NIOSH

155 Extramural Research Projects
183 Intramural Research Projects

National Occupational Research Agenda

Research Projects
September 2000

U.S. Department of Health and Human Services
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Washington, D.C.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

FOREWORD

In 1996, the National Institute for Occupational Safety and Health (NIOSH) worked closely 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 health and safety 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.

In this document, current research projects conducted or supported by NIOSH under NORA are summarized. For convenience of use, projects are classified as to whether they involve intramural or NIOSH-supported extramural research and are grouped by NORA priority area. The 155 extramural projects and 183 intramural projects illustrate the range of NORA priorities and the high quality of research that continues to result from this national partnership. 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 here in NIOSH, we have been inspired by NORA. As we continue to build new collaborations, we hope others will share this same excitement.

Lawrence J. Fine, M.D., Dr.P.H.
Acting Director
National Institute for Occupational Safety and Health

Contents

Extramural and Intramural Research Projects

Extramural Research Projects

Grants

• Allergic and Irritant Dermatitis

Prediction of Irritation Based on Exposure Duration

Researcher: James N. McDougal, Ph.D.
Affiliation: Wright State University
Dayton, Ohio
(937) 255-5150
Keywords: Skin irritation, mathematical modeling, duration of exposure, solvents

Purpose:
To develop a biologically based mathematical modeling approach to provide duration-based standards for dermal irritation.

Abstract:
This research will mechanistically model the relationship between duration of solvent exposure on the skin and the degree of irritation produced by three occupationally important surfactants and solvents: sodium lauryl sulfate, m-xylene, and d-limonene. The short-term distribution of chemicals to skin layers will be determined and a predictive pharmacokinetic model in the skin will be developed for each chemical. The cellular responses to these chemicals will also be developed. The profile of important cytokines, chemolines, vasoactive products, and a quantitative assessment of edema and erythema will be measured. A pharmacodynamic model for the relationship between skin concentration and cellular response will be developed. The pharmacokinetic and pharmacodynamic models will be combined to predict irritation from surface concentrations of the chemicals. The entire model will be validated by predicting irritation from another exposure scenario and predicting a duration of exposure that will provide a specific level of edema and erythema. This demonstration will have important applications in occupational health.

In Vitro Assay for Hapten-Specific Priming of Human T Lymphocytes

Researcher: J. Wayne Streilein, M.D.
Affiliation: Schepens Eye Research Institute
Boston, Massachusetts
(617) 912-7422
Keywords: In vitro assay, sensitizers and irritants, susceptible populations, contact or irritant contact dermatitis

Purpose:
To develop an in vitro assay that may help identify potential contact sensitizers and irritants as well as individuals susceptible to developing allergic contact dermatitis or irritant contact dermatitis.

Abstract:
In this research to generate sensitized T cells that closely resemble cells found in vivo, a comparison will be made of effector functions of T cells primed in vivo and in vitro. These comparisons will include phenotype of the T cells proliferating in a hapten-specific manner, their cytokine profile, and hapten-specific cytotoxicity. Attempts will be made to compare and contrast T cell responses to various haptens and irritants. This project can help to: (1) refine an in vitro assay for future application in the clinical laboratory for screening various potential haptens and irritants as well as susceptible individuals and (2) provide better understanding of cellular events that lead to allergic versus irritant contact dermatitis.

Quantification of Skin Acrylate Adducts

Researcher: Lenna A. Nylander-French, Ph.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
(919) 966-3826
Keywords: Multifunctional acrylates, enzyme-linked immunosorbent assay, epidermal tissue, noninvasive

Purpose:
To develop a noninvasive procedure for collection of epidermal tissue and to detect the deposition and penetration of a multifunctional acrylate into the stratum corneum and the formation of acrylate-keratin protein adducts as a biomarker of exposure.

Abstract:
Multifunctional acrylates are potent sensitizers, may cause allergic contact dermatitis, and promote skin cancer. This research will develop a quantitative enzyme-linked immunosorbent assay (ELISA) method with a high throughput capacity and efficiency to detect acrylate hapten-keratin protein adducts from skin samples. This research will make it possible to define the exposure of a multifunctional acrylate to the skin under both laboratory and occupational exposure conditions. These results will be useful for developing further the existing and new dermal monitoring methods as well as providing a basis for establishing the exposure limits for dermal exposure in the occupational setting where exposure to radiation curable acrylate formulations occur. Through biological monitoring of workers and exposure assessment using these new methods, strategies for minimizing exposure and preventing adverse health effects can be developed and implemented.

• Asthma and Chronic Obstructive Pulmonary Disease

Epidemiologic Study of Isocyanate Asthma in Auto Body Shops

Researcher: Mark R. Cullen, M.D.
Affiliation: Yale University
New Haven, Connecticut
(203) 785-5885
Keywords: Auto body workers, hexamethylene diisocyanate, epidemiology study

Purpose:
To conduct an epidemiologic study of hexamethylene diisocyanate (HDI) exposed auto body shop spray painters and coworkers.

Abstract:
Isocyanates cause a high percentage of the reported cases of occupational asthma in the U.S. and other developed countries. Primary prevention is limited by inadequate knowledge of isocyanate exposure patterns and the factors that cause and exacerbate the disease. Secondary and tertiary prevention opportunities are limited since there is currently no simple way to diagnose isocyanate asthma, or identify specific at-risk groups. To address these important problems, the investigators propose an epidemiologic study of hexamethylene diisocyanate-exposed auto body shop spray painters and unexposed coworkers. This research will: (1) develop an algorithm to diagnose isocyanate asthma using a questionnaire and physiologic measures validated against a specific bronchial challenge, (2) characterize isocyanate exposure patterns in auto body shops to determine the relationships between exposures and risk for development and progression of isocyanate asthma, and (3) identify potential acquired and genetic host susceptibility factors that may modify risk for the disease. The study design will be a cross-sectional investigation of 50 shops and 300 workers. This project should result in the highly practical knowledge needed to diagnose and prevent this disease.

New Approaches to Cross-Sectional Studies of Asthma

Researcher: Christina A. Holcroft, Sc.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(508) 934-3354
Keywords: Cross-sectional study, metalworking fluids, asthma

Purpose:
To conduct a cross-sectional study of a new cohort of 3000 autoworkers concentrating on asthma—both initial onset of disease and exacerbation of symptoms—using a questionnaire to collect data.

Abstract:
This project extends data obtained in a previous cross-sectional study of metalworking fluids and asthma suffered from the well-documented biases of the Healthy Worker Effect and sparse information about the pattern of asthma events since development. The metalworking fluid-asthma link merits further examination of the exposure-response relationship. The present study analysis will account for job transfer bias by employing time windows to redefine exposure in a biologically relevant manner and will apply a proportional hazards model to estimate risk in both the cross-section and the cohort. The new methods developed for data collection and analysis will improve techniques for studying asthma in cross-sectional studies of working populations, and further the understanding of the relationship between asthma and metalworking fluids.

Pulmonary Effects of Machining Fluid Aerosols

Researcher: Terry Gordon, Ph.D.
Affiliation: New York, University Medical Center
Tuxedo, New York
(914) 351-4837
Keywords: *Mycobacteria chelonae*, animal model, pneumonitis, machining fluid workers

Purpose:
To determine if *Mycobacteria chelonae* in machining fluids produce hypersensitivity pneumonitis in exposed workers.

Abstract:
This research will use an animal model to determine if *Mycobacteria chelonae* is responsible for the induction of hypersensitivity pneumonitis in machining fluid workers. Indirect evidence suggests that *Mycobacterium chelonae* is involved in the recent outbreaks of hypersensitivity. Laboratory studies are needed to determine if *Mycobacterium chelonae* causes these health effects before any control strategies are instituted, such as the addition of a biocide to machining fluids, to remove microbial contamination.

Respiratory Health in Potroom Work–An Inception Cohort

Researcher: Joel D. Kaufman, M.D., M.P.H.
Affiliation: University of Washington
Seattle, Washington
(206) 616-3501
Keywords: Potroom workers, nonspecific bronchial responsiveness, occupational asthma, questionnaire, medical assessment

Purpose:
To determine if aluminum smelter potroom exposures are associated with the development of increased nonspecific bronchial responsiveness (NSBR), new respiratory symptoms, and occupational asthma.

Abstract:
This research using a cohort of new aluminum smelter potroom workers will help to provide a model for understanding the role of the environment in asthma, as potroom work involves chronic low-dose irritant exposures. It will: (1) determine the incidence of increased nonspecific bronchial responsiveness (NSBR) and new asthma-like symptoms among newly hired potroom workers, (2) identify cases of verified and possible occupational asthma in the cohort, (3) explore the dose-response relationship of specific potroom exposures with the development of respiratory outcomes, (4) determine the influences of constitutional and behavioral factors

on the relationships between exposure and respiratory outcomes, and (5) characterize the natural history and pattern of the respiratory problems to gain insight into the mechanism of airway response. The study will include a questionnaire, spirometry, methacholine challenge, and skins tests for common antigens, provided to workers prior to beginning potroom work. Workers will be followed throughout their work in this industry.

Passive Sampler for Particles

Researcher: David Leith, Sc.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
(919) 966-3851
Keywords: Aerosol sampler, small, long-term concentrations, size distribution

Purpose:
To develop a miniature, passive aerosol sampler that will reliably estimate long-term average concentrations and size distributions.

Abstract:
This pilot study will evaluate the operation of a prototype passive aerosol sampler about the size of a dime that costs only a few dollars. It collects particles by gravity, diffusion, and convection. It will be tested in a wind tunnel under controlled conditions. Limited field trials will be conducted at an industrial site where the performance of passive and conventional samplers can be compared. This work, if successful, will lead to a proposal to evaluate passive particle samplers more thoroughly.

Estimation of Highest Task Silica Exposures

Researcher: L. Faye Grimsley, M.S.P.H.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 588-1843
Keywords: Silica, unsampled tasks, silicosis

Purpose:
To investigate innovative ways to estimate silica exposure in unsampled tasks.

Abstract:
After a complete literature review of the topic, three methods will be selected to use in imputing missing highest task exposure data. The following approaches are being considered: the mean exposure at sampled commodity-specific tasks, the lower bound of the 95 percent confidence interval of the median of commodity-specific tasks, and a maximum likelihood estimate. The results from the three methods will be described and contrasted. An exposure-response analysis will be conducted for the previously identified cases and controls. Any differences in the odds ratios using the highest task exposure metric and the cumulative exposure metric will be tested. If the highest task metric, with imputed values, is found to be related to silicosis development, changes in sampling methods and targeted control techniques could be implemented to decrease disease in the future.

Chemokine Biomarkers of Diisocyanate–Induced Occupational Asthma

Researcher: David I. Bernstein, M.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-4701
Keywords: Diisocyanate, occupational asthma, diagnosis, biomarker, cytokine, Monocyte Chemoattractant Protein-1

Purpose:
To validate an immunological assay of in vitro Monocyte Chemoattractant Protein-1 (MCP-1) reduction by Peripheral Blood Mononuclear Cells (PBMCs) as a sensitive and specific biomarker of diisocyanate-induced occupational asthma (DA), and to define a relationship between in vitro diisocyanate enhanced PBMC production and airway inflammation in DA.

Abstract:
Diisocyanate-induced occupational asthma (DA) is the most prevalent form of occupational asthma. At present, there are no sensitive biomarkers of asthma to facilitate an early diagnosis. This research will determine: (1) if diisocyanate antigen enhanced production of Monocyte Chemoattractant Protein-1 (MCP-1) is a biomarker of DA, (2) validate that the MCP-1 assay as a clinical test will allow differentiation of DA from non-DA, and (3) Peripheral Blood Mononuclear Cell (PBMC) production of MCP-1 in response to in vitro stimulation with diisocyanate antigens correlates with increased secretion of MCP-1 and TNF-alpha in induced bronchoalveolar lavage fluid of workers with DA as well as with other indices of lung inflammation elicited by workplace exposure to diisocyanates. Studies will involve workers both exposed to diisocyanates and nonexposed to validate the MCP-1 assay. A second study of workers with DA in whom bronchoalveolar lavage will be performed before and after diisocyanate inhalation challenge will also be conducted. 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 individuals with non-occupational asthma.

Irritant-Induced Asthma: Epidemiology and Pathogenesis

Researcher: Jean-Luc Malo, M.D.
Affiliation: Hospital du Sacre-Coeur
Montreal (Quebec), Canada
(514) 338-2796
Keywords: Irritant-induced asthma, reactive airways dysfunction syndrome, chlorine, epidemiologic, physiopathologic, animal model

Purpose:
To explore the physiopathological and epidemiological mechanisms of irritant-induced asthma.

Abstract:
This research will evaluate both physiopathologic and epidemiologic designs to answer the following questions: (1) do single and multiple exposures result in equivalent or enhanced consequences and (2) are baseline characteristics (atopy, airway

caliber and responsiveness) relevant in the susceptibility of developing irritant-induced asthma and reactive airway dysfunction syndrome? The investigators will examine and follow new employees at risk of acute exposure to chlorine and serially assess their characteristics (atopy, airway caliber and responsiveness, smoking, and nasal symptoms) and exposure events. In a subsample, induced sputum will be examined. In a rat model, investigators will: (1) examine the response to single and multiple exposures to chlorine vapor, (2) test the importance of background characteristics of the rat strain (atopy, airway muscle) to the response, (3) quantify the degree of airway remodeling in a susceptible and resistant rat strain, (4) assess the effects of neurokinin antagonists on the airway damage, and (5) evaluate the role of airway epithelial chemokines in the inflammatory response. This work will identify, both in an epidemiological survey and in an animal model the effect of multiple exposure as opposed to a single exposure to a respiratory irritant and the dose predisposing factors. It will also further our understanding of the physiopathology of reactive airways dysfunction syndrome and irritant-induced asthma as well as the natural history and physiopathology of asthma induced by irritants.

Iron Calcium and Oxidative Stress in Lung Injury

Researcher: Xi Huang, Ph.D.
Affiliation: New York University
New York, New York
(212) 263-6650
Keywords: Iron (Fe2+), coal dust-induced cell injury, oxidative stress, calcite (CaCO3), lungs, coal

Purpose:
To test the hypothesis that bioavailable iron (Fe2+) is the active component in coal dust-induced cell injury through oxidative stress pathway, and that calcite (CaCO3) may play a protective role in such injury by inhibiting solubilization of Fe2+, making Fe2+ less bioavailable.

Abstract:
Striking differences in the prevalence of coal worker's pneumoconiosis and chronic obstructive bronchopneumopathy exist between different coal mine regions despite comparable levels of dust exposure. In this research, investigators will assess the role of iron (Fe2+) as the potentially active component in coal dust-induced cell injury through oxidative stress and the possibility that calcite may be protective in preventing injury. Primary cultures of guinea pig alveolar macrophages (AM) and human lung type II cells (A549) will be used for coal treatments. Thirty samples from three coal mine regions with a prevalence of coal worker's pneumoconiosis of 4%, 10%, and 26% will be tested. The bioavailability of Fe2+, Ca2+, trace metals, and quartz released from coal dusts in these cells will be determined. The levels of tumor necrosis factor (TNF), interleukin-1 (IL-1), and fibronectin will also be determined as part of this study. By confirming the role of Fe2+ in coal-induced injury, the investigators will be able to predict which coal likely is more toxic, even before mining. By determining the role of calcite, it is possible to propose alternative methods for lung disease prevention.

Occupational Lung Disease in a Flocking Plant

Researcher: Kate T.H. Durand, M.H.S.
Affiliation: University of Washington
Seattle, Washington
(206) 616-2691
Keywords: Interstitial lung disease, textile plant, job exposure matrix, epidemiologic analyses

Purpose:
To complete and test an exposure assessment for a textile plant in which an outbreak of interstitial lung disease of unknown etiology has been described.

Abstract:
Air sampling results, detailed job histories, symptom questionnaire results from a NIOSH Health Hazard Evaluation and clinical data will be used to construct a job exposure matrix and to assign values for each of six different exposure metrics to each member of a previously described study cohort. Exposure metrics will include ever/never in each job category, duration in each job category, ever/never having had peak exposure, duration of exposure to peaks, cumulative total dust exposure, and cumulative respirable dust exposure. These exposures will then be used in two different epidemiologic analyses using two different study populations within the investigated facility. One population will include all workers for whom a completed NIOSH questionnaire is available (n=116). Disease will be defined as any worker with cough and shortness of breath beginning while employed at the studied facility and lasting for more than two months without physician diagnosis of obstructive lung disease. The other population will include all workers who had high resolution computerized tomography (HRCT) of the lungs, and disease will be defined as any worker with a finding of either diffuse ground glass opacity or micronodularity on HRCT. Differentiation of exposure metrics resulting in strong exposure-response relationships from those with none will help guide future investigations of respiratory morbidity in flocking plants.

Occupational Asthma Associated with Seafood Processing

Researcher: Thomas G. Robbins, M.D.
Affiliation: University of Michigan
Ann Arbor, Michigan
(734) 936-0757
Keywords: Lobster, saltwater bony fish, occupational asthma, allergic conditions

Purpose:
To (1) investigate occupational asthma and other allergic conditions associated with rock lobster and saltwater bony fish processing in South Africa, (2) determine the prevalence of allergic sensitization and health outcomes, and (3) characterize the relationship between exposure, allergic response, and lung function.

Abstract:
Allergic reactions most often related to inhalation of antigens have been increasingly recognized as a serious problem among seafood workers. The predictors of occupational sensitization and health

outcomes associated with lobster and bony fish (pilchard, Cape anchovy, mackerel, light fish, redeye, Cape horse mackerel, lantern fish) processing are not well-understood. This research proposes a cross-sectional study to characterize the occupational environmental exposure of workers in a factory on the West Coast of South Africa involved in the processing of rock lobster and saltwater bony fish through measurement of total protein and specific allergen collected by air sampling. The prevalence of allergic sensitization and health outcomes due to seafood processing will be determined through subject interviews, physical examination, spirometry, methacholine challenge tests, skin prick tests, and skin patch testing. The relationship between exposure, allergic response, and lung function will also be characterized. Statistical modeling will be used to identify the risk factors associated with the development of seafood allergy among seafood processing workers. The research will further isolate and characterize the seafood antigens present in aerosols generated during the processing of fish and investigate the extent to which any exposure response relationships are attenuated by the transfer of symptomatic workers from high to low exposure jobs.

Peak Exposures in Aluminum Smelting

Researcher: Noah S. Seixas, Ph.D.
Affiliation: University of Washington
Seattle, Washington
(206) 685-7189
Keywords: Smelting, asthma, hydrogen fluoride, sulfur dioxide, particulates

Purpose:
To adapt real-time instruments for monitoring hydrogen fluoride, sulfur dioxide, and nonspecific particulate in four aluminum smelting operations.

Abstract:
Workers operating aluminum smelting "potrooms" are at increased risk of asthma and other respiratory conditions. The etiologic agent(s) for these adverse health effects, however, have not been determined. Prime candidates are hydrogen fluoride (HF), sulfur dioxide (SO_2), and particulates. In this study, four aluminum smelting operations will be used to monitor exposure to HF, SO_2, and particulates using real-time instruments that have been modified for this research. Peak exposures will be characterized within specific job tasks and distribution of these exposures will be modeled as a function of smelter technology, location, work task, etc. Time-integrating instruments will monitor the particle size distribution and calibrate the direct reading instrument's response. Work observations will be conducted in order to identify the tasks conducted, determine the location of the worker during these monitoring periods, and investigate the use of respiratory protection. Respirator fit factors will be determined on each subject before and after each monitored period using a controlled negative pressure respirator test system. A set of exposure/dose metrics will be developed to characterize exposure and pulmonary dose during smelter work processes. These metrics will account for the variable exposure distributions and the time-course of exposure. Pulmonary deposition of particles and gases and the effectiveness of respiratory protection will also be incorporated into these metrics. Exposure/dose metrics that incorporate peak exposures will be applied to a previously studied inception cohort of potroom workers. Alternative metrics using only average exposures and the metrics incorporating peak information and pulmonary dose estimates will be compared in order to assess the likelihood that the development of increased bronchial hyper-responsiveness and asthma-like symptoms are associated with high exposure to these gases.

• Cancer Research Methods

Antibodies to Hemoglobin Adducts in Butadiene Exposed Workers

Researcher: Richard Hong, M.D.
Affiliation: Biomosaics, Inc.
Burlington, Vermont
(802) 656-8335
Keywords: Butadiene, antibodies, adducts, toxins, polyaromatic hydrocarbons

Purpose:
To validate the use of antibodies to DNA adducts for monitoring environmental toxin exposure in a population of workers with high butadiene exposure.

Abstract:
Previous work demonstrated antibodies to DNA adducts in coke oven workers with high exposure to polyaromatic hydrocarbons as well as an urban population with exposure to lower levels of these same compounds. The antibody titers were much higher in the coke workers. Little use of isotype characterization has been made except for the correlation of a high IgA response with alcohol intake and the demonstration of IgE antibodies associated with immediate hypersensitivity. Antibodies may show unique advantages for detection of toxin exposure. They persist and provide a measure of the etiologic agent of the health effect. They are suited to large field studies, relatively inexpensive to measure, and require minute amounts of blood. This research will concentrate on determining the usefulness of antibody-based monitoring and determining the value of isotype characterization.

• Control Technology and Personal Protective Equipment

Developing Exposure Controls by Material Balance Modeling

Researcher: Robert F. Herrick, Sc.D.
Affiliation: Harvard University
Boston, Massachusetts
(617) 432-0674
Keywords: Material balance model, exposure analysis, cast iron foundry

Purpose:
To develop a material balance model and a detailed exposure analysis as the basis to design, install, and evaluate control technology in a cast iron foundry.

Abstract:
Ventilation systems used to control airborne contaminants in foundries are often inadequate. As a result, workers often sustain

unacceptable exposures. Preliminary research indicates that exposure control systems may be improved by including information on contaminant generation rates, the resulting airborne concentrations, and detailed work activity exposure analysis. This information can be developed using a material balance modeling approach with workplace exposure measurements. This research will include the development of carbon monoxide emission factors for castings and the use of these factors in a material balance model developed from research conducted at NIOSH. Together with a detailed work activity exposure analysis of the casting process, a control technology system will be designed and installed in a test foundry. After the performance of the system in reducing exposures has been optimized, a set of design specifications will be prepared and disseminated to other foundries where similar exposure problems exist.

Ventilation Control to Reduce Airborne Contaminants

Researcher: Patrick Thomas O'Shaughnessy, Ph.D.
Affiliation: University of Iowa
Iowa City, Iowa
(319) 335-4202
Keywords: Ventilation system, costs, containments, lung function

Purpose:
To design an automated confinement ventilation system that will simultaneously minimize both costs and containment levels.

Abstract:
Workers in the swine industry may sustain exposures to particulates and gases (methane, hydrogen sulfide, ammonia, and carbon dioxide) that produce severe respiratory diseases. The use of ventilation systems is minimized by reducing fan usage so that costs of operating the system are less. This results in high airborne contaminant levels. The present research involves the development of an automated confinement ventilation system minimizing both costs and contaminant levels. Prior to the design and testing of such a control method, an analysis of the time-varying nature of two contaminants (total dust concentration and ammonia levels) and two climate factors (temperature and humidity) will be performed over the course of a year in a swine confinement facility. This work will result in information needed to ascertain the accuracy of real-time sensors used to measure these four "output" variables. In addition, it will indicate the noise qualities of the measurement signal. Sequential measurements of this type during a change in fan speed will also be used to determine a mathematical model of the dynamic relationship between a change in output variable and a change in fan speed. Using knowledge of the noise qualities and dynamic behavior of the output variables, the design and simulation of several possible feedback controls will be performed using software specifically developed for this purpose. A final aspect of the proposed research will involve a series of tests of the best control methods with the use of a full-scale ventilation-testing facility. Future work will involve: (1) the development and testing of the best control method in an actual facility, (2) the development of other engineering control methods to minimize the production and migration of airborne contaminants in a confinement, and (3) a verification of the control method's utility by measuring the change in contaminant levels and the lung function of workers.

Development of Accessible, Ergonomic Laboratory Benches

Researcher: Gary Davis, M.B.A.
Affiliation: Accessible Designs-Adjustable Systems, Inc.
Boise, Idaho
(208) 362-8001
Keywords: Height-adjustable, laboratory, benches

Purpose:
To complete the research and development of three versions of height-adjustable laboratory benches designed, built, and tested during previous research efforts.

Abstract:
This project is focused on creating an affordable height-adjustable laboratory bench that is economically feasible for private laboratories, federal laboratories, and universities. The proposed research will: (1) evaluate the technical and performance features of the three prototypes; (2) conduct consumer and purchaser evaluations; (3) perform business evaluations to guide the commercialization effort; and (4) integrate the technical, consumer, and business evaluation into a product development and subsequent commercialization plan.

Roll-Over Protective Structure (ROPS) Design and Testing for Agricultural Tractors

Researcher: Paul D. Ayers, Ph.D.
Affiliation: Colorado State University
Fort Collins, Colorado
(970) 491-0584
Keywords: Roll-over protective structure, tractors, operator protection

Purpose:
To investigate and evaluate roll-over protective structure (ROPS) designs for agricultural tractors in the United States to provide operator protection on tractors and in operating conditions not currently available.

Abstract:
Tractor overturns are the leading cause of occupational traumatic death in the U.S. agricultural industry. The research to be conducted will: (1) develop an inventory of agricultural tractor roll-over protective structure (ROPS) availability; (2) prioritize the agricultural tractor population for ROPS design feasibility; (3) design, construct, and test ROPS for the two highest prioritized pre-ROPS tractors; (4) conduct axle housing strength tests; (5) conduct field upset tests on the NIOSH auto ROPS; (6) evaluate false deployment possibilities of the auto-ROPS; and (7) present pre-ROPS tractor ROPS and auto-ROPS design and test results to commercial ROPS manufacturer for commercial construction and follow-up field testing.

Computational Fluid Dynamics (CFD) Analysis of Mine Face Ventilation Systems

Researcher: Andrzei M. Wala, Ph.D.
Affiliation: University of Kentucky
Lexington, Kentucky
(606) 257-2959
Keywords: Computational fluid dynamics, face ventilation systems, coal mines

Purpose:
To establish computational fluid dynamics (CFD) as a technique for studying modern underground coal mine face ventilation systems.

Abstract:
The use of extended (deep) cut mining with remotely-controlled continuous miners is increasing rapidly across the U.S. coal industry. Operators adopt this method to maximize the productivity of their continuous miner sections. The accompanying higher advance rates present the problem that higher levels of methane gas are liberated at the face during the extraction of the coal. Higher velocities mean that more dust is generated. This gives rise to many questions regarding miner health and safety. Computational Fluid Dynamics (CFD) is a promising new method that has potential to solve fluid flow problems and generate face ventilation designs without disadvantages. This research will establish CFD as a technique for study of modern underground coal mine face ventilation systems. It requires construction of CFD models of these systems, establishment of procedures to reliably obtain their numerical solution, and, especially, validation of the numerical results with experimental data on airflow, methane, and respirable dust levels. The long-term objective of this work is to develop a reliable procedure using CFD for analysis and design of face ventilation systems that are capable of protecting the health and safety of underground miners, particularly for the demanding situation of deep cut continuous miner sections using water sprays and scrubbers.

Electronic Safety Devices for Construction Workers

Researcher: Satish Mohan, Ph.D.
Affiliation: Technological Systems Research Design & Education
Williamsville, New York
(716) 689-4025
Keywords: Electronic safety devices, construction workers, equipment accidents, falls

Purpose:
To develop electronic safety devices to protect construction workers from equipment accidents and falls.

Abstract:
This project will develop two electronic safety devices: (1) the Moving Hazard Warning (MHW) to protect construction workers from struck-by, struck-against, and caught in/under/between equipment and (2) an Edge Detector (ED) device to prevent falls from roofs, and open-sided floors/platforms. These accidents account for 18.9 percent of the construction accidents and cost the nation $981 million, annually. These safety devices will be small and built into the tool-belt or waist-belt. They will work via sound and/or vibration alarm whenever the worker is closer than a safe distance from the approaching equipment or the edge of the roof/ open-sided floors. One hundred workers will test each of the devices. At this time, no engineering controls exist for preventing these accidents.

Ergonomic Solutions for Furniture Manufacturers

Researcher: Gary Allen Mirka, Ph.D.
Affiliation: North Carolina State University
Raleigh, North Carolina
(919) 515-6399
Keywords: Furniture industry, ergonomic controls, evaluate, interventions

Purpose:
To develop and implement ergonomic controls in a sample of furniture manufacturing companies and to evaluate the efficacy and effectiveness of these interventions.

Abstract:
This research will: (1) conduct a large-scale survey of furniture industry personnel to identify jobs/tasks of concern; (2) define biomechanical demands of these jobs through the use of existing ergonomic and biomechanical analysis tools and a stochastic model of hazard assessment where appropriate; (3) design, develop, and implement controls designed to reduce biomechanical stress and incidence of work-related musculoskeletal disorders; (4) evaluate the efficacy of these controls by comparing pre-intervention and one-week, six-month, and one-year post-intervention data©; (5) evaluate the effectiveness and feasibility of these controls through the use of industry-based surveys; and (6) evaluate the effects of participation by the workers in the design process on the acceptance of the final ergonomic solutions.

Hearing Protector Allowing Acoustic Communication

Researcher: Patrick M. Zurek, Ph.D.
Affiliation: Sensimetrics Corporation
Somerville, Massachusetts
(617) 625-0600
Keywords: Hearing protector, acoustic communication, monitoring, environmental sounds

Purpose:
To develop an advanced hearing protector that allows acoustic communication and the monitoring of environmental sounds.

Abstract:
The development of this advanced hearing protector involves the use of an array of microphones mounted on the headset of the device. By processing the signals from this microphone array, desired signals from a specified “look” direction can be enhanced relative to signals from other directions. The directional filtering provided by the array will allow face-to-face acoustic communication in many high-noise

environments, and allows the user a greater degree of contact with the acoustic environment than is available with current hearing protection devices. Work in Phase I will develop and evaluate a functional and portable prototype based on a wearable digital signal processor. In Phase II, head-worn units will be developed and assessed in field tests.

Improving the Work Environment in Livestock Buildings

Researcher: Ronaldo G. Maghirang, Ph.D.
Affiliation: Kansas State University
Manhattan, Kansas
(785) 532-2908
Keywords: Livestock, air contaminants, ventilation system

Purpose:
To develop and test a local ventilation system that will remove dust and gaseous contaminants from the worker's breathing zone more effectively.

Abstract:
Exposure to contaminants generated in livestock confinement facilities is a significant problem to agricultural workers and farmers. Use of personal protective equipment is not desirable because of working conditions and characteristics of the worker population. The research comprising this project is focused on reducing worker exposure to contaminants in livestock confinement buildings. The proposed ventilation design represents a typical approach in local ventilation systems, in which the air flow is directed so that the contaminant is driven away from the worker's breathing zone. This approach has not been adopted in livestock confinement facilities primarily because the focus in livestock building ventilation design is on providing adequate environmental conditions for the housed animals. In the proposed design, outdoor fresh air will be provided through a ventilation duct located above the feed walk. The effectiveness of the proposed design will be compared with that of the more conventional designs through laboratory tests. Performance will be evaluated in terms of dust concentration (inhalable and respirable), air velocity, and air temperature within the room.

Respirator Efficacy for Tuberculosis Aerosols

Researcher: John F. Koerner, M.P.H.
Affiliation: John Hopkins University
Baltimore, Maryland
(202) 237-5865
Keywords: *Mycobacterium tuberculosis*, aerosols, respiratory protection

Purpose:
To protect health care and other workers in correctional institutions from occupational exposure to *Mycobacterium tuberculosis*.

Abstract:
This research focuses on defining the performance of respiratory protection with respect to *Mycobacterium* aerosols. It involves five specific activities: (1) The density of the droplet nuclei that result from the aerosolization of solutions containing *Mycobacterium tuberculosis* will be determined. (2) The particle size distribution and particle shapes characteristic of the aerosol generated by the cough of human infections with tuberculosis will be investigated. (3) A new bioaerosol analytical technique that incorporates the new firefly luciferase assay for mycobacterium will be explored. (4) The leak characteristics of respiratory protection with respect to mycobacterium aerosols and using a method that incorporates inhalation and exhalation into the respirator performance test will be determined. (5) The differences in respirator performance, which result when respirators are challenged with a standard aerosol and *Mycobacterium tuberculosis,* will be assessed. Adequately characterized respirator function will assist in developing protective, usable, and cost effective respiratory protection programs to prevent tuberculosis. This research will reduce the risk of tuberculosis infection associated with work in these professions.

System for Measuring Workplace Protection Factors

Researcher: William A. Groves, Ph.D.
Affiliation: University of Iowa
Iowa City, Iowa
(319) 335-4213
Keywords: Respirators, workplace protection factors, sampling system, gases and vapors

Purpose:
To develop an intermittent sampling system to measure the concentration of gases and vapors inside the respirator during inspiration.

Abstract:
Approximately 20 percent of businesses have employees that use respiratory protection. It is, therefore, important to characterize the effectiveness of different types of respirators. Workplace protection factors is a method to evaluate the level of protection provided by respirators worn under actual conditions. This research will focus on the development of an intermittent sampling system designed to measure the concentration of gases and vapors inside the respirator during inspiration. This approach addresses two potential problems associated with continuous sampling: (1) biased results due to lower contaminant concentrations in exhaled air and (2) high humidity. Laboratory evaluation of the sampling system will be followed by building three prototype units and field testing using volunteers in actual work settings.

Statistical Modeling of Respirator Penetration Data

Researcher: Robert C. Spear, Ph.D.
Affiliation: University of California
Berkeley, California
(510) 642-0761
Keywords: Statistical methods, individual variability, respirator penetration values

Purpose:
To develop statistical methods for describing intra-individual and inter-individual variability in workplace respirator penetration

values to establish a respirator's assigned protection factor, to determine maximum use concentration, and to deduce the distribution of inhaled contaminant concentrations given data-based distributions of ambient contaminant levels and respirator penetration values.

Abstract:
This project will identify and compare statistical models appropriate for describing data sets of respirator penetration values. It will simulate the distribution of inhaled contaminant concentrations generated by the combined distributions of ambient contaminant concentrations and respirator penetration values. This analysis will assess the effect of intra-individual and inter-individual variability in both ambient contaminant and respirator penetration variables. It will develop a general statistical framework where an assigned protection factor (APF) can be determined for a respirator. It will also develop strategies for combining APF estimates from several studies involving the use of similar respirators under similar conditions. Finally, methods will be developed to describe data sets for which penetration distributions are so skewed that the transformations do not yield symmetric distributions.

• Exposure Assessment Methods

Personal Aerosol Sampler for Occupational Environments

Researcher: Sergey A. Grinshpun, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0504
Keywords: Personal aerosol sampler, worker exposure, airborne dust, microorganisms

Purpose:
To develop a new personal aerosol sampler for the assessment of worker exposure in indoor and outdoor occupational environments contaminated with airborne dust and/or microorganisms.

Abstract:
The major features of this new sampler are its low ambient wind sensitivity and high filter collection uniformity. The new personal sampler will be developed to sample inhalable fractions of inert dust particles and/or airborne microorganisms such as bacteria, fungi, and pollen. The applicability of the analytical methods used for the new personal sampler will be explored and sampler prototypes will be evaluated in the field in industrial, agricultural, and health care environments. The performance of the new sampler will be compared to standardized commercially available personal and ambient samplers. The American Conference of Governmental Industrial Hygienists (ACGIH) criteria for representative sampling of airborne dust particle and microorganisms and the NIOSH recommendations on current priorities in aerosol characterization will be taken into account in the development of the new sampler.

Electrostatic Sampling of Airborne Microorganisms

Researcher: Klaus Willeke, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0506
Keywords: Microorganisms, electrostatic mechanisms, bioaerosol sampler

Purpose:
To use electrostatic mechanisms to collect airborne microorganisms.

Abstract:
Exposure to airborne microorganisms in agriculture, industrial, indoor, and health care environments causes a significant number of respiratory infections in the U.S. Based upon laboratory findings from initial experiments, a field-compatible electrostatic bioaerosol sampler will be developed to collect microorganisms. The new sampler will be tested in the laboratory and in an agricultural environment with high concentrations of bioaerosols present. Comparison sampling will be performed against a conventional impactor and a conventional impinger. Analyses will be made on how to use the new collection method in indoor and health care environments where the bioaerosol concentration is low.

Development of New Personal Aerosol Samplers

Researcher: James H. Vincent, Ph.D., D. Sc.
Affiliation: University of Michigan
Ann Arbor, Michigan
(734) 936-0703
Keywords: Aerosol sampler, sampling flowrates, laboratory, field test

Purpose:
To develop sampling instrumentation for assessing the occupational exposures of workers to aerosol fractions.

Abstract:
This sampling instrument will allow aerosol sampling of relevant fractions to be conducted at much lower sampling flowrates than is currently the practice. This means that smaller and lighter sampling pumps can be used that will improve the convenience of using these devices for all workers. The research will involve: (1) the development of scaling laws so that new samplers can be designed to operate at much lower flowrates than existing devices and (2) the new devices will be tested in the laboratory and then validated in the field at nickel industry primary production facilities. This will enable examination of the feasibility of measuring metal aerosol exposures from the much smaller amounts of material that will be collected using the new devices.

Sperm Progesterone Receptor, Potassium (K+) Channel & Lead Exposure

Researcher: Asha Jacob, Ph.D.
Affiliation: North Shore University Hospital
Manhasset, New York
(516) 562-1049
Keywords Lead, in vitro fertilization, humans, K+ion channels, acrosome

Purpose:
To develop biomarkers for acute effects of occupational lead exposures focusing on the human acrosome reaction: the nonnuclear progesterone receptor and its associated K+ ion channel.

Abstract:
This research will be conducted as a blinded study of couples undergoing in vitro fertilization. In this population, more than 40 percent of the males have serum lead levels above the action limit for occupationally exposed workers. Lead reduces fertilization rates. Lead levels found in semen inversely correlate with the ability of sperm to undergo the acrosome reaction and the aggregation/translocation of nonnuclear progesterone receptor and its associated K+ ion channel. This study will characterize the K+ channel associated with the nonnuclear progesterone receptor. The investigators will perform dose-response studies with specific ion channel inhibitors to further characterize the K+ channel of human sperm, with the aim of distinguishing among possible subtypes. The endpoint will be progesterone-stimulated acrosome reaction. The investigators will prepare biotinyated charybdotoxin and attempt to visualize K+ channels on intact human sperm. They will clone and sequence the cDNA of the human sperm channel K+ from pooled human sperm RNA. This research will also determine the stage-specific expression of the human sperm K+ channel in human testis biopsy sections using RT/PCR.

Machining Fluid Microbiology and Health

Researcher: Donald K. Milton, M.D., Dr. P.H.
Affiliation: Harvard University
Boston, Massachusetts
(617) 432-3324
Keywords: Metalworking fluids, microbial biomarkers, respiratory hazards, survey

Purpose:
To develop biomarkers of exposure for microbiological agents in the metalworking fluids industry.

Abstract:
Metalworking fluids and their microbial contaminants are associated with respiratory symptoms, acute lung function changes, occupational asthma, and hypersensitivity pneumonitis. The methods to assess exposure to mixtures of microbiological agents will be developed and validated. Fifteen automotive machining operations will be studied where metalworking fluids are used. With these data, hypotheses will be tested concerning the suitability and improved utility of new biomarkers relative to traditional culture based methods of exposure assessment. Also to be tested is the hypothesis that the relationship between total metalworking fluid aerosol and airborne endotoxin varies from plant to plant, so that endotoxin measurements provide independent information about exposure to respiratory hazards in the machining environment. This study will be the first large survey of metalworking fluid exposure to incorporate microbial biomarkers.

Reconstruction of Doses for Chernobyl Liquidators

Researcher: Elisabeth Cardis, Ph.D.
Affiliation: International Agency for Research on Cancer
69372 Lyon Cedex 08, France
33 72 73 84 85 X-8508
Keywords: Dose reconstruction, radiation, workers, health effects

Purpose:
To develop and validate methods for dose reconstruction of Chernobyl accident recovery workers and apply these methods to collaborative case-control studies of leukemia, non-Hodgkin's lymphoma, and thyroid cancer in Belarus and Russia.

Abstract:
Little effort has been put forth to reconstruct doses specifically for Chernobyl accident recovery workers. Dose reconstruction studies have been performed considering personnel who worked on the site, but the accident recovery workers have less precise and accurate knowledge of the place and conditions of work, different exposure conditions, and different dosimetric control practices. Therefore, dose reconstruction methods of workers at the site need to be modified for the accident recovery workers. This research will adapt and validate the methods used for estimating doses for on-site workers and for the collection of questionnaire, measurement, and other information needed to validate the methods. The research will also extend to estimating doses and related uncertainties for the study subjects included in the European Union sponsored accident recovery worker case-control studies.

