications, and Document Development

Project Director: John Sestito, J.D., M.S.
Division: DSHEFS
Telephone: (513) 841-4428
Project ID: 9278174
Keywords/Phrases: Surveillance, public health, strategic plan

Purpose:
To support NORA surveillance research methods workshops and related information dissemination activities to advance the implementation of the strategic plan.

Abstract:
Public health surveillance is the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practices, closely integrated with the timely dissemination of these data to those who need to know. The project will (1) plan and convene two NORA Workshops, (2) develop the first draft of Chartbook 2003, (3) develop a prototype surveillance Web site through the CDC\NIOSH intranet site, (4) maintain scientific exchanges with and provide technical consultation to state-based surveillance programs, and (5) provide consultation to the NIOSH Surveillance Coordination Group.

• Traumatic Injuries •

Lockout / Tagout Jammed and Moving Machinery Controls

Project Director: John Etherton, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277058
Keywords/Phrases: Injury prevention, engineering controls, traumatic injuries

Purpose:
To develop automatic protection from hazardous machine energy.

Abstract:
In U.S. workplaces, failure to control hazardous machine energy is the primary cause of traumatic injuries such as amputations and crushing fatalities. For this research, an injury control device will be designed, tested, and introduced into the workplace to automatically protect workers when clearing, unjamming, and inspection work is performed at dangerous locations. The target for the Division of Safety Research (DSR) research component is crushing hazards for jam-clearing with baling equipment common in the recycling industry. As a result of this project, U.S. recycling industry workplaces will have a new machine injury prevention device that automatically initiates protective hazardous energy control before workers conduct maintenance, unjamming, and inspection tasks.

Evaluation of Emergency Service Vehicle Occupant Safety

Project Director: Paul Moore, B.S.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277136
Keywords/Phrases: Fatalities, emergency responders and firefighters

Purpose:
To identify and evaluate emerging vehicle crash-related injury risks for emergency service operators.

Abstract:
From 1992 to1997, it was estimated that the fatality rate for emergency medical service (EMS) providers was 12.7 per 100,000 workers per year, which is more than twice the national average of five fatalities per 100,000 workers per year. Transportation-related events, including ambulance crashes, were the most common causes of fatalities. In contrast to the occupant protection for passenger vehicles, the occupant safety of ambulance vehicles has yet to be addressed. Unrestrained occupants risk serious injury during a crash and are an injury risk to other occupants by becoming projectiles. This project will provide information that is critical to the design and recommendation of effective occupant protection systems to reduce the frequency and severity of occupational crash-related emergency responders and firefighters.

A Study of Ergonomic Interventions in the Drywall Industry

Project Director: Christopher Pan, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9277242
Keywords/Phrases: Construction, traumatic injuries, safety

Purpose:
To assess current intervention to reduce the contribution of ergonomic hazards to traumatic injuries in the drywall industry.

Abstract:
This project will quantify ergonomic hazards that will be identified from both field and laboratory studies to gain better data on those hazardous tasks and activities associated with stilts and teamwork techniques. Results will be used to determine the usefulness of interventions for drywall handling to reduce ergonomic hazards and traumatic injuries.

Thermal Imaging Cameras: Reducing Dangers to Firefighters

Project Director: Steven Proudfoot, B.A.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278044
Keywords/Phrases: Firefighters, injuries, fires
Purpose:
To examine the effectiveness of thermal imaging cameras (TICs) in reducing dangers to firefighters.

Abstract:
TICs allow firefighters to see through smoke, haze, and other conditions in which human eyes cannot. TICs detect heat energy rather than light. The project will focus on the areas of firefighter thermal imaging training and deployment and application of the cameras. This project will provide a basis for determining how best to incorporate thermal imaging with fire fighting to reduce firefighter exposure to hazardous conditions?which in turn may decrease the numbers of fatalities and injuries.

Evaluating Roadway Construction Work Zone Interventions

Project Director: David Fosbroke, M.S.F.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278105
Keywords/Phrases: Construction, injury prevention, effectiveness research
Purpose:
To reduce construction worker exposure to moving vehicles and equipment operating at roadway construction work zones.

Abstract:
This multidisciplinary project involves laboratory and field development, demonstration, and evaluation of selected interventions that construction contractors can use to protect their workers from being struck by construction vehicles and equipment operating inside work spaces of roadway construction projects. Internal traffic control plans and a variety of proximity warning devices are promising yet unproven interventions for preventing fatalities and injuries associated with construction vehicles and equipment. If proven to be effective, adoption of these interventions throughout the construction industry could substantially reduce exposure of workers to moving construction vehicles and equipment, thus reducing fatalities and injuries related to vehicles and equipment by nearly 50%.

