



NIOSH

**1989
PROJECTS**

**NATIONAL INSTITUTE FOR
OCCUPATIONAL SAFETY AND HEALTH**

Projects for FY 1989

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

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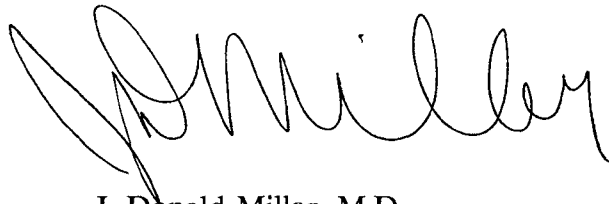
PREFACE

The projects described in this document reflect the direction provided by the National Strategies for the Prevention of the Ten Leading Work-Related Diseases and Injuries. In addition to orienting the NIOSH research program to address these leading work-related diseases and injuries, the occupational safety and health community is paying increasing attention to the National Prevention Strategies. In August 1988, the "VII International Conference on the Pneumoconioses," sponsored by the International Labor Organization, focused national and international attention on the "National Strategy for the Prevention of Occupational Lung Diseases." In September 1988, the American Academy of Dermatology sponsored a "National Symposium on the Prevention of Occupational Skin Diseases" which provided a "showcase" in the nation's capital for the "National Strategy for the Prevention of Occupational Dermatological Conditions." In November 1988, NIOSH convened State health and labor departments to discuss, among other things, the "National Strategy for the Prevention of Severe Occupational Traumatic Injuries." The University of Kentucky hosted a national conference featuring the "National Strategy for the Prevention of Occupational Noise-Induced Hearing Loss." We are now discussing plans with the American Psychological Association for a national conference to highlight the "National Strategy for the Prevention of Psychological Disorders."

NIOSH is one of our nation's great public health resources. NIOSH serves the nation as the federal scientific leader in the occupational safety and health community. The scientific expertise of the Institute is employed and highly regarded both nationally and internationally. The scientifically based policy documents and reports of our investigations identifying hazards and detailing means of controlling them to prevent disease and injury serve as standard references. Our work is to conduct research, disseminate and promote scientific determinations of the causes of disease and injury and means of prevention, and to stimulate and lead others in conducting scientific research needed to prevent work-related diseases and injury. This work represents our contribution to the national commitments embodied in the Occupational Safety and Health Act. NIOSH research is also continuing to provide important support to our sister agencies in the Department of Labor, The Occupational Safety and Health Administration, and the Mine Safety and Health Administration.

When NIOSH convened the first National Symposium on the Prevention of Leading Work-Related Diseases and Injuries in May 1985, we invited Dr. Steven Deutsch of the University of Oregon to address the symposium on the question, "Who Speaks for Workers Today?" After a beautifully reasoned dissection of the alternatives, Professor Deutsch concluded that in matters of safety and health, it is the professional who really speaks for workers today. Hence, as professionals in public health, and especially in occupational safety and health, ours is a critical mission and a serious responsibility.

Next year will mark the 20th anniversary of the signing of the Occupational Safety and Health Act and the creation of NIOSH. NIOSH has established, and is continuing to establish, a proud record in these first two decades. It has become a symbol of our country's promise to protect the American people from the untimely death and disability of its workers. We will continue striving to achieve this promise.

A handwritten signature in black ink, appearing to read "J. Donald Millar". The signature is fluid and cursive, with a large initial "J" and "M".

J. Donald Millar, M.D.
Assistant Surgeon General
Director, NIOSH

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INTRODUCTION

NIOSH Projects for FY 1989

The planning process for the National Institute for Occupational Safety and Health (NIOSH) has witnessed three major influences during 1988-89. The first two of these are pertinent to long-range planning. In 1987, the leadership of the Public Health Service decided to build on the 1990 Objectives for the Nation and establish Objectives for the Year 2000. Occupational Safety and Health (OSH) was reaffirmed as a priority area, and the lead for development of objectives in this area was delegated to NIOSH. An interagency working group, using the National Prevention Strategies for the Prevention of the Ten Leading Work-Related Diseases and Injuries, formulated draft Objectives for the Year 2000. Extensive public review and comment will result in the final set of these national objectives.

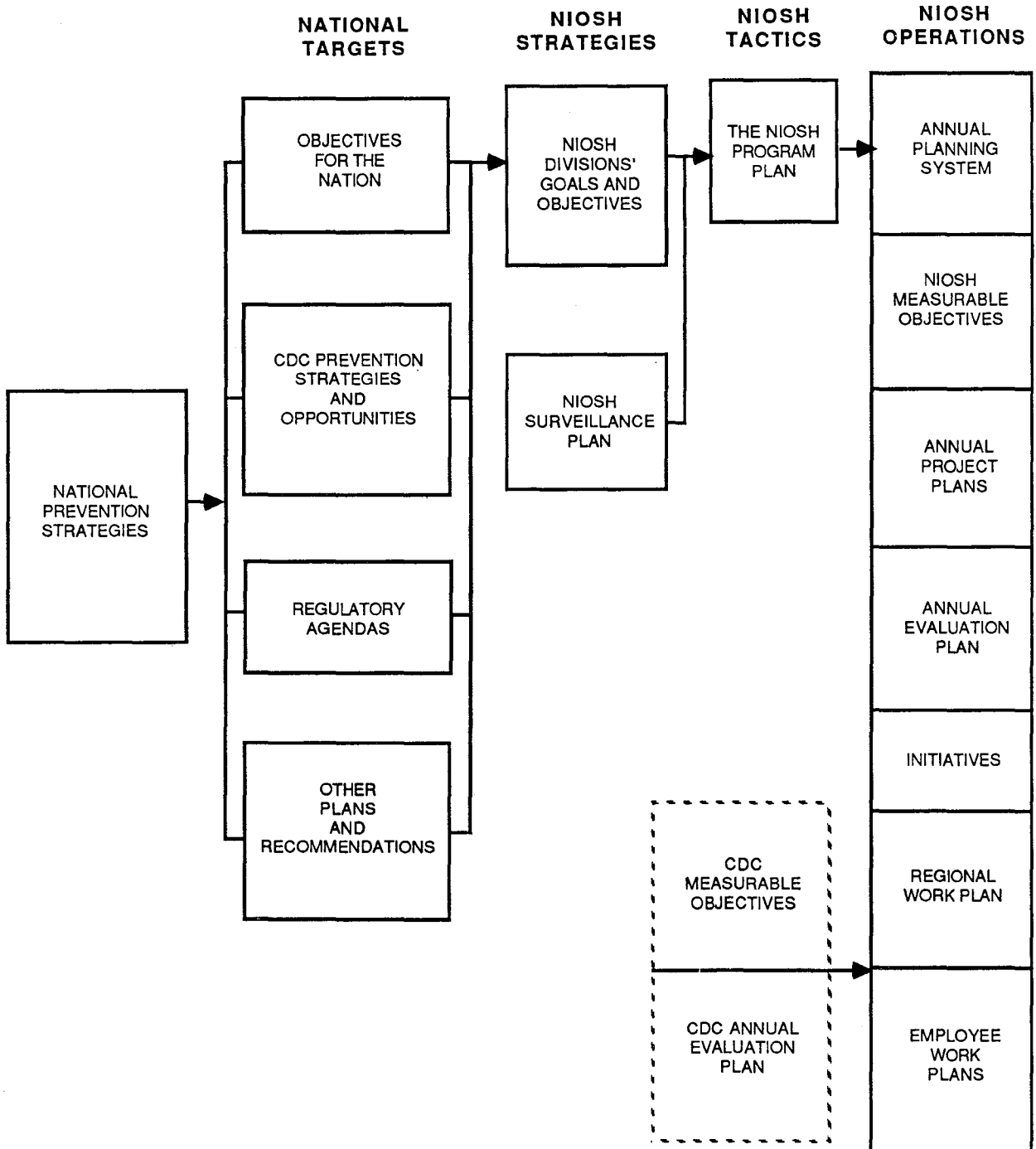
The Institute of Medicine, an agent of the National Academy of Sciences, together with the Centers for Disease Control (CDC), published a report named "The Future of Public Health." The author of that report concluded that the state of public health was in "disarray," and made many recommendations for improvement of the system. The CDC has paid serious attention to the report and is formulating a response which will include the Centers' recommended specific actions for improving the public health system. It is certain that these improvements will require programmatic changes for each of the Centers and Offices and the Institute.