Temporal and Impulsive Characteristics of Hand Tools

Researcher: Martin Cherniack, M.D.
Affiliation: University of Connecticut
Farmington, Connecticut
(860) 679-4095
Keywords: Hand tools, repetitive shock and vibration, injuries, laboratory, field study, construction workers

Purpose:
To address unresolved scientific questions on risks from extrinsic forces associated with hand tools and the development of reliable and effective field assessment methods.

Abstract:
Repetitive shock and vibration are routinely encountered with the use of powered and nonpowered hand tools. These exposures are associated with injuries to the arm, shoulder, neck, neurologic, and neurovascular disorders of the hand. This research will include both a laboratory and a field component. It will explore the effects of tool impulse, temporal pattern, and high frequency as well as

low frequency acceleration on acute physiological responses. These responses are transient threshold shifts (TTS) in the three major classes of mechanoreceptors of the fingertip and changes in the surface electromyogram. Understanding TTS deficits should provide useful insights for disease prevention through tool design and on shorter-term functional sensory deficits, which may be pertinent to hand-arm dysfunction and acute trauma injury. Construction workers are the target population. The characteristics of tools will be simulated in the laboratory and then laboratory results will be applied to tools in the field.

Tools for Exposure Assessment of Physical Risk Factors in Video Display Terminal Work

Researcher: Jack Dennerlein, Ph.D.
Affiliation: Harvard University
Boston, Massachusetts
(617) 432-2028
Keywords: Physical risk factors, computers, musculoskeletal

Purpose:
To investigate how to measure and characterize physical exposures in order to gain a better understanding of physical risk factors in the office workplace.

Abstract:
While other exposure assessment methods exist, few objectively measure exposure of the musculoskeletal system to multiple physical risk factors (forces applied to the keyboard and mouse, upper extremity postures, and patterns of work and rest activities) at the computer work station in the field. In this research, a new field-based exposure assessment monitoring system that measures keyboard and mouse usage, typing and mouse force, wrist postures, and computer work-rest cycles, will be developed. In addition, the new exposure assessment system will be tested in the workplace using 60 computer operators to quantify exposures, to assess whether there are differences in exposures to physical risk factors based on gender, and to determine if there is a difference in the development of chronic musculoskeletal disorders of the upper extremity between men and women. In the past, these effects have been reported more often in women than men. The outcomes of this study will include a portable, accurate, reliable exposure assessment system for collecting force and usage data in field settings as well as descriptive data of physical exposure differences between men and women.

A Simple Device for Measuring Personal Exposures to UV

Researcher: Stanley D. Echols, Ph.D.
Affiliation: Riverbend Instruments, Inc.
Birmingham, Alabama
(205) 320-1722
Keywords: Photometer, ultraviolet, worker exposure

Purpose:
To develop a system (photometer and actinometer materials) capable of quantitating exposure to ultraviolet light rays (UV-B and UV-C).

Abstract:
Exposure to ultraviolet light rays is prevalent in many occupations. There are presently no satisfactory personal dosimeters. This research will provide a system to measurement exposure in the field via badges worn during work.

A Model for Predicting Carpal Tunnel Disorders Due to Repetitive Loading

Researcher: Donald L. Fisher, Ph.D.
Affiliation: University of Massachusetts
Amherst, Massachusetts
(413) 545-1657
Keywords: Cumulative trauma disorder

Purpose:
To decrease cumulative trauma disorders in the workplace.

Abstract:
This research will demonstrate and evaluate an innovative method for dealing with carpal tunnel disorders in the workplace. The research will focus on the demonstration of a tendon adaptation model that is sensitive to repetition, force, posture, and worker anthropometry. In addition, the model performance will be evaluated and sensitivity analysis performed on the model parameters. The proposed model has potential in both preventing injuries and helping to design better products. With further validation, the model can be used to establish a quantitative relationship between carpal tunnel disorders and work conditions. The ultimate result will be the ability to: (1) identify high risk work conditions, (2) quantify the problems providing a rational means of altering these conditions, and (3) verify that the changes will indeed reduce the risks. This model will provide early detection and prevention of carpal tunnel disorders.

Pollution Prevention and Worker Toxic Exposures: A Method

Researcher: Darius D. Sivin, M.E.S.
Affiliation: Johns Hopkins University
Washington, D.C.
(202) 319-7753
Keywords: Pollution prevention, industrial hygiene, occupational epidemiology, evaluate

Purpose:
To evaluate the impact of pollution prevention on occupational exposures using established industrial hygiene and occupational epidemiology methods.

Abstract:
No systematic study of the impact of any particular pollution prevention program on occupational chemical exposures has been undertaken. An obstacle to undertaking such a study is the lack of methods to assess the impacts of pollution prevention activities on occupational exposures, especially in the absence of industrial hygiene monitoring data. This research will address this lack of methods. It uses retrospective exposure assessment that is well-established in industrial hygiene and occupational epidemiology to evaluate the impact of pollution prevention on occupational exposures. This research will develop comprehensive exposure

assessments with and without the use of monitoring data, determine whether the two methods of assessment produce similar rankings of exposure by occupational title, and determine whether the two estimates of exposure suggest similar conclusions as to the impact of pollution prevention on occupational exposures at the case study facility.

Laser Hazard Sensor with Recorder

Researcher: Stephen R. Smith, Ph.D.
Affiliation: Princeton Scientific Instruments, Inc.
Month Junction, New Jersey
(732) 274-0774
Keywords: Laser sensor, eyes, aircraft, law enforcement

Purpose:
To develop a low cost laser sensor with recording capability to warn workers of impending harmful exposure to the eyes from laser radiation.

Abstract:
Exposure to hazardous levels of laser radiation can be harmful to the eyes. Lasers are recognized by the Federal Aviation Administration as being a significant flight safety hazard to low flying aircraft, especially during landings. Another area where exposure of the eyes to lasers can occur without warning is to law enforcement personnel since there is increasing growth in the use of lasers for targeting and range finding. It would be invaluable to have warning of impending harmful exposure from lasers to the eyes. The laser sensor with recording capability developed for this research project seeks to address this need. It will be compact in size with minimal weight so that it can be worn by an individual or mounted in the cockpit of an aircraft. Phase I of the research experiments will be carried out to demonstrate the proposed principles of detection and determination of wavelength.

Airborne Heavy Metal Monitor

Researcher: Amy J. Hunter, Ph.D.
Affiliation: Physical Sciences, Inc.
Andover, Massachusetts
(978) 689-0003
Keywords: Airborne, lead, monitor

Purpose:
To complete the development of a monitor for airborne lead.

Abstract:
Airborne lead is a significant exposure in many occupations. This research will complete work on spark-induced breakdown spectroscopy technology as an ambient monitor for airborne lead. This monitor will augment the current NIOSH/OSHA air sampling protocols. Sensitive, real-time monitoring provided by the lead monitor will enable accurate identification and mapping point sources, tracking of contaminant migrations, immediate notification of concentrations exceeding OSHA-permissible exposure limits and action levels, and improved evaluation of variable or periodic sources and exposure.

Methods for Assessing Synthetic Textile Dust Exposure

Researcher: Margaret M. Quinn, Sc.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(978) 934-3196
Keywords: Synthetic textile dust, respiratory effects, air samples

Purpose:
To investigate alternative methods for synthetic textile dust sampling and analysis, compare them to the standard Particulate Not Otherwise Regulated method, and investigate synthetic textile dust exposure in a local textile mill.

Abstract:
Studies have shown that synthetic textile (ST) dust is associated with acute and chronic respiratory effects at levels under the stipulated permissible exposure limit. In addition, some fraction of the ST dust can be deposited in the lung. Improved methods are needed to comprehensively study the respiratory effects of ST dust. This research will investigate several alternative methods for ST dust sampling and analysis and compare them to the current accepted Particulate Not Otherwise Regulated method. Air samples will be assessed for quantitative exposure measures such as mass concentration, particle number concentration, and fiber number concentration. The composition of the ST dust that deposits in the three regions of the lung will be determined. Qualitative ST dust exposure measures will be developed based on perceptions of dustiness recorded during air monitoring. The standard and alternative methods will be compared for each quantitative assessment. The results will be used to improve the quality of data for future occupational epidemiology studies investigating respiratory disease. The second part of the research will investigate ST dust exposure in the same local textile mill. Statistical modeling will be performed to identify the production process determinants of the ST dust exposure measures. The results will be used to assist the mill in targeting specific aspects of the ST finishing process for ST dust control.

Uncertainty Analysis for Characterizing Plutonium Exposure to Improve Lung Cancer Risk Estimates

Researcher: A. James Ruttenber, Ph.D., M.D.
Affiliation: University of Colorado
Denver, Colorado
(303) 315-5627
Keywords: Measurement errors, epidemiologic studies, workers, risk estimates

Purpose:
To explore measurement errors in quantifying exposures and their effects on estimates of risk in epidemiologic studies.

Abstract:
This research will expand the current epidemiologic studies of workers at the Rocky Flats Environmental Technology Site to determine how measurement errors impact estimates of risk in epidemiologic studies. This project will: (1) develop and explore methods to assess the measurement error of radiation doses—

particularly those from internal exposures to isotopes of plutonium—so that they can be used in epidemiologic studies, (2) develop methods for analyzing exposure data from different sources for use in epidemiologic studies of combined populations of radiation workers, and (3) evaluate current and develop new methods for incorporating estimates of measurement error for radiation doses into estimates of risk in epidemiologic studies.

An Ergonomics Assessment Method for Work-Worker Systems

Researcher: Carolyn M. Sommerich, Ph.D.
Affiliation: North Carolina State University
Raleigh, North Carolina
(919) 515-8614
Keywords: Ergonomics, comprehensive assessment

Purpose:
To develop and apply a comprehensive assessment methodology for characterizing the work-worker system from an ergonomics perspective.

Abstract:
The research methodology developed through this research will consist of several standardized tools (questionnaire, work measurement protocols, and biomechanical assessment). The questionnaire provides qualitative demographics on the workers, work, and workplace. Work measurement protocols supply quantitative temporal information and qualitative biomechanical data. Biomechanical assessment provides understanding of the internal activity necessary to carry out activities observed in the workplace. Products of the assessments will be multidimensional work and worker profiles. The worker profiles will characterize the worker's interaction with his or her work as well as physical and administrative work elements. Together the profiles will be used to identify associations between worker attributes and perceptions, worker health outcomes, and work profiles. The methodology will be applied to mobile computing. The development of a predictive model of work-related musculoskeletal impairment that includes physical, psychosocial, work organization, personal factors, and has generalized applicability across job types for use in research from initial exploration to intervention demonstration efforts will be very useful.

• Fertility and Pregnancy Abnormalities

Occupational Demands in Women and Adverse Birth Outcome

Researcher: Laura Punnett, Sc. D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(508) 934-3269
Keywords: Adverse birth outcomes, physical occupational demands, women

Purpose:
To examine the association between occupational demands and the risk of adverse birth outcomes for active duty women in the U.S. Army during the years 1980-1994.

Abstract:
This research will assess the effects of occupational physical demands (lifting, turning, body position) upon the risk of antenatal, perinatal, and newborn outcomes, such as early fetal loss, spontaneous abortion, and low birth weight infants. The data for this study will use the Total Army Injury and Health Outcomes Database. This database contains demographic reproduction, hospitalization, and health risk data on active duty women during the years 1980-1994. It also includes the Military Occupational Speciality and the Dictionary of Occupational Title codes. This information will allow the investigators to assess similarities in civilian and military occupational exposures linked to adverse birth outcomes. Incidence rates of events will be calculated and compared by different factors such as age, sex, race, rank, medical history, occupational groups, ergonomic exposure, and health risk factors. Predictors of adverse birth outcomes will be identified. This study will shed light upon preventing untoward birth outcomes in both civilian and military women.

Portability of Biochemical Markers of Sperm Maturity

Researcher: Gabor Huszar, M.D.
Affiliation: Yale University
New Haven, Connecticut
(203) 785-4010
Keywords: Biochemical markers, semen, reproductive toxicity

Purpose:
To add biochemical markers to the conventional semen profile, in the monitoring of potential changes in sperm maturity, due to male reproductive toxicity.

Abstract:
This research will develop methods for preservation and shipping of samples for tests routinely used in the researcher's laboratory and introduce morphometric probes of sperm maturity on sperm slides submitted for analysis. In addition, the investigators will develop aspects of sperm portability (sperm binding to hyaluronic acid-beads, DNA nick translocation and the single sperm DNA comet assay). Finally, new sperm assessment approaches will be developed. This project will help to identify and make accessible the most effective and practical methods in order to simplify the monitoring of reproductive toxicity.

• Health Services Research

Evidence-Based Medical Examinations for Firefighters

Researcher: Stefanos N. Kales, M.D.
Affiliation: Harvard University
Boston, Massachusetts
(617) 423-1260
Keywords: Firefighters, medical examination, improve health

Purpose:
To study the periodic medical examinations in firefighters.

Abstract:
This prospective study will be continued using 340 firefighters with an expected 1,700 person-years of follow-up. Since the 1996 periodic questionnaire, physical and laboratory examination data have been obtained and will be repeated on a yearly basis during the study period. The specific aims include: (1) evaluate the ability of the National Fire Protection Association fitness guidelines and baseline health ratings to predict increased risks of injury, cardiac events, or other adverse outcomes; (2) determine whether firefighters with abnormal hearing are at an increased risk of injury or other adverse outcomes; (3) further evaluate the clinical utility of various components of the baseline and periodic medical examinations; and (4) integrate the information derived from the studies above to contribute to the development of evidence-based guidelines for the medical evaluation of firefighters. This proposal seeks to improve the medical examination process for firefighters.

Developing Community-Based Research with Immigrants

Researcher: Lenore Sandra Azaroff, Sc.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(978) 934-2587
Keywords: Immigrants, occupational health services, interventions

Purpose:
To evaluate the feasibility of community-based data collection and occupational health interventions among immigrants.

Abstract:
This study will develop and pilot community-based data collection methods for occupational health research among defined groups of minority workers (who are also immigrants), identify barriers to accessing occupational health services for these workers, and identify common work-related hazards and health effects among these workers. Data collected in surveys will be compared with existing data sources. Interventions to improve the target population's access to occupational health services will be developed and tested. Workers from Southeast Asia will be targeted in this study. Data will be obtained from the Massachusetts Department of Industrial Accidents, local hospitals, and household surveys on work-related acute health effects. Data from existing databases and surveys will be compared. Interventions will be developed in cooperation with a community-based coalition and piloted for feasibility and effectiveness.

• Hearing Loss

Identifying Risk Factors for Noise-Induced Hearing Loss

Researcher: Peter Rabinowitz, M.D.
Affiliation: Yale University
New Haven, Connecticut
(203) 785-7267
Keywords: Aluminum smelter and coal mine workers, noise exposure, risk factors, data set

Purpose:
To assess a longitudinal data set of noise-exposed workers in an aluminum smelter and coal mine regarding noise-induced hearing loss.

Abstract:
Noise-induced hearing loss is one of the most common occupational diseases and is considered to be totally preventible. Questions persist, however, about the overall effectiveness of industrial hearing conservation programs, how they can be evaluated, and how they can be improved on an ongoing basis. This research will use a large longitudinal data set of noise-exposed workers in the aluminum smelter and coal mine industry to conduct a case-control and cohort approach study. Once the data has been assessed, cleaned, and validated, it will be used to: (1) determine the true rate of noise-induced hearing loss in the aluminum smelter and coal mine, (2) assess the relative importance of host and environmental risk factors for noise-induced hearing loss, (3) identify and validate early indicators of noise-induced hearing loss, and (4) develop and validate a case definition of noise-induced hearing loss that can be used in future epidemiologic research.

Models for Assessing Risk of Occupational Hearing Loss

Researcher: Laurence D. Fechter, Ph.D.
Affiliation: University of Oklahoma Health Science Center
Oklahoma City, Oklahoma
(405) 271-6593
Keywords: Noise-induced hearing loss, carbon monoxide, cyanide, exposure conditions, firefighters

Purpose:
To identify the exposure conditions that facilitate the potentiation of noise-induced hearing loss by cyanide and carbon monoxide.

Abstract:
In this research, rats will be exposed to various types of noise alone or to noise in combination with carbon monoxide and cyanide to assess both temporary and permanent impairments of auditory function. These chemical exposures are common in firefighters. The principal objective is to prevent human hearing loss by

determining the exposure conditions that facilitate a synergistic interaction between chemical asphyxiants and noise. The investigators will determine the relationship between exposure duration, concentration of chemicals, and noise intensity in promoting a synergistic interaction as indexed by functional impairment of the cochlea and histopathological investigation. In addition, the relationship between the noise frequency spectrum and interactions with chemical asphyxiants will be determined so that accurate predictions can be applied to the workplace setting where band limited noise may be present.

Hearing Hazards Associated with Industrial Noise Exposure

Researcher: Roger P. Hamernik, Ph.D.
Affiliation: Plattsburgh State University
Plattsburgh, New York
(518) 564-7701
Keywords: Method, noise, assess, hearing loss

Purpose:
To develop a method to evaluate the industrial noise environment and its potential for causing hearing loss.

Abstract:
Chinchillas will receive noise stimuli designed with very specific but diverse statistical properties. New analytical methods developed in the laboratory will be applied to the continuously sampled noise stimuli to extract temporal and peak statistical properties of the noise stimulus. Effects on hearing will be correlated with the noise metrics to establish the validity of these metrics. The success of these experiments can lay the foundations for a new and more generalized approach to the evaluation of noise environments. The analytical methods may also have some application in identifying features of the noise environment that can be reduced or altered at their source. The demonstration of good correlations between the proposed metrics and hearing loss following realistic and diverse exposure conditions has widespread implications for industrial safety standards and noise measurement systems.

Epidemic Occupational Hearing Loss in Washington State

Researcher: William E. Daniell, M.D.
Affiliation: University of Washington
Seattle, Washington
(206) 685-3160
Keywords: Occupational hearing loss, workers' compensation data, identify industries with risk factors

Purpose:
To determine the major "awareness-health care-claim pathways" by which individual persons with occupational hearing loss are identified and reported to the workers' compensation system. Secondly, to determine if industries with substantial remediable risk factors for occupational hearing loss can be identified using workers' compensation data.

Abstract:
This project will identify factors or phenomena that may have contributed to the recent increase in reporting of occupational hearing loss (OHL). In addition, it will determine if there is any substantial work-related risk at the present time for OHL among workers in industries that have experienced high rates of claims for hearing loss. Finally, it will assess the effectiveness of approaches to interpreting workers' compensation claims data, for the purpose of "targeting" industries and worksites with remediable risk factors for an occupational health problem using OHL.

Hearing Damage Among Newly-Hired Construction Workers

Researcher: Noah S. Seixas, Ph.D.
Affiliation: University of Washington
Seattle, Washington
(206) 685-7189
Keywords: Distortion product otoacoustic emissions, hearing loss, new construction workers, audiometry

Purpose:
To monitor noise exposure in newly-hired construction workers by characterizing the effects of exposure on standard audiometry and distortion product otoacoustic emissions.

Abstract:
Participants in this research will be given an audiometric exam and distortion product otoacoustic emissions (DPOAE) (a recognized screening tool for early hearing damage, and possibly as a marker of susceptibility) for hearing loss every six months. Participants for the study will come from the construction industry. Baseline and follow-up questionnaires will be used to characterize other risk factors for hearing loss, non-occupational exposure to noise, characteristics of work, and use of hearing protective devices. Noise exposure will be monitored twice yearly on each subject using data-logging noise dosimeters in conjunction with time/activity cards. These data will be used to estimate individual exposures (using several metrics) over time. Investigators will conduct analyses between noise exposure and both audiometric changes and DPOAE. The relationship between DPOAE and audiometric changes will also be explored.

• Indoor Environment

Mircroanalytical System for Indoor Volatile Organic Compound (VOC) Monitoring

Researcher: Edward T. Zellers, M.D., Ph.D.
Affiliation: University of Michigan
Ann Arbor, Michigan
(734) 936-0766
Keywords: Low concentrations, volatile organic compounds, microanalytical system, hand-held

Purpose:
To develop a hand-held microanalytical system capable of on-site identification and quantification of low-sub-ppb concentrations of volatile organic compounds of anthropogenic and microbial origin encountered in nonindustrial indoor working environments.

Abstract:
In this research, advanced strategies for sample collection, component separation, and detection will be incorporated into an instrument usable in the field about the size of a notebook computer. The analytical power and versatility embodied in the development of this new system represents a significant advancement over the current state-of-the-art in vapor monitoring instruments. Dramatic reductions in the time cost of analyses of indoor volatile organic compounds and microbial volatile organic compounds will be realized, obviating the need for conventional sorbent-tube/GC-MS sampling and analysis for routine monitoring. This will facilitate the assessment of exposure distributions and the implementation of rational intervention strategies to address indoor environmental quality problems.

Prevention of Indoor Environmental Quality-Related Absence: An Intervention Study

Researcher: Donald K. Milton, M.D., Ph.D.
Affiliation: Harvard University
Boston, Massachusetts
(617) 432-3324
Keywords: Air supply rates, humidification, symptoms, office, workers

Purpose:
To assess the independent effects of outdoor air supply rates and active building humidification on absence rates, incidence of respiratory infections, and nonspecific building-related symptoms among office workers.

Abstract:
This research will test the following hypotheses: (1) low outdoor air supply rates and active humidification will increase the sick leave among office workers in air-conditioned buildings, (2) low outdoor air supply and active humidification will increase the frequency of symptomatic respiratory infections and the frequency with which office mates are infected by the same organism, (3) the effect of ventilation and active humidification on respiratory infections and absence is independent of perceived indoor environmental quality and nonspecific building related symptoms, and (4) the cost of experimental interventions is less than the cost of lost productivity due to sick leave. This study brings together objective health outcomes and molecular biology to identify the impact of buildings on worker health and productivity. In addition, it will provide objective data on the health impact of the modern office environment. Also, this study will lead to new and more cost effective approaches to protect the health of workers.

Health Effects of Exposures to Volatile Organic Compounds (VOCs), Ozone, and Stress

Researcher: Nancy Fiedler, Ph.D.
Affiliation: University of Medicine and Dentistry of New Jersey-Robert Wood Johnson
Piscataway, New Jersey
(732) 445-0919
Keywords: Volatile organic compounds, ozone, women, psychological stress, building-related

Purpose:
To determine the effects of a psychological stressor and the individual difference variables, negative affect and odor intolerance, on responses of women to a mixture of volatile organic compounds with and without ozone.

Abstract:
Building-related health complaints document that volatile organic compounds (VOCs), stressors, and individual characteristics (females) contribute to the reported nonspecific symptoms. Two hundred and eighty women will participate in this study of the responses of women to a mixture of VOCs with and without ozone. One-half of the subjects will be randomly assigned to exposure conditions with the stressor while the remaining subjects will complete the exposures without the stressor. During each exposure period condition, health effects measured before, during, and after exposure include: symptom questionnaires, neurobehavioral performance, salivary cortisol, nasal inflammation, and lung function. Secondary stable products of the ozone-VOC reaction will be measured during exposure.

Ultraviolet Lights in HVAC Systems–Effect on Health and Well Being

Researcher: Dick Menzies, M.D.
Affiliation: McGill University
Montreal, QC, Canada
(514) 398-8122
Keywords: Ultraviolet (UV), microbial contamination, buildings

Purpose:
To determine the effectiveness of UV in reducing microbial levels in buildings.

Abstract:
Microbial contamination occurs in heating, ventilation, and air conditioning (HVAC) systems of most modern office buildings and may result in specific building-related outbreaks if heavy contamination occurs. This study will evaluate the impact of UV lights on reducing microbial levels in buildings. Workers will be asked to rate their satisfaction with the indoor environment, report symptoms, occurrence of respiratory tract infections, sickness absence, and complete typing tests. Extensive measures of airborne and surface bacteria, fungal spores, and viable fungi will be measured at work sites and in the HVAC systems.

• Infectious Diseases

The Risk of Infectious Diseases in Prison-Based Health Care Workers

Researcher: Robyn R.M. Gershon, Dr. P.H.
Affiliation: Johns Hopkins University
Baltimore, Maryland
(410) 955-3046
Keywords: Health care workers, correctional facility, health risks

Purpose:
To estimate the seroprevalence of several bloodborne pathogens, to determine the immune status of hepatitis B vaccines, and to evaluate tuberculin skin test reactivity in correctional health care workers.

Abstract:
In this study, serologic and reactivity rates will be correlated with both community and occupational risk factors by analyzing data obtained from a risk management questionnaire. These data will then be provided to two total quality management teams so that they can identify risk reduction strategies for this population of health care workers. This study will improve the understanding of the occupational health risks associated with correctional health care and provide direction in terms of risk reduction interventions.

• Intervention Effectiveness Research

Personal Safety for Social Services Providers

Researcher: William V. Griffin, M.P.A., M.S.W.
Affiliation: Independent Living Resources, Inc.
Durham, North Carolina
(919) 402-0262
Keywords: Video, personal safety, social services providers

Purpose:
To produce and evaluate a video-based training program about personal safety for social services providers.

Abstract:
The intent of this program is to heighten awareness to areas of risk and to reduce dangers related to threats and violence. In Phase I, a 30-minute video was developed and produced that introduces social services staffs and others to basic personal safety issues. In Phase II, program content will be expanded to include a full two- to three-day training program with four additional 30-minute videos and provide in-depth examination of the wide range of issues introduced in Phase I. Content will be focused on all aspects of delivery of social services. Video and companion training curricula will provide high-quality skill-based training and will be marketed as a key segment of comprehensive on-site training and as stand-alone videos with accompanying manuals for training participants and curriculum trainers. The programming will include specific concerns in relation to field and office safety, interviewing, crisis intervention, and post-incident victimization and trauma.

Intervention to Mitigate Adverse Effects of Shift Work

Researcher: Anita Cavallo, M.D.
Affiliation: Children's Hospital Research Foundation
Cincinnati, Ohio
(513) 636-4506
Keywords: Alertness, sleep, physicians, melatonin, activity/sleep cycle

Purpose:
To determine if melatonin accelerates the adjustment of workers to a reversal in the activity/sleep cycle from daytime to night work.

Abstract:
The hypothesis for this research is that melatonin accelerates the adjustment of workers in activity/sleep cycle from day to night. This is proposed to occur by synchronizing sleep to the desired schedule and consequently improving alertness and mood during the waking hours. This research will be conducted in a hospital. Subjects will be physicians in training whose work requires intense alertness and vigilance. The design includes two treatment phases for each subject, melatonin and placebo, and two respective baseline phases. Each phase lasts two weeks. Melatonin or placebo will be administered daily in the morning. Outcome measures include: (1) sleep characteristics obtained by diary and wrist actigraphy, (2) alertness/vigilance assessed by the Conner's continuous performance test, and (3) mood assessed by the Profile of Mood States. This model can be generalized to other occupations that require a high level of vigilance and alertness. The expected benefits of the proposed intervention may lead to development of new strategies for adjustment to night work, resulting in increased safety and reduced accidents and fatalities related to sleep deprivation in night workers.

Leadership Intervention for Fire Service Personnel

Researcher: Randal D. Beaton, Ph.D.
Affiliation: University of Washington
Seattle, Washington
(206) 543-8551
Keywords: Firefighters, work-related illnesses and injuries, intervention

Purpose:
To evaluate a multicomponent leadership intervention for its efficacy in reducing on-the-job injuries, absenteeism, and non-injurious incidents, as well as other specified self-reported adverse health outcomes in firefighters.

Abstract:
This project will include an intervention to provide specific leadership, team building, and coping skills training for fire service officers. This worksite intervention will improve the leadership effectiveness of the department's fire service officers as reflected in supervisory ratings given by their line firefighter and paramedic subordinates. Furthermore, it is anticipated that these improvements in leadership effectiveness will result in reduced on-duty injuries, non-injurious incidents, and absenteeism by decreasing adverse mental and emotional health outcomes, thereby reducing distractibility as well as other psychological risk factors for injury and non-injurious incidents. It is anticipated that these health and safety benefits will persist for at least 18 months. This investigation will include a cost-benefit analysis to document the essential cost effectiveness of the proposed intervention. The findings from this research will provide the basis for implementing this intervention with other fire departments and will have direct relevance for parallel testing of the intervention for effectiveness with other high-stress occupations with elevated total injury and/or illness rates (mining and construction).

Health and Safety-Pollution Prevention in Hospitals

Researcher: Margaret Quinn, Sc.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(978) 934-3196
Keywords: Hospitals, intervention, polyvinyl chloride and mercury waste, pollution prevention

Purpose:
To develop workplace intervention strategies that reduce the use of polyvinyl chloride and mercury containing materials in hospitals while improving the occupational health and safety of hospital workers.

Abstract:
This project will: (1) establish multidisciplinary intervention teams in three hospitals, (2) identify the important occupational heath and safety pollution prevention problems, (3) develop a curriculum of education materials for the intervention teams, (4) conduct pre-intervention walkthrough surveys, (5) research intervention strategies for materials that generate polyvinyl chloride or mercury containing waste, (6) implement interventions, (7) conduct post-intervention walkthroughs, and (8) analyze the data collected and compare the study findings within and among the three hospitals. The products from this study will be: (1) a model plan and instructional manual for setting up hospital occupational health and safety programs; (2) case studies; and (3) a list of alternative work practices, materials, products, and vendors. Information about these alterations and the model occupational health and safety-pollution prevention program will be available to hospitals nationwide.

Field Study of Hearing Protector Evaluation Procedure

Researcher: Thomas W. Rimmer, Sc.D.
Affiliation: University of Arkansas
Little Rock, Arkansas
(501) 686-5289
Keywords: Bone conduction loudness balance, hearing protection devices, validate

Purpose:
To simplify the procedure for field use of the bone conduction loudness balance and to demonstrate its value for studying hearing protection devices.

Abstract:
There is a real need for a simple, reliable procedure to assess field performance of hearing protection devices. This research will simplify the bone conduction loudness balance procedure for field use and demonstrate its value for studying a new class of hearing protection devices that are designed to improve speech understanding for hearing impaired users by equalizing the degree of protection across all frequencies, rather than providing more protection against noise at high frequencies as do most hearing protection devices. Because of low attenuation ratings, these hearing protection devices cannot normally be used without a reliable means of assuring that they are delivering adequate protection. The bone conduction loudness balance procedure will be used to demonstrate the validity of this kind of hearing protection device when appropriately used.

A New Training Intervention to Prevent Back Injuries

Researcher: Steven A. Lavender, Ph.D.
Affiliation: Rush-Presbyterian- St. Luke's
Medical Center
Chicago, Illinois
(312) 942-9724
Keywords: *LiftTrainer*, back injuries, intervention

Purpose:
To demonstrate the effectiveness of an aggressive new intervention (the *LiftTrainer*) for training and maintaining lifting techniques.

Abstract:
The *LiftTrainer* uses a three-dimensional motion tracking system, computes the instantaneous three-dimensional dynamic spine moments, and provides an audible biofeedback signal proportional to the magnitude of the stress. This method combines a biomechanical analysis and concepts from learning theory in a protocol focused on changing lifting behavior and quantifying the extent to which behavior is modified. This project will: (1) validate that lifting behaviors and the resulting spine moments can be modified in workers who perform repetitive material handling and (2) determine the extent to which injury rates can be controlled through an aggressive training approach. More than 2400 employees will participate in this study. Workers performing simulated job tasks are coached in one-on-one training sessions of 30 minutes duration in how to minimize their spine moments while maintaining an acceptable task performance speed. Moment data gathered at the beginning and end of a session are used to quantify improvement within a session and retention between sessions. Behavior is maintained through the incorporation of reinforcement techniques borrowed from behavioral-based safety programs and repeated training.

Getting to Zero in Nursing Homes: Intervention Effectiveness

Researcher: Barbara Silverstein, Ph.D.
Affiliation: Department of Labor and Industries
Olympia, Washington
(360) 902-5668
Keywords: Nursing home workers, back injuries, zero-lift, intervention

Purpose:
To evaluate the implementation of zero-lift type programs in nursing homes in Washington state and the effectiveness of these programs in reducing the incidence and severity of low back and shoulder injuries.

Abstract:
Training and mechanical devices continue to be developed, yet back injuries are still occurring in nursing homes at an unacceptably high rate. This research will evaluate the use of the zero-lift programs to protect nursing assistants in nursing homes in Washington state and two workers' compensation incentive pilot programs for the implementation of zero-lift programs in a small subset of nursing homes. It will also evaluate the effectiveness of these programs in reducing the incidence and severity of low back and shoulder injuries in nursing assistants in nursing homes that are caused or

aggravated by resident handling activities. The zero-lift program consists of many components including: training, lifting devices, management enforcement of zero-lift policies, employee and management cooperation and participation, and injury investigation and management. The challenge to the nursing home industry is to effectively implement programs that reduce the physical load on nursing assistants while maintaining a safe and caring environment for the residents of the nursing homes.

Intervention to Prevent Construction Worker Hearing Loss

Researcher: Madeleine Kerr, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(612) 625-2669
Keywords: Construction workers, hearing loss, intervention, model

Purpose:
To design, implement, and evaluate an intervention that will help to prevent occupational hearing loss in construction workers.

Abstract:
To determine the best way of increasing the use of hearing protection by construction workers, this project will test the effectiveness of a tailored intervention (based on worker perceptions) and a control (standard training) on their use of hearing protection, thereby ultimately reducing workers' noise-induced hearing loss. This study will: (1) assess an individually tailored computer-based intervention concerned with the use of hearing protection equipment by workers, (2) determine the effect of a booster intervention on use of hearing loss protection, (3) determine whether the effects of the intervention and booster intervention are different among workers who also receive audiometric testing than they are among workers who do not receive such testing, (4) test the Predictors of use of Hearing Protection Model as a causal model of use of hearing protection, and (5) evaluate the congruence of the perceived hearing loss by workers with results of audiometric screening. Results from the proposed study will provide a model for future intervention research, and through dissemination of the intervention aid in reducing noise-induced hearing loss, a serious preventable impairment.

Evaluating Exposures Under OSHA's 1984 Ethylene Oxide Standard

Researcher: Anthony D. LaMontagne, Sc.D.
Affiliation: Dana-Farber Cancer Institute
Boston, Massachusetts
(617) 923-7747
Keywords: Ethylene oxide, standard, evaluation, worker exposures

Purpose:
To conduct a historical evaluation of worker exposures under OSHA's 1984 ethylene oxide (EtO) standard.

Abstract:
This research will: (1) characterize ethylene oxide exposures and include summary measures, exposures distributions, and job-based evaluations; (2) identify potential determinants of EtO overexposures using quantitative and qualitative assessment; and (3) assess compliance with the EtO Standard. The Integrated Management Information System database estimates of noncompliance will be compared with EtO standard with independent estimates. These analyses will be conducted for compliance with all principal sections of the standard as well as with exposure limits.

Intervention Studies in Agricultural Safety and Health

Researcher: James M. Meyers, Ed.M., Ed.D., M.P.H.
Affiliation: University of California
Davis, California
(510) 231-9514
Keywords: Musculoskeletal disorders, ergonomics program, farms

Purpose:
To reduce the incidence of musculoskeletal disorders and symptoms on farms.

Abstract:
This project will involve the implementation of a comprehensive ergonomics program by multiple cooperating agricultural operations. Each intervention will provide pre- and post-intervention ergonomic risk factor data and musculoskeletal disorder (MSD) incidence data for evaluation. Project-specific aims are:

1. Recruit cooperating partners from agriculture.
2. Describe and prioritize ergonomic risk factors and hazards for MSD in cooperators' operations.
3. Assess the incidence of MSD among workers.
4. Cooperatively agree on ergonomics program priorities, plans, and programs.
5. Measure post-intervention indication of impact of programs on incidence of MSD with involved workers.
6. Reevaluate ergonomic risk factors and hazards for MSDs.
7. Assess productivity impacts and perceived "adoptability" of programs.
8. Evaluate cooperative program intervention trials and compare with pre-intervention analyses.
9. Articulate a "best practices" model for agricultural ergonomics programs.
10. Communicate project findings.

Agricultural Safety and Health Best Management Practices (ASHBMP)

Researcher: Dennis J. Murphy, Ph.D.
Affiliation: Pennsylvania State University
University Park, Pennsylvania
(814) 865-7157
Keywords: Farmers, manual, audit, educational tool

Purpose:
To determine if the Agricultural Safety and Health Best Management Practices Manual is an effective educational and auditing tool for reducing hazard levels on farms.

Abstract:
The objectives of this study are to: (1) determine the reliability and iterator reliability of the Agricultural Safety and Health Best Management Practices (ASHBMP) Manual audit as an auditing tool for use by the insurance industry, (2) determine the efficacy of using the visually-oriented ASHBMP Manual as a hazard audit tool for reducing hazards on farms, and (3) develop a monitoring system to track the effectiveness of the ASHBMP Manual with the target audiences. This project will include working with three audiences—all of whom play an important role in the overall effort to reduce farm hazards. These audiences include local level educators, the rural insurance industry, and farm operators.

Wisconsin Production Agriculture Intervention Evaluation

Researcher: Larry J. Chapman, Ph.D.
Affiliation: University of Wisconsin
Madison, Wisconsin
(608) 262-7408
Keywords: Intervention, farmers, evaluation, interventions, safety

Purpose:
To evaluate the effectiveness of two production agriculture interventions in reducing traumatic and musculoskeletal injuries.

Abstract:
This research focuses on decreasing traumatic and musculoskeletal injuries through intervention. This research will continue ongoing interventions with dairy producers and vegetable growers. The purpose of the research is to adopt safer and more profitable production methods using a specially designed information dissemination effort through print media, Internet, public events, and other information channels. These channels are already used by dairy producers and vegetable growers. This research project will also evaluate the effectiveness of the interventions through process evaluations and annual mail questionnaires. Finally, new production method innovations will be added to each intervention. The investigators will develop materials and a promotion plan for these innovations.

Worker Musculoskeletal Disorders (WMSDs): Evaluating Intervention Among Office Workers

Researcher: Donald C. Cole, M.D., M.Sc.
Affiliation: Institute of Work and Health
Toronto, Ontario Canada
(416) 927-2027
Keywords: Musculoskeletal disorders, neck, upper limb, office workers, labor-management

Purpose:
To determine the impact of a joint labor-management directed program on primary, secondary, and tertiary prevention of worker musculoskeletal disorders (WMSDs) of the neck and upper limb among office workers.

Abstract:
Qualitative methods will be used to document the nature of interventions and their implementation for this research project. The primary comparison will be between self-reported risks for WMSDs of the neck and upper limb symptoms and disability associated with WMSD before the program and after 1.5 years of implementation, using a repeat cross-sectional survey. A number of independent measurements of exposures and outcomes will be carried out to increase study validity. Among a group of the workforce undergoing reorganization, with input from ergonomists, changes in physical and psychological exposures will be measured and these measures compared with those of a job-matched control group not experiencing reorganization. Active and passive workplace surveillance systems will be strengthened to monitor changes in risk factors for and severity of WMSD over time. Health outcome-based monitoring will be implemented to those reporting a WMSD to the workplace. The evaluation will determine the effectiveness of the intervention.

Healthy Work Organization: Intervention Effectiveness

Researcher: David M. DeJoy, Ph.D.
Affiliation: University of Georgia
Athens, Georgia
(706) 542-4368
Keywords: Healthy work organization, intervention, field-based

Purpose:
To evaluate the effectiveness of a field-based intervention designed to improve healthy work organization.

Abstract:
No research has addressed evaluating relevant interventions in real work settings. This research uses data-driven problem-solving teams that combine elements from total quality management, worker involvement, and community engagement. It will: (1) investigate changes in both health/safety and financial performance as a function of the problem-solving intervention, (2) investigate how the intervention impacts organizational climate–specifically dimensions related to participation and information exchange, and (3) explore the impact of the problem-solving intervention on the exogenous and endogenous components of the theoretical model of healthy work organization that undergirds this study. Baseline data will be collected from employees, and organizational effectiveness data (health/safety and financial performance outcomes) will also be collected. Qualitative data will be obtained from focus groups and organizational interviews.

Reducing Violence Against Nursing Home Caregivers

Researcher: Donna M. Gates, Ed.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-3793
Keywords: Certified nursing assistants, violence, intervention

Purpose:
To test the effectiveness of an intervention to decrease violence against certified nursing assistants.

Abstract:
Certified nursing assistants (CNAs) working in long term care are most at risk for workplace assault. Most CNAs have little training regarding the care of aggressive patients. Previous research has shown that CNAs daily experience verbal and physical violence and lack the knowledge/skills to prevent violence. This study will: (1) describe the context in which assaults occur, (2) increase certified nursing assistants' skills to prevent assaults, and (3) decrease the incidence of assaults against certified nursing assistants. Subjects from six nursing homes will be randomly selected. Individuals participating in the study will be assessed for changes in their assault prevention skills prior to the intervention and upon completion of the intervention. This is a three year study. Analysis of data will describe the context of the assaults and test whether there was a significant difference in the number of violent incidents between the intervention group and the control group. Data analyses will also determine if the intervention group demonstrated a significant difference in violence prevention skills from the control group.