Traumatic Injury Coordination Core

Project Director: Timothy Pizatella, M.S.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278104
Keywords/Phrases: Injury prevention, engineering controls, intervention
Purpose:
To develop and disseminate practical injury prevention devices and knowledge in a relatively short timeframe from the science to the prevention.

Abstract:
The traumatic injury research program is designed to "close the loop from science to prevention." The Coordination Core project has three overriding long-term goals: (1) provide the needed program coordination and facilitate the successful completion of individual research projects within the program, (2) develop permanent methods of improved injury prevention technology transfer within NIOSH, and (3) provide both a mechanism and ongoing recommendations for planning future integrated traumatic injury research at NIOSH.

Effectiveness of Collision Warning System in Large Trucks

Project Director: Guang Chen, M.D., M.P.H.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278107
Keywords/Phrases: Traumatic injuries, transportation, effectiveness research

Purpose:
To evaluate the effectiveness of a collision warning system (CWS) technology for preventing large truck highway collisions.

Abstract:
Circumstances that make this study necessary are the magnitude of large truck highway collisions and the potential preventive effect of CWS in reducing highway forward-moving collisions. A longitudinal observational cohort study will be conducted. Highway collision rates will be compared between trucks with and without CWS. Determining the effectiveness of CWS for preventing large truck highway collisions will allow NIOSH and Federal Motor Carrier Safety Administration to make scientifically justified recommendations or regulations regarding use of CWS as a highway collision countermeasure on heavy trucks.

Slips and Falls Prevention in Health Care Workers

Project Director: James Collins, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278108
Keywords/Phrases: Health care workers, falls, effectiveness research

Purpose:
To develop, implement, and evaluate a slips, trips, and falls (STF) prevention program in three hospitals.

Abstract:
Slip-resistant shoes, mats, waxes, prompt cleaning of spillage and debris, keeping stairs and walkways clear, improved lighting, adding hand-holds, and clearing ice and snow have the potential to reduce STF incidents. Injured workers will be interviewed to identify risk factors. A laboratory study will examine the slip-resistance characteristics of shoes, samples of hospital flooring, and floor treatments. Slip-resistant shoes, aggressive housekeeping, and other countermeasures identified in the lab will be introduced into the hospital to reduce STF incidents. The intervention will be assessed for 36-months pre-intervention and 36 months post-intervention for its impact on the frequency, severity, and cost of STF injuries.

Prevention of Violence Against Nurses: Feasibility Study

Project Director: Daniel Hartley, Ed.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278109
Keywords/Phrases: Violence, health care workers, feasibility assessment

Purpose:
To demonstrate the feasibility of evaluating the effectiveness of practices recommended for hospitals and nursing homes for reducing violence through the use of local health departments as liaisons for recruitment and data collection.

Abstract:
This project is a feasibility study for a large, future case-control study to evaluate the Occupational Safety and Health Administration guidelines for prevention of violence against nurses, nursing aides, and orderlies. The feasibility study will be conducted in two metropolitan areas. Cases and controls will also be reinterviewed 3 months after the assault to gather information about longer lasting physical and psychological effects.

Workplace Violence Initiative: Research and Implementation

Project Director: Eleanor Jenkins, M.A.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278313
Keywords/Phrases: Assault, homicides, violence

Purpose:
To support and coordinate the conduct of new research in the area of workplace violence prevention.

Abstract:
Workplace violence has been recognized as a significant public health and occupational safety and health issue, but gaps remain in our knowledge of risk factors and the effectiveness of particular intervention strategies. This research will (1) use the capacity of the National Electronic Injury Surveillance System (NEISS) to incorporate special topic follow-back surveys to conduct interviews with workers treated in hospital emergency departments for injuries related to workplace violence, (2) continue enhancements to the National Crime Victimization Survey (NCVS) and support conversion of industry and occupation coding to the North American Industrial Classification System (NAICS), and (3) establish a Federal interagency task force on workplace violence research and prevention. This project will use

the capacity of broad-based survey systems to incorporate supplements and to fill some of the most pressing knowledge gaps.

Harness Design and Sizing Effectiveness

Project Director: Hongwei Hsiao, Ph.D.
Division: DSR
Telephone: (304) 285-5894
Project ID: 9278426
Keywords/Phrases: Falls, construction, protective equipment

Purpose:
To develop a whole-body, fall-arresting, harness-sizing scheme and design that better control hazardous energy released during a fall from elevation.