In the Introduction to the Project Book for FY 1988, we described the Institute planning need to "take these different levels and different networks and create from them a system which begins with long-range plans dealing with broad topics, reduce them to shorter-range plans with more finite results, and link them more acutely to individual research plans." During the past year, the Institute has made considerable progress in meeting that need.

Dr. Millar has created several interdivisional "working groups" to arrive at strategic approaches to high-priority program needs. Current working groups are addressing Surveillance, Musculoskeletal Injuries, Construction, Agriculture, Indoor Air Quality, and Small Business. A working group is being formed in the area of dissemination. With the "National Strategies" as a base, the working groups determine the status of knowledge in the field, knowledge gaps which inhibit prevention, and describe attendant research needs. The benefit of this process is that it combines the diverse expertise of the various NIOSH divisions into a strategy.

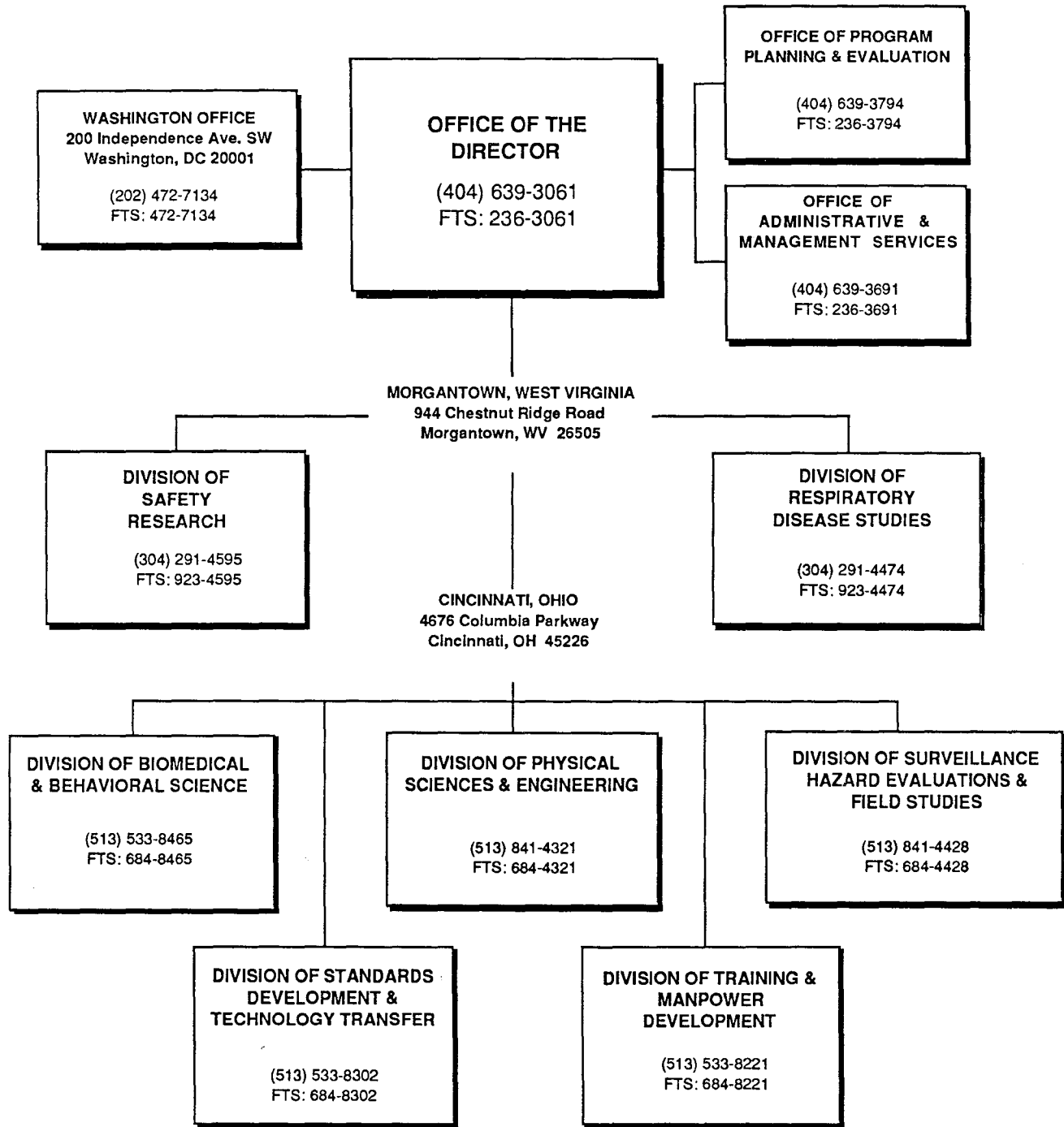
Each division then has a vested interest in the plan and may develop research projects with specific targets in mind. We anticipate the continued and expanded use of the working group concept in crystallizing Prevention Strategies into a research agenda.