Preventing Musculoskeletal Disorders Among VDT Operators

Researcher: Fredrick Gerr, M.D.
Affiliation: Emory University
Atlanta, Georgia
(404) 727-5884
Keywords: Musculoskeletal disorders, interventions, adverse health outcomes

Purpose:
To implement ergonomic and postural intervention for prevention of neck, shoulder, and upper extremity musculoskeletal disorders among computer users.

Abstract:
Two specific interventions will be studied in this research. The incidence and symptom-free survival time of neck/shoulder symptoms and hand/arm symptoms of each of the intervention groups will be compared to the control group during a six month follow-up time. Investigators will recruit subjects from video display terminal users and collect ergonomic, personal health, and other information. Investigators will randomly allocate subjects to one of three study groups (intervention 1 group, intervention 2 group, and control). The subject's workstation will be reconfigured to ensure that it meets the requirements of the assigned intervention group. A standard questionnaire documenting psychosocial stressors will be administered. During the next six months, subjects will keep a diary documenting a range of occupational and non-occupational activities as well as musculoskeletal symptoms. Incidence rates and symptom-free survival times for musculoskeletal discomfort of the neck, shoulder, hand, and arm will be calculated and relative risks estimated. These analyses will determine if members of the groups had significantly reduced risk of adverse musculoskeletal outcomes in comparison to members of the nonintervention group. Risk of adverse musculoskeletal outcomes will also be compared between the two intervention groups.

Outcomes of the Revised CA Bloodborne Pathogens Standard

Researcher: Marion E. Gillen, Ph.D.
Affiliation: University of California
San Francisco, California
(415) 476-1382
Keywords: Bloodborne pathogens, evaluate, needle safety products

Purpose:
To evaluate the impact of the Bloodborne Pathogen standard mandating health care facilities to use needle safety products.

Abstract:
This research project will: (1) assess facility compliance as measured by the Bloodborne Pathogen (BBP) Standard Compliance Checklist as well as barriers to and facilitators of compliance, (2) determine the number of needlesticks in health care facilities for the years 1998-2001, (3) assess employee perceptions of workplace safety as measured by the Safety Climate Measure for health care and determine the relationship between safety climate and compliance, and (4) determine facility costs before and after adoption of this standard. Two hundred and twenty-five hospitals, home health agencies, and skilled nursing facilities will be selected for participation. Auditing administrative and work practices, engineering controls, and written documents will be used to assess compliance. Participants will be surveyed about their perception of workplace safety, and the relationship between facility compliance and safety climate will be determined. The financial implications will be estimated and barriers to and facilitators of compliance will be assessed through interviews.

Prevention of Upper Extremity Cumulative Trauma Disorders

Researcher: Janie Gordon, Sc.M.
Affiliation: University of Maryland
Baltimore, Maryland
(410) 706-7464
Keywords: Upper extremity cumulative trauma disorders, intervention, incidence, functional outcomes

Purpose:
To evaluate the effectiveness of an educational intervention to reduce upper extremity cumulative trauma disorders for employers and improve functional outcomes for injured employees.

Abstract:
Cumulative trauma disorders of the upper extremity remain a major cause of lost-time injuries in American industry. In this research, participants will be identified from the Maryland Workers' Compensation Commission claims in a 12-month period. These participants will be randomized and assigned to an intervention or a control group. The intervention will be a series of educational efforts including mailed information (written and audiovisual) and an educational on-site meeting/walkthrough. The effectiveness of the educational interventions will be evaluated using process and outcome measures that include a questionnaire and telephone interviews. Subsequent claims during the 12-month period will be recorded for each employer in both intervention and comparison control groups.

Effects of OSHA Guidelines on Violence Prevention in Mental Health

Researcher: Jane Lipscomb, Ph.D.
Affiliation: University of Maryland
Baltimore, Maryland
(410) 706-7647
Keywords: Violence prevention, OSHA guidelines, mental health setting

Purpose:
To evaluate the effectiveness of the OSHA violence prevention guidelines for health and community workers.

Abstract:
This research will use three mental health facilities. An intervention will be implemented in each of the facilities selected that include key elements of the OSHA guidelines. A worksite analysis will include review of data, focus groups, a pre-intervention survey, risk mapping, and walkthrough evaluation. Hazard prevention and control will be accomplished by implementing recommendations from walkthrough surveys. Training on violence prevention will be offered annually. Formative evaluation will be ongoing. Evaluation of the program will be accomplished through analysis of post-intervention survey and data one year following the implementation of the intervention. The study will: (1) document and describe a process to implement OSHA violence prevention guidelines; (2) compare assault rates, risk factors for assault, and job satisfaction one year before and after the OSHA guideline program; and (3) assess the cost and benefit of implementing OSHA violence prevention guidelines in a state mental health facility.

The Impact of OSHA Inspections on Manufacturing Injuries

Researcher: John M. Mendeloff, Ph.D.
Affiliation: University of Pittsburgh
Pittsburgh, Pennsylvania
(412) 648-2651
Keywords: Inspections, data set, safety, injury

Purpose:
To obtain data and information about OSHA inspections concerning injuries in manufacturing. In addition, to explore new insights about the effects of: (1) inspections in different settings, (2) general enforcement strategies, and (3) new safety standards.

Abstract:
This project will create a new data set combining inspection data from OSHA's Integrated Management Information System with injury data on manufacturing plants that have been in the Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses for three continuous years between 1992-1995. These analyses will make use of two features: (1) the data set now contains information on injury and demographic characteristics for cases involving days away from work, and (2) the data set includes all states. The data obtained will be used to replicate earlier studies. It will also expand analyses to consider new variables and examine effects on different subgroups. Furthermore, it will examine the effects of citing particular violations on the prevention of particular injuries related to those violations. Moreover, it will examine the role of new safety standards in reducing injuries and the role of inspection in boosting that effect. In addition, it will examine the effects of different enforcement strategies carried out in different states and regions. Finally, it will facilitate efforts to explore some of the reasons for variations in injury rates among plants in the same industry.

Evaluation of Dust Control Technologies in Construction Tasks

Researcher: Noah S. Seixas, Ph.D.
Affiliation: University of Washington
Seattle, Washington
(206) 685-7189
Keywords: Masonry tools, effectiveness, dust

Purpose:
To evaluate commercially available, untested masonry tools to determine their effectiveness in reducing dust emissions.

Abstract:
Elevated dust exposure to workers can result from crystalline silica dust in the construction industry, particularly in the use of masonry tools. This research project will consist of a series of semi-controlled experiments conducted to determine the effectiveness of water suppression and local ventilation control techniques when used with six different classes of hand-held masonry power tools. The most promising tool/control combinations will be further tested at a construction site to evaluate how nonideal conditions affect tool/control performance and to assess worker and management acceptance. This research will provide practical guidance to masonry construction industry and reduce the possibility of occupational lung disease related to silica exposure in this industry.

OSH Program Evaluation in Manufacturing and Small Business

Researcher: Glorian C. Sorenson, Ph.D.
Affiliation: Dana-Farber Cancer Institute
Boston, Massachusetts
(617) 632-2183
Keywords: Occupational safety and health, needs assessment, evaluation, intervention

Purpose:
To develop methods for evaluating occupational safety and health (OSH) programs and to apply OSH program measures for needs assessment and evaluation uses in intervention effectiveness studies.

Abstract:
Two ongoing intervention trials, entitled Wellworks-2 and Wellworks-Small Business, are assessing the effectiveness of integrating occupational health and health promotion interventions as reductions in lifestyle cancer risks. These trials, which are collecting data on employee perceptions of OSH conditions as well as measures of the potential for exposure to hazardous substances, will be complemented by integration of organizational-level measures of OSH programs. In this research program, analysis will be conducted to characterize OSH programs and construct

composite organization-level OSH program measures in large and small manufacturing worksites. In addition, it will determine the relationship between OSH program measures and hazardous chemical exposure indices in order to validate the relevance of OSH program measures in the prevention of occupational illness and disease. Moreover, it will determine the relationship between OSH program measures and individual-level employee self-reports of OSH conditions in order to validate organizational level OSH program scores against employee perceptions of OSH conditions. Finally, the effectiveness of Wellworks interventions on OSH program measures using experimental designs in large and small manufacturing worksites will be evaluated. This research will substantially enhance intervention research, OSH practice, and regulatory applications of OSH program measures.

Claims-Based Surveillance to Identify Injury Prevention

Researcher: David J. Tollerud, M.D.
Affiliation: MCP Hahnemann University
Philadelphia, Pennsylvania
(215) 762-6514
Keywords: Claims-based, cost effective, record linking, surveillance

Purpose:
To improve workplace safety and health through research aimed at developing a cost-effective claims-based injury and illness surveillance system.

Abstract:
In this research, a database and prospective record linking system will be used to create a workplace surveillance program. In Phase I of this study, procedures will be developed to transform Workers' Compensation Claims data into a surveillance system for work-related injuries and illnesses. Reports will be generated and provided to the employer. In Phase II, the degree to which the claims-based surveillance system underreports workplace injuries will be determined using surveillance system data and a more comprehensive Employee Injury Report used in Philadelphia. Phase III will use claims-based data to develop and test methods to identify patterns that predict precursor events that could be addressed through primary prevention actions. Phase IV will develop employer guidelines for using their workers' compensation medical claims databases for surveillance activities. This will result in providing employers with a guide to translate their workers' compensation claims into a feasible, low-cost and functional surveillance program.

Evaluation of HomeSafe: Injury Prevention and Outcomes

Researcher: Philip L. Bigelow, Ph.D.
Affiliation: Colorado State University
Fort Collins, Colorado
(970) 491-1405
Keywords: Residential, construction, safety program

Purpose:
To identify and measure the changes in incidence, severity, and fatality rates among a sample group of residential construction workers participating in the HomeSafe Program.

Abstract:
In this research program specific attention is being paid to the associated risk factors for occupational back pain, changes in work safe behaviors, and analysis of workers' compensation data. Investigators have designed a longitudinal cohort quasi-experimental research design to identify and measure the effect of the HomeSafe Program (a residential construction safety program that includes engineering, behavioral and administrative interventions developed and sponsored by OSHA Region VIII and the local Home Builders Association) on a sample group and compare those findings to a control group and other construction data. Research includes the use of specifically designed survey instruments, data gathering including OSHA 200 Logs, workers' compensation loss summaries, employer's first report of injury, and correlation analysis of findings. Contact entails personal interviews, phone calls, mailing, and site visits. Data will be collected monthly and annually for three years prior to intervention and three years after intervention. If efficacy of HomeSafe is determined, a long-term goal is to export this method into the home building industry.

• Low Back Disorders

Trunk Stability and Spinal Load During Manual Materials Handling (MMH) Lifting

Researcher: Kevin P. Granata, Ph.D.
Affiliation: University of Virginia
Charlottesville, Virginia
(804) 982-0513
Keywords: Low back disorders, trunk stability, spinal mechanics, occupational hazards

Purpose:
To quantify trunk stability and associated spinal mechanics in order to identify and control occupational hazards for low back disorders (LBD).

Abstract:
Low back disorders are common in occupations with high exposures to unstable events and sudden loads such as construction and nursing. In general, lifts performed from twisted laterally bent and dynamic postures are considered significant low back disorder risk factors. The cause of this increased risk may be associated with reduced trunk stability in these manual materials handling postures. This research will quantify trunk stability and spinal mechanics to identify and control occupational hazards for low back disorder/risk. The investigators will: (1) develop a biomechanical model of in vivo trunk/spinal stability, (2) assess the influence of manual materials handling task parameters upon the relative stability of the trunk, and (3) quantify spinal loads and musculoskeletal behavior in response to unstable events.

Spine Loading During Whole-Body Free-Dynamic Lifting

Researcher: William S. Marras, Ph.D.
Affiliation: Ohio State University
Columbus, Ohio
(614) 292-6670
Keywords: Biomechanical model, spine loading, free-dynamic lifting

Purpose:
To further develop the biodynamic model created in this laboratory so that it can be used to accurately assess spine load during whole-body free dynamic lifting activities.

Abstract:
It is well known that most occupationally-related low back disorder risk is associated with manual materials handling tasks. The long-term objective for this work is to develop a means to accurately assess loads imposed upon the lumbar spine during actual workplace manual materials handling conditions. A biodynamic model has been developed in the present laboratory to account for the collective coactive influence of 10 trunk muscles upon the 3-dimension loading of the spine. This research will first develop the biodynamic model so it can be used to accurately assess spine loading during whole-body free dynamic lifting activities rather than a confined pelvic restraint system as it is now. This research will be accomplished via three activities: (1) determine how the biodynamic model must be changed once the lower body is permitted to move during the lift, (2) develop instrumentation that is necessary to adjust the model appropriately for body posture changes that occur during whole body free-dynamic lifting, and (3) validate the model. The model resulting from this effort will permit the accurate assessment of biomechanical risk of low back disorders associated with manual materials handling. In addition, since this model is subject specific, it will facilitate research into the biomechanical effects of psychosocial, work schedule, work rotation, and other work organization issues.

Predictors of Low Back Injury and Disability in the U.S. Army

Researcher: Gordon Smith. M.B., Ch.B., M.P.H.
Affiliation: Johns Hopkins University
Baltimore, Maryland
(410) 955-7981
Keywords: Low back disorders, incidence, disability, interventions

Purpose:
To examine and quantify the relationships of occupational, individual, and behavioral characteristics to the incidence of both low back disorders and the subsequent development of disability.

Abstract:
Low back disorders are a major source of morbidity, lost time, and physical disability in the workforce and represent a major cost to society. This study will examine and quantify the relationships of personal and job-related characteristics to the incidence of both low back disorders and the development of disability. This research will: (1) identify occupations with the highest rates of low back hospitalization, (2) identify occupations with the highest rates of disability, (3) identify risk factors for low back hospitalization and for long-term disability, and (4) propose potential interventions based on identification of modifiable risk factors. A retrospective cohort study of Army personnel between 1989-1997 will be conducted. Data from hospitalizations, disability, and health risk databases will be used in this study to provide job classification, physical job demands, medical treatment, personal factors, job factors, social factors, and disability board evaluations. Study findings will be used to develop interventions directed at both primary prevention and at preventing development of long-term disability. Benefits from this study include prevention of injury and disability and large potential cost savings applicable in both civilian and military settings.

Musculoskeletal Disorders (MSDs) in Nurses: Organization and Physical Work Factors

Researcher: Alison M. Trinkoff, Sc.D.
Affiliation: University of Maryland
Baltimore, Maryland
(410) 706-6549
Keywords: Nurses, musculoskeletal disorders, health care settings

Purpose:
To examine neck, shoulder, and back pain/disorders in registered nurses working in a variety of health care settings.

Abstract:
This study will examine the relationship between musculoskeletal pain/disorders and physical work factors and the modifying effect of organization of work factors on this relationship. Two thousand nurses in two states will receive a mailed survey seeking information for this study. This research will: (1) determine the incidence and prevalence of work-related neck, shoulder, and back pain/disorders in registered nurses working in a variety of settings; (2) assess physical work factors for neck and shoulder pain/disorders in registered nurses; (3) examine the modifying effect of work organization variables, including managed care penetration, staffing, job strain, and work schedules, on the relationship between physical work factors and neck, shoulder, and back pain/disorders; (4) determine the availability and use of workplace prevention initiatives and control measures such as patient handling devices, lifting teams and worker participation, and their relationship to MSDs among nurses working in a variety of settings; and (5) determine the prevalence of safety incentive programs and their impact on reporting work-related MSDs in a variety of health care organizations.

Low Back Pain: A Multicenter Randomized Trial

Researcher: James Weinstein, D.O.
Affiliation: Dartmouth Medical School
Hanover, New Hampshire
(603) 646-1110
Keywords: Lumbar spine conditions, surgery, nonsurgical procedures, cost effectiveness, multicenter

Purpose:
To conduct multicentered trials of lumbar intervertebral disc herniation, spinal stenosis, and spinal stenosis secondary to degenerative spondylolithesis comparing standard surgical treatment to standard nonsurgical treatment.

Abstract:
Low back pain is considered one of the most widely experienced health problems in the United States and the world. The three most common lumbar spine conditions for which spine surgery is performed are lumbar intervertebral disc herniation (IDH), spinal stenosis (SpS), and spinal stenosis secondary to degenerative spondylolithesis (DS). This study will use the National Spine Network to conduct multicentered, controlled trials of IDH, SpS, and DS to compare standard surgical treatments to standard non-operative treatments. This study will be conducted at 16 sites in the U.S. The primary endpoints will be changes in general health-related quality of life as measured by the SF-36 health status questionnaire and spine-related disability as measured by the Oswestry Low Back Pain questionnaire. Secondary endpoints will include patient satisfaction with treatment, resource utilization for estimation of cost, and utility for current health for estimation of quality adjusted life years. These secondary endpoints will be used to evaluate cost-effectiveness. Patients will be followed for two years. Possible follow-up may extend to four years. A total of 1450 subjects will be enrolled in the investigation. An additional observational cohort will be tracked to assess health and resource outcomes. Data will be analyzed to estimate the cost-effectiveness of operative versus non-operative procedures. This study will provide information on the relative effectiveness/efficacy of surgical versus nonsurgical treatment for these three common lumbar spine conditions.

• Mixed Exposures

Diesel Exhaust and Occupational Lung Cancer Risk

Researcher: Eric Garshick, M.D.
Affiliation: VA Medical Center
West Roxbury, Massachusetts
(617) 323-7700
Keywords: Diesel exhaust, lung cancer, miners, locomotive

Purpose:
To assess the relationship between diesel exhaust exposure and occupational lung cancer risk.

Abstract:
Workers in dieselized underground mines are exposed to 10-20 times greater levels of diesel particles than other occupational groups. Occupational groups exposed to diesel exhaust have an elevated risk of lung cancer. This research will concentrate on developing a profile of personal exposure to diesel exhaust for each subject and relating this exposure to lung cancer risk. This will be based on a review of historical records of railroad rosters and locomotive manufacturer's records. There will be an investigation of the influence of engine type of emissions by using published diesel locomotive particulate emission factors as a guide to relative differences in exposure associated with changes in a railroad's locomotive fleet. Job specific exposure data previously collected will also be used to estimate past exposure. Since errors in estimates of duration and intensity of exposure greatly influence projections of lung cancer risk, this research will enable the Mine Safety and Health Administration to assess the risk of lung cancer and the extent of controls needed in mines with greater accuracy.

Role of Ozone (O_3) in Modulating Chromium Toxicity in the Lung

Researcher: Richard B. Schlesinger, Ph.D.
Affiliation: New York University
Tuxedo, New York
(914) 351-5140
Keywords: Chromium, ozone, cancer, lungs, animal model

Purpose:
To investigate mechanisms underlying the elevated lung cancer incidence in welders exposed to welding fumes containing both chromium (Cr) and ozone (O_3).

Abstract:
Mixed exposures have been ignored commonly in evaluations related to worker health and safety. In this regard, chromium (Cr) is released with ozone (O_3) during welding, and a major health hazard from inhalation exposure to Cr-containing materials is lung cancer. This research program will investigate the hypothesis that the carcinogenic potential of insoluble Cr(VI) in the lungs of hosts inhaling the Cr/O_3 mixture is greater than that in hosts inhaling the Cr alone. This is thought to be due to the O_3-mediated increases in the lung tissue burdens of Cr(VI) and/or augmentation of one or more of the documented genetic/epigenetic mechanisms associated with Cr-induced conversion of normal cells to transformed types. In this project, rats will be exposed to atmospheres containing carcinogenic Cr(VI), namely calcium chromate, alone and in combination with O_3. This study will improve the understanding of the mechanisms underlying the interaction between Cr and O_3 in the lungs and the role that mixtures of air contaminants may play in pulmonary disease pathogenesis following exposure to realistic mixed atmospheres of occupational relevance.

Metalworking Fluids and Aerodigestive Cancer Risk

Researcher: David Kribel, Sc.D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(978) 934-3270
Keywords: Metalworking fluids, cancer epidemiology

Purpose:
To expand the epidemiologic evidence linking metalworking fluids to cancers of the upper aerodigestive tract.

Abstract:
There is growing evidence that suggest a relationship between metalworking fluids and cancer. This research project will: (1) estimate cancer risks from exposure to metalworking fluids (MWFs) for the upper aerodigestive track by groupings that correspond more closely to routes of exposure and likely target

issues for exogenous chemicals, epilarynx and hypopharynx, endolarynx, and esophagus; (2) evaluate the magnitude of potential confounding by tobacco and alcohol; and (3) apply a two-stage cancer model to the quantitative MWF exposure data to provide a biologically-based method to investigate the temporal contribution of different types and components of MWF to cancer risks in the upper aerodigestive tract. This project will address the issue of MWFs and cancer. In addition, it will contribute more generally to environmental cancer epidemiology by demonstrating the feasibility of incorporating more sophisticated, biologically-based, modeling methods into the widely used retrospective cohort study.

Combined Effect of Radiation and Asbestos in Producing Pulmonary Fibrosis

Researcher: Takaro Timothy, M.D.
Affiliation: University of Washington
Seattle, Washington
(206) 616-7458
Keywords: Radiation, asbestos, workers, pulmonary fibrosis

Purpose:
To determine whether concomitant radiation exposure increases the fibrogenic effect of asbestos.

Abstract:
Employees who work in the nuclear industry may be exposed to radiation and asbestos in their occupational environment. Both hazards cause pulmonary fibrosis. This cohort design study will use 300 asbestos exposed nuclear workers divided into very low and high radiation dose groups based upon personal dosimetry records and compared for evidence and degree of pulmonary fibrosis. The study will address the following questions: (1) does radiation dose increase the risk of pulmonary fibrosis in workers exposed to asbestos, (2) does exposure at ages greater than 45 years confer a greater risk than exposures at earlier ages, (3) are internal lung dose estimates a better predictor of pulmonary fibrosis effect than external film badge dosimetry, and (4) is Chronic Low Energy Transfer (LET) radiation more effective than brief exposures to high energy radiation in enhancing the fibrotic effects of asbestos? Answers to these questions should improve the risk profiling of former U.S. Department of Energy workers as well as those involved in future remediation of radiation and asbestos contaminated sites.

• Musculoskeletal Disorders of the Upper Extremities

Musculoskeletal Disorders in Automobile Manufacturing

Researcher: Laura Punnett, Sc. D.
Affiliation: University of Massachusetts
Lowell, Massachusetts
(978) 934-3269
Keywords: Upper extremity disorders, ergonomic stressors, automotive industry

Purpose:
To confirm and expand available data concerning the association between upper extremity disorders and occupational ergonomic stressors in an automotive stamping plant and an automobile engine manufacturing plant.

Abstract:
This study will be conducted in an automotive sampling plant and an automobile engine manufacturing plant where data was collected for a baseline survey six years ago. All eligible workers for the baseline study will be sought for interview and examination. The key areas of investigation for this study are: (1) changes in previously assessed exposures in the study jobs will be determined, and these will be supplemented with observation of physical exposures in noncyclical work and with new information on work organization characteristics of all study jobs; (2) the cumulative incidence of new upper extremity musculoskeletal disorders will be estimated as a function of ergonomic exposures assessed at baseline (and at the one-year follow-up, for some workers) and in this survey; and (3) the persistence of previously identified upper extremity musculoskeletal disorders will be estimated again as a function of prior and current ergonomic exposures. In addition to the "healthy worker" effect, the validity of psychophysical exposure ratings will be evaluated. Also, the short- and long-term reproducibility of workers' recall of occupational exposures, the reproducibility, and sensitivity of pressure pain threshold muscle testing as a field screening instrument will be assessed.

Tendon Force During Occupational Hand Activities

Researcher: David M. Rempel, M.D.
Affiliation: University of California
Richmond, California
(510) 231-5720
Keywords: Repeated hand tasks, fingertip load, tendon load, guidelines, hand tool, tendon-related disorders

Purpose:
To determine the dose-response relationships of fingertip load to tendon load in order to provide guidelines for hand tool design and tool use.

Abstract:
Ultimately, this research seeks to minimize tendon loading and reduce the risk of developing tendon-related disorders. This project will involve the direct measure of the index finger flexor tendon force at the wrist of 40 subjects undergoing hand surgery while the subjects perform specific hand tasks. Fingertip force and finger posture will also be recorded. A pinch grip task will be repeated followed by the use of switches of different design. Task conditions will be selected that can be generalized to the workplace. The effect of the different task conditions on tendon force and the ratios of fingertip to tendon force will be evaluated. Combined with the finger posture data, the information will also be used to evaluate existing biomechanical models. If the accuracy of the models is poor, then modified models or new models will be proposed.

An Intervention to Reduce Disability in Injured Workers

Researcher: Bradley Evanoff, M.D.
Affiliation: Barnes-Jewish Hospital
St. Louis, Missouri
(314) 454-8603
Keywords: Case management, ergonomic intervention, hospital workers, airline workers

Purpose:
To determine if early integrated case management and ergonomic intervention reduces work loss and costs resulting from work-related musculoskeletal disorders (WMSDs).

Abstract:
Although ergonomic interventions have proven valuable in primary prevention, there are few data available on the role of worksite evaluation and modification for workers who are already injured. It is hypothesized that a more comprehensive model of care delivery that includes worksite modification will hasten safe return to work. Three hundred and fifty injured workers from hospitals and a major airline will be used in this study. It will test traditional medical care versus multidisciplinary case management approach to the treatment of work-related musculoskeletal disorders that includes individual ergonomic evaluation and worksite modifications for injured workers. The study will: (1) be instituted very early in the course of time loss injuries, (2) routinely incorporate ergonomic workplace evaluations and job modifications, and (3) incorporate elements of a disease state management model emphasizing coordinated, comprehensive care across a spectrum of injury severity.

Worker Monitoring Tests for Carpal Tunnel Syndrome

Researcher: Robert G. Radwin, Ph.D.
Affiliation: University of Wisconsin
Madison, Wisconsin
(608) 263-6596
Keywords: Carpal tunnel syndrome, psychomotor, sensory, workers

Purpose:
To evaluate a battery of psychomotor and sensory tests used to monitor industrial workers for subtle functional deficits associated with carpal tunnel syndrome (CTS).

Abstract:
This research proposes to conduct a prospective study for investigating if temporal changes in test parameters can be observed among workers developing carpal tunnel syndrome (CTS) symptoms. An industrial population of 250 workers exposed to risk factors associated with CTS from a variety of industries associated with high CTS incidence rates will be periodically tested for changes in psychomotor and sensory functional test parameters over a four year period. Workers will annually undergo examination for CTS, including electrophysiological testing. Outcomes having positive/negative functional changes and positive/negative self-reported symptoms will be ascertained. In addition, sensitivity, specificity, and predictive value will be compared. Also, new parameters for these instruments will be investigated using outpatient subjects and controls.

A Model for Occupational Epicondylitis

Researcher: Karen B. King Ph.D.
Affiliation: University of California
San Francisco, California
(510) 231-5720
Keywords: Epicondylitis, model, dose-response

Purpose:
To investigate the dose-response relationships of various measures of load to connective tissue disease.

Abstract:
The research plan for this project involves modifying a repetitive finger loading rabbit model to investigate epicondylitis. This research will: (1) develop and validate the model, (2) identify relationships between the severity and location of the biochemical and histologic outcome measures, and (3) determine exposure-response relationships of force and repetition on the biologically important histologic and biochemical outcome measures. The results will provide a foundation to examine the relative importance of force, repetition, recovery, and duration in the pathogenesis of work-related epicondylitis.

Carpal Tunnel Syndrome Among Construction Workers

Researcher: John C. Rosecrance, Ph.D.
Affiliation: University of Iowa
Iowa City, Iowa
(319) 335-4554
Keywords: Carpal tunnel, electrophysiological tests, hand symptoms, wrist-intensive work

Purpose:
To characterize the prevalence of carpal tunnel syndrome (CTS) among construction apprentices.

Abstract:
Data will be collected from 350 construction apprentices with low exposure to hand- and wrist-intensive work and compared to previously collected data from 430 apprentices with high exposure to hand- and wrist-intensive work. Electrophysiological tests and hand symptoms will be used to identify carpal tunnel syndrome (CTS) cases among the operating engineer apprentices. Questionnaires will be used to determine occupational factors, personal factors, and medical histories associated with CTS. Focus group meetings will be held to determine why many apprentices do not seek medical attention for CTS symptoms. Electrophysiological tests and questionnaires will be repeated in the apprentices in two years to assess changes in electrophysiological variables and symptoms. These data collected in this research will provide a better understanding of the specific work factors associated with CTS, provide pilot data for planning future projects to study the natural history of CTS, and assist in the development of strategies for the prevention of CTS in construction and nonconstruction workplaces.

• Organization of Work

Organization Predictors of Successful Return to Work

Researcher: Benjamin C. Amick, Ph.D.
Affiliation: New England Medical Center
Boston, Massachusetts
(617) 636-8149
Keywords: Organizational practices and policies, return to work, injured workers

Purpose:
To identify organizational practices and policies (OPPs) that effectively support the injured worker's return to a productive work role.

Abstract:
This study will build on an ongoing cohort study of 250 carpal tunnel syndrome cases. Eighty different employers will participate in the research. This research seeks to: (1) determine the relationship between organizational practices and policies (OPPs) and successful return to work as well as reduced work disability and (2) examine the validity and reliability of worker reported OPPs. The hypotheses are: (1) OPPs will be associated with fewer lost work days, a quicker return to work, improved work, improved unpaid work role functioning, and less CTS symptoms; (2) worker reports of OPP will significantly co-vary with employer reports of OPP; and (3) worker reports of OPP will predict total lost work days, return to work, improved paid and unpaid work functioning, and fewer CTS symptoms. Worker OPP reports will be compared to employer reports. Demonstrating that worker self-reports are valid and reliable will provide new measurement tools unavailable before in occupational health research. A second unique feature of the proposed research is the use of new measures of successful return to work that include more than the fact that the employee has returned to work. In summary, this research will validate a critical new instrument (worker assessment of OPP) and, by defining the association between OPP and health outcomes, open avenues for interventions to enhance the well-being of injured workers.

Work Organization and Depression Among Nursing Home Aides

Researcher: Carles Muntaner, M.D., Ph.D.
Affiliation: University of West Virginia
Morgantown, West Virginia
(304) 293-3693
Keywords: Nurse aides, depression, working conditions

Purpose:
To assess the relationship between working conditions and the prevalence and incidence of major depression among nurse aides within 50 nursing homes in Ohio, West Virginia, and Kentucky.

Abstract:
The overarching hypothesis of this three-year study is that work organization (the amount of work to be performed and the capacity to decide how to do it) has a direct effect on the prevalence and incidence of major depression among nurse aides. This is the first study to examine work organization factors in nursing homes in relation to the prevalence and incidence of depression among nurse aides. Work organization will be measured at the individual and organization levels, and innovative statistical methods that are appropriate for the simultaneous analysis of two levels of data will be applied. The results of this study will have implications for workplace policies in nursing homes and have the potential to reduce depression and associated loss of productivity among nursing home workers.

The Effects of Shiftwork on Health Related Behaviors

Researcher: Melbourne F. Hovell, Ph.D.
Affiliation: San Diego State University
San Diego, California
(619) 505-4770
Keywords: Effect, shiftwork, behavior

Purpose:
To determine the effects of shiftwork and length of shift on health related behaviors such as sleeping, eating, and physical activity.

Abstract:
The study will survey 524 public safety dispatchers from California. Data will be collected by telephone interviews. The first stage will involve interviewing Public Safety Answering Point directors to obtain information regarding the working conditions, to determine the number of dispatchers employed in their center, and to obtain the consent of the directors for dispatchers to participate in the second stage of the study. The second stage involves a telephone interview to collect information from the dispatchers regarding their eating, sleeping, and physical activity behaviors during their shift on a typical work and nonwork day. Outcome measures include the total calories from fat, METs, and the number of hours of sleep in a 24-hour period. Day shift workers will be divided into those who work less than 8.5 hours per day and those who work more than 8.5 hours per day. This will allow for comparisons between day and shift workers within and across 8 and 12 hour schedules. Public safety dispatchers are a unique group in that the majority are female and they perform a high stress sedentary task. Therefore, the information learned from this study will make an important contribution to the literature concerning the health effects of shiftwork.

Caffeine and Naps: Practical Shiftwork Interventions

Researcher: James K. Walsh, Ph.D.
Affiliation: St. Lukes Hospital
Chesterfield, Missouri
(314) 205-6030
Keywords: Night shift work, caffeine, napping

Purpose:
To assess two interventions to counter the effects of night work–napping and caffeine administration.

Abstract:
Night work is associated with disturbed sleep, impaired alertness, decreased performance, and increased accidents (including transportation and industrial disasters). This research will study

two nap schedules, caffeine, and a combination of napping and caffeine. Objective physiologic and behavioral measures of alertness and performance at night and sleep quantity and quality during the day will be used to determine the most effective intervention in laboratory studies of simulated shiftwork. The most effective intervention will be tested with actual shiftworkers in the field using quantitative measures of performance, alertness, and sleep. The results of the experiments in this designated priority research area will directly lead to specific night work intervention strategies that can be readily applied in a variety of industries.

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

Researcher: Patricia McGovern, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(612) 625-7135
Keywords: Workload, postpartum health, quality of life

Purpose:
To estimate a function relating total workload (hours of paid and unpaid work), use of family medical leave, job stress, and work-family conflict to maternal health at critical points in time after childbirth.

Abstract:
How stress and role conflict from working affect women's postpartum health are not well established. Subjects for this research will be recruited from hospitals. Subjects will be surveyed at intervals 6 weeks, 3 months, 6 months, 12 months, and 18 months after childbirth using both telephone and mailed surveys. Data on women's total workload, use of family medical leave, job stress, work-family conflict, health status, and quality of life at each period will be collected. Results from this study will provide important information on 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, as well as 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.

Work Schedules and Health in Women Health Professionals

Researcher: Rosalind C. Barnett, Ph.D.
Affiliation: Brandeis University
Waltham, Massachusetts
(781) 736-2287
Keywords: Work schedules, working women, stress, and physical outcomes

Purpose:
To estimate the relationship between full- and part-time work schedules and stress-related mental and physical health outcomes in working women with families.

Abstract:
Women health care providers with children at home experience especially heavy distress and are high risk for psychological distress and poor marital- and job-role quality and stress related physical health problems. This will be a three year in-depth interview and survey study to estimate the relationship between full- and part-time work schedules and stress-related mental and physical health outcomes in a random sample of 200 married women with children working in medicine and licensed practical nursing who vary in race/ethnicity. This research will address the following questions: (1) Are full-time married women employed in medicine and licensed practical nursing with children at higher risk for stress-related mental- and physical-health problems than their reduced-hour counterparts? (2) Do these relationships depend on work arrangements, occupational prestige, race/ethnicity, age, household income, medical setting, number of children at home, elderly dependent care, and for doctors, area of medical specialization? (3) Are objective job conditions (work hours or arrangements) or subjective indicators (fit, discomfort over tradeoffs) better predictors of stress-related health outcomes? (4) What are the processes by which work schedules affect health outcomes?

Practical Circadian Interventions for Night Shift Work

Researcher: Charmane E. Eastment, Ph.D.
Affiliation: Rush-Presbyterian-St. Luke's
Medical Center
Chicago, Illinois
(312) 942-4472
Keywords: Night work, circadian rhythm, daytime sleep

Purpose:
To test interventions that are designed to phase delay the circadian clock so that circadian rhythms have a more appropriate phase relationship to night work and daytime sleep.

Abstract:
The interventions used in the research will be: (1) a very dark bedroom and a fixed seven-hour dark time for sleep at home after each night shift, (2) wearing dark goggles on the way home after night work, (3) taking melatonin at bedtime before daytime sleep, and (4) intermittent bright light during the night shift. Several combinations of these four interventions will be tested. These interventions would be feasible for real shift workers. The outcome measures will be: (1) circadian phase, (2) daytime sleep duration, and (3) night work sleepiness and performance. The goal is to advise shift workers and their employers about the relative benefits of the various combinations of interventions.

Work Schedules and Workplace Injuries

Researcher: Michael R. Pergamit, Ph.D.
Affiliation: National Opinion Research Center
Washington, D.C.
(202) 223-6040
Keywords: Sift work, workplace injury

Purpose:
To examine the relationship between shift work and other measures of demanding work schedules on the probability of a workplace injury.

Abstract:
Individuals who work night shifts and long or irregular hours are susceptible to fatigue that puts them at greater risk of a workplace accident. This project will study selection into shift work, investigate different measures of shift work schedules, explore different measures of injury severity, and examine long-term health outcomes. The relationship between shift work and work injuries has not been well-documented. The results of this project will substantially enrich knowledge of the personal and job characteristics which are determinants of work injuries.

• Risk Assessment Methods

The Utility of Biomarkers as Exposure and Dose Measures

Researcher: Elaine Symanski, Ph.D.
Affiliation: University of Texas
Houston, Texas
(713) 500-9238
Keywords: Variation, biological measures, occupational exposures

Purpose:
To examine variation in the levels of biological measures associated with occupational exposures.

Abstract:
Past research has not investigated the intra- and inter-differences for biological measures. A primary goal of this research is to compile a database of repeated biological measures so that the within- and between-person sources of variability can be partitioned for a wide range of biomarkers. The proposed study will also investigate whether systematic changes in the underlying body burden distribution have taken place and, if so, account for such changes in the analyses. If the within-person component of variance is large relative to the between-person component, then large numbers of repeated measurement would be necessary to sort out differences among workers. Under these circumstances when small numbers of repeated measurements are collected, epidemiological studies of occupational cohorts relying on these data would be subject to misclassification and a significant loss of power. Thus the impact of intra- and inter-individual variation on the design of health-effects studies will be investigated. Information about the variance components will be used to compare the sampling demands of airborne and biological measures of exposure to a particular contaminant. This comparison should enhance the ability of investigators to select the most appropriate exposure measure when epidemiologic studies are carried out. A secondary goal of the proposed study will be to investigate exposure-biomarker relationships taking into account both intra- and inter-individual variation and serial correlation. This research should provide investigators with a useful and novel method to investigate exposure-biomarker relationships in the future.

Understanding the Healthy Worker Survivor Effect

Researcher: Irva Hertz-Picciotto, Ph.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
(919) 966-7445
Keywords: G-estimation, occupational mortality data, healthy worker survivor effect

Purpose:
To apply G-estimation models to occupational mortality data, and generalize the application to ordinal exposures.

Abstract:
The healthy worker survivor effect tends to attenuate estimates regarding the effect of an occupational exposure. As such, a weak carcinogen may be missed. The G-null test has been generalized via structural nested failure time models known as G-estimation methods, and these models overcome the limitations of the G-null test. This project will: (1) evaluate feasibility and usefulness of the structural nested failure time models from control of the healthy worker survivor effect in occupational studies, (2) determine robustness of G-estimation to varying scenarios of differential job survivorship, and (3) determine in which situations ordinary methods are adequate. Use of methods to control for the healthy worker survivor effect is likely to improve the sensitivity of occupational studies, enabling detection of carcinogens and other toxins that are less potent or are present at low exposure levels. Also, since occupational studies are often used in risk assessments to establish standards for environmental or occupational exposures, this project may have policy ramifications.

Retrospective Exposure Assessment in Industrial Settings

Researcher: Gurumurthy Ramachandran, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(612) 626-5428
Keywords: Estimate, exposure histories, airborne particulates, probability distributions

Purpose:
To develop a framework for obtaining estimates of exposure histories for airborne particulates from limited historical measurements, using subjective expert judgment.

Abstract:
To establish dose-response relationships for diseases caused by long-term exposures to pollutants, it is vital to determine exposures of individuals or cohorts to airborne contaminants. Most existing occupational exposure databases do not contain continuous records of historical exposures to airborne contaminants. These gaps may be filled by using the knowledge base that experts in the field possess. This research to gain estimates of exposure histories for airborne particulates will use expert judgements informed by knowledge of historical plant conditions and work practices, and models describing process-dependent aerosol generation, ventilation, and worker activity patterns. This method will also incorporate knowledge about sampler performance, relationships between different types of measurements, uncertainties in

measurements, and systematic biases. The result of the synthesis will be probability distributions of the exposure of task groups of workers at each past time interval, in the form of an exposure matrix. This matrix can then be potentially used in epidemiological studies.

Correcting for Measurement Errors in Radiation Exposure

Researcher: Xiaonan Xue, Ph.D.
Affiliation: New York University
New York, New York
(212) 263-6614
Keywords: Measurement error, radiation, systematic error, unsystematic error

Purpose:
To develop better methods to correct for radiation exposure measurement error.

Abstract:
In this research, radiation exposure measurement error from differential sources will be classified into two groups: unsystematic error and systematic error. Different models will be developed for these two types of measurement error. A study of workers with detailed dosimeter readings indicating low exposure will be used to evaluate this type of systematic error. Issues for choosing statistical distributions will be determined to model both individual measurement of exposure and cumulative exposure at a longer interval. Methods for correcting radiation exposure measurement errors will be developed. Currently, measurement error is corrected in two steps. In this research, a joint model for measurement error and dose-response relationship will be developed, which leads to a more precise and accurate assessment of risk. The methods for modeling and correcting measurement errors will have application to ongoing and planned worker radiation studies and to a wide range of environmental exposure-response data.