Abstract:
Human size data will be used from an existing database of U.S. workers and three controlled laboratory studies on harness fit to construction workers, will be used. Researchers will use 3-D anthropometry information to determine the sizing scheme and to develop torso/hip/thigh strap assemblies and rigging components that best enhance the ability of the worker to select and use the harness. The new harness system will be validated for efficacy and will be introduced into the construction workplace. The research will help the construction industry to reduce the risk of injury that results from poor user acceptance/compliance, improper selection, and the failure to don the protective equipment properly.

Fundamental Studies of Factors Responsible for Falls of Ground

Project Director: Anthony Iannacchione, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 9270002
Keywords/Phrases: Unstable ground, falls, techniques

Purpose:
To characterize unstable ground and mitigate ground fall hazards in mining.

Abstract:
Because the root causes of many roof falls are poorly understood, appropriate engineering and administrative controls have not always been fully used by the mining industry to anticipate and mitigate their occurrence. To overcome this problem, NIOSH will apply, and in some cases develop, advanced monitoring and modeling techniques to characterize the behavior of unstable ground so that a fundamental understanding of rock failure processes can be realized. Advanced monitoring techniques will principally consist of microseismic analysis. This tool will be used to evaluate the precise failure pathways exhibited by actual roof falls. Geologic models will be developed to catalogue the fundamental factors responsible for anomalous stress fields and variations in structural integrity of mined strata associated with failed ground. Numerical models, such as finite difference, discrete element, and particle flow formulations, will be used to perform parametric studies to identify controlling failure mechanisms. The advancement of our understanding of this complex scientific problem will help to implement viable engineering controls and thereby reduce miner exposure to falls of ground.

Laser Safety in Potentially Flammable Environments

Project Director: Thomas Dubaniewicz, M.S.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P149
Keywords/Phrases: Injury prevention, explosions, mining

Purpose:
To determine when a laser beam may be an ignition source for flammable materials in the mining, agriculture, telecommunications, and petrochemical industries.

Abstract:
Laser power thresholds for igniting several flammable dusts and gases will be determined experimentally through this research. A predictive model proposed by NIOSH will be evaluated. The delay time before ignition will be recorded to aid manufacturers in the design of protective automatic shutoff systems. A method and apparatus for laser safety in hazardous locations will be developed. Knowledge gained will be transferred to industry through an international working group of researchers assembled to recommend safety guidelines.

Evaluating Roadway Construction Work Zone Interventions

Project Director: Gary Mowrey, Ph.D.
Division: PRL
Telephone: (412) 386-6602
Project ID: 927P151
Keywords/Phrases: Mining, construction, traumatic injury

Purpose:
To further the field development, evaluation, and demonstration of interventions aimed at reducing worker exposure to moving vehicles and equipment operating inside the boundaries of work zones and other work areas.

Abstract:
This multidisciplinary project involves laboratory and field development, demonstration, and evaluation of selected interventions that construction contractors and mine operators can use to protect their workers from being struck by mobile vehicles and equipment. Internal traffic control plans and a variety of proximity warning devices are promising, yet unproven interventions for preventing fatalities and injuries associated with mining and construction vehicles and equipment. Intervention costs, implementation problems, and worker and management acceptance of these interventions will be assessed. Results will be disseminated to unions, trade associations, equipment manufacturers, the Occupational Safety and Health Administration, the Mine Safety and Health Administration, and the Federal Highway Administration. If proven to be effective, adoption of these interventions throughout industry could substantially reduce exposure of workers to moving vehicles and equipment, thus reducing fatalities and injuries related to vehicles and equipment by nearly 50%.

Reducing Slips and Falls

Project Director: Floyd Varley, B.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S161
Keywords/Phrases: Slipping/falling injuries, surface mines

Purpose:
To reduce the frequency of slips and falls on mining equipment, ladders and steps, and other structures among an aging workforce at metal/nonmetal surface mines.

Abstract:
This project will (1) identify sources of slips and falls, (2) design intervention techniques to prevent slips and falls, (3) demonstrate promising interventions, and (4) transfer research results and technologies to industry for implementation and subsequent reduction of slipping and falling accidents. Slips and falls make up the second largest group of nonfatal injuries (sprains, bruises, or fractures to trunks or legs) at surface mines, accounting for 27% of the lost-time injuries between 1992 and 1994. Expected outcomes of the research will include improved methods of entry and exit from equipment, less slippery walking and stepping surfaces, and safety training materials and methods.