NIOSH PLANNING FORMAT FY 1989



THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

1600 Clifton Road
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JANUARY 1989



**NIOSH DIVISIONS'
MISSION STATEMENTS**



DIVISION OF BIOMEDICAL AND BEHAVIORAL SCIENCE

The Division of Biomedical and Behavioral Science (DBBS) conducts research in the areas of toxicology, behavioral science, ergonomics, and physical agent effects of health consequence. DBBS investigates problems created by new technology and develops biological monitoring and diagnostic aids to assure that the workplace is not responsible for diminished health, functional capacity, or life expectancy of workers. Consultation and data basic to the development of criteria for standards for workplace exposure are furnished.

DBBS plans and conducts laboratory and worksite research on the psychological, behavioral, physiological, and motivational factors which reflect stress situations posed by job demands as well as those induced by chemical and physical agents. The division assesses physical work capacity and tolerance for environmental conditions as influenced by age, sex, body build, and physical fitness. Interventions and control procedures using ergonomic and work practice approaches are developed and tested for their efficacy in reducing undue job stress and strain.

The DBBS toxicology research involves dose-response and methods development studies to evaluate the effects of toxic agents and to develop techniques which utilize biomarkers as indicators of toxic exposures and early indicators of pathological change. Approaches include applications of cellular biology, immunochemistry, pharmacokinetics, and neurophysiology. Through laboratory analysis of biological samples from animals exposed experimentally and humans exposed occupationally to workplace hazards, DBBS provides clinical and biochemical consultations for ascertaining the extent of exposure and for diagnosing occupational diseases.

DBBS conducts laboratory and worksite research on hazards from physical agents such as noise, vibration, and non-ionizing energy sources in the workplace. Studies seek to delineate exposure factors that are of consequence to the health and well-being of the work force. Investigations, including instrumentation and methods development, for characterizing and relating exposure factors to biological and performance changes in animal and human populations are undertaken.

DBBS is located at the Robert A. Taft Laboratory, 4676 Columbia Parkway, Cincinnati, Ohio 45226. The Division Director is Janet C. Haartz, Ph.D., telephone (513) 533-8465, FTS 684-8465.

DIVISION OF PHYSICAL SCIENCES AND ENGINEERING

The Division of Physical Sciences and Engineering (DPSE) conducts worksite and laboratory research to develop procedures and equipment for the control and measurement of occupational safety and health hazards. DPSE also provides assistance to the industrial hygiene community in operating a quality control reference program for industrial hygiene laboratories.

DPSE conducts a control technology assessment and research program to prevent occupational disease and injury before they occur by assisting employers, including smaller businesses, in better design and operation of the workplace. This work involves identification and evaluation of effective engineering controls and work practices used in a variety of processes and industries. The division promotes the transfer and widespread application of these preventive engineering control measures. It also provides engineering expertise in formulating effective workplace standards.

DPSE conducts research to establish performance requirements for direct reading, area, and personal instrumentation used in the evaluation and prevention of exposures to hazardous levels of chemical and physical agents. The division also provides consultation for the development of criteria and standards on monitoring strategies, instrumentation, and controls.

DPSE conducts research to develop and improve methods for analysis of toxic substances found in the workplace. Also, DPSE provides analytical chemistry support to the Institute's laboratory research and field investigation programs, including routine measurement of samples by established methods, special measurement of complex samples, and short-term development of methods. This analytical research and support involves the use of state-of-the-art analytical instrumentation such as high resolution gas chromatography, gas chromatography-mass spectrometry, high performance liquid and ion chromatography, and Fourier Transform Infrared Spectroscopy (FTIR). In addition, DPSE provides consultation in analytical chemistry to all elements of NIOSH, and to other government agencies, recommending appropriate sampling and analytical methods.

Quality of the nation's workplace environment analytical data is assessed through the Proficiency Analytical Testing (PAT) Program. DPSE (working with the American Industrial Hygiene Association) determines the analytical competence of participating laboratories, and assists the laboratories in improving analytical performance. The division also encourages and supports development and promulgation of national guidelines for accreditation of industrial hygiene laboratory facilities; selects and develops standard reference materials for use in the measurement of industrial hygiene hazards, and provides for quality assurance in the analysis of the Institute's laboratory and field programs and contract laboratories.

The Division of Physical Sciences and Engineering is located at the Alice Hamilton Laboratory, 5555 Ridge Avenue, Cincinnati, Ohio, 45213. The Division Director is Philip J. Bierbaum, telephone (513) 841-4321, FTS 684-4321.

DIVISION OF RESPIRATORY DISEASE STUDIES

The Division of Respiratory Disease Studies (DRDS) is the Institute focal point for clinical and epidemiological research on occupational respiratory diseases. The division provides legislatively mandated medical and autopsy services and conducts medical research to fulfill the Institute's responsibilities under the Federal Mine Safety and Health Act of 1977.

The division conducts field studies of occupational respiratory diseases, and designs and interprets cross-sectional and prospective morbidity and mortality studies of occupational respiratory disease. Field studies are conducted at mines, mills, and other industrial plants where occupational respiratory diseases occur among workers at those installations. The division uses epidemiological techniques, including studies of morbidity and mortality, to detect common characteristics related to occupational respiratory diseases.

To formulate and implement programs which will identify factors involved in the early detection and differential rates of susceptibility to occupational respiratory diseases, DRDS conducts cell biology research to determine the role of microorganisms and environmental exposure in occupational respiratory diseases. The division also provides autopsy evaluations and a pathology research program. Research is conducted on immunological mechanisms and cell physiology to elucidate the effects of environmental exposure associated with occupational respiratory diseases.

DRDS provides for planning, coordinating, and processing medical examinations mandated under the Federal Mine Safety and Health Amendments Act of 1977, and operates a certification program for medical facilities and physicians who participate in the examination program. DRDS also evaluates and approves employer programs for the examination of employees in accordance with published regulations, and arranges for the examination of employees who work at locations not having an approved examination program. The division also conducts the National Coal Workers' Autopsy Program and performs research into the post-mortem identification and quantification of occupational respiratory exposures.

DRDS is located at 944 Chestnut Ridge Road, Morgantown, West Virginia 26505-2888. The Division Director is Gregory R. Wagner, Ph.D., telephone (304) 291-4474, FTS 923-4474.

DIVISION OF STANDARDS DEVELOPMENT AND TECHNOLOGY TRANSFER

The Division of Standards Development and Technology Transfer (DSDTT) develops, from existing scientific and technical information, documents containing (a) criteria for recommended occupational safety and health standards, and (b) technical and scientific information relevant to a variety of occupational safety and health issues. In cooperation with the U.S. Department of Labor, DSDTT coordinates NIOSH testimony at the Department of Labor hearings on proposed standards to support scientific and technical considerations, and prepares and annually revises the legislatively mandated toxic substances list. DSDTT manages a clearinghouse for receiving, storing, retrieving, and disseminating technical information on occupational safety and health, and provides a statistical methodology review for NIOSH research activities.