Dermal Absorption Enhancers Affect Organotropism

Researcher: Glenn Talaska, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0519
Keywords: Noncarcinogens, carcinogens, target organ toxicity, risk assessment

Purpose:
To determine whether and how noncarcinogens can alter the target organ effects of a model carcinogen and to develop a risk assessment model for mixtures based on the interaction between carcinogenic and noncarcinogenic components in the whole animal.

Abstract:
When certain mixtures of carcinogens and noncarcinogens are applied topically, the DNA binding of the carcinogens is increased significantly in the lung. Enhancement of dermal absorption and saturation of dermal metabolism are two possible mechanisms where noncarcinogens can facilitate the increased dose of carcinogens reaching internal organs. This research will explore the potential for interactions in acute, sub-chronic and chronic exposure studies using a model carcinogen–benzo(a)pyrene and two noncarcinogens–pyrene and kerosene. The focus of the research will be to determine whether and how noncarcinogens can alter the target organ effects of a model carcinogen and to develop a risk assessment model for mixtures based on the interaction between carcinogenic and noncarcinogenic components in the whole animal. Since millions of persons in occupations are exposed to carcinogenic complex mixtures, these data should be very useful in decreasing the uncertainties of risk assessment concerning these exposures.

Measurement Error Methods for Underground Miner Studies

Researcher: Daniel O. Stram, Ph.D.
Affiliation: University of Southern California
Los Angeles, California
(323) 442-1817
Keywords: Measurement error, radiation, analysis exposure-time-response

Purpose:
To complete work on the development of statistical tools for measurement error problems associated with the analysis of health effects from exposure to radiation and to use these methods in a reanalysis of exposure-time-response in lung cancer mortality among uranium cohorts in Colorado and New Mexico.

Abstract:
The investigators working on this project have been working for three years to develop methods based on hierarchical models for temporal and geographic variation in dose. In addition, they have applied these methods to undertake a thorough review of the mine-year dose assignments for the Colorado cohort. New imputed doses based on the model have been used to fit a variety of basic models for lung cancer mortality in the Colorado plateau cohort and have shown extremely promising results. This work will extend these methods by: (1) encompassing additional dose information concerning the Colorado plateau cohort, (2) extending the analysis of both Colorado and New Mexico mines by fitting more elaborate time-response models, and (3) further developing and applying methods for assessing the influence of shared measurement errors assigned using job exposure matrices to the two cohorts.

• Social and Economic Consequences of Workplace Illness and Injury

The Employment Impact of Workplace Injuries in Five States

Researcher: Leslie I. Boden, Ph.D.
Affiliation: Boston University
Boston, Massachusetts
(617) 638-4620
Keywords: Employment and earnings impact, workplace injuries and illnesses

Purpose:
To assess the employment impact of workplace injuries in five states.

Abstract:
This study will develop standardized methods to measure the impacts of workplace injuries and illnesses on employment and earnings. These can be used in a variety of settings where different data are available. These measures allow more effective targeting of prevention resources. Data from 500,000 injured workers in five states will be used. The study also will quantify the impact on earnings when employers promote rehiring of injured workers. It will, also, measure the differential impact of workplace injuries and illnesses on men and women and on younger and older workers. Finally, it will develop methods for comparing average lost earnings among states that are different in important ways– with disparate industrial mixes, unemployment rates, and so on. This should improve our understanding of how interstate variation in laws, practices, and regulation affect consequences of workplace injuries and illnesses. Both parametric and nonparametric methods will be used to provide unbiased measures of the impacts of interventions.

Adult Asthma as a Predictor of Work Loss and Disability

Researcher: Paul Blanc, M.D.
Affiliation: University of California
San Francisco, California
(415) 476-7377
Keywords: Asthma, statistical estimates, work factors

Purpose:
To provide statistically powerful estimates of the occupational impacts of asthma among adults of working age and the factors that are associated with productivity, wage, and work loss.

Abstract:
To conduct this research, a random sample of pulmonary and allergy specialists initially enrolled 601 persons with asthma identified in patient visit logs. This established panel has completed 45-minute baseline and follow-up computer-assisted telephone interviews. A supplemental sampling frame of persons with asthma identified from family practitioners is in progress using 180 participants. The interviews assess disease severity and other covariables using established survey instruments. Work factors are assessed both by interview and by linking to established job factor matrix schemes. The proposed study will carry out an extended longitudinal follow-up study of this cohort. The analysis will test predictive models for productivity and wage loss and work disability among adults with asthma.

Functional Limitation and Recovery from At-Work Injuries

Researcher: Marion Gillen, Ph.D.
Affiliation: University of California, S.F.
San Francisco, California
(415) 476-1382
Keywords: Questionnaire, work-related injury, health costs, work factors

Purpose:
To test the sensitivity over time of the Health Assessment Questionnaire (HAQ) to changes in function, fatigue, and pain and to capture the economic costs of injury.

Abstract:
The primary hypothesis for this study is that the Health Assessment Questionnaire (HAQ) will demonstrate sensitivity to changes over time in function, fatigue, and pain determined by administering the questionnaire prospectively to workers as a measure of the noneconomic costs of work-related injury. In addition, it will determine the relationship between the HAQ scores, health care costs, and lost days from work as a measure of the economic impact of injuries. The investigators will test the utility of the HAQ as a measure of functional limitations and collect information on pain, fatigue, iatrogenic effects, need for personal assistance, comorbid conditions, and treatment costs. One hundred subjects will be recruited for the study. Only those cases that present with acute traumatic injuries or acute musculoskeletal conditions will be eligible. The HAQ will be repeatedly administered over several months. Sensitivity of the HAQ to changes over time will be analyzed. This study will further test the HAQ's ability to measure functional limitations in injured workers and expand knowledge by collecting information on the noneconomic and economic costs of injuries borne by workers and their families. Clinicians need patient-related measures that capture the patient impact of work-related injuries and that help them develop appropriate return to work programs.

• Special Populations at Risk

Factors Affecting the Health of Employed Pregnant Women

Researcher: Kathryn J. Luchok, Ph.D.
Affiliation: University of Kentucky
Lexington, Kentucky
(606) 323-6065
Keywords: Stress, levels of anxiety, pregnancy, women

Purpose:
To assess the effects of occupational stress, social resources, and non-occupation-specific chronic stressors on employed women's prenatal and postpartum levels of anxiety, depressive symptoms, and functional health; to investigate these effects on pregnancy outcomes of both mothers and infants; and to examine whether these effects vary across racial categories for women within service-clerical-sales-manufacturing categories.

Abstract:
Employed women who are pregnant may be at an increased risk of poor pregnancy outcomes, postpartum depression, anxiety, and poor functional health status if they are exposed to high levels of occupational stress during their pregnancies. It is hypothesized in this study that employed women who experience fewer stressors and perceive their families, friends, coworkers, and supervisors as supportive during the last trimester of pregnancy will have lower postpartum levels of anxiety and depressive symptoms, better functional health status, and better pregnancy outcomes than women who perceive more stressors and less support. A

prospective study population of 168 employed women will be used for this investigation, which will last three years. Data on pregnancy and pregnancy outcomes will be collected from interviews and from medical records. The findings from this study may have implications for changes in the organization of work for pregnant and postpartum women in service-clerical-sales-manufacturing positions. Occupational stress can lead to poor pregnancy outcomes, mental and physical health problems that lead to lost work time, low productivity, and increased use of health and community social services. Better understanding of how these stressors operate during pregnancy and postpartum may have implications for policy changes that save industry and community resources. More importantly, knowledge of these stressors may improve the well-being of working mothers.

Risk Factors for Injury Among Migrant and Seasonal Farm Worker Children

Researcher: Harlan E. Amandus, Ph.D.
Affiliation: Battelle Memorial Institute
Arlington, Virginia
(703) 875-2996
Keywords: Children, injuries, farms, risk factors

Purpose:
To estimate the prevalence of injuries among children of migrant and seasonal farm workers and to evaluate risk factors for injury.

Abstract:
Injuries among migrant farm children are very high. This study will develop information to develop better policies and prevention programs. Five thousand and fifty children to be assessed in this research will be accessed through parents enrolled in the Job Training and Partnership Act job training and emergency support services program. The results of this research will identify populations of migrant and seasonal farm worker children that are at high risk of injury. It will also identify key risk factors (including exposure to hazardous agricultural activities, physical, cognitive, and behavioral risk factors potentially related to injury) that may be modified by intervention to reduce injuries. The study results will provide federal agencies information to make recommendations, policy, and direct future research into interventions development and evaluation.

Wisconsin Childhood Agricultural Safety and Health Intervention

Researcher: Larry J. Chapman, Ph.D.
Affiliation: University of Wisconsin
Madison, Wisconsin
(608) 262-7408
Keywords: Children, intervention, agricultural injury

Purpose:
To develop, implement, and evaluate an intervention to protect children and adolescents from agricultural injury.

Abstract:
This research seeks to reduce childhood and adolescent musculoskeletal and traumatic injuries associated with work in the dairy and fresh vegetable market sectors in Wisconsin. The aims of this project are to: (1) learn about the work that children and adolescents typically perform and what hazards they face, (2) learn what has already been done to improve safety and health among working children and adolescents, (3) evaluate modifications that have been made to better document the type and degree of advantages to profits and safety, and (4) share the results with other state producers and vegetable growers in a public information campaign. This research will be adaptable on a wider scale and be especially relevant to the "traditional agriculture" areas of the North Central states as well as elsewhere in North America. The modification should be easy for farmers to adopt since economic and organizational factors will be included, and there will be a focus on modification that creates a safer and more profitable and efficient workplace.

Childhood Health Outcomes in a Rural Cohort

Researcher: James A. Merchant, M.D.
Affiliation: University of Iowa
Iowa City, Iowa
(319) 335-9823
Keywords: Children, health outcomes, agricultural jobs

Purpose:
To assess health outcome data for injuries, asthma, and suicide/depression among farm and other rural children who frequently work in agricultural jobs.

Abstract:
The Keokuk County Rural Health Study is a prospective study of 1000 households in Iowa. It is comprised of detailed questionnaires, medical examinations, and farm and household environment assessments. Data on over 550 children will be collected by the completion of the study. Preliminary analyses document a significant prevalence of childhood injuries, asthma, airway hyperactivity, and depression. These data will be supplemented with new occupational and environmental data that will be collected for these health outcomes in the second part of the study. It is anticipated that the results of these studies will have direct applicability to children exposed to Midwestern farming operations, but it will also be relevant to children in agricultural settings nationally.

Etiology and Consequences of Injuries Among Children in Farm Households: A Regional Rural Injury Study

Researcher: Susan G. Gerberich, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(612) 625-5934
Keywords: Children, risk factors, injuries, agriculture

Purpose:
To address the etiology and outcomes of agricultural injury in five states.

Abstract:
This five state study, including Minnesota, Wisconsin, North Dakota, South Dakota, and Nebraska, will potentially include 8000 farms and 26,000 people including 8800 children less than or equal to 19 years of age. It provides a unique methodology for collecting data, simultaneously for both risk factors, incidence, and consequences of agricultural injuries. It can serve as a basis for surveillance. Critical risk factors for injuries in children in the farming environment will be identified by incorporating both case-control and case-crossover studies that can be implemented, in concert with data collection on the incidence and consequences of injuries. This will be carried out using the computer assisted telephone interview system and specially designed instruments. All cases and controls less than or equal to 19 years of age will be interviewed to obtain data on the designated exposures, as well as confounding and modifying variables. Follow-up every six months over a period of one year will identify individuals who were injured in the previous six months. The ability to identify the risk factors, incidence rates, and consequences of injury are critical for providing sound scientific data for the development of focused intervention strategies. This approach is essential to reduce morbidity and mortality from injuries in the agricultural community and can be used as a model for other regions in the nation.

Youth Teaching Youth: Are TASK Teen Ready to Teach?

Researcher: Robert Edward Petrea, Ph.D.
Affiliation: University of Illinois
Urbana, Illinois
(217) 333-5035
Keywords: Children, teaching, agriculture, evaluation, curriculum

Purpose:
To evaluate the Illinois Easter Seal Society's - Teaching Agricultural Safety to Kids (TASK) Program.

Abstract:
The popularity of youth teaching safety to other youth continues to rise. However, little research is available to document the effectiveness of using this strategy. This study will evaluate the Teaching Agricultural Safety to Kids (TASK) Program. It will: (1) evaluate the historical and ongoing training process used by the TASK program; (2) observe and appraise the application of TASK training by TASK presenters in elementary classes; (3) describe the beliefs, attitudes, and motivations of Future Farmers of America (FFA) members toward their TASK experience; (4) interpret the findings to improve the TASK program; (5) assess the impact of TASK presentations on the knowledge and comprehension of elementary students; and (6) review the TASK curriculum materials for improvements. Quantitative techniques for this study include descriptive statistics and inferential statistics. Qualitative techniques include content analysis, observations, interviews, and participant perceptions.

Green Tobacco Sickness in Minority Farm Workers

Researcher: Thomas A. Arcury, Ph.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
(919) 962-3512
Keywords: Farm workers, tobacco, risk factors, illness

Purpose:
To understand the nature of Green Tobacco Sickness and the social and biologic factors that influence the risk to minority farm workers for developing this occupational disease.

Abstract:
Green Tobacco Sickness is acute nicotine poisoning following dermal contact with tobacco plants. Most tobacco is harvested in the U.S. by migrant and seasonal farm workers. The study goals are: (1) estimate the incidence of Green Tobacco Sickness (GTS) in seasonal and migrant farm workers employed in tobacco production in North Carolina; (2) determine the risk factors for GTS including physical, environmental, and social risk factors; (3) measure the association of tobacco exposure biomarkers with GTS symptoms and with work- related exposure to tobacco plants, as modified by GTS risk factors; (4) understand farm worker and health care providers interpretations of GTS symptomatology, self-care behaviors, and barriers to prevention and seeking treatment; and (5) disseminate findings concerning GTS risk factors to farm workers and farm workers service providers. This research will include: (1) surveillance of 36 farm worker labor sites for one year; (2) a clinical case-control comparison of 60 cases; (3) in-depth interviews with farm workers and health care providers to delineate farm worker interpretations of GTS symptomatology, self-care providers, and barriers to prevention and treatment; and (4) a program to disseminate findings about GTSs risk factors directly to farm workers and those who provide services to this occupational group.

Empirical Derivation of Work Guidelines for Youth in Agriculture

Researcher: John R. Wilkins, III, Dr. P. H.
Affiliation: Ohio State University
Columbus, Ohio
(614) 293-3897
Keywords: Children, agricultural hazards, guidelines, work

Purpose:
To develop work guidelines that parents/caregivers can use to protect children working in agriculture.

Abstract:
This study of rural youth will: (1) develop multivariate risk prediction models of agricultural injuries among children and adolescents exposed to agricultural hazards, (2) evaluate with ergonomic methods the potential for worker-task mismatch among youth who work in agriculture, and (3) derive work guidelines with medical decision-making methodologies that parents and other care givers can use to judge the age- and developmental-appropriateness of job/chore assignments. Risk factors to be investigated include

chronological age, developmental competence, anthropometric and strength characteristics, and selected psychosocial/behavioral factors such as risk-taking behavior or risk perception. Caregiver perceptions will also be considered. Data will be collected from the children participating and their primary caregivers. The final multivariate risk prediction models will be translated into practical work guidelines that parents/caregivers can use in assigning work to children on farms.

Work and Social Environments: Urban Youth and Cardiovascular Disease Risk

Researcher: Sheila T. Fitzgerald, Ph.D.
Affiliation: Johns Hopkins University
Baltimore, Maryland
(410) 955-4082
Keywords: Young adult, personal stress, job stress, cardiovascular effects

Purpose:
To evaluate the contributions of the combined and separate effects of occupational and social environments on adolescents as they mature and develop into adulthood with a focus on the impact of job strain and the characteristics of cardiovascular disease risk.

Abstract:
Five hundred and twenty-five multiracial urban adolescents previously studied will be recruited for this new research. The impact of the work environment will be examined in the context of other social relations including family, peer group, neighborhood, and school. A primary focus of this study will be on the impact of job strain and the characteristics of work on cardiovascular risk, including measures of blood pressure both resting and ambulatory, serum cholesterol, and body composition. Jobs characterized by high strain are expected to be associated with higher resting and ambulatory blood pressure. A second set of analyses will test the hypothesis that emotional vulnerability demonstrated in high school predicts both perception of job strain and cardiovascular risk. Potential moderating effects of social support from family, friends, coworkers, supervisors, and neighborhood environment on cardiovascular risk will be examined.

Childhood Injuries in Washington State Agriculture

Researcher: Bruce Alexander, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(206) 685-8317
Keywords: Children/adolescents, agricultural injuries, work, prevention

Purpose:
To evaluate determinants of agricultural injuries in children and adolescents in Washington state.

Abstract:
The distribution and determinants of pediatric agricultural injuries have not been adequately characterized. The principal objectives of this study are to: (1) enumerate and describe agriculture related pediatric injuries treated at five emergency departments, three farm worker clinics, and one large pediatric practice in the valley; (2) compare the cases to suitable neighborhood controls with respect to the child's age, gender, size, work history, recent activities, activity at time of injury, indicators of fatigue, school performance, and time lost from school or work for the child or parent; and (3) evaluate the effect of transient exposures, including indicators of fatigue, work tasks, or activities, on the risk of injury in a case-crossover analysis. Injury cases will be prospectively identified by routinely reviewing records at the participating emergency departments and clinics. The children/adolescents with agriculture related injuries and their parent or guardian will be recruited to participate in the study. Ultimately the results of this investigation should contribute significantly toward directing future injury prevention efforts in pediatric populations living and working in agricultural environments.

Agriculture Disability Awareness and Risk Education

Researcher: Deborah B. Reed, Ph.D.
Affiliation: University of Kentucky
Lexington, Kentucky
(606) 323-6396
Keywords: Youth, permanent disabilities, farms, prevention

Purpose:
To prevent permanent disabilities in farm youth.

Abstract:
The prevention of permanent disabilities among farm youth is not considered in many prevention programs. The research described here seeks to address this problem in a demonstration project using simulations to focus on three disabilities (amputation, hearing loss, and long-term effects of chemical exposure). The objective is for students to increase their knowledge of the consequences of cumulative and catastrophic injury, better understand the economic and personal cost of permanent disability, and make specific injury-reduction attitudinal and behavioral changes. Two types of simulations will be used: a narrative exercise and a set of physical devices that simulate disability through experimental learning. The intervention simulation will be developed using focus groups composed of farm youth. The second part of the study will concentrate on the testing and implementation of the simulations. The benefits of the proposed project are: (1) the focus on disability prevention rather than global injury prevention; (2) the testing of different formats for administering simulations; (3) the generalizability of the results across different states, cultures, and agricultural commodities; and (4) the longitudinal follow-up of randomly selected farm youth to determine the degree to which training is effective over time.

Work Guidelines: Evaluation of Dissemination Methods

Researcher: Barbara L. Marlenga, Ph.D.
Affiliation: Marshfield Medical Research and Education Foundation
Marshfield, Wisconsin
(715) 389-3021
Keywords: Children, work guidelines, farms, evaluation

Purpose:
To assess what kind of interventions will influence parents to use/apply new work guidelines for children living and working on farms.

Abstract:
The North American Guidelines for Children's Agricultural Tasks will assist parents and others in assigning appropriate and safe tasks for children 7-16 years living and/or working on farms in North America. This study will compare the efficacy of the standard dissemination strategy with an enhanced, multiphased dissemination approach in influencing parents' knowledge and use/application of child development principles and work guidelines in assigning their children to jobs on the farm. A random sample of farms will be selected from Wisconsin, California, and Ontario, Canada. Baseline data will be collected by telephone interview prior to the intervention. Follow-up of the experimental group will occur in three months after the intervention. Fifteen months post-intervention, a telephone interview will be conducted with both experimental and control groups. Data from telephone interviews will be analyzed to assess differences between groups. The perceived effectiveness of the various components of the enhanced intervention will also be analyzed. During the second year of the project, focus groups will be conducted with minority farmers in California and two other sites to collect qualitative data necessary to design interventions specific to these special populations.

Enhancing Agricultural Safety and Health Through Education

Researcher: David L. Parker, M.D.
Affiliation: Minnesota Department of Health
Minneapolis, Minnesota
(612) 623-5220
Keywords: Adolescents, curricula, work-related hazards, agriculture, schools

Purpose:
To measure the effect on student knowledge and behavior of a new curricula concentrating on agricultural safety and health.

Abstract:
The research will: (1) develop and implement curricula for adolescents that focus on work-related hazard recognition and problem solving skills within production agriculture; (2) evaluate whether the implemented curricula have increased knowledge about agricultural injuries/fatalities, changed behaviors concerning agricultural/worker health and safety, and increased hazard recognition and control; and (3) establish ongoing community-wide support for the curricula. Five rural schools have agreed to participate in the study. Curricula materials will concentrate on student ability to resolve diverse health and safety problems in a variety of agricultural and work settings. This material will be integrated into the school curriculum. The study was designed to measure the effect of the new curricula on student knowledge and behavior. Process and outcome evaluations will be used to assess the intervention. In the last year of the program, the new curricula will be offered to all county schools. The results are potentially applicable to a broad range of agricultural communities throughout the U.S.

Evaluating Ohio's Tractor Certification Program

Researcher: J.R. Wilkins, III, Dr. P.H.
Affiliation: Ohio State University
Columbus, Ohio
(614) 293-3897
Keywords: Youth, tractor, certification, evaluation

Purpose:
To evaluate the extent of participation in the Ohio Tractor Certification Program and determine if the program results in enhanced safety protection for farm youth.

Abstract:
This research consists of two studies. The first study will determine the number of youth who are eligible to take the Ohio Tractor Certification Program (OTMCP) by conducting a pre-assessment screening in a minimum of 10 randomly-selected counties in Ohio. In the second study, youth in all counties in Ohio that plan to offer the OTMCP will be screened for eligibility to participate in the study. To be included, the person must be a 4-H member or a vocational agriculture student, between the ages of 13-16, and currently operates or will operate a tractor or other farm machinery before age 17. A questionnaire measuring safety knowledge, attitudes, and behaviors will be administered four times during the course of the OTMCP training. Data will be analyzed to determine how well training is retained by students regarding change in safety knowledge behavior and increased protection.

Children's Injuries on Kentucky Beef Cattle Farms

Researcher: Steven R. Browning, Ph.D.
Affiliation: University of Kentucky
Lexington, Kentucky
(606) 323-4602
Keywords: Children, injuries, farms, characteristics, risk factors

Purpose:
To characterize the work tasks and exposures of children on cattle farms and to explore the risk factors for these children.

Abstract:
Each year a significant number of children who live on farms suffer injuries or death. This research will be conducted as a three-year longitudinal cohort study of children. A cohort of 999 children identified in a previous study will be used for this research. The children will be reinterviewed at the beginning of the study and will have repeated assessment every six months for all injury events that require medical attention or treatment or lead to a loss of time at work or school. Subjects will be divided into two groups those on beef cattle farms and those on tobacco or grain farms. The study will examine selected child characteristics (physical size, risk perception, family role) and parental influences (supervision, prohibitions on work tasks, and assessment of the child's ability) as risk factors for agricultural injuries. In addition, detailed data collection efforts regarding farm management practices, including procedures concerning the handling of cattle and characteristics of

confinement facilities, are planned for the beef cattle farms. This study is intended to provide: (1) needed data for the formulation on age and developmentally appropriate guidelines for children's work on beef cattle farms, (2) ideas for engineering and technologic improvements regarding cattle handling procedures, and (3) the design of equipment and confinement facilities for these farms.

Ergonomic Aspects of Older Workers' Postural Balance

Researcher: Amit Bhattacharya, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0503
Keywords: Age, neuromuscular performance, postural balance, work performance

Purpose:
To investigate the influence of age on workers' neuromuscular performance and ability to maintain safe upright postural balance during task performance.

Abstract:
There has been in increase in the workforce in the U.S. consisting of workers from 45-64 years. This research will assess the abilities and limitations of this growing segment of the workforce. One-hundred and thirteen workers will be used to assess neuromuscular performance and the ability to maintain safe upright postural balance during task performance, such as reaching and bending to pick up objects and walking with weights in hand on various types of surfaces with various kinds of shoe wear. The results of the study will expand the knowledge obtained for younger workers to include workers up to age 75 years. Intervention strategies for fall/loss of balance prevention can be developed from the results of the present study. Also, the findings from this research will provide scientific data to determine whether older workers are capable of performing tasks on ramp surfaces under various combinations of risk factors and whether handrails are needed on ramps that are slippery.

Injury and Musculoskeletal Disorders Among Aging Workers in an Industrial Workforce

Researcher: Mark R. Cullen, M.D.
Affiliation: Yale University
New Haven, Connecticut
(203) 785-6434
Keywords: Older worker, injuries, risks, job characteristics, musculoskeletal disease

Purpose:
To assess the occupational safety and health issues of older workers.

Abstract:
This research will involve multilevel analyses of a group of health, injury, administrative, and environmental databases. It will also include the collection of some additional data regarding work organization. Specifically, the study will determine: (1) the frequency of injury and musculoskeletal disease (MSD) at the job specific level in older workers, (2) the severity of injuries and MSDs for each job type for older workers, (3) the characteristics at the job-level with higher and lower relative risks for older workers compared to younger workers, (4) the potential modifying effects of demographic facts and health status on injury and MSD risk among older workers at the individual level, and (5) the potential modifying effect of work organization and culture on risks for older workers at the location levels. The results of these analyses will be used to develop strategies for subsequent intervention trials in this organization, and industrial workforces in general.

Work Injuries and Illnesses in Older Workers: Causes, Consequences, and Prevention

Researcher: Glen S. Pransky, M.D.
Affiliation: University of Massachusetts
Worcester, Massachusetts
(508) 856-4159
Keywords: Older workers, occupational conditions, injuries

Purpose:
To study the long-term outcomes in older workers with occupationally-related conditions.

Abstract:
This research is a prospective, population-based study of older workers with occupationally-related conditions. Data obtained from the state will be used to identify workers over 55 who have sustained an occupational injury or illness. Workers will be contacted 2-6 weeks after the event and will complete a mailed baseline questionnaire with prospective follow-up at 3 and 9 months after the initial questionnaire. A comparison younger worker with similar affected body parts and gender will be selected for each case. Over 1000 workers older than 55 will be recruited and the same in the comparison group. The prospective design will allow evaluation of causal relationships and avoid recall bias. Precise estimates can be developed and specific subgroups, such as those in high-risk industries with particular types of injuries or who have chronic health conditions, can be examined from the use of the large cohort.

Work-Related Risk Factors Associated with Falls During Pregnancy

Researcher: Grace Lemasters, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0045
Keywords: Pregnant, workers, falls, injuries, epidemiologic cohort

Purpose:
To determine the prevalence rates of falls and fall-related injuries and to identify the occupational and non-occupational risk factors leading to falls and fall-related injuries at the workplace.

Abstract:
There are no surveillance methods in place to monitor falls and injuries of pregnant workers. For this group, it is hypothesized that: (1) risk factors associated with falls will be significantly

different from those occurring elsewhere, (2) the rate of falls and injuries among those in health service and trade will be higher than other occupations, and (3) the rate and severity of injuries will be higher in the workplace compared to elsewhere. This epidemiologic cohort study will survey 3627 women using a birth certificate database record system. Women will be identified within 4-6 weeks after delivery. Their work history during pregnancy, occupational and non-occupational risk factors, and pregnancy history related to falls and injuries will be collected. A total design system using both telephone and mailed questionnaires to contact participants is proposed. This will involve a partnership with local public health officials. This study provides a model program for surveillance of this vulnerable and high-risk population of pregnant workers.

• Surveillance Research Methods

Occupational Cancer Surveillance Through Record Linkage

Researcher: Debora J. Boyle, Ph.D.
Affiliation: Minnesota Department of Health
Minneapolis, Minnesota
(612) 623-5765
Keyword: Cancer, linkages, cohorts, surveillance

Purpose:
To determine if and when cancer risks can be estimated by establishing record linkages between statewide cancer surveillance systems and occupational cohorts.

Abstract:
This research will: (1) determine the feasibility of using statewide cancer surveillance systems in the evaluation of cancer incidence within occupational cohorts, (2) compare and contrast the relative merits of standardized incidence ratios with standardized mortality ratios as determined from cancer surveillance systems incidence data and death certificate mortality data, and (3) provide recommendations concerning how and when statewide cancer surveillance systems should be used in the evaluation of occupational cohorts. This study will assess the utility and limitations of cancer surveillance systems as a tool for occupational cancer research. Recommendations for use will be developed.

Injury and Illness Surveillance in Migrant Farm Workers

Researcher: Sharon P. Cooper, Ph.D.
Affiliation: University of Texas
Houston, Texas
(713) 500-9460
Keywords: Farm workers, children, surveillance, risk factors

Purpose:
To develop a surveillance system and to identify risk factors for adverse health outcomes in a population of migrant farm worker children and their families.

Abstract:
Little is known about the magnitude of injury and illness in the migrant farm worker population. This research will establish a surveillance system and estimate the incidence rate of occupational injuries, the prevalence of illness symptoms, and workplace hazards. In addition, this study will attempt to identify risk factors for adverse health outcomes in a population of migrant farm workers' children and their families. The research will consist of a two-year cohort study. Participants will be identified through a computerized system in the school district designed to track school progress of children. A survey will be used to gather baseline information about intention to migrate and health status. Two hundred and fifty families will be selected and asked to maintain a work diary. A questionnaire will obtain information on risk factors that may predict injury and illnesses (demographic, work, psychosocial, medical care, childcare, injury and illness questions). Agreement issues between mother/child and husband/wife will also be assessed. An advisory group will advise on relevant issues and build a coalition for the future. This research may be helpful for doing surveillance of migrant farm workers in the future.

Laboratory Reporting for Pesticide Illness Surveillance

Researcher: Rupali Das, M.D.
Affiliation: Public Health Institute
Oakland, California
(510) 622-4406
Keywords: Cholinesterase test, pesticides, direct reporting, surveillance

Purpose:
To develop a method for direct laboratory reporting of blood cholinesterase test results and to assess the efficacy of this system as a method for surveillance of illness due to cholinesterase-inhibiting pesticides.

Abstract:
Three laboratories will be requested to report the results of all cholinesterase tests performed to the California Department of Health Services. Occupational pesticide illness cases will initially be identified through telephone follow-up of health care providers. Laboratory forms will be developed to facilitate the identification of occupational pesticide-related cholinesterase tests and the forms will be tested for physician acceptance and compliance. If compliance is demonstrated, suspected occupational pesticide-related cases will be identified through laboratory reports, not solely through physician follow-up. All suspected cases will be interviewed to assess issues related to pesticide illness and exposure at work. Surveillance data gathered by the research project will be evaluated for its ability to detect additional occupational pesticide illness cases. Underreporting pesticide related illness will be assessed, and the data will be used to identify populations at risk for illness due to cholinesterase inhibiting pesticides and work associated with the illness. If this research contributes significantly to occupational pesticide illness surveillance, laboratory-based reporting may be introduced as a requirement in legislation.

National Institute for Occupational Safety and Health Surveillance Research Methodology

Researcher: David L. Parker, M.D.
Affiliation: Minnesota Department of Health
Minneapolis, Minnesota
(612) 676-5220
Keywords: Work-related trauma, surveillance, definition, issues

Purpose:
To establish a surveillance system with a set of uniform definitions for serious work-related traumatic injury as well as establish surveillance systems to facilitate understanding the magnitude, distribution, etiology, outcome, and trends of serious work-related trauma.

Abstract:
A significant number of workers are killed or injured each day in the United States. There is a need to develop better surveillance to deal more effectively with work-related traumatic injuries. This research will: (1) develop, test, and refine a definition for serious work-related trauma; (2) determine the feasibility of establishing a surveillance system for serious work-related trauma by linking existing sources of information, such as workers' compensation data, etc.; (3) determine the reporting biases found in data compiled from different reporting sources; and (4) determine the magnitude, distribution, etiology, and outcome of serious work-related trauma. This research will establish a multisource surveillance system consisting of the Minnesota Department of Health Trauma Registry and the Minnesota Department of Labor and Industry. A definition of serious trauma will be developed. Data completeness and referral patterns will be evaluated. Data analysis will consist of descriptive statistics, timeliness, and computation of incidence rates by industry.

• Traumatic Injuries

Work-Site Intervention to Reduce Work-Related Assault Injury

Researcher: Jess F. Kraus, Ph.D.
Affiliation: University of California
Los Angeles
(310) 825-7066
Keywords: Violence, high risks, intervention

Purpose:
To introduce an intervention program in high-risk businesses for the purpose of reducing violence in the workplace.

Abstract:
Homicides and assaults have increased in the workplace. This study is concerned with introducing preventive counter-measures in the work setting. This research will: (1) identify specific risk factors for work-related assault in high-risk businesses, (2) establish an ongoing surveillance system to measure work-related assault incidents, (3) design and implement a business-specific educational intervention program, and (4) measure process and outcome effectiveness of the intervention in reducing workplace assault injuries. This is a community-based program. The results of the study will determine the success of the program and what parts of the program were most effective.

Implementing Behavior-Based Safety for Mining Operations

Researcher: E. Scott Geller, Ph.D.
Affiliation: Virginia Tech
Blacksburg, Virginia
(540) 231-6223
Keywords: Guidelines, evaluation, safe work, mining

Purpose:
To develop a set of guidelines and a comprehensive evaluation system that will increase safe work practices in the mining industry.

Abstract:
This research will derive cost-effective procedures and guidelines for increasing miners' safe behaviors and reducing miners' at-risk behaviors. It will employ systematic analysis of intervention methods implemented and evaluated at two mining facilities and a comprehensive safety culture survey. This research will demonstrate the injury-prevention potential of employee-driven behavior-based safety for mining operations. Specifically, the following will be developed: (1) evaluation procedures to measure process progress and outcome benefits; (2) practical measures and methods to assess behavior and attitude change and estimate culture readiness to actively care for safety; and (3) property damage metrics as predictors of injury rates and indicators of intervention effectiveness. The primary deliverables are: (1) training and education materials for effectively teaching behavior-based safety to miners, (2) specific guidelines for implementing and maintaining a successful behavioral observation and feedback process throughout a mining culture, and (3) a set of procedures for using property damage as an evaluation tool both to predict injuries and assess occupational safety performance. This is a two year program. During Year 1, a behavior based safety process will be developed for the mining operations. In Year 2, behavior-based safety will be taught and implemented at two mines. Controls will be recruited from two mine facilities.

Etiology of Injury in Drywall and Residential Carpentry

Researcher: Hester J. Lipscomb, Ph.D.
Affiliation: Duke University
Durham, North Carolina
(919) 286-3232
Keywords: Injury investigations, work-related injury, carpenters, risk factors, back disorders, loss of work time

Purpose:
To test the utility and feasibility of active injury investigations in identifying causes of work-related injury among a large cohort of residential and drywall carpenters and to explore specific risk factors for occupational back disorders that result in prolonged loss of time from work.

Abstract:
Construction workers have high rates of work-related injuries. This research seeks to determine if active injury investigations can identify causes of work-related injury among carpenters and specific risk factors for back disorders that result in prolonged loss of time from work. The investigators will: (1) identify a cohort of drywall and residential carpenters to participate in a prospective study of the etiology of workplace injuries; (2) develop methods for reporting injuries, systematic collection of data from injury investigations, and analyses of both coded and descriptive data; (3) conduct both rate-based and case-based analyses of injuries among the defined cohort of drywall and residential carpenters; and (4) demonstrate the use of these prospectively collected data in exploring risk factors for prolonged loss of time from work following back injury using a case-control design.

Impact of Time and Self-Contained Breathing Apparatus Tank Utilization on Injury Prevention in Firefighters

Researcher: David J. Prezant, M.D.
Affiliation: Montefiore Medical Center
Bronx, New York
(718) 920-6054
Keywords: Time, injuries, prevention, firefighters

Purpose:
To assess the impact of exposure duration and the use of self-contained breathing apparatus on injury prevention in firefighters.

Abstract:
Emphasis on reducing firefighter injuries and fatalities has concentrated on improvements in personal protective equipment (PPE) to prevent exposures to heat, smoke, and toxins. The benefit of improved PPE on reducing smoke inhalation and burn injuries is undeniable and long overdue. Despite improvements, duty injuries and fatalities have remained remarkably constant over the last five or more years. Also, firefighters now operate at the fire scene for longer periods of time. Firefighters work at near maximum exertion, and overexertion occurs with longer, uninterrupted work time at the fire scene. Overexhaustion is clearly a major risk factor for injuries and fatalities. There are no known fire departments that monitor and control the time that firefighters work uninterrupted at the fire scene. It is believed that firefighting Standard Operating Procedures must change to include time control as a primary factor to ensure firefighter safety and reduce injuries.

A Case Crossover Study of Occupational Hand Injuries

Researcher: Murray Mittleman, M.D., Ph.D.
Affiliation: Harvard University
Boston, Massachusetts
(617) 632-7653
Keywords: Hand and finger injury, workplace factors, case-crossover study

Purpose:
To conduct a case-crossover study of the association between workplace factors and occupational traumatic injury to the hand and fingers.

Abstract:
Occupational upper extremity trauma is an extremely common yet understudied problem with few case-control studies in the literature. The case-crossover method is well-suited to study these problems. This research will evaluate: (1) work equipment factors including unusual performance of equipment or tools and the use of gloves; (2) work practices such as performing an uncommon work task or using an unusual work method; and (3) worker-related factors including fatigue, feeling ill, being rushed, and being distracted. In addition, an evaluation will be made of the industrial sector, specific occupation, and worker characteristics including gender, age, left or right handedness, job experience, race/ethnicity, and hand injury history as modifiers of the relative risks observed. Preliminary data indicate a 5.8 fold increase in risk of occupational traumatic injury to the fingers or hand when the worker is using an unusual work method compared to standard work practice. Successful completion of this study will identify potentially modifiable factors that increase the risk of occupational hand injury. This knowledge will facilitate the development of specific interventions designed to reduce the incidence of these injuries.

A Study of Risk Factors for Violence Among Nurses

Researcher: Susan G. Gerberich, Ph.D.
Affiliation: University of Minnesota
Minneapolis, Minnesota
(612) 625-5934
Keywords: Nurses, work-related violence, risk factors, case-control

Purpose:
To identify the magnitude of work-related violence within the nursing profession and to identify specific risk factors.

Abstract:
Work-related violence is a major problem. There is a serious deficit in the knowledge of nonfatal work-related violence and the associated risk factors. This study will focus on the relation between work-related violence in a cohort of registered and licensed practical nurses. Areas to be investigated are: personal exposures including patient contact hours, workload, shifts worked, illness/injury history including prior work and non-work-related assault injuries, use of alcohol, tobacco, other drugs, and demographics. Also, environmental situations/exposures in the workplace such as types of hospitals/department/speciality wards, staffing patterns, management protocols, physical environment (lighting, barriers, room configurations), general social environment, patients/relevant diagnoses /hospitalization duration, and demographics will be evaluated. Initially, a survey will be sent to a random selection of nurses who worked in the state of Minnesota during a 12-month period to identify persons who did and did not experience work-related events meeting the definition of violence. A nested case-control study will be used to examine the relation between potential risk factors and work-related violence. A questionnaire will be sent to the cases and selected controls to obtain data on workplace exposures including the characteristics of nurses and significant others in the workplace and surrounding environmental factors. From this effort, better specific prevention and control strategies can be developed.

Effects of Musculoskeletal and Sensory Degradation due to Aging on the Biomechanics of Slips and Falls

Researcher: Jeffrey C. Woldstad, Ph.D.
Affiliation: Texas Tech University
Lubbock, Texas
(806) 742-3543
Keywords: Older workers, walking, slips, falls

Purpose:
To investigate changes in walking and the ability to recover from slips due to increase in age.

Abstract:
Slip and fall accidents are a problem in industry because of the human suffering and economic losses. The investigators hypothesize that increasing the work demand will affect the ability of older subjects to maintain balance on the slippery surface more than their younger counterparts. This research will measure how deterioration of muscular strength and sensory function among older individuals affect the biomechanical parameters of slip and fall accidents under normal and abnormal conditions. Floor surfaces will be changed without subjects knowing this has occurred. Biomechanical parameters measured will include stride length, heel, velocity, ground reaction force, slip distance, and the velocity of the center-of-gravity of the body during the heel contact phase of the gait. A sensory organization test will be performed on subjects prior to the experiment to determine proprioceptive, visual, and vestibular function. Isometric and isokinetic strength tests will evaluate leg strength. This research will provide a better understanding of gait characteristics of different age groups as they walk on slippery floor surface and the effect of work demand on biomechanical parameters of slip and fall accidents. The results will help engineers to design better work environments and jobs to reduce the incidence of slips and falls for an aging workforce. It will also provide information for possible intervention strategies for improving dynamic equilibrium in older workers.