Safety Enhancements for Off-Road Haulage Trucks

Project Director: Todd Ruff, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S162
Keywords/Phrases: Accidents, dump trucks, mining

Purpose:
To develop interventions that will reduce injuries involving off-road dump trucks in surface mining operations.

Abstract:
This research will reduce fatalities and injuries caused when a truck operator cannot see all areas around the equipment from the cab and by a lack of operator training or experience in adverse conditions. To reduce injuries from dump trucks colliding with unseen obstacles or people and from trucks backing over the edge of dump points, a system will be developed that will supplement the operator's vision through sensors, cameras, or other means. Training methods and materials will be evaluated and recommendations will be made to improve truck driver training in emergency conditions.

Slope Stability Hazard Recognition for Metal / Nonmetal Mines

Project Director: Jamie Girard, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 2927S320
Keywords/Phrases: Surface mining, slope stability

Purpose:
To develop new methods for designing, monitoring, and supporting mine slopes to minimize the hazards to mine workers.

Abstract:
Highwalls, waste dumps, tailings dams, and stockpiles are examples of slopes that may fail and endanger the lives of mine workers. The mechanics of rock mass movement and rock mass strength are poorly understood at large scales. For this project, an understanding of slope failures related to mining and the technology available to prevent failures will assist engineers in constructing stable rock structures, thereby reducing the number of fatalities and injuries. New methods of assessing mine slope stability and identifying hazards include radar and spec-

tral imaging, photogrammetric change detection, and computer modeling of rock fall hazards. Results can be transferred to a number of other civil engineering projects, including design of roadcuts, railroads, canals, refuse disposal sites, earth dams, and others.

Reducing Injury Risk from Jolting / Jarring on Mobile Equipment in Construction and Agriculture

Project Director: Fred Biggs, B.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 2927S362
Keywords/Phrases: Construction/agriculture, low-back disorders, traumatic injuries

Purpose:
To reduce jolting and jarring injuries among heavy equipment operators in construction and agricultural industries.

Abstract:
This project seeks to reduce injury risk from jolting and jarring on mobile equipment in construction and agricultural industries through the use of engineering controls to eliminate or minimize health hazards and associated lower back disorders. The research is designed to determine whether the hazards related to jarring/jolting are associated with lower back disorders.

Injury Prevention for Metal / Nonmetal Drilling and Bolting Operations

Project Director: Robert McKibbin, B.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 927S372
Keywords/Phrases: Mining, drilling, injuries

Purpose:
To identify the root causes of injuries associated with drilling and bolting cycles in metal/nonmetal mines and develop the technology needed to reduce or eliminate the risk associated with drilling and bolting.

Abstract:
As a first step, development of a lightweight jackleg drill was started in FY1999. The drill, which has several components made of aluminum and titanium, is 25% lighter than a standard steel drill. Additional improvements under development include a vibration damping handle, an ergonomically-shaped handle, additional nickasil-coated aluminum components, and a variety of noise mufflers. Laboratory testing of the drill started in FY99 and is ongoing. In-mine testing began in FY01 and is also ongoing. Initial results have been favorable.

Mine Injury and Disease Prevention Research Planning

Project Director: Michael F. Jenkins, M.S.
Division: SRL
Telephone: (509) 354-8000
Project ID: 2927S692
Keywords/Phrases: Mining, injuries, technology transfer

Purpose:
To address short-term requests for assistance from stakeholders and to provide additional support for ongoing research efforts.

Abstract:
This project is designed to address short-term requests for assistance from stakeholders and to provide additional support for ongoing research efforts. It provides the flexibility needed to respond to requests for both special assistance to intermural research projects and for addressing special needs within NIOSH but outside the individual research project plans or funding capabilities.

Assessing the Risks of Injury in Trenching and Evacuation in the U.S.

Project Director: Thomas Brady, M.S.
Telephone: SRL
Telephone: (509) 354-8000
Project ID: 927S231
Keywords/Phrases: Trench fatalities, perceptions of risk, cost of compliance

Purpose:
To determine why trench fatalities continue to occur despite the detailed and comprehensive regulations in place to prevent trench collapses.

Abstract:
This research project will explore several possible factors including the perceptions of risk on the part of workers digging and working in trenches and the costs of complying with the regulations. In addition to analyses of existing cases, the study will interview workers and excavation firms regarding their decision-making about trench construction. A report will be prepared and included based on the findings and further recommendations for research, education, or enforcement.

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