DSDTT compiles and analyzes the results of research and investigations pertaining to selected occupational safety and health hazards for the purpose of preparing recommended standards. These standards include environmental limits, requirements for medical examinations for workers, labeling, personal protective equipment and clothing, employee notification of hazards, safe work practices, sanitation, monitoring, and recordkeeping. The division prepares special occupational hazard reviews and risk assessments of potential workplace hazards where new evidence of a particular hazard is received, and prepares recommended emergency temporary standards as appropriate.

DSDTT identifies information on worker exposure, chemical hazard severity, and other data through profile development, and maintains a system for determining the status of projects in other federal agencies and the private sector for quick response in identification of potential workplace hazards. The division establishes liaison with government and non-government sources to obtain technical data, and develops and maintains the NIOSH computer-based technical information system and other computer-oriented information resources.

The division identifies, in priority order, those substances, industries, and occupations which pose an unacceptable safety and health hazard, and prepares priority lists of substances, processes, industries, etc., for which document development and Institute research should be developed or revised. DSDTT also analyzes information on the exposure of workers to safety and health hazards, and assesses the adequacy of studies, research, and data collection activities to provide the basic information needed for decisions on document development, priorities establishment, and other actions coming from essential information.

DSDTT is located at the Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, Ohio 45226. The Acting Division Director is Richard W. Niemeier, Ph.D., telephone (513) 533-8302, FTS 684-8302.

DIVISION OF SURVEILLANCE, HAZARD EVALUATIONS, AND FIELD STUDIES

The Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS) conducts surveillance of the nation's work force and workplaces to assess the magnitude and extent of job-related illnesses, exposures, and hazardous agents. DSHEFS conducts legislatively mandated health hazard evaluations and industrywide epidemiological research programs including longitudinal record studies and clinical/environmental field studies and surveys. DSHEFS also provides technical assistance on occupational safety and health problems to other federal agencies, State and local agencies, other technical groups, unions, employers, and employees.

Surveillance efforts are designed for the early detection and continuous assessment of the magnitude and extent of occupational illnesses, disabilities, deaths, and exposures to hazardous agents, using new and existing data sources from federal, State, and local agencies, labor, industry, tumor registries, physicians, and medical centers. DSHEFS also conducts evaluation and validation studies of occupational illness reporting systems with the intent of improving methods for measuring the magnitude of the national occupational health problem.

Health hazard evaluations and industrywide studies programs (1) provide a technical service to the occupational safety and health community, (2) identify the occupational causes of disease in the working population and their offspring, and determine the incidence and prevalence of acute and chronic effects of work-related exposures to toxic and hazardous substances, and (3) provide information used in standards development for the control of occupational health hazards.

DSHEFS is located at the Alice Hamilton Laboratory, 5555 Ridge Avenue, Cincinnati, Ohio 45213. The Division Director is Lawrence J. Fine, M.D., telephone (513) 841-4428, FTS 684-4428.

DIVISION OF SAFETY RESEARCH

The Division of Safety Research (DSR) serves as the focal point for the Institute's occupational safety research program, and designs and conducts safety research efforts aimed at preventing or mitigating traumatic injury and death to workers in all industries except mining. The division evaluates, certifies, and maintains records of respirators and hazard measuring instruments, and develops new performance criteria, standards, and guidelines for certification of personal protective equipment and hazard measuring instruments. The division is responsible for the day-to-day operation of the respirator and coal mine dust personal sampling unit testing and certification regulations pursuant to 30 CFR 11 and 30 CFR 74, respectively.

DSR plans and conducts laboratory and worksite studies to establish effective methods for making work safe through the use of personal protective equipment and engineering controls for equipment, machines, tools, safety devices, and other factors in the workplace. The division conducts worksite research to identify, develop, and document effective work practices and managerial approaches for minimizing the risk of workers being injured as the result of exposure to workplace hazards. DSR also provides technical assistance in solving safety problems which require engineering or system safety expertise for solution, and develops technical criteria to support recommendations for safety standards.

DSR maintains a national surveillance data system for the early detection and monitoring of the occurrence and extent of accidents and injuries in occupational settings, and conducts field epidemiologic studies of occupational injuries and their etiologies. To identify and document effective methods for reducing musculoskeletal injuries, DSR conducts studies to characterize the effects of workplace environment factors on safety, and provides technical assistance on problems requiring expertise in ergonomics, industrial engineering, and related disciplines. Using systems safety techniques, the division analyzes operations to identify hazards and develop injury prevention strategies.

The division also conducts general occupational injury surveillance, including the collection, analysis, and interpretation of injury statistics, and maintains various surveillance data bases. DSR works with State agencies to upgrade injury surveillance and maintains a national injury surveillance system for risk assessment, research needs prioritization, and identification of problems for the occupational safety and health community.

To ensure that air purifying respirators and air supplied respirators continue to meet regulatory requirements, DSR conducts audits and reviews performance requirements, standards, and guidelines for certification. The division also develops new performance requirements and standards for respirators and evaluates the quality control plans for them.

DSR is located at 944 Chestnut Ridge Road, Morgantown, West Virginia 26505-2888. The Division Director is Thomas R. Bender, M.D., M.P.H., telephone (304) 291-4595, FTS 923-4595.

DIVISION OF TRAINING AND MANPOWER DEVELOPMENT

The Division of Training and Manpower Development (DTMD) implements Section 21 of the Occupational Safety and Health (OSH) Act, which mandates the training and education functions. DTMD develops programs to increase the numbers and competence of the OSH professional and paraprofessional work force. This continuing education program provides short-term technical training courses, including seminars, independent study packages, and specialized workshops to federal, State, and local government; private industry; labor unions; and other organizations in the OSH field. The curriculum development program provides for the designing and producing of course packages and other training materials for Institute-sponsored training programs, including those presented by in-house faculty as well as those conducted by universities and other outside training organizations.

Through the educational resource development program, manpower needs for OSH practitioners and researchers are continually assessed on a nationwide basis. To help meet the demand, DTMD administers a major training grant program to foster the development of academically-based training programs for occupational physicians, occupational health nurses, industrial hygienists, toxicologists, epidemiologists, and safety professionals. DTMD also develops specific criteria for the selection of qualified organizations to conduct research training, graduate degree and continuing education, and outreach programs to expand the network of knowledgeable professionals in occupational safety and health.

DTMD initiates special emphasis projects targeted to physicians, engineers, managers, vocational education students, and science teachers to include occupational safety and health knowledge in their formal program of study. The division establishes a collaborating relationship with the many professional societies and accrediting bodies to formalize the process of long-term commitment through professional networking.

DTMD is located at the Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, Ohio 45226. The Division Director is Thomas C. Purcell, Ph.D., telephone (513) 533-8221, FTS 684-8221.