Electrical Arc Injury Parameters and Prevention

Researcher: Mary Capelli-Schellpfeffer, M.D.
Affiliation: University of Chicago
Chicago, Illinois
(773) 702-1633
Keywords: Computerized 3-dimensional models, electrical arc, blast conditions, workers

Purpose:
To develop computerized 3-dimensional (3-D) models for electrical arc events and their use in severity rating blast conditions for planning triage and prevention.

Abstract:
There are significant injuries, deaths, accidents, and economic losses associated with electrical exposure to electrical workers. This project will use modeling to theoretically recreate electrical and workplace experimental conditions. Three-dimensional simulations to determine the interaction of acoustic forces and workers during electrical arc events will be completed. Then, a severity rating of blast conditions based on simulation results is to be piloted against 500 electrical incidents. This project is essential to address the lack of data and analysis concerning the interaction of acoustic forces and workers during electrical arc events. This research is important to develop treatment and prevention strategies that can be enhanced with applied technical knowledge in medicine, engineering, and safety management.

Homicide During Robbery: A Case Control Study

Researcher: Dana P. Loomis, Ph.D.
Affiliation: University of North Carolina
Chapel Hill, North Carolina
(919) 966-2251
Keywords: Homicide, robbery, workplace, risk factors

Purpose:
To determine workplace and risk factors for workplace robbery-homicide.

Abstract:
The majority of occupational homicides are the result of robbery or attempted robbery in the workplace. This study will compare workplace robberies that result in homicide (cases) to robberies that do not result in homicide. Cases will be identified through the state medical examiner system. For every case, two controls will be selected from investigations of workplace robberies, not resulting in homicide, conducted by the same law enforcement agency that investigated the case. This study will use and extend the successful methodologies, collaborations, and databases developed in connection with recent studies of occupational injury and homicide. The study will make a significant contribution to our knowledge about how best to reduce the incidence of occupational robbery-homicide.

Occupational Knee Injury and Disability in the U.S. Army

Researcher: Sandra I. Sulsky, Ph.D.
Affiliation: University of Massachusetts
Amherst, Massachusetts
(413) 545-2187
Keywords: Occupational disability, work and nonwork factors, interrelationship

Purpose:
To elucidate the determinants of occupational disability and the interrelation between work and nonwork factors.

Abstract:
This research is a case-control study of severe knee injuries and discharge from the Army for knee-related disability nested within the cohort of all enlisted personnel on active duty in the U.S. Army between 1980-1997. These research will address the questions that follow: (1) What are the risk factors for severe knee injury? This includes personal and occupational characteristics that increase the risk of knee injuries. From this information, pre-injury risk factors can then be the impetus for intervention programs that will reduce the risk of future injuries. (2) What are the determinants of discharge from the U.S. Army for knee injury?

Studying all knee conditions severe enough to lead to disability discharge will identify factors that operate both before and after injury. Post-injury factors relate to the likelihood of successful recovery and the likelihood of being granted disability benefits. (3) What are the differences between injuries that lead to disability discharge and those that do not? Comparing individuals with severe knee injuries who are discharged with those who are not discharged but have similar injuries will allow for the identification of post-injury factors predictive of disability. This research will help to identify which risk factors for injury are also determinants of disability discharge and identify which determinants of disability discharge are not risk factors for injury.

Postural Stability Effects in Low Seam Mining Tasks

Researcher: Amit Bhattacharya, Ph.D.
Affiliation: University of Cincinnati
Cincinnati, Ohio
(513) 558-0503
Keywords: Postural stability/balance, mines, falls, slips

Purpose:
To collect information on postural stability/balance for material handling in underground mines.

Abstract:
Information about material handling in a stooped posture and dynamic stooped posture while exposed to individual and/or combined ergonomic risk factors commonly found in underground mines does not exist. This research will collect information in a series of experiments with mine workers. In this research project, experimental conditions (accompanying risk factors such as restricted work postures, task type, surface slipperiness, surface unevenness, and environmental lighting and glare) will be rank-ordered for postural instability and/or loss of balance. Slips/falls experienced during the performance of simulated industrial tasks will allow determination of the relationship between measures of postural instability and/or loss of balance and actual incidence of slips/fall in the simulated environment. The results will provide enhancement to the existing statistical model of prediction regarding postural instability associated with workplace risk factors encompassing environmental job task factors.

Slip, Trip, and Fall in Construction and Transportation

Researcher: Michael L. Peterson, Ph.D.
Affiliation: Colorado State University
Fort Collins, Colorado
(970) 491-8502
Keywords: Engineering controls, slips, trips, falls, construction, transportation

Purpose:
To develop engineering controls to reduce slips, trips, and fall injuries in the construction and the transportation industries.

Abstract:
The focus of this effort is to develop a general understanding of the mechanisms of falls and slips on an unimproved surface. If these injuries can be controlled through engineering controls, future work will be directed toward testing of these controls. Information on the mechanisms of falls in this environment is currently limited. Possible engineering control approaches include specific work boot sole designs for particular types of soils to modification of soil modulus and strength through the addition of fibers. In both cases, the costs would be modest for a number of applications and could have significant financial impact, particularly when viewed from the perspective of a human capital approach. Tests will be performed and an existing model extended to make it possible to predict the impact of some of the engineering controls on the mechanics of walking. In addition, a small scale study will be performed to determine if the mechanics of walking are impacted by surface conditions.

Cooperative Agreements

• Emerging Technologies

Respiratory Exposure Hazards in Composting

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Agriculture, dust bioaerosols, airborne contaminants, respiratory disease, industrial hygiene, OSHA, control technology

Purpose:
To characterize the exposures and controls in the agricultural composting industry.

Abstract:
In this project, descriptive information will be developed regarding: (1) exposures to airborne contaminants such as dusts, bioaerosols, and gases associated with composting operations and (2) control technology efforts aimed at reducing exposures and preventing respiratory disease. The results from this study will provide data for future investigations.

• Infectious Diseases

Evaluation of Health Care Worker Glove Protection during Surgery

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH
Keywords: Gloves, stability, degradation, fatigue, viral permeability

Purpose:
To evaluate the degradation characteristics of medical gloves.

Abstract:
Health care workers are reluctant to use substitutes for latex gloves until studies demonstrate that the substitutes are equally protective. This will be an observational study of puncture and tear resistance of latex versus nitrile gloves and the effect of various chemicals and storage conditions on gloves. There are three parts to this research project. The first investigations will address glove stability. This will be conducted by subjecting five different medical gloves to four different temperatures for a period of time. This study will predict the shelf life of each type of glove at specified temperatures. The second study will address the degradation effect of chemical or biological materials on the same five glove types subjected to stretch and release cycles up to six hours. The principal endpoints are changes in the mechanical properties of the membranes as indicated by tensile properties and tear strength of treated and control gloves. The third study will evaluate the same five glove types for fatigue to mimic anticipated glove use. Viral permeability will be measured on these fatigued samples. Fatiguing and viral transmission testing will also be conducted on samples of gloves aged in the first part of the study addressing glove stability.

A Program to Estimate the Risk of Occupational Infectious Diseases in State Prisons

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Health care workers, bloodborne diseases, prison, prevention strategies

Purpose:
To quantify risks to prison health care workers for developing occupational infectious diseases in state prisons.

Abstract:
This project will quantify the risk of prison health care workers for occupational transmission of bloodborne pathogens and tuberculosis. It will also evaluate the success of prevention strategies in the unique prison setting where custody and care issues must be weighed.

• Intervention Effectiveness Research

Community Partners for Healthy Farming (CPHF): Intervention Research

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Evaluation, intervention research, community-based programs, agriculture

Purpose:
To evaluate intervention research conducted under the community based project Community Partners for Healthy Farming.

Abstract:
Community Partners for Healthy Farming-Intervention Research (CPHF-IR) will expand NIOSH's community-based intervention efforts through a series of cooperative agreements for four years to study potentially generalizable interventions related to selected hazards, illnesses, or injuries which, because of frequency, preventability, or other factors, are ripe for such efforts. CPHF-IR is an outgrowth of previous CPHF-IR, CPHF-Surveillance, and other NIOSH research and surveillance efforts. In these cooperative agreements, community-based and potentially generalizable interventions will be evaluated. These interventions may have been previously developed but are in need of implementation and evaluation, or they may need to be newly developed. The results of this research give valuable guidance to the best use of limited resources for local, community-based, and national intervention efforts and will be published in appropriate peer-reviewed and public forums.

• Organization of Work

Preventing the Health and Performance Consequences of Downsizing/ Reorganization

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Negative consequences, health, performance, downsizing /reorganization, employees

Purpose:
To reduce the negative health and performance consequences of downsizing/reorganization among those employees who retain their jobs.

Abstract:
In FY97, site visits were made to three Department of Energy locations, and focus groups were completed to identify the nature and range of health and performance consequences of downsizing. Common themes mentioned during focus groups included anxiety, guilt, low morale, job dissatisfaction, high workload, and poor work performance. The first phase of the project involves identifying key organizational factors that influence "survivor" reactions to downsizing/reorganization, and formulating best practice guidelines for use by companies to reduce the negative health and performance consequences. The project addresses two key questions: (1) what are the health and performance effects of downsizing/ reorganization on job survivors and (2) can we identify best practices that result in fewer adverse health and performance consequences?

The project involves both extramural and intramural work. Extramural work is being accomplished via a cooperative agreement with Boston University to study downsizing in the nuclear defense industry (Department of Energy sites) and to identify those practices that reduce negative health and performance consequences.

Intramural work consists of the collection of productivity and worker well-being data by the University of Maryland from nine large U.S. manufacturing companies that have used different processes to downsize or reorganize in the past five years. A final

report was received from the University of Maryland indicating that health and performance consequences were apparent regardless of the processes used, but the negative effects were shorter-lived in organizations that used strategic downsizing and provided timely information to workers.

Creating Healthy and Productive Work Organizations

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Design, interventions, healthy, work organizations

Purpose:
To design and test interventions for creating healthy work organizations.

Abstract:
This project is a cooperative agreement. It will involve the design, installation, and evaluation of healthy work organization interventions at multiple company locations. The interventions will be based on the NIOSH healthy work organization profile and related research, which will be supplied to the cooperative agreement recipient. Evaluations of the efficacy of the interventions will include subjective and objective indicators of worker health/well-being (e.g., perceived stress, job satisfaction, morale, health symptoms, medical care costs) and organizational effectiveness (e.g., earnings per share, return on investment, etc.).

The methodology will involve pre- and post-intervention assessments in selected companies. The exact nature of the interventions will be specified by the contractor but can be expected to include many of the key characteristics in the NIOSH profile of a healthy work organization. The time frame for the project is five years.

• Special Populations at Risk

Young Worker Regional Health Education Center

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Young workers, cooperative agreement, training

Purpose:
To address the problem of high rates of occupational injuries among young workers.

Abstract:
This project will use a community health education framework to address the problem of high rates of occupational injuries among young workers. The project will take place within two areas of the country, the city of Los Angeles and the New England region, and will capitalize on lessons learned from previous young worker community health 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 intervention will be developed.

Intramural Research Projects

• Allergic and Irritant Dermatitis

Validation Studies in Occupational Immunotoxicology

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Latex, airborne toxins, biological monitoring

Purpose:
To study the effects of workplace hazards on workers' immune systems.

Abstract:
Research currently conducted under this project is directed towards: (1) learning what causes latex allergy in workers and (2) developing a biological monitoring method for exposure to another workplace hazard–mycotoxin. Tests to identify individuals sensitized to latex will be used in an attempt to identify which of the many different latex proteins cause latex allergies. In addition, an immune test for evidence of mycotoxin exposure will be studied for its ability to identify exposed workers.

Occupational Dermatoses (A Program for Physicians; Employee/Employer Program)

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Skin, dermatitis, education

Purpose:
To update educational information on allergic and irritant dermatitis.

Abstract:
This project will serve to update statistical and clinical information in the 1981 NIOSH Educational Slide Show, Occupational Dermatoses (A Program for Physicians; Employee/Employer Program). Using the current program as a base, slides will be updated, new concepts and entities will be introduced, and new text will be written. New media (e.g. CD-ROMs, booklets, Internet) and ways of disseminating the information (NIOSH Publications, NTIS) will be investigated. The expected outcome of

this project is a new educational tool to increase the recognition of occupational skin dermatoses, their proper diagnosis and treatment, and introduce prevention strategies.

Mechanisms of Workplace-Related Irritant Contact Dermatitis

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Dermatitis, immunotoxicology, stress

Purpose:
To address the molecular mechanisms of irritant and allergic contact dermatitis.

Abstract:
This project will employ mouse models and an in vitro skin system to study the molecular mechanisms of allergic and irritant contact dermatitis. In particular, NIOSH will investigate the dermal effects of chronic, low dose chemical exposure and the role of irritation in the development of contact hypersensitivity. Studies on the interaction between neuropeptides and cytokines in the skin will advance our understanding of the effect of chronic stress on the development of contact dermatitis. A third set of studies will evaluate chemical structure-activity computer models designed to predict the irritation potential of new workplace chemicals. This project will increase our understanding of the interaction between workplace chemicals and the protective, homeostatic mechanisms in the skin and will provide a scientific basis for continued efforts in prevention and intervention.

Can One Assay Identify Potential Allergies and Irritants, and Distinguish Type 1 Reactions?

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Allergies, immunotoxicology, hazards

Purpose:
To examine the use of flow cytometry in the development of a single assay for the identification and differentiation of chemicals that produce irritation and IgG mediated and T Cell mediated hypersensitivity responses.

Abstract:
This research will use a panel of known human irritants and sensitizers to validate the assay. By combining the parameters of an ear swelling assay for irritation with phenotypic analysis of the lymph nodes draining the site of chemical exposure, this assay has the potential to significantly reduce the number of animals used, the time, and expense required for chemical testing. Although developed for use in hazard identification, with refinement this method may prove useful in risk assessments for occupational hazards.

The Percutaneous Absorption of Latex Proteins

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Latex, skin, health services

Purpose:
To investigate the role skin penetration plays in immediate hypersensitivity to latex proteins.

Abstract:
The studies performed for this research are a part of a joint project between NIOSH and its external partners to study latex allergies. Although there is evidence of an increased prevalence of latex allergy among health care workers, there is little data on the role of exposure route (lungs or skin) in the sensitization of individuals to latex proteins. Various animal and human skin preparations will be used in specific, validated flow-through diffusion cells to determine the penetration of latex proteins. Results from these studies will be compared with in vivo sensitization studies. These data will provide new information on the skin's role in the development of latex allergy and can be used to set threshold limits in the workplace.

Mechanisms of Arsenic Skin Diseases

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Dermatitis, cancer, immunotoxicology

Purpose:
To investigate cellular and molecular mechanisms associated with the development of skin cancer and toxicity following arsenic exposure in the occupational or environmental setting.

Abstract:
The studies for this research project are ongoing and employ primary human skin cultures, transgenic animals, and skin biopsies from humans chronically exposed to arsenic. Arsenic has been found to selectively alter the gene expression of keratinocyte growth factors. There is evidence in animals and in arsenic-exposed populations indicating that arsenic serves as a tumor co-promoter that is responsible for the increased cancers in exposed populations. Current studies focus on explaining the molecular and physiochemical mechanisms responsible for these events. These studies will help identify therapies and prevention for arsenic-mediated skin diseases and will aid in risk assessment.

• Asthma and Chronic Obstructive Pulmonary Disease

Identification of Occupational Allergens

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Immunoassays, characterization, monitoring, allergens

Purpose:
To develop sensitive specific immunoassays that can be used in the workplace to provide better air monitoring for and/or biochemical characterization of allergens.

Abstract:
This project will investigate different methods to more effectively identify allergens in the occupational setting by addressing limitations in current methods. During the past several years, NIOSH has become increasingly involved in the identification of allergens in the workplace and the detection of antibodies to the allergens as a way of estimating exposure and risk of disease. The agency has developed and validated several new assays, but has also become aware of some of the limitations and problems in the methodological approach. The agency approach has been to use sera from exposed persons as a source of antibody and using that antibody to identify allergens. By this technique, it has been possible to identify allergen source material. However, NIOSH researchers have been unable to take the next step, which is to develop sensitive, specific immunoassays that could be used in air monitoring for and/or biochemical characterization of the allergens. A major limitation is the quantity of sera available. In addition, it is difficult to collect sera during a field investigation. Another difficulty has been that allergen extracts are biochemically very complex mixtures and the allergens of interest may be only a small component of that mixture. By purifying the allergens, NIOSH has found that the specificity, sensitivity, and precision of the assay can be enhanced. Finally, NIOSH researchers have focused attention on the detection of IgE antibodies as both markers of exposure and to identify subjects at risk of allergic/asthmatic reactions.

Occupational Asthma Identification Methods

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)

Keywords: Asthma, allergies, isocyanates, insect rearing, wood products plants

Purpose:
To examine medical screening measures used to detect occupational asthma.

Abstract:
This project will evaluate medical screening measures used to detect occupational asthma by assessing sensitivity, specificity, and predictive value from each measure in detecting asthma. To date, the project has evaluated workers engaged in insect rearing and workers in wood products plants where isocyanates are used. The occurrence and risk factors of occupational asthma have been evaluated in these groups along with the efficacy of using serial peak flow measurements of occupational asthma detection.

Chronic Beryllium Disease Among Beryllium-Exposed Workers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Beryllium, lung disease, take-home toxin

Purpose:
The objective of this project is to improve primary and/or secondary prevention efforts for chronic beryllium disease.

Abstract:
This research will be accomplished by continuing to support two-cooperative agreement recipients: the National Jewish Center and Michigan State University. Also, NIOSH will collaborate directly with the National Jewish Center in the measurement of take-home beryllium and the evaluation of the effectiveness of worker notifications in a precision machining operation in Alabama. The purpose of the project will be achieved by a better understanding of: (1) the natural history of chronic beryllium disease; (2) the exposure-response relationship, with a more detailed consideration of particle size; (3) beryllium as a take-home toxin; and (4) worker notifications in industries using beryllium.

Feasibility Study of Occupational Asthma Incidence

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Occupational asthma, epidemiology, cooperative agreement

Purpose:
To measure the frequency of both work-related exacerbation of asthma and new-onset occupational asthma.

Abstract:
In this project, a recently purchased data set will be analyzed and a new data set will be purchased for analysis (Part A) to estimate the work-related exacerbation of asthma. The estimate of the incidence of new-onset occupational asthma will be accomplished by providing assistance to two cooperative agreement recipients (Part B). The outcomes of this project will be estimates of the frequency of occupational asthma that are virtually nonexistent in the United States. The findings will help to inform future research and intervention activities.

Hypersensitivity Pneumonitis and Concurrent Respiratory Conditions

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Metalworking fluid, hypersensitive pneumonitis, auto manufacturing, epidemiology

Purpose:
To document the prevalence of respiratory disease in machining plants using water based metalworking fluids.

Abstract:
This research is concerned with hypersensitivity pneumonitis, asthma, and bronchitis. In addition, it will attempt to identify whether microbial contaminants of inhaled metalworking fluid aerosols are causing these respiratory diseases. Finally, it will seek to initiate follow-up procedures for hypersensitivity pneumonitis cases to describe the natural history of the disease, in particular the outcome of return to work practices. The results of these studies will have major impact on prevention and management of metalworking fluid-induced respiratory disease.

Role of Adhesion Molecules in the Pathogenesis of Lung Disease

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Agriculture, asthma, chronic pulmonary obstructive disease

Purpose:
To explore the molecular mechanisms regulating inflammatory processes in the lung.

Abstract:
The role of lung surfactant in regulating the production of reactive species, such as nitric oxide by alveolar macrophages, will be studied in the present research. The information from this project will be useful in developing strategies to relieve the inflammatory response to occupational exposures and thus decrease the incidence of lung diseases, such as chronic obstructive lung disease.

Occupational Asthma: High and Low Molecular Weight Asthmagens

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Asthma, respiratory disease, toxicology

Purpose:
This project will develop models for detection and dose-response characterization of high and low molecular weight asthmagens and hard metals.

Abstract:
The effects of ovalbumin, toluene diisocyanate, ozone, and industrial hard metal mixtures on airway reactivity will be investigated in this research project using animal models and in vitro experiments with isolated airway preparations. This research will address: (1) the relationship between airway inflammation and the development of airway hyperreactivity after inhalation of workplace asthmagens and irritants; (2) the role of the epithelium in the development of occupationally-induced respiratory disease; and (3) the nature of epithelium-derived, reactivity-modulating factors and what mechanisms are involved in their synthesis, release, and effects in the airway wall. The results of this research will aid the development of prevention strategies for occupational asthma.

Cough Sounds and Aerosols as a Predictor of Respiratory Disease

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Respiratory disease, chronic obstructive pulmonary disease, asthma

Purpose:
The objective of this study is to develop a new noninvasive method to detect lung disease in the worker population based on voluntary cough sounds.

Abstract:
In conducting this research, a worker will voluntarily cough through a mouthpiece and tube system. The cough signal will be decomposed into two parts that represent 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 have indicated 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.

The Role of Dextran Powder in Latex Hypersensitivity

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Latex sensitization, allergies, immunotoxicology

Purpose:
To determine the role that dextran powder plays in latex sensitization.

Abstract:
This project will be conducted to explain the role of dextran glove powder in the development of the signs and symptoms associated

with latex hypersensitivity. Studies will be conducted to: (1) determine the mitogenic activity of dextran in vitro in murine models and human lymphocytes, (2) evaluate the potential of naive dextran glove powder to elicit an IgE response in a murine inhalation model, (3) investigate the role of dextran as a carrier for latex proteins, and (4) determine the potential of dextran to act as an adjuvant. This information will be useful in the development of intervention protocols and occupational policy development in the area of latex allergy.

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

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Latex, allergies, immunotoxicology

Purpose:
To investigate the role of exposure with respect to specific latex proteins in the development of latex allergy.

Abstract:
Allergic responses to latex products have become a serious health hazard to numerous occupational groups (members of the health care industry, spina bifida patients, etc.). Although the prevalence of latex allergy has increased, the primary route of exposure and latex proteins that result in sensitization remain unclear. In these studies, animals will be sensitized with latex proteins by the subcutaneous, topical, and respiratory routes. The IgE response to specific latex proteins will be quantified and compared using enzyme-induced immunosorbent assay (ELISA) and immuno-blot methodology. By understanding the relationship between the route of exposure and the specific antigens producing the allergic response, preventative measures can better be adopted.

Beryllium Disease Surveillance/ Research

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Beryllium, genetics, exposure assessment

Purpose:
To utilize new measurement techniques to characterize a beryllium-exposed cohort for the cumulative incidence of beryllium disease, genetic and other risk factors, and exposure-response relations.

Abstract:
This research will increase the understanding of the level of beryllium exposure that results in disease among workers who exhibit genetic susceptibility. This information can guide prevention efforts, affect rulemaking now underway in the federal government, and inform efforts to prevent occupational asthma, a common lung disease with both genetic and exposure components.

• Cancer Research Methods

Molecular Mechanism of Metal Carcinogenesis

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Cancer, prevention, risk assessment

Purpose:
To test the hypotheses that proto-oncogene activation and tumor suppressor gene inactivation are associated with cell transformation induced by metals of occupational concern and that genetic alteration in cancer-related genes may play an important role in occupational carcinogenesis.

Abstract:
Using molecular analyses, the nature of the activation and inactivation in the genes associated with DNA amplification, over-expression, and gene mutation will be characterized in this project. The research will provide important information regarding: (1) possible mechanisms of beryllium and cadmium carcinogenesis and (2) the usefulness of oncoproteins, cancer-related gene mutation, and genetic instability as potential biomarkers for molecular epidemiology studies and early detection of metal-induced cancer.

Mapping of Lung Tumor Susceptibility Loci

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Cancer, risk assessment, special populations

Purpose:
To expand mapping studies on mouse lung tumor susceptibility genes that will eventually lead to the identification of human lung tumor susceptibility genes and susceptible populations.

Abstract:
Lung cancer is the leading cause of death in the U.S., and a considerable number of lung cancer cases are believed to have resulted from occupational exposure. Lung cancer has a genetic component, and studies using inbred mouse models indicate that a number of genetic loci influence lung tumor susceptibility. This four-year project will allow the mapping of lung tumor susceptibility loci and will eventually allow human lung tumor susceptibility genes and genetically susceptible populations that are at risk in the workplace to be identified. Analysis of sequential chromosomal changes in mouse and human lung tumors may provide biomarkers for the early detection of occupational lung cancer.

Biomarkers of Occupational Disease Risk: Role in Human Carcinogenesis

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Cancer, epidemiologic, mining

Purpose:
To investigate the roles of biomarkers of susceptibility and internal exposure to assist in identification of workers at risk before disease occurs.

Abstract:
Not all workers are exposed equally and not all of those exposed develop disease. The use of biomarkers would have a significant impact on future prevention and intervention strategies. This project is a complementary and integrated epidemiologic/ laboratory approach to the understanding of occupational disease susceptibility. By this strategy, molecular epidemiology identifies specific disease susceptibility factors and assists conception of basic mechanistic questions. Mechanistic studies help to refine molecular epidemiologic studies. The long-range goal of this project is monitoring health effects of exposures in the workforce.

Genetic Susceptibility to Prostate Cancer

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Cancer, risk assessment, special populations

Purpose:
To analyze the polymorphic variants of the enzymes that govern amine metabolism and androgen biosynthesis, which will help in determining the risk of developing prostate cancer from exposure to heterocyctic amines.

Abstract:
Prostate cancer is now the most frequently occurring male, non-skin cancer in America and other Western countries. This research will help to unravel the relationship between polymorphic variants of the enzymes that govern heterocyclic amine metabolism and androgen biosynthesis enzymes and the development of prostate cancer. Exposure to heterocyclic amine exposure occurs in industrial, dietary, and environmental settings.

Investigation of Occupational Diseases Caused by Metals

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Mixed exposures, dust, cancer

Purpose:
To determine if reactive metal intermediates and free radical reactions play an important role in the development of lung cancer in workers exposed to various metal fumes or dusts.

Abstract:
In this research, in vitro and in vivo electron spin resonance, high performance liquid chromatography, and molecular biology techniques will be employed to: (1) develop biomarkers for early detection of oxidative stress; (2) study metal-induced free radical generation, metal-mediated DNA alternation, oncogene expression, activation of nuclear transcription factors, and metal-modulated signal transduction; and (3) establish animal models for the study of dose-response relationships. Results obtained may assist in the early detection of disease, the development of occupational standards, and the implementation of secondary prevention strategies.

• Control Technology and Personal Protective Equipment

Noise Reduction Characterization of Nonlinear Hearing Protection Devices

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Noise, protective equipment, emerging technology

Purpose:
To evaluate the performance characteristics of different types of nonlinear hearing protectors and correlate these characteristics to the needs of specific jobs.

Abstract:
In certain occupational settings, traditional hearing protectors block noise that may be necessary for job safety and proficiency (e.g. alarms or tool noise). Newer hearing protection devices, which customize the noise getting through to the wearer while protecting the ear, are called nonlinear hearing protectors (NLHPs). In this project, the performance characteristics of types of NLHPs will be determined, and these characteristics will be correlated with the hearing needs of specific jobs. The new information about the performance of these hearing protectors 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, testing laboratories, and relevant standard-setting groups.

Exposures and Controls in Museums, Including Restoration

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Museums, exposures, health complaints

Purpose:
To identify and categorize exposures in museums.

Abstract:
A variety of potential health hazards have been found in museums due to exposure to materials used in the preservation and restoration of artifacts and the preparation of displays for artifacts. Based on census data, an estimated 80,000 workers are potentially exposed to hazardous agents. Additionally, indoor air quality complaints have come from exposures to these or other nonspecific substances. NIOSH has conducted studies investigating exposure of museum workers to asbestos, heavy metals (including lead and arsenic), various hydrocarbons, organophosphorus pesticides, ethylene oxide, immunotoxins, and various indoor air quality (IAQ) complaints. The published literature also cites other investigators who have studied problems in museums from radon, ozone, noise, IAQ effects, unspecified contact dermatitis, mold spores, formaldehyde, asbestos, and organophosphates. The first phase of this project will consist of the identification and categorization of exposures in several museums. Following a literature search, meetings with these museums and organizations will include preliminary inspection of various museums and subsequent development of a protocol for the second and third phases of this work.

Control of Lead and Rosin Vapor Exposures During Manual Soldering

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Rosin, solder, asthma-causing agents

Purpose:
To determine worker exposure routes to airborne asthma-causing agents arising from manual soldering using rosin-core solder.

Abstract:
In this project, measurements of airborne components of heated rosin in the breathing zone of manual solderers will be made to evaluate the effectiveness of available control approaches. These measurements may require modifications to the current recommended method. Controls to be considered include primarily substitution and local exhaust ventilation. Other controls will be considered, if necessary. If adequate controls are not available, improved approaches will be developed and their effectiveness documented through field studies. On the basis of this research and other information, recommendations for minimizing exposure to heated rosin emissions during manual soldering will be developed and disseminated.

Effectiveness of Engineering Controls for Metalworking Fluids

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Evaluation, controls, metalworking fluids
Purpose:
To evaluate the technical and economic effectiveness of control measures involving metalworking fluids.

Abstract:
Exposure to metalworking fluid (MWF) mist has been associated with an increased incidence of occupational cancer, respiratory, and dermatological diseases. These effects can be reduced by various changes in procedures. As a result, NIOSH will conduct the following study. Researchers will identify study sites with excessive exposure to airborne metalworking fluid mist. These study sites may come from a current NIOSH study of exposure in the machining industry. At other sites, NIOSH researchers will need to obtain preliminary measurements which indicate that the mist exposures are excessive. For each site, NIOSH, with input from the plant management and employees, will devise a strategy to control occupational exposure to metalworking fluid mists. This control strategy involves the conceptual design and selection of methods used to control mist exposures. NIOSH partners will design, purchase, install, and commission the control measures being installed. NIOSH researchers will measure air contaminant concentrations, including full-shift area and personal samples. These measurements will be conducted before and after the control measures have been implemented. In addition, researchers will estimate the capital and operating costs of these control measures. This study will identify and evaluate the effectiveness of control measures for metalworking fluids. Studies will also be conducted to evaluate the effectiveness of "in use" control measures at sites. The Occupational Safety and Health Administration (OSHA) will use the study results to help assess the efficiency and efficacy of engineering controls for future OSHA rulemaking on metalworking fluids.

Control of Occupational Exposures During Construction

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Controls, construction, pavers

Purpose:
To investigate the availability of engineering controls for identified construction processes.

Abstract:
In this project, commercially-available engineering controls for construction will be evaluated for performance efficiency in a controlled environment. These controls will then be field-evaluated for worker acceptance and field performance at active construction sites. As necessary, new controls will be designed and similarly evaluated. Successful results will be disseminated to labor,

industry, equipment manufacturers, and other occupational safety and health professionals. Project objectives are to facilitate the design, identification, and implementation of engineering controls and to improve health-related worker training. In this project, NIOSH is collaborating with external partners for each construction process under evaluation. In FY97, the laboratory and field evaluations on highway-class (>16K pounds) paving prototype controls were completed. This research resulted in the development of the Engineering Control Guidelines for Hot Mix Asphalt Pavers, Part 1: New Highway-Class Pavers, a detailed document recommending engineering controls on all highway-class pavers manufactured after July 1, 1997. In addition, the guidelines were the foundation for an OSHA Voluntary Agreement (signed January 1997). Eventually, as new pavers replace existing equipment, 100 percent of highway-class pavers will be protected by these controls. During FY98 and beyond, data analysis from the highway-class research will continue, as well as research efforts addressing commercial-class (<16K pounds) pavers and the retrofit of existing paving equipment.

Dye Dustiness Evaluation

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Dye, dust, tester, exposure

Purpose:
To evaluate the correlation between dustiness tester results and dye dust exposure during the manual weigh-out of dyes.

Abstract:
In this project, one or two dye weigh-out facilities with worker exposure to dye dusts will be used to measure the dustiness of the dye. Regression analysis will be used to evaluate the correlation between dustiness test result and worker dye dust exposure. The Ecological and Toxicological Association of the Dye Organic Pigment Manufacturers (ETAD) will partner with NIOSH during this project and will supply the Roaches' tester. In addition, ETAD will play a major role in arranging the study site(s). NIOSH will conduct the testing with some assistance from ETAD personnel.

Engineering Controls to Reduce Injuries and Pesticides Exposure in Greenhouses

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Greenhouse workers, pesticides, musculoskeletal disorders

Purpose:
To evaluate the exposure of greenhouse workers to pesticides and their risk of developing musculoskeletal disorders.

Abstract:
This research will evaluate the safety and health of greenhouse workers, concentrating on both their exposures to pesticides and their risks of developing musculoskeletal disorders. Greenhouse workers are most often exposed to pesticides during their application. The pesticide exposure part of this project will concentrate on evaluating pesticide application spray nozzles and effective ventilation during and after the procedure, as well as reducing the pesticide-covered plant as an exposure source. Greenhouse workers also suffer from back pain (31%), upper extremity pain (11%), lower extremity pain (8%), and neck pain (2%). These pains are the result of such tasks as cutting, pruning, potting, and transporting plants. The musculoskeletal part of this project will evaluate these job tasks and evaluate and recommend engineering controls that will reduce the repetitiveness of the task or the weight being lifted. Specifically, the project will evaluate: (1) hand tools that are used in this industry, including shovels and shears and (2) material handling devices that may be retrofitted for specific handling of delicate flowers and other potted plants. This research project will involve field evaluations at greenhouses and equipment evaluations conducted in collaboration with equipment manufacturers.

Control of Worker Exposure to Roofing Asphalt Fumes

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Worker, asphalt fumes, roofing kettle operators

Purpose:
To reduce worker exposure to asphalt fumes.

Abstract:
This project will be carried out using a combination of isolation and local ventilation techniques, identified work process changes, and the development of industry and labor partnerships. Specific recommendations will be based on initial surveys and quantification of exposure levels. The project will evaluate asphalt fume exposures to roofing kettle operators, examine the efficiency of existing exposure controls, and provide/evaluate recommendations as necessary. Literature searches, discussions with roofing kettle manufacturers and operators, and walkthrough surveys will provide pertinent information on asphalt fume generation and control. In-depth studies will be conducted using conventional and real-time air sampling techniques to evaluate worker exposure and the effectiveness of controls. Results will be widely disseminated.

Computational Fluid Dynamics (CFD) Application in Occupational Safety and Health

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Airborne contaminants, control technology, prevention

Purpose:
To gain a better understanding of Computational Fluid Dynamics modeling.

Abstract:
This project will concentrate on Computational Fluid Dynamics (CFD) modeling, a new analytical tool that can give a detailed description of fluid or airflow, heat transfer, and contaminant transport in the workplace. By solving the fundamental equations of conservation of mass, momentum, and energy, a CFD model will permit rigorous laboratory review of exposure prevention controls prior to field implementation. Current applications of the tool have been applied to booths at border crossings and to designs for paint booths. CFD affords the designer with state-of-the-art capabilities to evaluate the effects of operational/design changes on airflow. CFD will reduce the amount of time and expense necessary to design and test prototype control systems.

Human and Metabolic Simulator Testing of SCSR (Self-Contained Self-Rescuers)

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)

Keywords: Respirator, emerging technology, mining

Purpose:
To compare the respirator performance data between human testing and Automated Breathing Metabolic Simulation testing for Self-Contained Self-Rescuer equipment.

Abstract:
In this study, data obtained during the human testing of the latest approved Self-Contained Self-Rescuers (SCSRs) used in mining (100%) will be compared to data obtained during testing of the SCSRs during the recently acquired Automated Breathing Metabolic Simulator (ABMS). Identical exercise protocols that simulate Man Test 4, the current certification test for service time, will be used for human and ABMS testing. This study will provide information concerning the potential for using the ABMS in certification to set service time for SCSRs.

Validation of a Fit Test Method for Full Facepiece Respirators

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)

Keywords: Respirators, industrial hygiene, exposure assessment

Purpose:
To determine which of five quantitative fit tests provide fit factors that correlate best to an exposure assessment of Freon 113.

Abstract:
In this research, controlled negative pressure, continuous high flow with deep probe, continuous low flow with flush probe, short duration particle counting, and long duration particle counting will be evaluated to determine which of these fit tests correlates to an exposure assessment of Freon 113 calculated from exhaled breath of a respirator wearer during a simulated workplace test. The project methodology consists of characterization, assessment of different exposure scenarios, skin absorption, and method correlation testing. This research will demonstrate if quantitative fit test methods provide a fit factor that does or does not correlate with a wearer's actual exposure during a simulated workplace test. The results can be used by agencies such as OSHA and industrial hygienists to determine the appropriate assigned protection factor for full-facepiece negative pressure respirators.

Development of Automatic Roll-Over Protective Structure (ROPS)

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Roll-over protective structure, tractors, control technology

Purpose:
To develop and test a reliable automatically-deployed roll-over protective structure (ROPS) for tractors used in farming.

Abstract:
A spring-action, telescoping roll-over protective structure and mechanism are being designed and tested. These Roll-Over Protective Structure (ROPS) components will be combined with a sensor that detects impending roll-over for tractors used in agriculture. The resulting automatically-deployable ROPS can provide protection on new tractors that will be operated in low overhead clearance areas such as orchards. Tractor roll-overs are the most prevalent factor in fatal traumatic injury to U.S. agricultural workers. The functional components of the prototype are being tested in the lab for concurrent release, time of deployment, reliable latching, ASAE S519/SAEJ2194 static load test satisfaction, and ease of hydraulically resetting the structure after a deployment. A patent is being sought for this new control technology. Manufacturers will be able to license use of the auto Roll-Over Protective Structure technology on new equipment.

Laboratory Evaluation of Back Support Belts

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Back belts, ergonomics, injuries

Purpose:
To evaluate the biomechanical complexity and physiological effects of workers wearing a back support belt during repetitive lifting activities in a laboratory work setting.

Abstract:
This project will develop a method to evaluate the use of back belts, evaluate the physiological and biomechanical effects of using one

specific back support, and provide the scientific protocol to assess the effects of additional types of back belts. This ergonomic research project will directly impact workers in virtually all industries, who may experience musculoskeletal stress when manually handling items, by contributing to the scientific basis of recommendations for back belt usage. The project results will provide guidance for using back supports in a variety of work environments and conditions that require manual materials handling.

Development of Automatic Roll-Over Protective Structure (ROPS) Overturn Sensor

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Roll-over protective structure, tractors, control technology

Purpose:
To develop a sensor to identify impending overturns and initiate the roll bar extension for use on farm tractors.

Abstract:
This research involves the use of the telescoping roll-over protective structure (ROPS) and deploying mechanism developed by NIOSH. Under normal operating conditions, the roll bar will normally be stored out of the way but will extend to its full dimensions to protect the operator if an overturn occurs. The sensor for this project will be evaluated through laboratory testing and actual field overturns with an instrumented, unmanned tractor, according to the test sequence prescribed in ASAE Standard S519. If successful, an automatically-extending roll-over protective structure should reduce the risk of injuries from not raising a manually-operated ROPS and from not using a ROPS in a low clearance situation.

Electrical Injury Protection System

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Protective equipment, construction, traumatic injuries

Purpose:
To develop a protective system for construction workers and electricians that will reduce the chance of electrical shock and electrocution.

Abstract:
The system being developed for this research will include a device that is worn by the worker and acts as a warning system, transmitter, and a receiver to be mounted on the electrical source/hazard. The completed system will be able to: (1) provide body-approach-to-power line warning, (2) trip a circuit breaker at any detected electrical contact, and (3) trip an existing ground fault circuit interrupter with its maximum sensitivity at any detected electrical contact. The results of this research will be provided to electrical safety device manufacturers. Extensive use of this equipment should significantly reduce the rate of occupational electrical traumatic injuries and fatalities.

Feasibility of Protective Clothing Exposure Monitors

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Industrial hygiene, dermatitis, protective equipment

Purpose:
To reduce occupational dermatitis by using protective equipment.

Abstract:
This laboratory industrial hygiene study is intended to reduce occupational dermatitis through the use of protective equipment. The study will determine the utility of two different commercially-available products to function as end-of-service-life indicators (EOSLI) for chemical protective gloves. One product is direct reading (colorimetric) EOSLI. This product will have wide application in small businesses with limited industrial hygiene expertise. The second product requires a high degree of chemical and industrial hygiene knowledge and equipment to evaluate the level of chemicals that permeate and become trapped in a sorbent material. This product is viewed as having greater application in larger industrial settings.

Biomechanical Stress Control in Drywall Installation

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Overexertion, falls, construction

Purpose:
To identify biomechanical hazards associated with drywall installation and provide possible solutions to reduce hazardous exposures.

Abstract:
The field component of this project includes a Bureau of Labor Statistics (BLS) injury-database search, a video analysis of actual drywall installation, and a questionnaire to identify current drywall installation techniques and the hazardous tasks and activities associated with drywall installation. Laboratory simulation will be conducted to evaluate the biomechanical stresses associated with drywall lifting and hanging. Results from this project will provide recommendations on the least stressful drywall handling methods and recommendations to reduce the biomechanical hazards resulting from overexertion and falls. Results from this study will also provide further understanding and research focus for future intervention efforts on drywall-installation work, which can lead to the development of effective injury prevention and control strategies.

Anthropometry of Construction and Agriculture Populations

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)

Keywords: Construction, agriculture, protective equipment

Purpose:
To study the size, form, and functional capacities of construction and agriculture workers for evaluating the interaction of workers with their tasks, tools, machines, vehicles, and personal protective equipment.

Abstract:
For this project, a state-of-the-art three dimensional laser scanning system will be used to reconstruct human images and establish an anthropometric database of agricultural and construction worker populations. These data will be used to develop optimal facial, hand, and whole body models for designing eye/hand/face/body protection apparatuses, such as eye goggles, helmets, masks, gloves, construction tools, fall-protection equipment, protective clothing, and personal protective equipment.

Dust Suppression Mechanisms in Abrasive Blasting

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)

Keywords: Construction, control technology, dust

Purpose:
To study the mechanisms of dust suppression by certain agents and their impact on the reduction of dust that may be inhaled by workers.

Abstract:
This project is designed to conduct experiments using a small abrasive blasting system to investigate the mechanisms of successful dust suppression by certain agents that are sometimes added to the abrasive. Abrasive blasting operations using silica-sand are especially hazardous because they produce very large amounts of silica dust in the respirable size range. Despite these hazards, the parameters that control the production of respirable dust in abrasive blasting are largely unknown. A better understanding of the dust suppression mechanisms in abrasive blasting is expected to result in new and improved dust suppression techniques for construction and other industries.

Surface Mine Dust Control

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Silicosis, eradication, surface mines, dust

Purpose:
To develop a broad-based approach to eradicate silicosis in workers employed in surface-mine operations.

Abstract:
This project will focus on reducing silica exposures to workers in surface mines. It will assess multi-occupational dust sources and current control technologies, sample variability, drilling parameters, and testing of new control technology. The first phase will access silica dust sources and current control technology used at surface mines. The second phase will research deficient areas of surface mine dust control technology. Since rock drills are expected to be the most significant silica source, the major area of technology development will likely focus on reducing the amount of silica dust generated from the drilling operation.

Control of Silica Dust Exposures in Underground Coal Mining

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Silica, dust, underground coal mining, control technology

Purpose:
To identify and evaluate patterns of silica dust exposure and control technologies used to reduce silica exposure in coal mining.

Abstract:
In this project, Mining Safety and Health Administration (MSHA) compliance records will be examined to evaluate levels of silica overexposure. Silica overexposures will be categorized according to coal producing region, mining operation, and mine characteristics such as seam height and mining system. Nearly all underground coal operations use such proven technologies as flooded-bed scrubbers, water sprays, wet drilling, or dry dust collectors to control respirable silica dust exposure. However, silica overexposure continues even with use of these proven dust control methods. To determine reasons for silica overexposure, mining operations that suffer from silica overexposure while using control technologies will be identified. MSHA dust control plans for these operations will be reviewed to determine the type of dust control present and the operating level for each system. These levels will be compared to those deemed minimally acceptable for that technology. This work will serve two important purposes. It will identify operating levels necessary for improved performance of these conventional dust control technologies. Furthermore, this work will identify possible limitations in the use of such accepted dust control methods. Given the widespread use of these control technologies, the compiled operating information will be disseminated throughout the underground coal mining industry.

This information will be formulated as minimally acceptable operating standards or recommended operating guidelines. Workshops and technology transfer sessions are possible platforms for distributing this information.

Nontraditional control technologies also will be examined for their effectiveness in reducing silica dust exposures. Nontraditional technologies are those that are not widely used in the coal mining industry. These include use of wet-head miners, mushroom bits, scrubber blocking sprays, and two-phase drilling. Identification of operations and surveys of MSHA dust and ventilation plans will define those operating levels needed for improved performance. Furthermore, limitations in the use of these nontraditional systems will be identified. This project also will conduct interventions by installing a nontraditional dust control system at an underground operation. The effectiveness of the intervention will be assessed by the reduction in silica dust exposure.

Investigate Proximity Detection and Collision Avoidance

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Sensor, underground/surface mining

Purpose:
To investigate numerous state-of-the-art sensor technologies that can be applied to proximity detection and collision avoidance in mines.

Abstract:
This project will emphasize low-cost, easily-implemented systems that will be suitable for the underground/surface mining environments. Selected sensors will be purchased and tested at NIOSH and on equipment at local cooperating mines. In FY97, the Mining Safety and Health Administration (MSHA) approached NIOSH to develop a proximity warning system for workers around a continuous mining machine for underground coal. A system for this application was pursued in cooperation with MSHA and continued in FY98 with field evaluations of prototype technology. Future work on this project will be determined.

Chemical Hazards in Active Metal/ Nonmetal Mines

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Mining, dust, airborne contaminants

Purpose:
To characterize workers' exposures to mercury and silver during refinery operations.

Abstract:
This project will characterize worker exposure to mercury and silver during refinery operations. Research is also being conducted to develop an analytical method that will differentiate between soluble silver compounds and metallic silver. The results of this project will be successful implementation of engineering controls that minimize chemical exposures within the refinery to protect the health of the miners.

A Survey of the Resistance to Workplace Degradation of Particle Filters Certification

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Respirators, airborne, contaminants, metalworking fluids

Purpose:
To identify airborne contaminants that are potentially degrading to N, R, and P-series respirator particulate filters certified under 42 CRE 84.

Abstract:
This research will include laboratory airborne contaminant exposure studies (aerosolized metalworking fluids and gas/vapors). The NIOSH recommendations for service-time limitations for N, R, and P-series filters will be evaluated. Particulate filter efficiency data will be generated on the stability of the filter media, particularly the new electrostatic filter media that has become prevalent. Recommendations will be made concerning the selection and use of particulate respirator filters. The data will be disseminated to particulate respirator users and necessary revisions made to the NIOSH *Guide to the Selection and Use of Particulate Respirators Certified* under 42 CFR 84.

Ability of a UV Germicidal Light System to Inactivate Mycobacteria

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Tuberculosis, engineering control, hospitals

Purpose:
To evaluate the effect of a well-designed and thoroughly characterized ultraviolet germicidal irradiation system on killing airborne tuberculosis bacteria in a simulated health care room.

Abstract:
The Centers for Disease Control and Prevention (CDC) recommends ventilation as a primary engineering control against the spread of tuberculosis in the health care industry. The CDC guidelines, however, also recommend ultraviolet germicidal irradiation systems as a temporary solution for low airflow rates. Furthermore, there is disagreement as to the proper role of dilution ventilation versus ultraviolet germicidal irradiation as a primary engineering control. This research should establish whether or not ultraviolet light systems provide a cost-effective efficacious control strategy for protecting health care workers and the general public.

Reducing Diesel Particulate Exposure in Western Mines

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Mining, diesel, airborne contaminants

Purpose:
To reduce the exposure of workers in Western mines to potentially dangerous levels of exhaust from diesel engines.

Abstract:
The products from this research will be information and tools that the mining industry can use to help meet federal mandates and reduce worker exposure levels. The research will identify various interventions and rigorously evaluate the technical and financial feasibility of each. The goal of the program is to reduce current exposure to diesel particulates by 90 percent or more. This would mean that nearly 100,000 workers would see significant reduction in diesel particulate exposure.

Comparison of Fit Test Methods-N95 Filtering-Facepiece Respirators

For more information, contact:
The National Institute for Occupational Safety
and Health
1-800-35-NIOSH (356-4674)
Keywords: Respirators, tuberculosis, hazards, fit tests

Purpose:
To determine which of five fit test methods adequately screen out poorly fitting N95 respirators.

Abstract:
In this investigation, five fit test methods—the Saccharin, Bitrex, TSI Porta Count with Companion, generated aerosol, and TSI PortaCount—will adequately screen out poorly fitting (face seal leakage greater than one percent) N95 respirators that are used to protect from such hazards as tuberculosis. The results of the fit tests will be compared to multiple total penetration measurements to determine if the respirator provides adequate protection (total penetration value less than or equal to 10 percent). Five statistical tests will be used to determine if a given fit test method is adequate in screening out poorly fitting respirators. Research will also be done to define how filter efficiency and resistance affects respirator performance by measuring face seal volumetric leakage as a function of pressure. The results will provide workers with effective fit test methods for N95 filtering-facepiece respirators and improve particulate filters.

Evaluation of Factors Affecting Disease Transmission in Commercial Aircraft Cabins

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Infectious disease, confined space, engineering controls

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

Abstract:
There are approximately 148,000 flight personnel, including pilots, flight attendants, and other flight crew members, who are potentially exposed to infectious diseases brought into the enclosed aircraft environment by passengers. The recommendations resulting from this project will be engineering strategies and controls (including airline cabin ventilation) for decreasing the possibility of aerosol transmission from passengers to flight personnel and other passengers.

Generation and Control of Aerosol Emissions from Arc Welding

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Welding, particle-size, ultrafine

Purpose:
To determine the factors influencing particle-size distribution in a typical arc welding operation and the efficacy of low-cost control techniques to remove particles from the gas stream.

Abstract:
Census data indicate over 700,000 U.S. workers are involved in welding or allied processes. This laboratory investigation will focus on determining what factors influence particle-size distribution in arc welding operations indicative of the efficiency of particles deposited within the lungs. Additionally, this study will determine the efficacy of several novel, low-cost engineering control techniques to remove these aerosols from the gas stream. Previous research focused on the mass of particles collected and did not emphasize the underlying particle-size distribution. Recent research indicates that ultrafine aerosols (nanometer or sub-micrometer in size) may intensify potentially detrimental health effects. Arc welding processes generate very high concentrations of nanometer-sized particles.

Control of Nitrous Oxide in Dental Operations

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Engineering controls, health care workers, reproductive hazards

Purpose:
To reduce nitrous oxide exposure to dental workers.

Abstract:
This project will develop partnerships with industry, labor, and other government agencies interested in the dental community. The goal of the partnership will be to reduce nitrous oxide exposure to dental workers. The partners will work to develop control strategies then test these strategies, including the design, construction, and evaluation of control devices. The final goal of this project is to implement proven control strategies on a national level by leveraging the wide-based membership of all the partners.

New Approaches to Ventilation Control

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Airborne contaminants, control technology, engineering controls

Purpose:
To determine the effect of exhaust recirculation on worker exposure.

Abstract:
With the advent of more stringent environmental regulations relating to ultrafine particle emissions, recirculation techniques may become more prevalent, especially in foundries and welding operations. Conventional ventilation systems vary in efficiency because of inlet and exhaust configurations and in effectiveness from point-to-point within a facility. All workers whose exposures are controlled by general ventilation systems may be adversely affected. If the goals of this project are met, technology will be available to reduce significantly or to eliminate exposures caused by general ventilation system inefficiencies and to reduce the volumetric airflow rates required for control, thus, conserving energy.

Pilot Study of Control of Silica Exposures During Construction

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Construction, airborne contaminants, silicosis

Purpose:
To identify and evaluate engineering control methods that will reduce exposure of airborne contaminants to construction workers.

Abstract:
This project will concentrate on developing engineering control methods needed to reduce airborne contaminant exposure to construction workers who drill, cut, grind, or jackhammer silica-containing materials, such as concrete, bricks, and ceramic materials. These workers are potentially exposed to excessive crystalline silica concentrations, especially when using electric grinders or masonry saws without water. Worker exposures are typically 20 to 160 times the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for respirable crystalline silica and also exceed the Occupational Safety and Health Administration's permissible exposure limit (PEL). These widespread silica exposures in the construction industry cannot be controlled by available respiratory protection. This project will identify which operations are generating the greatest crystalline silica exposures and recommend engineering controls.

Identification and Control of Rock Burst Hazards

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Underground mining, ground control, rock bursts

Purpose:
To develop methods for forecasting the probable locations of adverse geologic conditions and assess how these conditions may lead to rock burst control hazards.

Abstract:
Researchers hypothesize that rock burst hazards are controlled by localized deviations from average expected conditions. This project consists of several tasks. It will first concentrate on analyzing adverse geologic conditions. Preliminary results suggest that vitreous quartzite, silicified rock of any type, core discing, breakouts, and bedding discontinuities and/or faults oriented parallel to opening walls, roof, or face are associated with heightened rock burst hazards. In addition, an analysis of adverse geologic conditions will be completed. Current studies are concentrating on buckling of rock slabs in development and the redistribution of *in situ* stresses by geologic structures. Also, the research will explore adverse geologic conditions. Tools are needed to spot adverse geologic conditions during the exploration phase of a project so that ground control safety can be planned. Development efforts are concentrating on video borescope. Finally, the project will develop rock burst instrumentation to detect the occurrence of a rock burst to speed rescue of miners. This is important since many rock burst fatalities are caused by suffocation of buried miners. Other tools being explored include noninvasive methods for measuring closure and closure rates of openings and assessing fracture density in rock surrounding a mine opening.

• Emerging Technologies

Evaluation of Substitute Materials Used in Construction

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Construction, asbestos, silicosis

Purpose:
To develop a database for in vitro and in vivo toxicity of several abrasive substitutes and determine the role of length versus chemistry in the fibrotic potential of asbestos substitutes.

Abstract:
This project will conduct laboratory studies to identify the toxicity of abrasive substitutes and evaluate the role of length versus chemistry in the ability to develop fibrosis of various asbestos substitutes. In addition, mechanistic investigations (oxidant generation, activation of transcription factors, induction of mRNA for cytokine production) will explain events that initiate the development and progression of pulmonary inflammation, damage, and fibrosis. Such information will be used to evaluate the potential occupational health hazard posed by substitute materials (abrasive substitutes for silica and substitute fibers for asbestos) and could result in the development of early diagnostic tests for pulmonary disease.

• Exposure Assessment Methods

New Methods for Assessing Exposure to Radio Frequency (RF) Communication Sources

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Techniques, exposure assessment, radio frequency (RF) communication sources

Purpose:
To develop, test, and evaluate new technologies for the exposure assessment of workers in close proximity to radio frequency communication sources.

Abstract:
Workers in field situations who are very close to a transmitting antenna may render unreliable, current methods used to assess exposure. Promising new devices are now available for these exposure conditions, but their utility has not been studied. The goal of this project is to determine if new methods can provide reliable exposure assessments for these situations. Using peer input (mail review), a measurement sampling procedure will be developed for promising new devices that are available through external partners. The methods using these new devices will be compared to existing methods measuring only field strength to determine if the new methods are more reliable in assessing worker exposure. Comparisons will be made in appropriate field situations. Body current methodology developed at NIOSH has improved exposure assessments for operators of radio frequency (RF) heaters. The present project will apply this expertise and other recent methods to the problem for RF communication sources. Initial results indicate that body current methodology provides more reliable exposure assessments. These results support the NIOSH recommendation to the Federal Communication Commission (FCC) that body current must be measured that make reliable exposure assessments near RF sources.

Exposure Assessment Methods for Evaluating Electromagnetic Frequency (EMF) Health Effects

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Electromagnetic frequency, exposures, methods, public health risk, diseases

Purpose:
To test new methods for assessing electromagnetic frequency (EMF) exposure.

Abstract:
In this new three-year project, NIOSH will conduct a pilot study using a personal monitor called the Multiwave III that takes comprehensive measurements of electromagnetic field (EMF) exposure. The Multiwave III collects the exposure data needed to plan an epidemiologic study. Since the Multiwave III and NIOSH's computer software can measure exactly the magnetic field metrics hypothesized to have biologic effects, a study with this new instrument will be a more definitive test of the association between EMF and disease than any previous epidemiologic study. This project will also estimate EMF exposures from existing measurements for a study of neurodegenerative diseases like Alzheimer's Disease and amyotrophic lateral sclerosis (ALS). These studies will help assess whether the public health risks from occupational exposures to EMFs are far greater than cancer studies have indicated. Whether existing epidemiologic findings justify the reduction of EMF exposures to workers will be evaluated by a meta-analysis of the occupational cancer studies.

Biomarker Development for Human Exposure Assessment

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Biomarkers, occupational toxicants, glycol ethers, oxidative damage, DNA damage

Purpose:
To develop biomarkers of exposure and effect for occupational toxicants (e.g. glycol ethers, toxicants causing oxidative damage, DNA damaging agents).

Abstract:
The development of biomarkers of exposure, effect, and susceptibility 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 risk from a hazard can be more accurately determined. Goals for this research are to develop three biomarkers for: (1) exposure to glycol ethers, (2) exposure to toxicants that cause oxidative damage, and (3) effect of exposures to DNA damaging agents.

Every year, several hundred thousand workers are exposed to glycol ethers that have been shown to be teratogenic. Glycol ethers are a priority compound for EPA standard setting. A marker of exposure would be of value for this standard. Many compounds, like silica or asphalt fumes, cause oxidative damage that may lead to cancer and organ toxicity. Development of a biomarker to determine the biologically effective dose is critical to understand the implications of exposures that result in oxidative damage. A method is also proposed to develop an assay to assess DNA damage as a biomarker of effect of exposure. This method would have wide applicability over a range of occupational agents, although initially it would be developed to investigate exposures to asphalt fumes and pesticides in workers. A feasibility study to assess genotoxicity of asphalt fumes has been integrated into this project. The biomarkers discussed above will be investigated for their utility to measure genotoxicity of asphalt fumes.

Perchloroethylene: Biomarkers for Human Exposure Characterization

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Biomarkers, dry cleaners, women's health

Purpose:
To develop biomarkers that will characterize the time between occupational exposure to perchloroethylene and disease.

Abstract:
Perchloroethylene is a widely used solvent in the dry-cleaning industry. Epidemiologic studies have reported that the incidence of several cancers is increased in people exposed to perchloroethylene. Biomarkers of exposure, effect of exposure, and genetic susceptibility are being developed that can be used to accurately measure the internal dose of perchloroethylene and its metabolites and to evaluate the potential health risks in workers exposed to this dry-cleaning solvent. This research will produce new and improved biomarker methods that will be applied to biological samples from women exposed to perchloroethylene in the dry-cleaning industry. This research will also enhance the capability for early detection of occupational disease.

Biomonitoring Methods for Agricultural Exposures

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Biological monitoring, agriculture, organophosphate pesticides, herbicide, immunochemical pesticides

Purpose:
To develop new immunochemical methods for organophosphates and the herbicide metolachlor that will be cheaper and easier to use than conventional assays.

Abstract:
Large quantities of pesticides and herbicides are applied each year in agricultural settings. NIOSH currently has studies investigating exposures to applicators of organophosphate insecticides and the herbicide metolachlor. These studies require sensitive and accurate methods to assess the exposure of workers. Since much worker exposure occurs through the skin, biological monitoring is needed to complement environmental monitoring. Because conventional biological monitoring methods are relatively time consuming and expensive, new immunochemical methods, enzyme-induced immunosorbent assays (ELISAs), for organophosphates (chlorpyrifos, azinphos-methyl, and phosmet) and metolachlor are being developed and will be used to analyze specimens collected in 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.

Use of a Hepatocyte Model for Identifying Biomarkers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Biological monitoring, exposure assessment, agriculture

Purpose:
To develop a model system using human liver cells that will determine how humans metabolize chemicals encountered in the workplace.

Abstract:
Biological monitoring techniques, which detect exposure to workplace chemicals within a person's body (usually by testing urine or blood), are essential to conduct many occupational health studies. Because the body often metabolizes chemicals very quickly, biological monitoring techniques must be provided both for the parent chemical and its metabolites. In this project, a model system will be developed using human liver cells from 150 donor livers to study the variability in the way individuals metabolize foreign chemicals and to study how specific agricultural chemicals are metabolized. Based on this information, specific biological monitoring methods will be developed that can be used to assess workers' exposure to occupational chemicals.

A Method for Simultaneous Analysis of Multiple Pesticides

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Biological monitoring, exposure assessment, agriculture

Purpose:
To develop an exposure method using Fluorescence Microbead Immunosorbent Assays to measure levels of several pesticides simultaneously in urine.

Abstract:
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 exposures for these workers requires separate, costly, and time-consuming analyses for each individual pesticide. A new urinary biological monitoring technology, Fluorescence Microbead Immunosorbent Assays, will be developed via the project to measure levels of several pesticides simultaneously in urine. Successful application of this multi-analyte technology will allow for a more complete and cost effective characterization of workplace exposures that, in turn, should allow for enhanced intervention measures to prevent future exposures.

Aerosol Sampler Development

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Fiber classifier, fiber length, lung disease cancer, sampler

Purpose:
To improve the design of the fiber length classifier to: (1) study fibers that can cause lung diseases including cancer and (2) improve the quality of respirable and inhalable dust samplers.

Abstract:
A new type of instrument, a fiber length classifier, was developed in a previous project that opens up a range of fiber research possibilities. It allows vastly improved investigation of fibers that can cause lung diseases, including cancer. One part of the project is to improve the design of the classifier and make the design available to other researchers. NIOSH will determine the in vitro toxicity of fibers as a function of fiber length. Samples of length-classified fibers have been and will be generated for this purpose. A collaboration has been established with the Health and Safety Executive in the United Kingdom (U.K.) to provide the U.K. with this technology and to develop a personal thoracic sampler for fibers. The thoracic sampler will replace the current sampler, which has been demonstrated in a previous project to have problems with sample uniformity and losses at the inlet.

The second part of this project involves the evaluation or development of improved respirable and inhalable dust samplers. The current "total" dust sampler has been shown to be inefficient for large particles that can exhibit respiratory system toxicity. The sampling efficiency of several commercial samplers mounted on a mannequin will be evaluated in a large wind tunnel. The wind tunnel will be improved to allow accurate estimation of air flow around the mannequin as well as providing a uniform dust cloud for sampler testing. Several aspects of the samplers, including inlet efficiency, internal sampler losses, capture of very large "projectile" particles, and filter weighing accuracy will be addressed.

Diffusive Sampler Test Protocol

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Performance tests, acceptance criteria, diffusion sampler

Purpose:
To prepare a broadly accepted set of performance tests and acceptance criteria for proving the efficacy of any given diffusive sampler.

Abstract:
There are specific peculiarities of diffusive sampling not found in the pumped systems. Some diffusive samplers are sensitive to the time-dependence of the analyte concentration. Transients within the air spaces of the sampler following a concentration change may be significant. If the analyte is not strongly bound to the sorbent, then transients within the sorbent itself can be important. Change in a sorbent's effectiveness can significantly affect the sampling rate. Relatedly, the sampling rate can be temperature-dependent, and in some instances, depend on the presence of interfering substances. Finally, the sampling rate of some samplers has been reported to depend on the ambient wind speed.

This project will counter the uncertainties in diffusive sampling through preparation of a broadly accepted set of performance tests and acceptance criteria for proving the efficacy of any given diffusive sampler. Some of both the theoretical and experimental work to accomplish this has been completed. In order to test many of the potential problems of diffusive sampling, a dynamic exposure chamber is needed–i.e., one in which the concentration can be quickly changed in time. Such a chamber is being developed.

Method Development for Fungi Involved in Occupational Diseases

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Fungi, soil, bird and bat droppings, analytical methods, mycotic diseases

Purpose:
To develop analytical methods to detect fungi in soil, bird droppings, and bat droppings.

Abstract:
NIOSH has received numerous inquiries and has been actively engaged in Health Evaluations pertaining to worker concerns involving *Histoplasma capsulatum, Cryptococcus neoformans, Blastomyces dermatides,* and *Coccidiodes immitis* associated with bat and bird droppings or contaminated soil in various occupational settings. The extent of occupational risk in these work environments is unknown as no fast, specific, relatively inexpensive analytical methods are available for the detection of these particular fungal pathogens. Outbreaks of mycotic diseases among construction workers continues to be reported as a result of demolition of contaminated buildings and related activities. Inhalation of spore-containing dust often contaminated with bird or bat droppings is the primary cause of these diseases. The efficacy of various technologies and methods for preventing these infections has not been adequately evaluated. Fast, inexpensive, specific fungal analytical methods would permit the detection of these fungi in soil and bird and bat droppings. The efficacy of various disinfectants could then be evaluated as well as environmental control measures such as dust suppression methods.

Applied Monitoring Studies

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Information, instruments, analytical methods, worker exposure

Purpose:
To update information on instruments and methods useful to safety and health practitioners.

Abstract:
The global industrial hygiene community relies on direct-reading instrumentation for monitoring worker and workplace exposures to toxic substances. This project will result in information on instruments valuable to, and otherwise unavailable to, safety and health practitioners. This work will benefit anyone who uses or manufactures direct-reading instruments. The NIOSH *Manual of Analytical Methods* includes sampling and analytical methods used to determine exposures to toxic gases, vapors, and aerosols. There is interest in accepting methods developed outside of NIOSH for inclusion in the manual. To that end, acceptance criteria for the external methods are required and will be established. Additionally, some methods that had been developed in-house or under contract to NIOSH require updating or improvement. Two methods, SO_2 and H_2S by ion chromatography, will be upgraded.

NIOSH *Manual of Analytical Methods* Cooperative Research

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Analytical methods, sampling methods, method development

Purpose:
To conduct methods research to address exposure assessment needs and foster partnerships.

Abstract:
The NIOSH *Manual of Analytical Methods* (NMAM) is a widely used repository of sampling and analytical methods for hazardous workplace substances. A joint American Industrial Hygiene Association (AIHA) survey of over 350 public and private laboratories identified frequently analyzed substances where NMAM methods do not exist, methods that need improvement and laboratories willing to cooperate with NIOSH in method development. This project will conduct methods research addressing the priorities of the AIHA/NIOSH laboratory survey and use cooperating public and private laboratories to the maximum extent possible for this work.

Determination of Volatile Organic Compounds in the Workplace

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Exposure assessment, indoor air quality, analytical methods

Purpose:
To develop a method that can identify and quantify volatile organic compounds in the workplace.

Abstract:
Workers concerned about their working environments have requested that NIOSH perform more than 1000 Health Hazard Evaluations. Generally, traditional charcoal tube sampling and analytical methods are used in these evaluations, but results are often inconclusive because existing methods lack sufficient sensitivity to detect low levels of volatile organic compounds (VOCs). The method developed in this project will provide results that help researchers associate observed health effects with VOC exposures when determining risk. These results will also be used to evaluate control measures and compliance with regulatory standards.

Revision of Methods in the NIOSH *Manual of Analytical Methods*

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Airborne toxins, control technology analytical methods

Purpose:
To update methods in the NIOSH *Manual of Analytical Methods.*

Abstract:
This project will address out-of-date analytical methods in the NIOSH *Manual of Analytical Methods* (NMAM), 4th edition. Some of these are older than 15 years and in need of updating or complete revision. NIOSH uses these sampling and analytical methods for monitoring occupational exposures to toxic

substances. The agency performs approximately 12,000 analyses per year to support NIOSH programs, such as engineering control technology surveys or health hazard evaluations. The NMAM is also used by many private sector laboratories and universities in the United States and abroad. Validated sampling and analytical methods of known accuracy, specificity, and reliability are essential to measurement quality. They can have a profound impact on the workplace when the research used in public decisions includes the data these methods generate.

On-Site Monitoring of Heavy Metals Exposure in Construction

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Lead, analytical methods, sampling methods

Purpose:
To evaluate field-portable methods for lead, hexavalent chromium, and other metals in air, surface dust, paint, and other environmental samples.

Abstract:
Several million U.S. workers are exposed at work to lead and hexavalent chromium (and other heavy metals). Many of these workers are minorities working in construction or renovation and are employed by small businesses. Traditional laboratory analyses to monitor exposures are not always useful in the construction industry because results were not available quickly enough to avoid high exposures or prolonged shutdown periods. Therefore, field-portable methods were developed. This project will assess these methods and develop additional research to evaluate methods for other sample matrices and elements.

Ergonomic Exposure Assessment Methods Development

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Ergonomic exposure assessment, methods development

Purpose:
To describe uniform quantitative methods to measure upper extremity ergonomic exposure in jobs.

Abstract:
There is need for more uniform, reliable, valid, and practical quantitative methods to measure upper extremity ergonomic exposures in jobs. For this research, a written composite data collection sheet is currently being developed that will be validated using a series of videotaped jobs. Initial agreement among observers will be calculated, and reasons for disagreement will be explored and used as the basis for further decision rules and training. Job observations will be repeated following training, and agreement among observers will be reevaluated with the proposed method then being used to evaluate jobs in NIOSH field studies. The development of more uniform and scientifically valid ergonomic exposure assessment methods will enable NIOSH to more clearly define the causes of musculoskeletal disorders and to reduce them through preventative action.

Blood Lead Monitoring Evaluation Project

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Lead, exposure assessment, biomarker

Purpose:
To validate a field instrument that rapidly analyzes capillary and venous blood lead levels.

Abstract:
This project will field test an anodic stripping voltammetry field instrument that rapidly analyzes capillary and venous blood lead levels. This instrument has only been used with children where blood lead levels are significantly lower than in occupationally exposed adults. This project will compare the instrument's results with split samples analyzed according to NIOSH Method 8003 from high-lead exposed adult populations. The study will assess the practicality and cost effectiveness of using this instrument in the workplace and estimate its precision. The second objective of this project is to collect saliva samples and determine whether they can be used to monitor recent lead exposure. This sampling 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

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Pesticides, organophosphate pesticide, agriculture

Purpose:
To evaluate the pesticide exposures of rose-growing greenhouse workers and assess intervention techniques to reduce exposures.

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. The primary objective of this study is to characterize the exposure of rose-growing greenhouse workers to selected pesticides and evaluate intervention techniques to reduce exposure. In the initial phase of the 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 intervention to reduce workers' pesticide exposures and potential health effects.

Herbicide Exposure Assessment Among Custom Applicators

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Herbicides, pesticides, agriculture

Purpose:
To assess the exposure of custom applicators to seven herbicides (atrazine, cyanazine, simazine, alachlor, metolachlor, and two esters of 2,4-D).

Abstract:
This project assessed the exposure of custom applicators to seven herbicides (atrazine, cyanazine, simazine, alachlor, metolachlor and two 2,4-D esters) used in corn and soybean fields. These herbicides are potential carcinogens, endocrine disruptors, and/or teratogens. Applicators were sampled multiple times during a season to improve the exposure characterization. Urine, saliva, dermal patch, hand wash, and air samples were collected. This study produced new analytical methods for measuring herbicide exposure and excreted metabolites. Findings from this project may be useful for conducting risk assessments, identifying intervention strategies, and classifying applicators into exposure groups for epidemiologic studies and to the EPA, which has initiated a special review of the triazine herbicides based on possible carcinogenic risks to applicators and the public.

A Biomarker Study of Ethylene Oxide Exposure

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Biomarker, cancer, hospitals

Purpose:
To determine whether DNA adducts can be used to predict the internal dose of exposure to ethylene oxide.

Abstract:
This research involves conducting a biomarker study of 73 U.S. and Mexican operators of hospital sterilizers that have been exposed to ethylene oxide as well as nonexposed workers. It will determine whether DNA adducts provide a measure of internal dose exposure to ethylene oxide and provide an indication of "early" biological effects that may lead to increased risks of developing certain diseases, including cancer. The findings will be relevant in the consideration of proposed changes to the International Agency on Research in Cancer classification of ethylene oxide as a Group I carcinogen.

Monitoring System for Human Responses to Workplace Conditions

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Exposure assessment, electromyography, stress

Purpose:
To develop a system to assess human stress in the workplace.

Abstract:
This project is developing an exposure assessment instrument for monitoring and analyzing human stress in the workplace. The assessment system being developed for this project is video based and is capable of real time monitoring of human stress exposures in construction and other workplace conditions. The system will synchronize human activity video images with an electromyography device and an O_2 consumption/CO_2 generation device for data acquisition. The completed instrument will be useful as a research tool for conducting occupational injury and ergonomics research.

Monitoring Crystalline Silica Dust

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Infrared spectrometry technology, silica dust, air concentrations, filters, field use

Purpose:
To develop a new infrared spectrometry technology for measuring the mass of crystalline silica dust collected on air filters.

Abstract:
The benefits of a relatively low-cost, low-resolution, rugged, infrared spectrometer that could be used in the field by nonchemists to estimate the air concentrations of crystalline silica and other mineral and organic aerosols are significant. This on-site measurement technology will eliminate the turnaround time associated with current laboratory measurement methods. Thus, immediate correction of overexposure situations can be made. To date, this research project has initiated studies using standard and customized optical, electronic, computer, and software components to construct a model of the instrument according to design calculations. It is anticipated that laboratory studies will be completed to optimize the resolution and sensitivity of the device, demonstrate the ability to measure crystalline silica dust on filters, establish the lower limit of detection, draft operational software, and test preliminary approaches to building a rugged prototype. At least two prototypes will be constructed and tested in field studies. It is anticipated that field studies will be conducted at construction and mining worksites. During FY00, design criteria for a rugged, portable silica monitor to be used in the field will be developed based on the field evaluations. Technology transfer to interested manufacturers will be established. Follow-on efforts will be started to evaluate the manufactured products and, if

appropriate, to encourage field industrial hygienists to apply this commercially available technology to evaluate and control workers' exposures to crystalline silica dust. Application of the technology to other organic and inorganic dusts will also be explored. If the studies show that the current design is not practical, work on the project will still proceed in the development of two prototype filtometers, the fall-back technology.

Development of a Portable X-Ray Fluorescence (XRF) Unit for Air Sample Screening

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Portable x-ray fluorescence, particles, metal-containing aerosols, health hazard, exposure assessment

Purpose:
To examine the applicability of commercial portable x-ray fluorescence (XRF) technology to detect metal-containing particles that may pose a health hazard in the workplace.

Abstract:
This project will first focus on laboratory evaluation of a commercial portable x-ray fluorescence (XRF) device. Secondly, it will concentrate on the applicability of using this screening technology to conduct exposure assessment measurements for welders at construction sites. Finally, it will develop information on the design criteria of a relatively low-cost, rugged, portable XRF device to be used in welding as well as other types of workplaces where airborne metal-containing substances may pose a health hazard. Potential external partners include academia, the construction industry, the American Welding Association, and the XRF manufacturers. The laboratory was set up and conducted studies to evaluate the capabilities and limitations of the commercial portable device, such as the sensitivities and detection limits, interelemental interferences, and matrix effects. Both laboratory-generated and field-collected samples will be analyzed and compared using XRF, as well as other methods of analysis in conjunction with scanning electron microscopy (SEM). Filter samples that contain welding fumes from different arc welding operations will be evaluated. Field studies will be conducted in collaboration with project partners to determine the applicability of using the same technology in workplaces by considering the acceptability of this technology to workers, owners, and field industrial hygienists and evaluating its effectiveness in identifying and reducing potential over exposures. During FY00, design criteria of a rugged, portable XRF device to be used in welding environments as well as the metal-cutting or metal-grinding machine shops will be developed based on the field evaluations and technology transfer to interested manufacturers. Follow-on efforts will evaluate the manufactured products and, if appropriate, encourage field industrial hygienists to apply this commercially available technology to reduce workers' exposures to metal-containing aerosols.

Local Positioning System for Exposure Assessment and Control

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Miniature unit, positioning information, workers, exposure risks, laboratory, field tests

Purpose:
To design and develop small, personal, electronic units that may be worn in a shirt pocket or clipped to clothing to provide positioning information about workers on exposure risks and help to control occupational hazards.

Abstract:
The prototype, miniature, personal, electronic units used in this research will be approximately three cubic inches in size. When worn by workers, these miniature units, in conjunction with remote references and signal processing software, form local positioning systems (LPS). Local positioning systems will link precise positioning coordinates to real-time exposure levels to help NIOSH researchers better understand exposure risks and optimize control.

LPS units that function inside and outdoors will be designed. For inside use, LPS will be optimized for performance over only a local area. Moreover, since LPS reference stations will be stationary, reference data will be of higher quality, likewise improving precision. LPS pocket-sized position determining units will be designed specifically for use in the assessment and control of occupational safety and health hazards. LPS units will use industry-standard connectors to input data from exposure monitors. LPS remote reference station software, being modular, will allow future analysis packages to be used by way of industry-standard object linking and embedding (OLE).

Potential users will be consulted in order to obtain insight into the diversity required in the processing software. After the first prototype LPS is laboratory tested, field tests will be conducted by potential users. From lessons learned, an iterative design-debug-test cycle will converge upon a mature functional specification. Although the software design will be extensive, a modular "plug and play" system will eliminate the barriers of user acceptance and thereby should maximize return on investment. In FY98, various approaches to precision positioning were studied. In FY99, prototypes were built and extensively tested in different environments. In FY00, units will be optimized for performance and reliability. They will be minimized for size, weight, battery requirements, and cost. Software design will be finalized. Both personal units and remote support electronics will undergo FCC type acceptance testing if required.

Development and Evaluation of a Portable Gas Chromatography/Mass Spectrometer (GC/MS) Unit

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Portable GC/MS, exposure assessment, field application

Purpose:
To evaluate the newly redesigned field deployable gas chromatography/mass spectrometer (GC/MS) unit to conduct better exposure assessment screening measurements.

Abstract:
In order to study the feasibility and efficacy of field gas chromatography/mass spectrometer (GC/MS) studies, NIOSH scientists conducted laboratory and field testing of a commercial transportable GC/MS. That unit was re-engineered and reconstructed as a more portable GC/MS by significantly reducing the weight and size of the pump. This project will concentrate on the applicability of the newly redesigned portable GC/MS as an approach to conducting exposure assessment screening measurements for the following operations: cleaning up hazardous waste sites, parts vapor degreasing, cleaning petroleum hauling barges, furniture stripping, and dry cleaning. This project will also develop information to determine the applicability of GC/MS in other applications, such as measuring microbial volatile organic chemicals (VOCs) as an indicator of microbiological contamination in buildings. A suitable laboratory with a desktop GC/MS unit was set up and field sites were identified. During FY99, laboratory tests and field tests of the newly redesigned unit were conducted. Limitations and disadvantages of the newly redesigned GC/MS were also identified. During FY00, further improvements will be implemented to eliminate those limitations.

Evaluation of LIF Technology for Bioaerosol Screening

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Laser-induced fluorescence (LIF) technology, airborne microorganisms, workers, health hazards

Purpose:
To examine the applicability of laser-induced fluorescence (LIF) technology to meet the need of differentiating airborne bioorganisms from nonbioorganisms at worksites where bioaerosols may pose a health hazard.

Abstract:
This project will first focus on gathering information on the capabilities and limitations of this emerging laser-induced fluorescence (LIF) technology and, at the same time, developing collaborations with a number of internal and external partners. Laboratory available devices such as the dual-beam spectrofluorimeter and the flow cytometer will be used to investigate potential fluorescence emitted from microorganisms. The project will then, by means of service contracts, acquire a portable LIF device and, through collaborations, conduct laboratory and field evaluations of the device by emphasizing the applicability of using this technology as an approach to detecting airborne microorganisms for exposure assessment screening in workplaces. If applicable, this LIF technology will be recommended to the industrial hygienists for workplace monitoring of airborne microorganisms.

Surface Chemistry Characterization of Respirable Particles

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Respirable particles, characterization, occupational hazards, exposure, respiratory disease hazards

Purpose:
To develop methods to characterize surface chemical functional groups and the reactivities of respirable particles that control or predict occupational respiratory disease hazards.

Abstract:
The initial year of work on this project will be developmental. Research will be initiated developing advanced methods for analysis of surface chemical functional groups and activities using new spectrometers obtained by NIOSH. Specific research tasks and sample applications will be sought and initiated. The new spectroscopic capabilities now being installed include Fourier Transform-Infrared (FT-IR) Spectroscopy, FT-IR Microscopy, Raman Spectroscopy, Raman Microscopy, and Magnetic Resonance Spectroscopy (MRS) with magic-angle spinning capabilities for analysis of solid materials. Solid-state and molecular modeling of surface chemical functional groups and interactions with organic molecules will be performed using commercial molecular modeling software to guide and analyze the results of the spectroscopic studies. Specific research applications will be selected based on the toxic interactions of respirable particles with the lung which are dominated by two factors: the particle's surface chemistry and the particle's interaction with pulmonary surfactant. Investigations will be initiated on: (1) surface functional groups of mineral particles, (2) surface chemistry of the interactions of pulmonary surfactant and respirable particles, and (3) surface chemistry of complex particles of organic or heavy metal toxin-coated substrate carrier particles. Specific investigations to be carried out in FY99 and FY00 will address: (1) surface chemical functional groups of quartz (crystalline silica), amorphous silica, thermally treated silica, and mineral fibers to identify the basis for observed differences in pathogenicity of particles of similar bulk composition, e.g., crystalline versus amorphous silica; (2) surface chemistry interactions of pulmonary surfactant and respirable particles such as quartz, amorphous silica, clay, diesel soot, asphalt, and hard metals to identify surface properties controlling the biological availability and time of expression of toxicity after particle deposition on the lung surfactant; and (3) methods development to characterize the structure and reactivities of complex particles of organics on minerals such as asphalts on environmental and construction mineral dusts or heavy metals or pesticides on soil particles, and to identify other factors controlling hazards in complex exposures, e.g., UV light activation of particulate surface organic materials. NIOSH will evaluate agency needs and opportunities for development of advanced spectroscopic methods to identify the surface chemistry properties and interactions of particulate agents of exposure responsible for occupational disease hazard.