SUMMARIES
OF
NATIONAL PREVENTION STRATEGIES

Occupational Lung Diseases

Musculoskeletal Injuries

Occupational Cancers

Severe Occupational Traumatic Injuries

Occupational Cardiovascular Diseases

Disorders of Reproduction

Neurotoxic Disorders

Noise-Induced Hearing Loss

Dermatological Conditions

Psychological Disorders

SUMMARIES OF NATIONAL PREVENTION STRATEGIES

INTRODUCTION

In 1983, the National Institute for Occupational Safety and Health (NIOSH) published a suggested list of leading work-related diseases and injuries. Scientists at the Institute had developed this list as a guide for setting priorities and allocating resources within the Institute, and as a focal point for discussion among occupational health professionals throughout the country. NIOSH then undertook the preparation of proposed national strategies for the prevention of each condition on the list.

In May 1985, NIOSH and the Association of Schools of Public Health (ASPH) co-sponsored a national symposium for the in-depth evaluation of proposed strategies for the first five conditions: occupational lung diseases, musculoskeletal injuries, occupational cancers, severe occupational traumatic injuries, and occupational cardiovascular diseases. Under the direction of 51 expert panelists, the more than 450 symposium participants--representing academia, management, organized labor, professional associations, and voluntary organizations--discussed, revised, elaborated, and further developed the strategies.

In October of 1986, the second NIOSH National Symposium on the Prevention of Leading Work-Related Diseases and Injuries was convened. This symposium presented and modified the second five of the "ten leading work-related diseases and injuries." Like the first, it was a resounding success. These symposia provided an opportunity for discussion,

modification, and input to the strategies that were developed by NIOSH. We now have the first "national" plan to eliminate, by preventing, negative health effects of work. These strategies generally include four parts: definitions, description of the nature of the problem, depiction of the preventive measures that can now be taken, and depiction of the knowledge required to move forward. The specific content of these strategies is diverse, reflecting the many professionals whose ideas are there; however, the attempt to emphasize "basics" undergirds each.

At these symposia, a new national vision was introduced--a vision that unsafe working conditions are no longer tolerable and that clear and understandable steps can be taken to prevent the leading occupational diseases and injuries. Throughout these National Prevention Strategies, common themes emerge: (1) An important component in each prevention strategy is surveillance. Surveillance is needed to accurately estimate the incidence of the disorder, to identify the population at risk, to direct the most effective preventive measures where they are needed, and to measure the impact of intervention. (2) The strategies also focus on scientific research. Research is needed to develop the specific knowledge and understanding on which prevention depends. (3) Another integral component is training. Effective communication through education, technology transfer, the dissemination of information, and training is required to reach the full potential of

any prevention program. (4) Finally, the strategies emphasize the importance of applying and adapting existing knowledge to prevent occupational diseases and injuries. Research results are only effective in preventing such conditions if they are applied in the workplace. Useful information is already available, and ways must be found to target and apply it where it will do the most good.

Out of the symposia and the subsequent voluminous exchange between NIOSH and the participants came the National Strategies for the Prevention of Work-Related Diseases and Injuries. They have been published and widely disseminated, and are designed to serve as working documents to guide NIOSH, other agencies, business, labor, and academia to work more cohesively toward providing for safe and healthful working conditions.

OCCUPATIONAL LUNG DISEASES

The lung is both a target organ and a portal of entry for toxic substances. The likelihood of toxic exposure to the lung can be high; for example, an estimated 1.2 million U.S. workers are potentially exposed each year to silica dust alone. Although occupational lung disease is caused by the inhalation of toxic substances in the work environment, the association between occupational exposure and lung disease is not always apparent or simple. The occurrence of multiple or mixed exposures, the non-specificity of symptoms, the relatively long latency for these diseases, and the independent or synergistic effects of cigarette smoking may all confound the recognition of occupational factors in lung disease.

Classifying lung disease by the type of occupational exposure that leads to it permits rapid identification of toxicants and the application of available control technology. Major types of exposure include inorganic dusts (silica, asbestos, coal dust), organic and metallic dusts (cotton, grain, metallic salts, antibiotics), gases and fumes (nitrogen, methane, ammonia, phosgene), viable aerosols (bacteria, viruses), and respiratory carcinogens (arsenic, chromium, coke oven emissions). Four occupational lung diseases that are deemed preventable are asbestosis (caused by exposure to asbestos), byssinosis (cotton dust), silicosis (silica), and coal workers' pneumoconiosis (coal dust). These have been targeted in the 1990 objectives of the U.S. Public Health Service for elimination of new cases among workers newly exposed after 1985 (USDHHS, 1980). These diseases and their causative agents will be cited as examples in the following prevention strategy. Methods for their

control may be adapted for most other occupational lung diseases.

Disease descriptions

The asbestos-related diseases include nonmalignant fibrogenic effects on the lung parenchyma and pleural plaques as well as malignant neoplasms of the lung and the serosal linings of the chest and abdomen (mesothelioma). The latency is ≥ 15 years for asbestosis and 20-40 years for malignancies. Synergistic effects of smoking increase the risk of lung cancer.

Byssinosis includes both acute (reversible) and chronic lung disease. The effects may be due to specific causal agents in the dust of certain varieties of cotton or other vegetable fibers.

Silicosis may be acute or chronic (nodular pulmonary fibrosis) and affects workers in foundries, stone quarries, sand and gravel operations, and mines. Latency is long, and disease progresses even after exposure ends.

Coal workers' pneumoconiosis (CWP) shows a clear dose-response relationship to coal-dust exposure. Enforcing lower dust standards in both Great Britain and the United States has reduced the incidence of this disease. When workers with early, simple CWP are identified, serious disabling disease may be prevented by transferring the workers to lower-dust environments.

Implementing what we know

Surveillance: Environmental surveillance of hazardous agents is needed to identify occupations, industries, and worksites with potential for high incidence of

occupational respiratory disease (e.g., asbestos-removal operations, industries using cottons with high levels of endotoxins, and ground silica). Current environmental surveillance should continue, and activities for prevention should be targeted to the locations identified. Disease surveillance of workers is also important and can help determine pre-existing conditions (reduced ventilatory function), early development of disease (simple CWP), or hypersusceptibility to given agents (acute reactions to cotton dusts). Interventions, such as reducing further exposure, should focus on the affected workers.

Substitution: Hazardous agents can often be replaced by less hazardous and noncarcinogenic substitutes. Cottons that cause less acute responses in humans (e.g., high-grades, blends, or washed cottons and synthetic substitutes) can be used; and silica can be banned as an abrasive blasting material, with non-toxic materials substituted.