Photoacoustic Fourier Transform-Infrared (PA-FT-IR) Spectroscopy for Crystalline SiO2 Analysis

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Silicosis, exposure assessment, dust, photoacoustic fourier transform-infrared spectroscopy

Purpose:
To determine if Photoacoustic-Fourier Transform-Infrared (PA-FT-IR) Spectroscopy can be a valid laboratory technique for crystalline silica analysis.

Abstract:
Photoacoustic Fourier Transform-Infrared (PA-FT-IR) has the potential for performing analyses directly on the air sampling filter to avoid time-consuming sample preparation. This work will determine the crystalline silica measurement accuracy and precision while using a customized PA-FT-IR analysis cell using silica dust alone and in mixtures. If successful, this project will develop a new crystalline silica analysis method for inclusion in the NIOSH *Manual of Analytical Methods* for widespread use to determine workplace concentrations of silica at significantly reduced cost.

Diesel Engine Emission Measurement and Analysis

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Diesel emission, particulate, techniques, mining

Purpose:
To adapt techniques for measuring diesel particulate emissions to the mine environment and certify their accuracy.

Abstract:
Several new techniques for measuring diesel particulate emissions developed in the past 10 years may be useful as both regulatory and hygiene tools. However, all these techniques must be adapted for the mine environment, and their accuracy certified. Specific tasks for this study include completing the commercialization of the size selective sampler developed by the Bureau of Mines. In addition, the degree of equivalence between size-selective, respirable combustible dust (RCD), and the elemental carbon sampling and analytical method must be established. Also, the interlaboratory comparison of analytical methods for elemental carbon must be completed. Finally, the current continuous respirable dust monitor for use as a continuous diesel aerosol monitor must be adapted. Several techniques for accurately measuring gaseous contaminants in mine air, in particular NO_2, will also be investigated.

Personal Dust Dosimeter

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Dust, measurement, device, screening

Purpose:
To provide an inexpensive dust measuring device that is modeled after the external design of a gas detector tube.

Abstract:
The dust detector tube and pump equipment are economical to obtain for the dust measuring device used in this research. In addition, the detector tubes are reusable This device is intended to be used as a screening tool, with a possible accuracy of 35 percent, to determine if additional, more rigorous dust evaluation is warranted. Preliminary laboratory testing of the device indicates that accuracy of better than 35 percent is possible for specific coal types. The principle of operation relies on the correlation of increasing pressure restriction across a filter as dust levels on the filter increase. The commercially available pump contains an integral real-time pressure transducer that can be used to determine the pressure restriction on a detector tube type device. The detector tube contains a preclassification section designed to meet the ACGIH criteria for respirable dust and Teflon bonded fiberglass mat type filtration media that has good pressure drop versus mass loading characteristics. Performance of the device in field conditions and further laboratory studies are to be conducted.

Analytical Techniques for Silica

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Silica, exposure assessment, mining

Purpose:
To develop a new laboratory method to measure silica content of mine dusts.

Abstract:
Respirable crystalline silica is a toxic agent that causes silicosis and aggravates Black Lung disease. This research will develop a new method to measure silica content in mine dusts within minutes by placing filter samples directly in an Fourier Transform Infrared Spectrometer without pretreatment. Currently, the method to quantify silica in coal mine dusts is labor intensive and time consuming. A quicker and easier method will permit more rapid responses to overexposure and facilitate wider scale monitoring. The research will produce a new analytical method for crystalline silica with accuracy comparable to established analytical techniques but with substantial improvements in convenience and speed. When fully developed, this will include hardware and software tools for automated analysis.

TEOM/ Personal Dust Monitor-Contract

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Mining, dust, instrumentation

Purpose:
To develop a personal respirable dust monitor.

Abstract:
This research will develop a respirable dust monitor that can provide a rapid readout of a full-shift exposure and real-time respirable dust concentration readings during a shift. NIOSH will design and fabricate 10 production Personal End-of-Shift Continuous Respirable Dust Monitors. These instruments, designed to strict performance and environmental specifications, will be used in underground coal mines as personal exposure monitors with real-time feedback capabilities. They will help the Mine Safety and Health Administration monitor compliance with coal dust exposure standards, and assist mine personnel in identifying operations where improved dust controls are needed.

Analytical Microbiology

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Metalworking fluids, microbiological, respiratory disease

Purpose:
To develop analytical methods that characterize and monitor workplace exposures to microbiological contaminants in metalworking fluids.

Abstract:
Airborne microbes and their by-products, e.g. endotoxins, may contribute to inflammatory lung disease, potentially affecting more than one million metalworking fluid-exposed workers. Current studies address endotoxins (collaborative evaluation of ASTM PS94), cellular organic phosphate (to estimate biomass), and metalworking fluid microbial ecology. Researchers need exposure data to decide which interventions to use, assess intervention effectiveness, interpret epidemiologic studies, develop quantitative risk assessments, assess feasibility of recommendations or standards, and monitor compliance. Understanding the microbial ecology of metalworking fluids may form the basis for better methods to control and reduce workplace exposures.

Field Methods for Hexavalent Chromium

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Exposure assessment, control technology, airborne toxins

Purpose:
To develop a field-portable method to measure hexavalent chromium Cr(VI) in the workplace.

Abstract:
Existing methods for chromium determination are laboratory-based. Cr(VI), a human carcinogen, is found in structural materials, building components, coatings, and pigments. Worker exposures may arise from construction and renovation activities when structural materials are disturbed and Cr(VI) becomes airborne, such as by welding or other work activities. Air particulates containing Cr(VI) can be inhaled, therefore exposing workers to deleterious health effects. To reduce worker exposures to this compound in the temporary workplace, such as a construction site, and to reduce corresponding health effects, field-based analysis methods for Cr(VI) are needed to determine exposures and effectiveness of controls.

Analytical Method for Total Isocyanate in Air

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Exposure assessment, analytical methods, isocyanates

Purpose:
To develop methods for total isocyanate group exposure assessment and evaluation of control technology effectiveness.

Abstract:
Because isocyanate exposures cause occupationally-induced asthma, NIOSH is interested in inhalation and dermal isocyanate exposures. Thousands of U.S. workers are exposed to isocyanate compounds used to produce polyurethane materials in the manufacturing, construction, automotive, and mining industries. If these methods under development show a strong correlation between total isocyanate group exposure and adverse health effects, this would support the issuance of exposure limits for nonmonomeric isocyanate species. Currently, NIOSH Recommended Exposure Limits exist for monomeric isocyanate species only.

Field Methods for the Analysis of Airborne Particulate Lead

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Lead, analytical methods, exposure assessment

Purpose:
To develop and evaluate field-portable techniques for the detection and determination of airborne lead and other potential lead sources.

Abstract:
The methods being developed for this research will benefit not only federal agencies in making regulatory and risk assessment decisions, but also health professionals and safety managers in making exposure assessments and evaluating control effectiveness. Lead

poisoning is an occupational hazard for more than a million U.S. workers, many of whom are minorities involved in construction and renovation work and are employed by small businesses. Since conditions at construction sites vary widely and change quickly, field-portable screening and analytical methods for lead will provide on-site workplace hazard assessments.

Analysis of Silica Polymorphs

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Silica, analytical methods, accuracy

Purpose:
To improve the precision of the different analytical methods used to characterize occupational silica.

Abstract:
Health problems associated with silica have been markedly reduced recently but have not yet been entirely eliminated. Although silicosis is believed the major killer associated with several of the polymorphs of silica, in 1996 the International Agency for Research on Cancer concluded that silica is a definite human carcinogen. Improvement in analytical methods will give a better understanding of health effects, legal defensibility of methods employed by the compliance agencies, and another step towards the elimination of silicosis.

Airflow and Concentration Predictors of Sampling Efficiency

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Aerosols, airflow, sampling methods

Purpose:
To examine the airflow around a worker's body and the particle concentration produced by this airflow in the worker's immediate area.

Abstract:
How the airflow around a worker's body and the particle concentration produced by this airflow affect the amount of dust in the worker's breathing zone and the capability of various personal samplers to give accurate measurements of the dust or aerosol will be determined. The suitability of today's most commonly used aerosol sampling methods and instruments for size-selected aerosol fractions (such as inhalable aerosol) is unknown. Knowing these relationships will establish the capability of certain personal aerosol samplers to measure exposures reliably and will direct research toward improved personal samplers. Accurate measurement of personal aerosol exposures, such as lead aerosols or dusts that cause asthma or chronic obstructive pulmonary disease, will afford better health protection for workers.

Biomonitoring of Workers Exposed to Roofing and Asphalt Fumes

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Asphalt, exposure assessment, biomarkers

Purpose:
To increase the understanding of the health effects of exposure to roofing asphalt.

Abstract:
In this investigation, biological samples were collected from roofers exposed to asphalt fumes during a typical work week. The samples are being used to assess internal exposure to asphalt-related chemicals and to determine whether this exposure can cause genetic damage. Biological markers of internal exposure, DNA damage, and genetic variations in enzymes that metabolize asphalt-related chemicals will be employed. The study will provide new information regarding the genotoxic effects of workplace exposure to roofing asphalt. The results will also aid in identifying particular work practices during the application of roofing asphalt that lead to increased genetic damage and determine if control technologies would be effective in protecting roofers from these effects.

Short-Term Methods Development

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Analytical methods, chemistry, method development

Purpose:
To develop analytical chemistry short-term methods in support of all NIOSH research.

Abstract:
This project consists of developing analytical chemistry short-term methods for NIOSH research where existing methods do not exist. Short-term method development is provided to NIOSH researchers upon request (as resources permit) and is integral to research on exposure assessment and control technology evaluation. Methods developed follow the 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, and establishment of limits of detection and quantitation. 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*.

Biological Monitoring Research and Support

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Biological monitoring, asphalt, herbicides

Purpose:
To develop new biological monitoring methods for assessing whether workplace chemicals have entered the body.

Abstract:
This research will involve the development of new biological monitoring methods to assess whether workplace chemicals have entered the body. These methods will be used for NIOSH worksite investigations. Currently, in-house effort focuses on: (1) development of methods for testing urine for evidence of exposure to four different herbicides and (2) providing the capability to test urine for exposure to fumes generated during the heating of asphalt fumes. 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.

NIOSH *Manual of Analytical Methods* Cooperative Research

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Analytical methods, sampling methods, method development

Purpose:
To conduct methods research.

Abstract:
The NIOSH *Manual of Analytical Methods* (NMAM) is a widely used repository of sampling and analytical methods for hazardous workplace substances. A joint American Industrial Hygiene Association/NIOSH survey of over 350 public and private laboratories identified frequently analyzed substances where NMAM methods do not exist, methods that need improvement, and laboratories willing to cooperate with NIOSH in method development. This project will conduct methods research addressing the priorities of the AIHA/NIOSH laboratory survey and use cooperating public and private laboratories to the maximum extent possible for this work.

Fixed Site Dust Monitoring

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Mining, dust, instrumentation

Purpose:
To monitor coal dust exposure in mines using machine-mounted respirable dust monitors.

Abstract:
Between 1968 and 1990, Coal Workers' Pneumoconiosis, caused by the prolonged inhalation of respirable coal mine dust, resulted in the deaths of 55,467 American coal miners. Accurate, real-time measurement of respirable dust is crucial to successfully reducing dust exposures and eliminating disease. NIOSH with a partner has designed and fabricated 10 production machine-mounted respirable dust monitors that will be able to continuously evaluate the atmosphere for respirable dust. These instruments, designed to strict performance and environmental specifications, will be used in underground coal mines on continuous miner, longwall shearers, and haulage vehicles. These activities will help the Mine Safety and Health Administration monitor compliance with coal dust exposure standards and aid mine personnel to identify operations where improved dust controls are needed.

Analytical Methods for Organic Compounds

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Analytical methods, metalworking fluids, mining

Purpose:
To develop analytical methods which characterize occupational exposures to hazardous airborne contaminations.

Abstract:
Under this continuing project, researchers develop analytical methods to characterize occupational exposures to hazardous airborne contaminants. Current studies address metalworking fluid aerosols and diesel exhaust. Millions of workers in the metalworking, mining, transportation, and construction industries are potentially exposed by inhalation to these contaminants, which are associated with increased risks for respiratory diseases and cancer. Following method development, project researchers will transfer the technology for occupational exposure assessment. Exposure data are essential to the goal of reducing occupational disease. The data will help to determine which interventions to use, intervention effectiveness, substance-specific exposure-response relationships for epidemiologic studies and quantitative risk assessments, the feasibility of recommendations or standards, and compliance.

Asphalt Fume Chemical Characterization and Hazard ID

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Asphalt, sampling methods, analytical methods

Purpose:
To identify specific compounds or compound classes in asphalt fumes that may cause irritation and genotoxic effects.

Abstract:
In 1983, an estimated 470,000 workers were potentially exposed to asphalt fumes on the job and many did not have union representatives because they were employed by small paving and roofing companies. This project proposes to identify specific compounds or compound classes found in asphalt fumes that may cause irritation and genotoxic effects. This research will be integral to sampling and analytical method development that assesses exposures to asphalt fumes and to specific irritants and genotoxins. It will provide laboratory research, laboratory information, and technology transfer. This will be useful in the design of better protocols for conducting asphalt worker exposure surveys, in identification of specific biomarkers to assess a worker's true exposure, and in the design of animal studies to evaluate a variety of physiological and toxicological effects associated with exposure.

Method Development for Airborne *Mycobacterium Tuberculosis*

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Tuberculosis, analytical methods, airborne

Purpose:
To develop a sampling and analytical method to measure airborne tuberculosis (TB).

Abstract:
This project will develop a sampling and analytical method to measure airborne tuberculosis (TB). Because TB is an occupational health risk, implementation of a TB standard is an Occupational Safety and Health Administration priority. Among infectious diseases, the leading cause of death worldwide is TB. Of particular U.S. concern is the rise of multidrug resistant tuberculosis, having mortality rates of 40 to 60 percent. The efficacy of technologies to prevent airborne TB transmission has not been adequately evaluated. Development of a reliable sampling and analytical method for airborne TB would permit early detection of TB-contaminated indoor air and give the extent of TB transportation within a facility. It would allow facilities to monitor the efficacy of environmental controls, such as increased ventilation, negative pressure rooms, or HEPA filtration.

• Fertility & Pregnancy Abnormalities

Methods Assessing Male Reproduction Toxicity

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Male, reproductive assessment, sexual function, evaluation, field studies

Purpose:
To evaluate current methods used to assess male sexual function.

Abstract:
The male reproductive assessment profile developed by NIOSH has been used in field investigations. However, as the basic understanding of reproductive biology increases and technology improves, modifications to this profile are essential to ensure that the most complete health information is collected. New methods have to be modified and validated for field conditions. Advances in fluorescence equipment and fluorochromes facilitate the reliable assessment of cellular constituents and functions. Applications of fluorochrome biomarkers to the assessment of sperm quality and function include identification, viability, motility, acrosome reaction, DNA stability, and chromosome identification. State-of-the-art equipment needed for these studies–including an epifluorescence equipped microscope and flow cytometer–is available. In 1997, work was conducted to evaluate the effectiveness of fluorescent probes for assessing sperm count motility and DNA stability. In 1998, work on this project continued. Once these methodologies have been perfected they will be field tested for use in field studies.

Field Application of Male Reproductive Health Biomarkers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Fisherman, polychlorinated biphenyls (PCBs), endocrine disruptors, reproductive problems

Purpose:
To assess the effect of various types of exposures to suspected toxicants on the reproductive health of workers.

Abstract:
This project will provide data on the versatility and utility of the male reproductive health profile when evaluating a spectrum of suspected reproductive toxicants. In 1997, charter fishing boat captains operating in the Great Lakes area were studied. These workers have had chronic exposures to polychlorinated biphenyls (PCBs) by consuming large quantities of contaminated fish. Historically, PCBs have been associated with a negative impact on reproductive function, but there are no objective studies in men exposed to PCBs. The current hypothesized mechanism of PCB toxicity is an alteration of reproductive hormones (endocrine disruption) causing fertility problems. This field study will provide an important test of the reproductive profile with a unique class of chemicals. This project involves collaboration with external partners also assessing important reproductive toxicants. Additionally, this project will provide data required to assess the exposure-response relationship in risk assessment.

Female Reproductive Effects of Exposure to Jet Fuel at USAF Bases

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Jet fuels, sex hormones, reproductive function, females

Purpose:
To determine if differences in endogenous sex hormone concentrations influence the metabolism of exogenous chemicals in jet fuels that affect reproductive, mutational, or neurotoxic outcomes.

Abstract:
There is evidence that gender differences exist for the metabolism of chemicals in jet fuel fumes that can explain differences in their toxicity in women versus men. Sex hormones affect metabolism of xenobiotics. Since metabolism can activate or deactivate xenobiotics, effects of sex hormones may have health benefit or detriment. Sex hormones affect metabolism of xenobiotics through actions on the liver, kidney, lung, intestine, adipose, skin, placenta, and fetus. This study assesses the adverse reproductive effects of jet fuel exposure at workplace operational levels on women personnel in the Air Force. The study will evaluate environmental and internal dose measurements of jet fuel components during the normal working activities of these women. Concurrent hormonal and menstrual pattern data will be collected.

Methods for Assessing Reproductive Potential in Females

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Methods, female reproductive health, occupational exposure, field studies

Purpose:
To develop methods that identify female reproductive toxicants and incorporate these methods into occupational field studies.

Abstract:
The investigators conducting this project hypothesize that specific and sensitive methods can be developed and used to identify female reproductive toxicants in population studies. Methods development will focus on specific and sensitive immunoassays to female reproductive hormones or their metabolites in readily collectible body fluids (such as urine and saliva).

Workers Exposed to National Toxicology Program Prioritized Reproductive Toxicants

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Reproductive toxicants, survey, workplace

Purpose:
To survey the use of the 25 top workplace reproductive toxicants as classified by the National Toxicology Program (NTP).

Abstract:
This project will identify the number of workers at risk, the occupations and industries involved, the production rate, uses and companies manufacturing or using chemicals that are reproductive toxicants. This will require the use of numerous data bases (including NOES, RTECS, NIOSTIC, HSDB, DIDS, SRI, CMR). The project investigators will then prioritize the toxicants on the list based on the population at risk, exposure, and availability of worker populations. Contact will be made with companies/unions requesting their assistance or participation in evaluating exposed workers to determine if reproductive impairment exists. Study designs will be developed to cover both observational and laboratory studies to determine prevalence, incidence, and risk. Workplace studies will be initiated with input from NIOSH and external partners (unions, trade/industrial organizations).

Occupational Epidemiologic Studies of Reproductive Function

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Male, reproductive hazards, workplace, lead, 2, 3 ,7, 8-Tetrachlorodibenzo-*p*-dioxin (TCDD)

Purpose:
To identify occupational reproductive hazards by conducting epidemiologic field studies in working populations.

Abstract:
Currently, this project consists of two studies:

(1) HORMONE LEVELS IN MEN OCCUPATIONALLY EXPOSED TO LEAD: The primary hypothesis to be tested in this study is whether lead exposure adversely affects male hormone levels as has been suggested in previous literature. In this cross-sectional study, conducted in 1994, serum testosterone and LH levels were measured in 155 exposed men (average blood lead level of 39 ug/dl) and 85 unexposed men. NIOSH analyzed the relationship between blood lead and male hormone levels.

(2) DIOXIN REPRODUCTIVE OUTCOME STUDY: The primary hypothesis to be tested in this study is whether spontaneous abortion is associated with the father's exposure to 2, 3, 7, 8 Tetrachlorodibenzo-*p*-dioxin (TCDD). As part of the dioxin morbidity study, extensive reproductive histories from the wives of the exposed workers were collected. Current 2, 3, 7, 8 TCDD serum levels obtained from the men were used to calculate the approximate serum levels at the time of conception. Statistical analysis evaluated any relationship between the father's serum dioxin levels and spontaneous abortion. Dose-response analyses and a publication were completed.

Reproductive Disorders in Female Flight Attendants: Health Effects

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Flight attendants, ionizing radiation, circadian rhythm, adverse reproductive outcomes, questionnaire, feasibility study

Purpose:
To determine if flight attendants experience adverse reproductive outcomes as a result of workplace exposures.

Abstract:
This study will evaluate the potential effects of ionizing radiation and circadian rhythm disruption on the reproductive health of flight attendants. In FY98, telephone interviews with 3500 flight attendants and 3500 teacher referents were completed for the Reproductive History Questionnaire Study. The telephone questionnaire collected information on reproductive histories and risk factors and detailed work histories were obtained for each group. For flight attendants, records of past flight schedules were obtained from the airlines. Exposures to radiation, circadian rhythm disruption, and other potential reproductive toxicants will be estimated retrospectively for each pregnancy, and rates of adverse outcomes will be compared to those of the comparison group of teachers. Analyses within the flight attendant group will be conducted to examine dose-response relationships.

The feasibility study for the Ovulatory Function Study enrolled 50 flight attendants and 25 teachers in FY95-96 to evaluate the logistical aspects of a biomonitoring study. Women were asked to complete a health questionnaire, collect daily urine samples, and keep a daily diary. Validated sleep scoring and bioassay of urinary melatonin were used to monitor circadian disruption. Sensitive urinary hormone assays developed and validated by NIOSH were used to detect subtle hormonal changes. Biomonitoring and questionnaire data were analyzed in FY98 to identify any problems with collection of data in such a mobile population. Feasibility data will be analyzed and used to develop a protocol for the Ovulatory Function Study.

In Vitro Assessment of Reproductive Toxicity

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: In vitro models, reproductive toxicants, pathways, biomarkers

Purpose:
To establish in vitro culture models to examine reproductive toxicants, identify the pathway that is effected, and to identify biomarkers of exposure and sensitivity.

Abstract:
It is hypothesized that specific chemicals encountered in the workplace (including xenoestrogens, pesticides, and heavy metals) have direct toxic effects on the testes and ovaries and contribute to the prevalence of infertility and other reproductive disorders in the U.S. The objectives of this project are to: (1) establish in vitro cell culture models to examine direct toxic effects of xenoestrogens, pesticides, and heavy metals on testicular and ovarian function and establish a dose-response relationship; (2) identify secondary intracellular step(s) in the regulatory pathway that is inhibited; and (3) identify specific biomarker(s) that indicate cellular exposure and sensitivity. These studies should establish in vitro models to determine the sensitivity of testes and ovaries to occupational chemicals. The sensitivity of gonadal cells to mixed exposures and the risk of occupational exposures will also be evaluated.

Endocrine Disruption: Consequence for Occupational Exposure

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Agriculture, construction, reproductive risks, agents, male, female

Purpose:
To identify agents and materials used in the agricultural and construction arenas that may pose significant reproductive risks.

Abstract:
This research will assess the effect of pesticides, potential endocrine disruptors, and asphalt fumes on indices of fertility capacity in both males and females. Male and female animal models will be exposed to agents via inhalation. After exposure, the following parameters will be measured: (1) hormonal profiles in blood for luteinizing hormone, follicular stimulating hormone in both males and females, testosterone in males, and estrogen in females, both under basal and stimulated (GnRH challenge) conditions; (2) steroid hormone metabolite levels in the urine; (3) gonadal disruption as indexed by histological analyses, DNA adduct formation, and apoptosis; (4) uterine dysfunction by epithelial cell transport capability; (5) fertility abnormalities as indexed by sperm count and motility; and (6) estrous cycle length, successful mating, and embryo implantation.

• Hearing Loss

Hearing Loss Prevention Programs for Construction Workers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Prevention, occupational hearing loss, construction workers, carpenters

Purpose:
To field test three new intervention components for preventing occupational hearing loss in construction and carpentry workers.

Abstract:
This project consists of three parts. In the first part, the Task Based Exposure Assessment Model and the resultant Hazardous Task Inventory will be used to identify hazardous construction work situations. Disseminating this information will enable carpenters to know which tasks jeopardize their hearing. In the second part of the project, the results of laboratory research in health communications will be used to apply new training tools capable of shaping positive behaviors regarding hearing protector use. This involves: (1) training materials to remove the barriers that carpenters indicate prevent them from taking responsibility for protecting their hearing and (2) a survey tool that can confirm the effectiveness of the training materials. This survey tool will reduce to two years the time needed to determine the effectiveness of this hearing loss prevention program as compared to the present situation of 5 to 10 years of annual audiometry. In the third part, a

new information management system using an optical card will enable both workers and management to have better control over and access to occupational safety and health records. The optical card system will enable managers, workers, and health care professionals to have prompt feedback on the presence or absence of significant hearing changes to both individuals and worker populations. This feedback will be a powerful motivating tool either to encourage the continuation of effective hearing health behaviors or to stimulate changes to an ineffective hearing loss prevention program. NIOSH is working closely with several external partners to implement this hearing loss prevention program.

Methods for Evaluating Hearing Conservation Effectiveness

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Hearing Conservation Plans, workers, evaluation, feasibility study

Purpose:
To evaluate the effectiveness of Hearing Conservation Plans (HCPs) and conduct a feasibility study for the evaluation of longitudinal HCP data.

Abstract:
This project involves separate studies: (1) an evaluation of whether workers enrolled in several Hearing Conservation Plans (HCPs) still suffer from noise-induced hearing loss and (2) a feasibility study for the evaluation of 30 years of longitudinal HCP data collected by the Eastman Kodak company. This project will examine factors (other than audiometric variability) that might affect the effectiveness of a Hearing Conservation Plan (HCP), such as background room sound levels, worker training, declines in noise exposure over time, and hearing protection use. The HCP data is unique in that audiometric records, industrial hygiene noise exposure measures, data regarding hearing protection use, and dates of worker training have been computerized for all active workers. Database analyses will include: (1) development of longitudinal models to examine how rates of change in hearing vary as a function of noise exposures and other variables; (2) examination of different standard threshold shift definitions in each HCP population; (3) examination of measures of audiometric variability developed by the ANSI standard; and (4) development of measures of HCP data quality that examine errors due to (a) response uncertainty, (b) high test room background noise, and (c) unilateral hearing loss.

Quiet By Design-Engineering Noise Control

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Quiet mining, noise, prevent hearing loss, research, equipment

Purpose:
To develop quiet mining machines that will control noise and prevent hearing loss.

Abstract:
The underground mining environment presents the greatest challenge for engineering control of noise. Where feasible, cooperative research with equipment manufacturers will be sought in order to ensure a new generation of quiet mining machines. There are numerous machines and processes that should be researched (based on available Mine Safety and Health Administration [MSHA] data). Those that should be addressed at the design stage are: (1) Percussion drills: In numbers and severity, drills remain the most serious noise problem in mining. An extramural approach with a drill manufacturer is anticipated. (2) Cutting heads: Both continuous miners and longtail cutting drums continue to generate noise levels in excess of 105 dBA. Initial work will be directed to developing a better understanding of the cutting forces and their transfer into the body of the mining machine for use in developing a computer model. (3) Conveyors: Previous research identified the concept of a variable speed driven conveyor as the solution to noise from armored flight chain conveyors employed in continuous and longwall mining. This concept is based on varying the chain speed to keep the conveyor trough full at all times. (4) Mobile diesel equipment: The use of diesels is increasing, especially in underground coal mines. Of particular interest is the application of active noise control.

Cross-Sectional Survey: Characterization of Mine Noise Sources & Worker Exposure

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Noise, cross-sectional study, mine workers, occupations

Purpose:
To conduct a cross-sectional field study of noise exposure to mine workers in different occupations.

Abstract:
The primary task of this research is to establish representative noise exposure profiles for various occupations. This can only be accomplished by undertaking comprehensive and extensive noise exposure measurements. Time-resolved dosimeters should permit this type of approach. Typical exposure patterns will be established for the different occupations through repeated sampling with dosimetric instrumentation. Currently, NIOSH sees a great range in the Time-Weighted-Average (TWA) for a given occupation. This variation could be caused by the mine environment, operating cycle, equipment condition, other sources, etc. The source of this variability needs to be understood to successfully identify the appropriate solutions. Specifically, cross-sectional information on occupations, highlighted by available Mine Safety and Health Administration data, will be collected that includes: (1) full shift noise exposure level time histories, (2) relevant mine operational data, and (3) spectral information by machine type/operational mode.

Audiometric Assessment in NHANES IV

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Hearing loss, surveillance, risk assessment

Purpose:
To collect data for use in developing a baseline to compare other audiometric data.

Abstract:
This project supports the adult hearing assessment portion of the National Health and Nutrition Examination Survey (NHANES) and is collaborative with the National Institute on Deafness and Other Communication Disorders and the National Center for Health Statistics. It will be the first effort to collect information about the hearing of adolescents and adults including histories, middle ear function, and hearing thresholds. NIOSH is providing technical assistance for the six years of the survey, including the development of training materials, training of technicians, oversight of data collection, and analysis of data. In this project, hearing data will be collected using methods designed to be free of artifacts and errors. The data will serve as a baseline against which all other audiometric data are compared for determining the excess risk of hearing impairment due to exposure to noise and other ototraumatic agents.

• Indoor Environment

Studies of Indoor Environmental Quality: Health Effects, Risk Factors, etc.

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Indoor environmental quality, intervention, exposure assessment

Purpose:
To identify risk factors and/or effective interventions for indoor environmental health effects.

Abstract:
This project focuses on conducting three studies. All involve the analysis of previously collected study data and share a hypothesis that currently unmeasured indoor exposures cause disease characterized only by nonspecific building-related symptoms. Current analyses are assessing: in cross-sectional data, ventilation system risk factors for building-related symptoms; in intervention study data, efficacy of enhanced air filtration and of surface cleaning in reducing severity of building occupant symptoms over four seasons; and in cross-sectional/standardized case series data, analyses of risks for symptom reporting in 80 “complaint” office buildings. Outcomes will help identify risk factors and effective interventions for building-related nonspecific symptoms.

Statistical Methodology for Analysis of Indoor Contaminant Data

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Indoor air quality, airborne contaminants, epidemiologic

Purpose:
To develop statistical methods that will characterize indoor air contaminant exposures and the associations between exposures and symptom prevalence.

Abstract:
This research uses indoor environmental quality data collected during Health Hazard Evaluations of 80 office buildings. Methodologies appropriate for the characterization of factors such as indoor contaminant exposures or comfort factors (such as humidity or temperature and their association with environmental symptoms) are being developed in this project. This research will identify techniques appropriate to quantify indoor exposures for use in studying the relationship between exposure and symptom prevalence.

Female Flight Attendants

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Indoor air quality, exposure assessment, radiation

Purpose:
To assess exposure to cosmic ionizing radiation and cabin air quality parameters aboard commercial flights.

Abstract:
The findings from this research will be used in conjunction with concurrent reproductive health outcome studies to determine if female flight attendants are at increased risk of adverse reproductive outcomes. This study is funded in large part by the Federal Aviation Administration. Data collection for the project has been completed. The findings of this project will be used to determine the need for future exposure assessment studies and the need for intervention on flight crew exposures, as well as to communicate risks to reproductive health incurred by work in the commercial flight environment. The cosmic radiation measurements also will be used to determine the adequacy of predictive exposure models for estimating cosmic radiation dose per flight.

• Infectious Diseases

Susceptibility of Workers to Lung Infection After Exposure to Different Occupations

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Infectious disease, welding, asbestos

Purpose:
To evaluate mechanisms that may increase workers' susceptibility to respiratory disease and infection.

Abstract:
It is essential to identify the mechanisms by which silica, welding fumes, diesel exhaust particulate, and asbestos fibers may increase a worker's susceptibility to respiratory disease and infection. This project will use a rat model of bacterial infectivity in the lung to generate data concerning lung injury, information, antimicrobial activity of phagocytes, and pulmonary infection to evaluate these issues. An explanation of the mechanisms will enable researchers and professionals to educate and protect workers exposed to these dusts and fibers and potentially prevent adverse health effects.

Inflight Disease Transmission and Diffuse Symptomatology

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Airborne contaminants, infectious disease, transportation

Purpose:
To study the dispersal and removal of aerosols generated in passenger and cockpit cabins.

Abstract:
This project will study the dispersal and removal of aerosols generated in passenger and cockpit cabins in order to answer two important questions: (1) What are the major factors that determine the spread of human aerosols in aircraft cabins? (2) How can this information be used to improve new aircraft designs or retrofit existing aircraft with equipment that will decrease the possibility of transmitting infectious agents? Activities supported by the project include characterizing the number and size distribution of human aerosols present in aircraft cabins and determining the dispersal and removal of the different sized aerosols. This work will be done with empty cabins and artificially generated aerosols and with passengers and airline workers occupying the cabins.

Evaluation of Portable Room Air Cleaners

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Tuberculosis (TB), bioaerosols, prevention, air-cleaning

Purpose:
To evaluate the efficacy of a portable air-cleaning unit in controlling bioaerosols in health care rooms.

Abstract:
This research will use an existing bioaerosol chamber to assess how well portable air-cleaning units control bioaerosol contamination in health care rooms. The Centers for Disease Control and Prevention guidelines for preventing the transmission of Mycobacterium tuberculosis (TB) recommends portable air cleaners as a temporary solution for low airflow rates in TB isolation rooms. Experts cite a lack of control technology criteria as impeding effective control. Health care facilities will use these project results in future selections of portable air-cleaning units, thereby, reducing worker exposure to TB.

• Intervention Effectiveness Research

Applied Health Communications Research Support

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Communication research, evaluation, intervention

Purpose:
To develop effective, measurable, health communication strategies and methods to enhance the effectiveness of workplace interventions.

Abstract:
Five workplace interventions will be selected to receive this health communication enhancement. This effort is designed to improve the communication effectiveness of each intervention. It will use applied health communications research skills such as targeting and profiling audiences, developing and piloting communication messages with test audiences, and selecting appropriate communication channels. The selected preventive interventions will receive enhanced health communications services to improve their communication effectiveness, efficiency, impact, and contribution toward improving worker safety and health.

Hearing Loss Prevention: Putting Theory Into Action

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Feasibility, hearing loss prevention program, food processing facility

Purpose:
To assess the feasibility of implementing a model hearing loss prevention program in a noisy food processing facility.

Abstract:
This research will be conducted in a food processing facility that has had a compliance-driven hearing conservation program for 1,800 employees for the past 15 years. NIOSH staff will provide technical assistance for this project to on-site health and safety professionals, supervisors, and workers in a food facility to enable them to establish and monitor a program tailored to their work environment. External partners will also provide services. The hearing loss prevention program will follow the principles noted in the newly revised NIOSH manual, *Preventing Occupational Hearing Loss: A Practical Guide*. This intervention will use a number of products recently developed: (1) an attitudes/beliefs survey that targets barriers to preventing hearing loss, (2) a training video and accompanying classroom materials to educate and motivate employees and management, (3) an on-site hearing protector fit-test system to assess the effectiveness of each worker's hearing protection, and (4) the HearSaf 2000 integrated computerized information management system including workers' health and training data, noise exposure monitoring/analysis systems, and audiometric monitoring/analysis systems.

Dry Cleaning Campaign: Communicating Risks to Improve Exposure Control

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Dry cleaning, perchloroethylene, intervention

Purpose:
To reduce perchloroethylene exposure risk and other health and safety hazards to owners, workers, and families in the dry cleaning industry.

Abstract:
Dry cleaning facilities are typically small operations without resident engineers or health and safety specialists. This project will assist these small companies by introducing engineering retrofits, investigating the significance of dermal exposure, and communicating this knowledge to individuals within the dry cleaning industry. Messages that work in explaining risks and motivating owners and workers to reduce them will be distributed to trade associations and unions and directly to dry cleaners around the country.

A Feasibility Study to Evaluate Non-Union-Contractor Health and Safety Training

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Construction, training, communication

Purpose:
To compare the health and safety status of workers in open shops who receive health and safety training versus workers who do not.

Abstract:
While much of the research in construction is conducted on union work sites with union workers, approximately 80 percent of the construction workforce are not covered by collective bargaining agreements. It is important to evaluate the health and safety status of these workers as well. It is anticipated that findings from this study will provide evidence for the importance of implementing training efforts in open-shops. Expected outcomes are to show nontraining open-shop contractors that training their workforce can reduce their losses, both financial and human, and they can also remain competitive.

Evaluation of Best Practices Back Injury Prevention Program

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Intervention, musculoskeletal disorders, traumatic injuries

Purpose:
To evaluate the best practices program for preventing back injuries in nursing staff working in nursing homes.

Abstract:
The cost of workers' compensation claims have prompted insurance companies to encourage nursing homes to move towards a "best practices program" for preventing back injuries among nursing home staff. The "best practices program" contains elements of primary and tertiary prevention. The primary prevention component is based on mechanical lifting equipment and manual patient transferring methods that have been shown to reduce the physical stresses exerted by nursing assistants in laboratory studies. The tertiary component is a medical management program that encourages quality health care, rehabilitation, return to work, and provides light duty work for injured workers returning to work. The prevention programs will be implemented with as much input as possible from the nursing staff who will be using the interventions. This study will evaluate the process and methods of program implementation and most importantly the impact of the program for reducing the incidence, disability, and injury-related costs associated with back and other injuries among nursing staff in nursing homes.

Effectiveness of Crane Operator Certification

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Intervention, traumatic injuries, construction

Purpose:
To evaluate the effectiveness of crane operator certification in reducing crane-related incidents.

Abstract:
Crane operators and others who work in close proximity to cranes are at high risk of serious injury due to cranes and hoists. This project will concentrate on the value of crane operator certification as a means to decrease crane-operator incidents. "Incidents," defined as events that result in a crane stopping work, will be

examined for the two-year period before and after the company's operators were certified by the National Commission on Certification of Crane Operators. Project results will assist in determining the potential effectiveness of certification in reducing injuries related to crane operation and will assist OSHA in determining the value of mandatory certification.

Evaluation of a Model Training Program for the Food Service Industry

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Training, evaluation, injuries

Purpose:
To evaluate the impact of worker safety and health training conducted by the National Restaurant Association, to change restaurant workers' knowledge, attitudes, and behaviors towards working safely, and to reduce injury and illness.

Abstract:
In this project conducted by the National Restaurant Association, NIOSH will participate in the study by assisting with: (1) the design of the study, (2) the design and pretesting of knowledge and attitude measurement instruments, (3) review of training curriculum, (4) collection of post-training measures of effectiveness, (5) data analysis, and (6) preparation of reports of study results. Three major food service corporations are involved. During the one-year training period, data was collected from all stores about employee knowledge, attitudes, and behaviors. Participating companies are being asked to provide illness and injury data and other demographic data for all study participants. This study will evaluate the effectiveness of the training in changing employee knowledge, attitudes, and behaviors toward working safely as well as assessing any reduction in injury and illness rates. Study results will add to the knowledge base on safety and health intervention effectiveness, training methods, and field study methods.

Model Hearing Conservation Program for Miners

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Intervention, training, exposure assessment

Purpose:
To develop and implement a hearing conservation program for an underground mine.

Abstract:
This program will incorporate the best practices of well-run programs in other industries and will evaluate the effectiveness of this strategy over a five- to six-year period. An external partner will collaborate with NIOSH on this project.

Ergonomics Interventions in Mining

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Mining, ergonomics, musculoskeletal disorders

Purpose:
To assess musculoskeletal disorder exposures and to evaluate the effectiveness of ergonomic interventions in mining environments.

Abstract:
This research is planned as a two-phase effort. The first phase is concerned with conducting musculoskeletal disorder (MSD) exposure assessments in a variety of mining environments. The results of these assessments will be used to establish health and safety baseline data and identify general means to reduce musculoskeletal disorder risk factors. 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 ergonomic interventions in reducing mine worker exposure to musculoskeletal disorder risk factors and the occurrence of MSD injuries.

Supplementary Rest Break Intervention for Repetitive Musculoskeletal Work

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Work organization, intervention, musculoskeletal disorders

Purpose:
To evaluate the long-term effectiveness of a supplementary rest break intervention that has recently been implemented for data transcribers at the Internal Revenue Service.

Abstract:
The implementation, in which 5-minute hourly breaks are being provided to supplement the two 15-minute breaks provided under the conventional schedule is a direct consequence of background studies conducted by NIOSH. These studies, which were brief (4-12 weeks) in duration, indicated that supplementary rest breaks alleviated symptoms of musculoskeletal and eye strain, fatigue, and stress without impairing performance. The present study comprises a more extensive evaluation of the long-term effects of supplementary rest breaks at the intervention sites. Outcome measures will include absenteeism, sick leave, disability, employment retention, and possibly performance.

Crosscutting Research and Interventions in Hazardous Work Environments

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Intervention, special populations, work organization

Purpose:
To implement and evaluate safety and health interventions that reduce workload or workplace hazards, reorganize the work, or provide new information to change how the workplace hazards are managed.

Abstract:
Interventions with crosscutting potential for the industries of agriculture, construction, and mining will be undertaken. 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 will be developed into: (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 industries, and (3) an ongoing exploration of crosscutting approaches to common problems in these industries.

Long-Term Study of Alternative Keyboard Effectiveness

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Musculoskeletal disorders, work organization, intervention

Purpose:
To assess the efficacy of alternative keyboards in preventing or alleviating musculoskeletal disorders among keyboard users.

Abstract:
This project will be conducted with a large news agency. A range of alternative keyboards will be assessed over a period of 1-2 years. Outcome measures will include medical assessment of symptomatology, job/task and workstation assessments, stress/discomfort/fatigue, worker perceptions of the psychosocial work environment, and a range of physical/physiological indicators of musculoskeletal risk factors (e.g., postural analyses, etc.). This project will be completed in FY00 and recommendations regarding effective keyboard designs will be made.

Field Evaluation of Hearing Protector Fit-Test Systems

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Hearing loss, noise, hearing protectors

Purpose:
To develop and test new audiometric technologies and methods that realistically and accurately determine how well hearing protectors work for noise-exposed workers on the job.

Abstract:
Several potential methods of "fit-testing" hearing protectors to the workers who actually depend upon them are being evaluated for reliability, validity, and feasibility, both in worksites and in a standard audiometric suite. It is expected that one or more of these methods will be incorporated into other comprehensive hearing loss prevention efforts developed and assembled in partnership with other groups.

Evaluation of the Effectiveness of Medical Management and Rehabilitation for Work-Related Musculoskeletal Disorders

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Musculoskeletal disorders, intervention, health services

Purpose:
To assess the effectiveness of medical management programs for rehabilitating and returning employees with work-related musculoskeletal disorders to work.

Abstract:
The purpose of this cooperative agreement and demonstration project is to assess the effectiveness of medical management programs for rehabilitating and returning employees with work-related musculoskeletal disorders to work. Reliable information on the effectiveness of such programs is lacking, and this project will develop and apply objective evaluation criteria that will form the basis upon which to compare the success rate of various programs. The demonstration project will provide data on the types of programs in existence, the elements necessary for successful programs, and the effectiveness of programs in returning populations to work. The information developed through this project will be disseminated to state health officials, health care providers, employees, employers , and unions. The conclusions will be useful to many in the medical, industrial, and scientific communities.

Hearing Loss Prevention: Putting Theory into Action

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Hearing loss, noise, intervention

Purpose:
To evaluate the effectiveness of the model hearing loss prevention program that has zero tolerance for noise-induced hearing loss.

Abstract:
Traditional compliance-driven hearing conservation programs, although good for tracking hearing loss in workers, are now known to be inadequate for the conservation of hearing. NIOSH recently developed a model hearing loss prevention program that has zero tolerance for noise-induced hearing loss. This project is designed to evaluate this intervention in the manufacturing setting. Key features of the program include evaluation to ensure the use of engineering controls has been maximized, intensive one-on-one worker education and training at the time of annual audiometry, and fit-testing of hearing protectors to optimize selection and use of appropriate devices. When fully implemented and evaluated over two years, this project will provide a detailed and timely assessment of the real-world effectiveness of this approach in a typical industrial setting.

Safety for Workers' Eyes

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Communication research, construction, eye injury

Purpose:
To increase the use of protective eyewear among carpenters by developing theory-based safety messages tailored to workers, supervisors, and contractors.

Abstract:
The United Brotherhood of Carpenters Health and Safety Fund of North America has developed field techniques for assessing safety eyewear use and have estimated that only about 50 percent of carpenters wear safety eye protection during hazardous tasks. This project will develop targeted eye safety messages to improve the use of safety eyewear and reduce eye injuries among union carpenters. One of the major contributors to the failure of safety messages is a lack of appropriate effectiveness regarding the intervention strategies. This project will provide public health investigators with a theory-driven eye injury prevention program and the tools to implement it.

• Low Back Disorders

NIOSH Lifting Equation (NLE) Evaluation: Exposure Assessment and Documentation

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Lifting, equation, evaluation

Purpose:
To evaluate the NIOSH lifting equation (NLE) using a retrospective study to investigate the dose-response relationship between lifting index (LI) and risk of low back pain, conduct a laboratory study of the asymmetric multiplier component of the NLE, and teach how to use the revised lifting equation.

Abstract:
This project consists of three components. The first component was a feasibility study of the NIOSH Lifting Equation (NLE). A modular retrospective cross-sectional study design was used to investigate the dose-response relationship between the lifting index (LI) and risk of low back pain. The study provided data on physical exposure for 50 manual lifting jobs in four industries, and a total of 281 persons who were employed in those jobs completed a health effects questionnaire. An additional 99 persons employed in nonexposed jobs, without risk factors to back pain, also completed the questionnaire. Additional data were collected at a fifth industry. A second component of the project is a laboratory-based research study to evaluate the asymmetric multiplier component of the NLE. The final component of the project is to complete development of a CD-ROM-based multimedia training program to teach users how to properly use the revised NIOSH lifting equation. It is anticipated that data will be needed from 6 to 10 additional sites in order to provide sufficient statistical power to properly determine the effectiveness of the NLE. Goals included: (1) identify and collect data at one-half the remaining sites and (2) return to one or more previous sites to collect data on the temporal aspects of low back pain (LBP). NIOSH identified and collected data at the remaining sites in order to increase the accuracy of the equation, streamline the equation, and make it easier to use.

Ergonomic Interventions in the Construction and Repair of Ships

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Job risk factors, injuries, illnesses, construction

Purpose:
To assess the relationship between the high rate of injuries and illnesses in the construction industry and associated job risk factors.

Abstract:
Because of the very high injury and illness rates in the construction industry, it is imperative that research be undertaken to better understand the relationship between the high rate of injuries and

illnesses as noted in the OSHA 200 logs and associated job risk factors. Once this association is better understood, effective ergonomic intervention strategies can be developed to prevent such injuries and illnesses. This study will be conducted in two phases. The first phase, which will take one year to complete, is to: (1) conduct walkthrough surveys of 3-5 shipyard construction sites to examine injury and illness databases kept by the company medical department to determine specific injury and illness rates for the various trades for the past three years, (2) conduct qualitative job risk factor assessments of the various trades, and (3) determine if specific job risk factors can be associated with the injury and illness database information. If an association is made between health outcome and job risk factors, then the second phase will begin. The second phase will take two years and will follow the first year activities to: (1) quantify job risk factors in the trades and (2) recommend engineering and administrative controls to reduce these risk factors. Another task for the third year will be to reevaluate the injury and illness databases from the first year where engineering and administrative controls have been implemented and quantified and to determine if the reduction in these job risk factors have resulted in a decrease in the incidence and severity of musculoskeletal disorders in the trades mentioned above. This information will be disseminated as a report to the construction industry partners; the report will be generated at the end of each year. The final report, at the end of the third year, will also include ergonomic guidelines for the construction maritime industry.

NIOSH Lifting Equation

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Lifting equation, ergonomics, low back disorders

Purpose:
To collect data about the accuracy of the NIOSH recommended weight limit and lifting index equations to predict the risk of low back pain associated with manual lifting.

Abstract:
In 1993, NIOSH published the recommended weight limit and lifting index equations to provide a useful tool for characterizing the physical demands of a wide range of manual lifting jobs. The equations, which were originally developed to assist in the ergonomic design of manual lifting jobs, have also been extensively used as a risk indicator for low back pain due to manual lifting. This project is designed to provide data about the accuracy of the NIOSH recommended weight limit and lifting index equations to predict the risk of low back pain associated with a specified manual lifting job. The results of this project will be useful to OSHA and other practitioners using the NIOSH lifting equations to assess low back injury hazard due to manual lifting.

Evaluation of the Efficacy of Back Belts in Material Handling Workers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Back belts, exposure assessment, low back disorders

Purpose:
To determine the efficacy of back supporting belts in preventing first and recurrent low back injuries in retail store employees.

Abstract:
This study will be conducted in retail workers with the highest lifting exposures from 160 Wal-Mart stores located in the eastern United States. Limitations of previous epidemiologic studies will be addressed through longitudinal data collection, assessment of physical work exposures, collection of adequate sample sizes, and assessment of psychosocial factors using validated scales. Study results will make significant contributions to the appropriate literature by providing higher quality information on the value of back belts in preventing workplace injuries, and thus a clearer basis for future recommendations to industry and the public.

• Mixed Exposures

Mixed Chemical/Radio Frequency Radiation Teratogenesis: Generalizability

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Mixed exposures, radio frequency, radiation, glycol ether, teratogenicity

Purpose:
To determine if the effects of mixed exposures to radio frequency (RF) and glycol ether (2 ME) can be applied to other chemical agents.

Abstract:
In this project, pregnant rats will be exposed to chemicals alone, to radio frequency (RF) radiation alone, or to both agents concurrently. Chemicals (aspirin, methanol) have been selected based on recommendations of a peer-review panel and the following criteria: (1) presence and prevalence in workplace, (2) developmental toxicity in human and rat, and (3) number of exposed workers. NIOSH initially began work on the effects of combined physical and chemical agents based on field studies of worker exposure and toxicological data on the teratogenicity of RF and 2 ME. This project will draw on the knowledge gained in earlier NIOSH research that found that the synergistic teratogenic effects produced by mixed RF and glycol ether (2 ME) exposure increase with both the 2 ME dosage and duration of RF exposure of rats.

Cohort Mortality Study Among Asphalt Road Pavers: Feasibility Assessment

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Asphalt, feasibility study, health effects, workers

Purpose:
To determine if a cohort mortality study can be conducted among a population of asphalt pavers.

Abstract:
This research project is a feasibility assessment to determine if a cohort study can be conducted in asphalt pavers. In the United States, 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 on the potential 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 our understanding of chronic health effects, including cancer, in this large occupational group.

Pulmonary Responses to Occupational Dusts

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Mixed exposures, agriculture, construction

Purpose:
To determine the potential of native dust and its components to cause lung injury.

Abstract:
This project will use in vitro and in vivo techniques to determine if native dust and its components can cause respiratory disease. Dust samples collected from work sites will be characterized. Bioassays of pro-inflammatory secretions, acute phase proteins, activation of the metallothionine gene, generation of reactive oxygen species, and pathological changes will be conducted. The results of this project will provide NIOSH with guidelines to recommend appropriate control technology in occupational settings where workers are exposed to mixed dusts.

Asphalt Fumes: Study of First Stage Lung Cancer Biomarkers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Asphalt, hazards, mixed exposures

Purpose:
To investigate the effects of asphalt fumes on pulmonary irritation, inflammation, airway reactivity, and lung injury.

Abstract:
This research will evaluate pulmonary injury by measuring oxidant generation, inflammatory cytokine secretion, and nuclear transcription factor activation in lung cells. 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 increase the understanding of the potential health hazards associated with occupationally-related asphalt fumes exposure.

Machining Fluids (MFs): Study of Biological Responses

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Metalworking fluids, dermatitis, hazard

Purpose:
To determine if metalworking fluids (also known as machining fluids) when applied to skin of mice have a local and systemic effect.

Abstract:
The impact of metalworking fluids on the body will be studied in this research project. The exposure route for this study will be mouse skin used to determine if dermatitis and distant target organ toxicity result from exposure to metalworking fluids. These fluids are complex mixtures containing petroleum derived products, water, several kinds of amines, anti-welding and anticorrosive agents, biocides and biostats, and other agents. The adverse responses in industrial workers may manifest as contact dermatitis or hypersensitive pneumonitis. In addition, the role of oxidant species in the development of dermatitis will be evaluated. This information will aid in the development of prevention strategies for occupational dermatitis in workplaces that use metalworking fluids.

Characterization of Inorganic Dust Exposures

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Dust, respiratory disease, mining

Purpose:
To determine if the prevalence of lung fibrosis correlates to the amount of surface-available silica.

Abstract:
Advanced surface analysis methods will be used in this project to determine both the bulk and the surface elemental composition of the silica particles. Although most exposures involve particles of mixed composition, the importance of particle surface in dust toxicity is unknown. Without this knowledge, current methods of exposure assessment may under or overestimate the true hazard of an exposure. Successful completion of this project will result in better occupational standards for estimating the degree of hazard presented by respirable particle exposures.

Chronic Stress and Susceptibility to Workplace Chemicals

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Stress, neurotoxicology, hormones

Purpose:
To examine the factors associated with chronic stress, molecular/cellular markers of stress, and increased response to neurotoxic chemicals.

Abstract:
In this project to identify the most sensitive and predictive biomarkers for stress, conventional and transgenic models will be used to examine molecular and biochemical changes from chronic stress. Once identified, the effect on chronic stress in occupationally related diseases (e.g., irritant contact dermatitis) will be studied. Chronic stress biomarkers will help identify workers at risk for stress and determine the impact of stress on workplace problems in which the nervous system is implicated in either etiology or susceptibility (e.g., sick building syndrome, contact dermatitis).

Mechanism of Action 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Risk assessment, cancer, toxicology

Purpose:
To examine several aspects of the toxicology of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin to improve estimates of quantitative risk assessment for workers exposed to halogenated aromatic hydrocarbons.

Abstract:
This project will study: (1) details of the 2,3,7,8,-tetrachlorodibenzo-*p*-dioxin mechanism of action, (2) a two-stage model of carcinogenesis, and (3) the combined effects of multiple agonists on the same receptor. The results of this study will provide better estimates of quantitative risk assessment for workers exposed to halogenated aromatic hydrocarbons.

Risks from Emerging Hazards

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Hazards, mixed exposures, toxicology

Purpose:
To generate information that will be used to develop prevention strategies that address occupational hazards.

Abstract:
This project will improve NIOSH's ability to respond rapidly to emerging occupational hazards in workplaces where diseases may occur from mixed exposures. Researchers will assess the risk from evolving toxic hazards, such as those identified by Health Hazard Evaluation teams. The risk will be assessed through animal modeling, chemical characterization, and the morphopathogenesis of the experimental disease. When potential new hazards are identified, the investigations will explain the type and extent of adverse responses, the time-course and dose-dependence of these responses, and the etiologic agent in mixed exposures. The information from this project will be disseminated to the scientific community, NIOSH partners, and other agencies with regulatory authority. The project-generated information will be used to develop prevention strategies that specifically address emerging occupational hazards.

• Musculoskeletal Disorders of the Upper Extremities

Evaluation of Tool Design Characteristics for Use in Construction Work

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Hand tool, safe, efficient, construction

Purpose:
To determine if hand tools can be used safely and efficiently in the construction industry.

Abstract:
This research project is divided into three phases.
Phase I: The criteria for safe and efficient use of a hand tool in the construction industry will be organized in a multi-point checklist

such that the evaluation can proceed sequentially from simple characteristics like appropriateness of size, shape, weight, and material, to more complex design features like meeting guidelines for muscular force, and acceleration produced during tool use. Phase II: The efficacy of the hand tool evaluation criteria will be assessed, first in the laboratory, and then in the field. The evaluation criteria will be applied to a set of selected manual hand tools, which may range from hammers to dry wall carrying jigs. The laboratory evaluation will result in: (1) a standardized hand tool test procedure, (2) a description of ergonomic features and design characteristics of tools that are compatible with the principles of ergonomics, and (3) a rating of the various features of the tools evaluated (similar to those provided by consumer groups). Phase III: These criteria will be tested in the field. Focus groups and other outreach mechanisms, such as worker surveys, will be used.

Ergonomic Interventions for the Household Appliance Industry

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Engineering controls, laundry manufacturing, workers, ergonomic stressor, injury, illness

Purpose:
To: (1) evaluate engineering-based controls at a laundry manufacturing plant and (2) assess the effect of front-end engineering controls on worker exposure to ergonomic stressors and on the incidence of work-related injury and illness, particularly musculoskeletal symptoms and lacerations.

Abstract:
Training in ergonomics and technical assistance has been provided by NIOSH staff for company personnel to improve the design of workstations, jigs, fixtures, and tooling in accordance with ergonomic design principles along a new production line. The effectiveness of the intervention activities have been evaluated in a base line and a follow-up assessment of worker health and exposure. One additional follow-up assessment was conducted. In addition to the study group, two comparison groups from the same production facility were selected for enrollment into the study. Engineering-based controls that are found to have successfully reduced ergonomic stress will be documented and this information disseminated in the form of information bulletins, trade magazines, and technical publications for the household appliance industry.

• Organization of Work

Work Schedule Designs to Reduce Job Strain: Evaluation of Existing Interventions

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Evaluate, work schedule, interventions

Purpose:
To evaluate the effectiveness of work schedule design interventions.

Abstract:
Existing outcome data associated with schedule design will be obtained from at least three companies. Three to six interventions will be examined in three to six different occupations or industries. At least two to four of the occupations must require physical work. Targeted outcomes will include health/safety indices such as health-related absences, visits to clinics, injury and incident rates, changes in somatic complaints, and behavioral/psychological indices such as changes in perceived stress, fatigue, rest and recovery, and satisfaction with domestic and other social relations. Since most of these interventions also involve training programs to assist workers in coping with demanding work schedules, a separate set of analyses will focus specifically on training effectiveness.

Work Organization Interventions for Prevention of Musculoskeletal Disorders

For more information, contact:

The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Work organization, cooperative agreements, job design standards, Internal Revenue Service

Purpose:
To extend NIOSH work organization studies and to conduct collaborative field studies geared to develop empirically based job design standards for implementation throughout Internal Revenue Service centers.

Abstract:
Prior NIOSH laboratory and field studies have demonstrated that more frequent rest breaks in video display terminal (VDT) work produce significant reductions in upper extremity discomfort with no adverse effects on productivity. The present project follows from these studies and has the following components:
(1) Replication and extension of NIOSH work organization studies via cooperative agreements with university partners. The current cooperative agreement recipient (University of Wisconsin) implemented teamwork and job enlargement interventions among two groups of office/VDT workers and is assessing the effectiveness of these interventions. A second cooperative agreement was awarded for continued study of the interventions.
(2) Collaborative field studies with the Internal Revenue Service (IRS) and the National Treasury Employee's Union (NTEU) to develop empirically based job design standards for implementation throughout IRS service centers was implemented. Preliminary results indicated a very positive reception to the interventions and trends toward reduced stress and discomfort among the workers. A report summarizing the health and performance results was developed.

Psychosocial Risk Factors for Injury in Retail Material Handling Workers

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Psychosocial risk factors, low back disorders, injuries

Purpose:
To determine if psychosocial risk factors are related to low back injuries.

Abstract:
The psychosocial factors (such as job satisfaction, job demands, and worker control) for approximately 8000 workers in 160 retail stores are being collected to determine if they are causally related to low back injuries. Since psychosocial factors as causes of injury have not been established, this study will help determine if these factors are a risk factor for back strain injuries, falls, and lacerations. The study will collect baseline data and follow-up data over a 26-month period in 160 Wal-Mart stores. The duration of follow-up will vary from 6 to 18 months in the final analysis. This research will generate new information about the etiology of injury and its relationship to both individual and larger organizational influences. The results will provide information to prioritize and guide future organizational-level intervention strategies.

• Risk Assessment Methods

Model of Particle Retention in Lungs of Coal Miners

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Biomathematical model, long-term retention, respirable particles, coal miners, overloading, lung clearance

Purpose:
To develop a biomathematical model of particles retained in the lungs and evaluate the importance of overload in lung clearance.

Abstract:
This research will use the exposure-dose model. The biologically effective dose will be estimated, as will (if applicable) the doses below which no fibrotic lung disease is expected from working lifetime exposures to respirable coal mine dust.

Development of Risk Assessment Methods

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Cancer, disease, risk assessment

Purpose:
To develop enhanced methods for quantifying the risks from occupational hazards.

Abstract:
Risk assessments are often influential in making public health decisions including setting NIOSH Recommended Exposure Limits and OSHA or Mine Safety and Health Administration Permissible Exposure Limits. The methods used for these risk assessments are based on modeling assumptions that are subject to considerable uncertainty. Issues that are currently being examined include: (1) uncertainty in the exposure information from epidemiologic studies, (2) methods for evaluating uncertainty associated with the use of physiologically based pharmacokinetic models, and (3) methods for characterizing the risk of injuries. The outcome of this work will be publications in the peer review literature that will impact the practice of risk assessment.

Development of Pharmacokinetic Models for Risk Assessment

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Risk assessment, cancer, toxicology, method development, chlorinated hydrocarbons

Purpose:
To develop improved physiologically based pharmacokinetic models to improve the quality of extrapolating from animals to man.

Abstract:
Physiologically based pharmacokinetic (PBPK) models provide information on the uptake, distribution, metabolism, and excretion of toxic chemicals. These models are used in risk assessments for extrapolating doses across species and routes of exposure. Where necessary, human or animal tissues, cells or subcellular fractions, or human blood, breath, or urine samples gathered in laboratory or field studies will be used to obtain specific information on metabolic products. The project will initially focus on the development of PBPK models for chlorinated hydrocarbons, including trichloroethylene and tetrachloroethylene. This information will be used to improve PBPK models that can be incorporated into quantitative risk assessment used by NIOSH, OSHA, and other regulatory agencies to set occupational exposure limits.

Interspecies Comparison of Particle-Related Disorders

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Dust, respiratory disease, risk assessment

Purpose:
To compute quantitative risk estimates for fibrosis and lung cancer in humans with occupational exposures to respirable particles using data from both humans and rodents.

Abstract:
Although the rat is one of the most frequently used models to assess the toxicity of inhaled particles, differences in the rat and other species responses to inhaled particles have led to questions about whether the rat is a valid model for predicting disease response in humans. This study will provide a quantitative basis for evaluating the validity of the rat model for predicting particle-related lung cancer risk in humans. Where data are available for nonneoplastic lung responses (e.g., inflammation, fibrosis) in humans and rats, risk estimates will also be computed using these pathological responses. These findings will be useful to NIOSH, regulatory agencies, and others in assessing particle-related health risks in humans.

Transcription Factors in Workplace-Related Inflammatory Disease

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Immunotoxicology, disease, toxicology

Purpose:
To examine the regulation and role of cytokines in models of chemically induced liver and kidney toxicity.

Abstract:
Reactive oxygen species, generated by the toxicant or by the leukocyte activation, activate nuclear transcription factors, which regulate cytokine expression. In turn, cytokine exerts both regenerative and pathological influences on the target organ. Experimental studies have indicated that excessive local inflammatory responses are largely responsible for target organ injury following exposure to many occupational toxicants such as: organic solvents and alcohols in the liver; phenol in the skin; diesel particles and fibers in the lung; organotins in the central nervous system; and heavy metals in the kidney. Understanding the roles of these cytokines in occupational diseases will provide better avenues of prevention and improve the ability to conduct risk assessment.

• Social & Economic Consequences of Workplace Illness and Injury

Economic Models Estimating the Costs of Occupational Disease and Health and Safety Intervention

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Models, occupational disease, health and safety, intervention

Purpose:
To develop models to estimate the costs of occupational disease and health and safety intervention programs.

Abstract:
NIOSH has committed substantial resources to develop surveillance systems for occupational disease and injury. The need and value of such data are unquestioned in directing program development, establishing priorities for research, and informing regulatory and public health authorities of the costs and benefits of prevention. With an evolving emphasis on risk management in public health decision making, economic and public health costs are emerging as important information needs for decision makers in the funding for prevention and intervention research. This project supports a health economist research fellow to develop "models" to estimate the costs of occupational disease, health, and safety intervention programs.

Development of an Economic Model of Traumatic Injuries and Their Interventions

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Economic consequence, analytical methods, injuries

Purpose:
To develop a standardized method for calculating the cost of occupational injury.

Abstract:
This project will concentrate on developing a method to determine the cost of occupational injury that can be used in research throughout NIOSH and other agencies. This standardized method will be specified after investigating existing cost models, determining appropriate data sources, and determining which cost elements should be included based on sound economic theory and feasibility of acquiring data for those elements. This research will provide an electronic model to estimate the cost of injuries or fatalities and be used to measure the overall burden in society; to measure the cost-effectiveness of specific interventions; and to measure the effectiveness of NIOSH programs in economic terms.

Supplementary Occupational Illness/Injury Module for Health-Related Quality of Life (HRQOL) -4 Survey

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Psychosocial, surveillance, psychosocial risk factors

Purpose:
To develop an occupational safety and health database containing measures of health-related quality of life associated with an occupational injury and illness.

Abstract:
This project will develop a supplemental set of questions to augment the Behavioral Risk Factor Surveillance System (BRFSS)—an existing health status active surveillance system—to gain information on the association between work-related injury or

illness and perceived health status. The database will provide researchers with a state-specific occupationally related quality-of-life measure comparable to the general population quality-of-life measures currently collected through the BRFSS. This project will establish the groundwork for program expansion to a national model for health surveillance of health-related quality of life.

The Economic Burden of Occupational Illness, Injuries, and Accidents

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Economic consequence, psychosocial risk factors, evaluation

Purpose:
To provide information on the cost of occupational illness, injuries, and accidents.

Abstract:
The purpose of this project is to provide better cost information regarding occupationally-related illness, injury, and accidents for NIOSH, other occupational researchers, regulatory agencies, industry, and labor. This project will compile existing methodologies and data sources and design a flexible model using presently collected data while considering improvements in the current data that would direct the analysis of the economic burden of occupational illness, injuries, and accidents. The specific aims of this project are to prepare a document on the various approaches, including the advantages and disadvantages of each method, data requirements, and situations when the approach should be used, and to design a general, yet flexible, model for different occupational solutions.

• Special Populations at Risk

Workplace Hazards to Children and Adolescents in Agricultural Work Settings

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Agriculture, workload, injury, injuries, stress, risks, children

Purpose:
To assess the workload pressure for farmers especially children working on farms.

Abstract:
This effort will seek to: (1) identify a specific set of jobs, tasks, and activities performed by children and adolescents on farms that have a high risk of injury; (2) perform an on-site job analysis of each of the high risk jobs to quantify the specific risk factors; (3) examine the relationship between workload pressures, stress, and risks for injury in the context of the entire farm operation; (4) develop interventions for controlling or eliminating hazards for each of the jobs, including changes in the organization of the work processes and practices; and (5) evaluate the interventions and disseminate the results. In conducting the research, external partners will be consulted to select a specific set of high risk jobs for comprehensive ergonomic analyses. The ergonomic analyses will consist of a comprehensive assessment of force, posture, repetition, and work-rest patterns using assessment methodologies developed at NIOSH (e.g., NIOSH lifting equation and ergonomic toolbox methods). These analyses will be integrated with a survey of the overall pattern of the organization of work and workload on family farms, including chore introduction, phasing, and demands for children and adolescents. The survey will also assess the management of workload pressures by farmers, including the work activities of young family members. Finally, recommendations to reduce injury and illness exposures in adolescent farm workers will be developed and evaluated, and educational materials will be developed and disseminated.

The Aging U.S. Workforce Reducing Safety and Health Risks

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Work organization, special populations, psychosocial risk factors

Purpose:
To collect data that will describe occupational safety and health risks facing aging workers.

Abstract:
Despite a U.S. workforce that is becoming increasingly older, little is known about the actual occupational safety and health risks facing aging workers. This one-year development project focuses on the occupational safety and health implications of recent changes in work organization (e.g., increased restructuring/downsizing, greater reliance on technology, etc.). In collaboration with the National Institute on Aging (NIA), data will be collected from a broad spectrum of sources, including an advisory panel of experts on aging and work organization, the current research literature, focus groups with older workers, and site visits to companies with programs for older workers. This information will form the basis of a research plan for FY00 and beyond that will study organizational-based interventions designed to reduce occupational safety and health risks in older workers.

Farm Worker Health Surveillance Using Camp Health Aide (CHA) Encounter Records

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Migrant worker, surveillance system, encounter records

Purpose:
To develop an innovative surveillance system based on encounter records that are a part of the Migrant Camp Health Aide (CHA) program.

Abstract:
The Migrant Camp Health Aides (CHAs) are lay health advisors who are farm workers themselves, trained to provide education and health referrals for members of their community. As part of their job, each CHA conducts at least five health-related encounters per week and records information about the farm worker, the reason for the encounter, and the action taken on an encounter form. This project is being proposed to augment the previous Interagency Agreement to sustain the Illinois and Florida CHA programs while focusing on providing more complete information. The objectives are to: (1) generate baseline information on the number and types of occupational health problems (e.g., injuries, joint or back problems, dermatitis, etc.) identified on the encounters filed to date, (2) develop and implement a CHA training module and modified forms focused on improving the quality of the encounter records, and (3) review post-training encounter records for improved details on the health problem and how it was resolved, emphasizing occupational health. In addition, CHA will assess and assist with simple interventions (engineering changes, work practice recommendations, and training programs) for selected health conditions identified through the encounter system or through health surveys conducted with this population. In collaboration with federal agencies, this project is also supporting a special health and safety supplement to the National Agricultural Workers Survey. This survey will complement NIOSH's community-based efforts with the CHA program by providing national baseline prevalence rates of occupational health conditions and injuries among U.S. hired farm workers.

• Surveillance Research Methods

Hazard Surveillance Data Feasibility Study: OSHA Compliance

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Analytical data, hazard surveillance, risk assessment, information dissemination

Purpose:
To use analytical data to assist NIOSH risk assessment programs and information dissemination.

Abstract:
The primary sources of NIOSH hazard surveillance data that link occupations and work environments with specific chemical exposures are the 1972-1974 National Occupational Hazard Survey and the 1981-1983 National Occupational Exposure Survey. While they continue to be a unique and valuable resource, they are quite dated and lack any environmental level data. Environmental measurements are frequently made in the course of federal and state compliance inspections and consultative visits by state-based 7(c)(1) program personnel. The analytical results of this sampling are maintained in databases assembled by laboratories in Madison, Wisconsin, and Salt Lake City, Utah. These data represent potential data sources to supplement and update existing NIOSH hazard surveillance data systems. This project is intended to support exploratory use of these data within existing hazard surveillance efforts to assist in institute risk assessment programs and information dissemination systems. Several avenues of data use will be explored, including the potential for development of a national online data system for chemical-specific occupational exposure identification and quantification.

Comparison of Two Occupational Fatality Surveillance Systems

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Fatalities, surveillance, risk assessment

Purpose:
To compare data from two nationwide occupational fatal injury surveillance systems for the purpose of determining how these two systems should be used to determine the risks and patterns of fatal injuries in U.S. workers.

Abstract:
In this research project, the National Traumatic Occupational Fatalities and Census of Occupational Fatalities surveillance systems are compared. These two surveillance systems differ in methods used to collect data and periods of coverage. This project will make national, regional, state, and case-specific comparisons of the two systems for overlapping periods of data collection. The results will be used to provide information on how the two systems should be used independently and together to determine the risks and patterns of fatal injuries to U.S. workers.

Develop Nationally Standardized Occupation and Industry Coding (SOIC) Software

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Surveillance, epidemiologic, traumatic injuries

Purpose:
To provide comparable and consistently coded data to national public health systems.

Abstract:
This project encourages coding of narrative occupation and industry (O/I) information in public health data to standardized numeric codes to facilitate research on occupational injuries and illnesses. Standardized Occupational and Industry Coding (SOIC) software uses artificial intelligence to enable the provision of comparable and consistently coded data from O/I narratives. Development, implementation, and oversight of the coding software are directed by a national collaborative committee with representatives from agencies including the National Association of 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. The goal of the project is standardized O/I coding through integration of SOIC into state vital records and other records systems on a national level.

Sensitization To *Mycobacterium Chelonae* by Exposure to Metalworking Fluids

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Metalworking fluids, method development, *Mycobacterium chelonae,* respiratory disease, skin, airborne

Purpose:
To develop a *Mycobacterium chelonae* skin test to study sensitization caused by inhalation of *Mycobacterium chelonae*-contaminated metalworking fluids by workers.

Abstract:
Metalworking fluids (MWF) are used for lubrication and cooling in fabrication of metal products. These fluids often become contaminated with microorganisms, including *Mycobacterium chelonae*, which has been associated with outbreaks of the disease hypersensitivity pneumonitis. It is thought that hypersensitivity pneumonitis occurs because inhalation of metalworking fluids aerosols sensitizes workers to microbial contaminants. Subsequent inhalation of the microbial contaminants can then result in immune-mediated inflammation and hypersensitivity pneumonitis. This project will develop a skin test for *Mycobacterium chelonae* that is much like a TB skin test. This test will provide information about the sensitization caused by inhalation of *Mycobacterium chelonae*-contaminated metalworking fluids by workers. The test will be useful for evaluation of whether *Mycobacterium chelonae* exposure is an important cause of hypersensitivity pneumonitis in metalworking fluid-exposed individuals.

• Traumatic Injuries

Ergonomic Evaluation of Carpenter Tasks

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Scaffolding, falls, overexertion

Purpose:
To identify hazards and possible control methods associated with erecting and dismantling scaffolding frames.

Abstract:
This project involves a field study of 12 construction sites, a computer simulation study, and two pilot laboratory studies. These studies will evaluate worker biomechanical stresses while lifting and carrying scaffold end-frames. A laboratory study that examines subject balance and motor reaction times during scaffold end-frame carrying will complete this project. The study results will provide new knowledge for scaffold erection and scaffold manufacturing industries to improve work techniques, scaffold components, and lifting assist devices that will directly benefit scaffold handlers by helping to reduce the likelihood of falls and overexertion injuries.

Dynamic Scaffold Modeling for Fall Protection

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Scaffolding, fall, anchorage

Purpose:
To determine if scaffolding has sufficient stability to be a fall protection anchorage in the absence of an anchorage to a permanent structure.

Abstract:
Proposed OSHA regulations will require that fall protection be available during erection and dismantling of scaffolding. Accompanying nonmandatory recommendations are to provide guidance on how such fall protection could be achieved. One method of providing such fall protection would be to tie off to scaffolding in the absence of an anchorage to a permanent structure. This project will use laboratory investigations and possibly computer modeling to determine those conditions, if any, under which scaffolding can be used as an anchorage. Input will be sought from external partners. This input is expected to include the types of scaffolding and styles of scaffold construction to be tested, the methods of simulating a falling worker or workers, the fall conditions to be simulated, and the human and nonhuman loading of the scaffold in addition to the load imposed by the fall.

Influence of Visual Cues and Restricted Space on Workers at Elevations

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Virtual workplace, visual cues, heights, safety

Purpose:
To study the effects of the visual cues of height and restricted space on workers' performance.

Abstract:
This study will be conducted using a virtual workplace, created by a mini-super computer and virtual reality software. The subjects will be immersed in a virtual workplace in which they are standing on an elevated scaffolding board. The height and width of the scaffolding board will be changed via software for the different performance tests. The width ranges will be examined at various heights, various speeds, and various tasks. The data from this project will be used to determine the minimum and optimal width requirements of platforms and planks for construction workers to safely perform their tasks at various heights.

Acute Eye Injury-Epidemiology and Engineering Controls

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Eye injuries, eyewear compliance, epidemiology

Purpose:
To study eye injuries and to test impact testing equipment for safety eyewear compliance.

Abstract:
The investigators will continue work on eye injuries in conducting this research project. They will set up impact testing equipment for safety eyewear compliance with ANSI Z87.1. In addition, the research will include continuing the epidemiologic investigations including completing the NEISS follow back study, extending the analysis of the NEISS data to all occupations, and analysis of other data sources such as the U.S. Eye Injury Registry. The impact testing laboratory will be used to test eyewear to determine the margin of safety that the ANSI requirements provide for the range of real-world situations encountered in the workplace particularly the construction trades. Through this work NIOSH will assist ANSI in developing new standards to best protect workers from occupational eye injuries. The investigators plan two intervention programs. The first involves the development of educational materials to test the feasibility of distributing eye safety information in unconventional settings. The second major component is to sponsor a workshop for industry, labor, and safety manufacturers designed to bring together the interested parties to focus on safety needs, eyewear design, and eyewear use.

Prevention of Vehicle and Mobile Equipment-Related Injury

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Construction, traumatic injuries, prevention

Purpose:
To develop guidelines addressing highway and street construction work zone safety.

Abstract:
This project will be conducted through NIOSH collaboration with public and private sector partners. This research will be accomplished through a comprehensive literature review on vehicle and mobile equipment-related injury in work zones and supplementary data analyses. An issues paper summarizing research findings, status of existing regulations, and recommended interventions will also be developed. A workshop on prevention of workers injuries occurring in highway construction zones will be held. The final product of the project will be a NIOSH document containing recommendations for preventing vehicle and equipment-related injuries to workers in highway construction zones. The guidelines may include recommendations to OSHA and other regulatory agencies to develop or modify safety standards pertaining to highway construction.

Reducing Accidents Related to the Failure of Intersections in Coal Mines

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Intersections, model, stability, underground, coal mines

Purpose:
To analyze data regarding the successes and failures of intersections found in underground coal mines for the purpose of developing a model to protect underground coal mines.

Abstract:
Tens of thousands of 2-, 3-, and 4-way intersections exist and are being driven each year in underground coal mines. By analysis of the success or failure of intersections in this huge database, a model could be developed that could describe the stability of an intersection. This method would save thousands of dollars and time by eliminating expensive field trials. The project will begin with a critical survey of the Mine Safety and Health Administration safety data to determine current accident rates involving intersections. Other important data includes 2-, 3-, or 4-way intersection types, length of spans, primary support, geologic quality of the roof, time of roof exposure, fall geometry, and height of fall above support. Once these data are gathered and analyzed, sources of failure can be addressed. Statistical methods will be employed at individual mines to determine significant relationships between variables such as CMRR, bolt type, length, density, and span.

Products from this research will include guidelines on entry span and intersection width, roof support in intersections with variable geology, mining and bolting methods, 3- or 4-way intersections, and historical tracking of failures. Data collected on roof failure in intersections is now sufficient to be expanded into a stand-alone research project to solve the problem of hazardous intersections.

Safety Enhancements for Rock Scaling Personnel

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)

Keywords: Scaling process, accidents, rock fall

Purpose:
To examine the link between rock fall accidents and scaling, and to determine how the scaling process may contribute to potential accidents.

Abstract:
The hypothesis for this research is that many ground fall accidents are closely related to the scaling of loose material from the back and ribs (roof and walls) in underground mines. The objective is to examine the link between rock fall accidents and scaling and determine how the scaling process may contribute to potential accidents. This knowledge will then be used to design a solution that will positively impact the safety records of underground miners. The approach taken in this project will be to examine the

problem of rock falls holistically, with special attention paid to the task of scaling. The tasks include:

Task 1: Problem Assessment. Assess current scaling methods and their associated safety risks using mine workers and supervisors. In addition, mine accident data will be assessed to identify problem areas.
Task 2: Design Concepts for Safer Methods and Equipment. A specific technique or piece of equipment that would enhance the safety of mine workers while they are performing manual scaling activities will be identified.
Task 3: Create and Test Safety Enhancements. Enhancements, such as new techniques and/or a safety training program, will be developed by using in-house and external test groups. If the safety enhancement involves equipment, the development process will involve building, testing, and demonstrating a prototype.

Injury Prevention for Metal/Nonmetal Drilling and Bolting Operations

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Mining, drilling, injuries

Purpose:
To identify and develop technology that will reduce or eliminate injury to workers involved in metal/nonmetal drilling and bolting operations.

Abstract:
In this project, technology will be developed to solve the problem of injury to workers in the metal/nonmetal drilling and bolting operations. This may include a mechanical engineering solution such as reducing the weight of the drill components. It may involve a design modification to prevent being caught in rotating components. It may require a modular add-on to an existing piece of machinery. Design recommendations to equipment manufacturers or procedural changes based on results of human factor evaluations may be needed. Long-term impact will be to reduce cost to industry and provide a safer, healthier workplace for miners.

Methods for the Prevention of Mine Roof Support Failure

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Prevention, roof support failures, reduce, roof falls

Purpose:
To develop methods for the prevention of roof support failures that will reduce the occurrence of roof falls.

Abstract:
The approach for this project is to use fully grouted bolts instrumented with strain gages to measure the effect of geology, geometry, and in situ stress fields at several mines. This information will be used to develop a tool that the Mine Safety and Health Administration (MSHA) can use to more accurately estimate roof support requirements during the approval of roof control plans. Laboratory tests will be done to study the bending mechanics of support-rock interaction using the large-scale biaxial shear machine. This information is critical to the success of this study because steel is weakest in shear and field observations and can be the primary mechanism of failure.

Slope Stability Hazard Recognition for Metal/Nonmetal Mines

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: 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 all 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. This project will concentrate on developing new methods for designing, monitoring, and supporting mine slopes to reduce the hazards to workers in mines. 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. Results of this research can be transferred to a number of other civil engineering projects including design of roadcuts, railroads, canals, refuse disposal sites, earth dams, and others.

Hazard Reduction for Surface Mining Haulage Equipment

For more information, contact:
The National Institute for Occupational Safety and Health
1-800-35-NIOSH (356-4674)
Keywords: Mining, hazards, haulage

Purpose:
To investigate, evaluate, and develop tools to reduce haulage-related accidents and injuries in surface coal and metal/nonmetal mines.

Abstract:
This project will investigate, evaluate, and develop tools to reduce haulage related accidents and injuries in surface coal and metal/nonmetal mines. The project addresses three issues: hazard recognition, economics of safety, and operator training.

For Information on Other Occupational Safety and Health Topics

Call NIOSH at: 1-800-35-NIOSH (356-4674)

or visit the NIOSH Web site at: www.cdc.gov/niosh

NIOSH
DHHS (NIOSH) Publication No.
2000-124