Control: Technology is already available to control many hazardous exposures through engineering design and automation, ventilation, and isolation. Although silica exposures above legal limits are still occurring, control can nearly always be achieved through engineering or substitution once exposure is recognized. Personal protective devices (e.g., respirators), however, should not be considered primary protection mechanisms because they rely on human intervention and may not provide the level of protection determined in the laboratory.

Incentives and Regulation: Economic incentives, such as lower insurance premiums, will often stimulate the adoption of control measures. More often, regulatory enforcement is needed for effective control of exposure levels. The permissible exposure limit for

asbestos should be reduced, as recommended by NIOSH, to the lowest measurable level--100,000 fibers/m³, and OSHA should require a dust-control and monitoring plan before any work involving asbestos exposure begins. Present silica standards range from 33 ug/m³ to 98 ug/m³ and should be unified. The 1970 coal dust standard (2 mg/m³ with medical monitoring) appears to reduce the incidence of CWP, and the authority of federal inspectors to shut down coal mines where hazards are severe may help to enforce compliance.

Education: Both the Mine Safety and Health Act and the Occupational Safety and Health Act place responsibility on employers to provide safe, healthful workplaces. Workers should be told about hazardous exposures and available control measures, and then workers and managers should cooperate to control exposures through technology transfer, changes in work practices, implementation goals, and periodic assessment. Technical information already available should be used to increase awareness of work-related lung problems and to produce clear, easily understood texts on control for small- as well as large-scale operations. Educational programs targeted to engineers, managers, occupational health professionals (including primary care physicians), and workers should cover the nature of the work environment and how to assess and control work exposures. State and local health departments can provide expertise and leadership for these programs. Although workers' compensation provides financial relief after exposures occur, awareness is needed before exposure through adequate warnings and product labeling.

Tobacco smoking may have additive and/or synergistic effects on the development of lung disease, both for

smokers and for others exposed to tobacco smoke. Labor management policies are needed for smoking in the workplace, and appropriate State legislation on smoking in public places could also be used to limit workplace smoking.

What knowledge do we need?

Research: Several research needs have been suggested. Substitute agents should be tested to determine their toxicity before they are used. Studies should determine whether serious effects result from episodic, low-level exposures to pulmonary irritants and whether long-term effects follow acute responses. Workers exposed to asbestos should be studied to determine dose-response relationships, the effects of intermittent and short-term high exposures, the pathogenicity of various asbestos fibers (e.g., "short" fibers) and asbestos substitutes, and the significance of pleural changes and pleural plaques. Studies should also identify the fiber-release potential of in-place asbestos materials, the relative risks and benefits of asbestos removal, and the effectiveness of removal practices. The relationship in cotton workers of acute responses and chronic respiratory disease can be clarified if normal annual decrements in lung function are determined. Research on exposure to silica should include dose-response relationships, particularly at low levels and for mixed dusts containing silica. Analysis of current MSHA and OSHA environmental data on exposure to silica will help identify hazardous industries, locations, and specific processes. The carcinogenic properties of quartz also need study. The problem of hypersensitivity pneumonitis and the relationship between smoking and diffuse lung fibrosis should be investigated. Host risk factors (e.g., smoking and atopy) must also be examined.

Hazard Detection and Disease Diagnosis: Better methods are needed to measure airborne concentrations of hazardous substances and to enhance environmental surveillance, especially for mixed dusts in underground and surface coal mines. More sensitive techniques must be developed for screening workers to recognize early signs of disease (particularly at the cellular level) and to predict susceptibility to lung diseases. An operational definition of silicosis will help standardize diagnosis and reporting.

Incentives and Regulation: Incentives and educational materials should be available to encourage the efficient use of strategies for controlling exposures. The mandate for medical surveillance in the current Cotton Dust Standard should be reassessed to determine whether new recommendations from NIOSH are needed. Results of long-term studies on the adverse health effects of dust exposure (including nonpneumoconiotic lung diseases, such as bronchitis and emphysema) will help in setting total dust regulations for both coal mining and general industry. Data on the relative causality of exposures to carcinogens and on exposure-response measurements will help in setting effective exposure standards.

Control: When the exact etiologic agent(s) of byssinosis are identified, their removal by cultivating or processing cotton can be facilitated, and effective controls and exposure standards can be developed. Changes in mining techniques necessitate that mine planning and the design and installation of new equipment be based on forecasting and predictive techniques, such as predictive models. For example, the increased use of longwall mining, the continuous use of mining equipment, and the increased rates at which coal is broken all require new approaches to control.

The characteristics of respirable dust will need to be correlated with coal seam and mining methods; and new technology implement intermittent dust sources.

Summary

This prevention strategy cannot succeed on the basis of any one element alone; all must be addressed to prevent occupational lung diseases. Thus, although problem areas can be identified by environmental and medical surveillance, follow-up and elimination or reduction of exposure are also needed. Surveillance must be coupled with exposure control (e.g., work practices, automation, ventilation, incentive systems, strict enforcement of exposure standards) and other important elements described here. Health promotion and development of workplace smoking policies, while not always directly related to occupational exposures, are additional important elements.

MUSCULOSKELETAL INJURIES

Musculoskeletal injuries include both acute and chronic injury to the muscles, tendons, ligaments, nerves, joints, bones, and supporting vasculature. These injuries may be sprains, strains, inflammations, irritations, and dislocations. In the medical literature, this broad class of physical symptoms or complaints is collectively referred to as wear-and-tear disorders, overuse injuries, osteoarthritis, degenerative joint diseases, chronic microtraumas, and cumulative trauma disorders.

To find preventive measures for these injuries, it is helpful to identify contributing elements and to look at these elements in the four main categories outlined by the Canadian Health Fields Model.

Environmental Hazards: A workplace hazard to the musculoskeletal system is called a *traumatogen*, or a source of biomechanical stress that results when job demands exceed the worker's strength or endurance.

Human Biologic Factors: Innate qualities, such as physical size, strength, range of motion, work endurance, and the integrity of the musculoskeletal system, influence a worker's ability to perform a job safely.

Behavioral or Lifestyle Factors: Such factors as insufficient sleep or recovery from exertion, job dissatisfaction, obesity or lack of adequate physical fitness, unhealthy diet, and substance abuse may increase a worker's risk of musculoskeletal strain or injury.

Inadequacies in Health Care Systems: A lack of medical knowledge or of appropriate training in the etiology, diagnosis, and treatment of musculoskeletal problems may result in inadequate health care.

Much remains to be learned about the causes of work-related musculoskeletal injuries. Because few of these injuries are accepted as coming only from work, the workplace hazard must often be identified to define an occupational injury. High physical stress can frequently be traced to ordinary work activities, including repetitive or sustained lifting, bending, twisting, climbing, reaching, gripping, pinching, rubbing, kneeling, and squatting, as well as vibration from equipment. Sometimes these activities are performed in awkward postures and involve high forces.

Scope of the National Problem

Although present surveillance systems are inadequate and estimates of the national problem may not be accurate, awareness is growing that these injuries result in significant human suffering, loss of productivity, and economic burden to the country. High risk industries include manufacturing, construction, and food processing. In the 1977 Health Interview Survey of the National Center for Health Statistics, musculoskeletal injuries ranked first in frequency among health problems that affect the quality of life. They are the leading cause of disability in the working years, affect 19 million persons annually, and involve nearly half the workforce at some time in their working life. The frequency and impact of these disorders are expected to

increase in the future, and some increases are already evident with modern office technology. Although this equipment is designed to reduce physical labor, it often generates new, pervasive, and even more insidious sources of biomechanical stress.

Potential for Prevention and Control

An important first step in preventing musculoskeletal injuries is identifying their causes, but this is often difficult because of the many complex etiologic factors, long latency, effects of aging, and lack of standardized diagnostic criteria. Many biomechanical hazards, however, could be eliminated if knowledge already available were put to use (e.g., redesigning work processes or tools to impose less biomechanical stress). A management concept of "working smarter is better than working harder" will maintain better production levels than a demanding work schedule, since it reduces time lost due to work injuries. And, finally, cooperation on common prevention problems can be fostered among key professionals from different backgrounds (e.g., engineers and health care personnel) by dispensing and applying accumulated knowledge.

Tactical Areas of a Prevention Strategy

The present, inadequate surveillance systems do not separate chronic from acute musculoskeletal injuries nor do they have standard terminology for defining such conditions. New systems of both health and hazard surveillance are needed to identify occupations with a high incidence of musculoskeletal injuries and to define types and ranges of work-related biomechanical stresses. Multilevel data bases for the country, the States, and local areas will increase awareness within the medical community

of the benefits of prevention and thereby help implement a prevention strategy.

Health professionals, engineers, and scientists must cooperate in using surveillance and clinical data to identify causes and effects from the interacting variables that produce musculoskeletal injuries. For example, (1) low back pain results from interacting job factors (e.g., load weight, location, and frequency of materials handling) and personal factors (age, gender, strength, fatigue, postural stress, trauma, emotional stresses, degenerative changes, congenital defects, physical fitness, and body awareness); (2) biomechanical analyses of hand and arm motions, repetition rates, amounts of force, and postural factors have helped identify stresses leading to carpal tunnel syndrome and tenosynovitis; and (3) injuries to lower extremities, mainly the knee, result from repetitive loading, constant kneeling, squatting, and contact with specialized tools. New evaluation and laboratory techniques are now available but more are needed to clarify the stress patterns.

The three approaches for controlling risk factors are redesigning jobs or tools, training workers, and selecting workers for specific jobs. (1) The use of ergonomics to design new jobs and tools is better than personal protective equipment or safe work practices, but this is still an undeveloped science, and research is needed on anatomic, mechanical, physical, and human factors. While initial costs and complications of overlapping stresses have prevented widespread use of ergonomics, the high costs of workers' compensation and rising insurance premiums may make ergonomics attractive for reducing medical costs and lost time from injuries and for increasing worker productivity. (2) The preventive value of training programs that teach employees specific work

practices for safety and hygiene has been difficult to evaluate. Current programs seek to increase worker awareness of hazards and to help them participate in hazard control through problem-solving techniques. (3) Screening employees for specific jobs is difficult because of the wide variety of job demands and the range of individual physical capacities. Radiologic screening for back problems, although largely discredited, is still widely used and may pose a radiation hazard. Thus, ergonomics is the preferred approach, with employee selection and training as secondary elements.

Because awareness is essential for implementing any prevention strategy, information should be disseminated to help change attitudes and behavior of both management and workers, especially in the many small businesses that employ 25 or fewer workers. To accomplish this, the Educational Resource Centers (ERCs), medical schools, and schools of business can provide personnel trained in ergonomics for service at regional levels and can produce guides for users to prevent and control cumulative trauma. Modern technology for disseminating public service messages should also be explored.

Action plan

The knowledge and skills to implement many of the recommendations below are now available; others must await future advances. For now, the availability of trained health professionals and their degree of cooperation will determine progress in combating musculoskeletal problems in the workplace.

Committee: A multidisciplinary National Committee for Occupational Musculoskeletal Disorders should be established with representatives from industry, labor, academia, professional groups, and

government. It could function as an advisory body to prevent musculoskeletal injuries by coordinating national efforts in research, training, and prevention and by promoting clinical and scientific consensus on definitions, diagnostic criteria, surveillance terms, and criteria for the outcomes of these injuries.

Training: More clinical personnel should be trained in the etiology of musculoskeletal disorders, and, with the help of the National Research Council's National Academy of Engineers and others, design engineers could be trained in biomechanics and ergonomics. Workers should be trained to participate in the redesign of jobs, tools, and workstations. Young investigators could be encouraged through post-doctoral grants and research assistantships to seek advanced training in preventing musculoskeletal injuries.

Surveillance and Research: Innovative surveillance systems must be developed with cooperating federal, State, and local officials to improve the understanding of the nature, extent, and magnitude of musculoskeletal problems. Longitudinal studies, evaluations of ergonomic hazards, and assessments of health effects of new emerging technologies (robots, electronic office operations) are needed. Grants from NIOSH and the National Science Foundation can promote research on etiology and prevention and on the relationship of certain job tasks to resultant injuries or disorders.

Coordinating Group Activities: State and local health agencies, universities, and community health groups could, through a grant mechanism, evaluate workplaces to identify traumatogens, determine the efficacy of proposed countermeasures and prevention strategies, and conduct demonstration studies in select, high-risk industries. The Institute of Industrial

Engineers, industrial hygiene organizations, equipment manufacturers, and others could develop and test means for controlling cumulative trauma. The proposed National Committee could help coordinate activities of OSHA, MSHA, AIHA, and State and industry groups to formulate guidelines for ergonomic control and could encourage standard-setting groups, such as the American National Standards Institute, to develop consensus standards. The Committee could also evaluate the benefits of a national ordinance or generic standard for controlling biomechanical hazards, similar to the Swedish ordinance regulating work postures and working movements. (Danielson, et al, 1983)

Dissemination: The DHHS Office of Disease Prevention and Health Promotion along with local and regional health agencies could convey the true costs of musculoskeletal injury (in terms of economics and human suffering) to public and professional health societies through an awareness program. A model for dissemination should identify target groups, the types of messages needed, effective media, procedures for evaluating the effectiveness of information programs, and overall marketing plans for dissemination. The proposed National Committee could promote an interchange of information on basic research through symposia and workshops; a national clearinghouse of information could be established; and the results of worksite studies should be published in trade and management magazines. Labor and management should explore new ways of informing workers, especially those in small businesses and industries, of the causes, risk factors, prevention, and treatment of occupational musculoskeletal disorders. The occupational health nurse must be recognized as a first-line link between worker

and health professionals, and worker-participation programs, such as the Ergonomic Task Force, should be employed to help introduce ergonomic changes.

OCCUPATIONAL CANCERS

Cancers induced by occupational exposures usually occur decades after the exposures take place. Most observed associations between exposure and occupational cancer involve tumors of a common type, such as lung cancer. Specific cancers sometimes occur in such a high fraction of workers that the work-related association is inescapable. In 1775, Sir Percivall Pott first identified an excess risk of cancer in an occupational group--cancer of the scrotum in chimney sweeps. This led to the first demonstrated prevention of cancer development in workers by interrupting the interactions of agent, environment, and host that take place as a result of workplace exposures. Since then, several other occupations have been shown to pose an increased risk of cancer, and, in the 20th century, other specific carcinogens have been identified as well.

Three health actions for prevention, outlined in the 1979 Surgeon General's Report on Health Promotion and Disease Prevention (USDHEW, 1979), can be applied to work-related exposures to carcinogens: *health protection* (activities to reduce exposure, such as redesigning the job), *health promotion* (helping workers develop and improve behaviors for good health, such as stopping the use of tobacco with its additive or synergistic effects on workplace exposures), and *health services* (although less satisfactory than the above, early detection may permit treatment and even cure of some cancers).

Scope of the problem

Conservative estimates attribute 17,000 cancer deaths each year to workplace exposures. Although over 100,000

workers are potentially exposed to the 21 chemicals now regulated by OSHA as carcinogens (NIOSH, 1978), adding the agents OSHA is currently considering for regulation and those recommended by NIOSH for control as carcinogens increases the total of potentially exposed workers to 3-9 million. Since such exposures are neither ubiquitous nor homogeneous but affect distinct populations to varying degrees, the cancer rates in specific populations may be substantially higher than expected.

Preventive actions

This strategy presents a continuum of potentially effective techniques for preventing occupational cancer, including what can be done now and what additional knowledge is needed.

Identifying and evaluating carcinogens: Epidemiologists, toxicologists, industrial hygienists, and safety engineers should coordinate efforts in research on carcinogens. Increased support for such research will help improve methods in epidemiology, toxicology, industrial hygiene, and screening. A committee of government, industry, labor, and academic experts should prepare a list of agents that warrant toxicologic and epidemiologic study and set priorities for research.

Setting standards: The most familiar mechanism for setting standards is through NIOSH recommendations to OSHA, which then promulgates standards. NIOSH can also provide technical assistance to MSHA, State governments, companies, and insurance carriers for setting standards. Additional recommendations come from such voluntary groups as the American Conference of

Governmental Industrial Hygienists and the American Industrial Hygiene Association. To avoid the time needed to regulate carcinogens on an agent-by-agent basis, OSHA has promulgated a carcinogen policy that will help clear the backlog of unregulated carcinogens. More effort is needed to identify carcinogens in the workplace and to disseminate information to all potentially exposed groups, such as by a broad hazard communication standard. Some gaps in information must still be filled before priorities for epidemiologic and toxicologic studies can be set.

Elimination and substitution: When the risks of using an agent in the workplace exceed the benefits, the most effective way to eliminate exposure is to eliminate the agent. More detailed information is needed on the carcinogenic properties of agents currently used in the workplace and their possible substitutes. Lists of potential carcinogens, substitutes, and replacements should be developed and broadly disseminated.

Control technology: Engineering controls that enclose a system or provide ventilation are preferable to personal protective devices or work practices because they are perceived as less likely to fail. Studies should evaluate the effectiveness of control technologies and should identify examples of effective controls for specific agents. Information from these studies could be disseminated by a national clearinghouse, especially to small businesses.

Personal protective devices: Personal protective devices are necessary when the use of a carcinogen is essential and engineering controls are neither available nor adequate. Devices must be matched to specific agents because exposure may take place through inhalation, ingestion, or skin absorption. Some

devices may even introduce hazards by interfering with vision, dexterity, or worker comfort. NIOSH should continue to certify respirators and alert users to possible failures or defects. A clearinghouse could be established to disseminate state-of-the-art information on personal protective devices.

Environmental monitoring: Environmental monitoring measures the amount of a carcinogen in the workplace, assesses the adequacy of engineering controls, and determines the need for personal protective devices. Validated strategies for such monitoring are needed, and NIOSH, MSHA, OSHA, industry, and others should press for better and more precise analytic methods that are as accurate in the field as the laboratory. NIOSH should continue to assure the accuracy of laboratory testing, and a surveillance system should be developed to collect, evaluate, and disseminate the results of environmental monitoring.

Biologic monitoring: Both the inherent biologic characteristics of individuals and the absorption of specific carcinogens can be determined by biologic monitoring. The efficacy of current methods must be assessed under field conditions and new methods developed where necessary. The value of new and current methods for determining the individual enzymatic constitution of workers and predicting carcinogenic risk must be measured. The proficiency of commercial laboratories that perform biologic testing should be ascertained. Surveying the results of current biologic monitoring will help identify worksites where exposures to carcinogens occur.

Medical screening: Evaluating the efficacy of such medical screening techniques as urinary and sputum cytology will enhance early detection of occupational cancers and thus permit treatment

and awareness of risk. State-of-the-art information should also be updated and disseminated in NIOSH recommendations and in OSHA and MSHA regulations. We need to know the effectiveness of medical screening techniques and subsequent therapy and more effective methods of identifying populations with past exposure to carcinogens.

Health promotion: As an adjunct to the overall prevention strategy, health promotion can help eliminate personal behaviors--such as smoking--that may act synergistically with workplace exposures. Professional organizations, like the American Occupational Medical Association, the American Association of Occupational Health Nurses, and the American Industrial Hygiene Association, can be enlisted to help sensitize the health care establishment to specialized needs of certain occupational populations. Interaction between occupational exposures and personal health behaviors must be more clearly delineated.

Therapeutic health care and rehabilitation: Although the field of clinical oncology has burgeoned, training of personnel has lagged. Efforts by NIOSH, professional organizations, and the National Cancer Institute (NCI) are needed to increase educational materials, training programs, and certification for physicians and nurses in the field of occupational cancer. Placing experienced personnel in State and local agencies would increase awareness. Information from attempts at medical intervention is needed to assess the adequacy of early detection, therapy, and risk-reduction techniques. Identifying populations with increased risk of cancer or past exposures to carcinogens, particularly in small firms or those not covered by regulation, will help ensure timely application of diagnostic and therapeutic services.

Surveillance of disease: Because most cancers have such a long latency, surveillance of current disease may not identify current exposures. Nevertheless, some cancers may be sentinel health events that identify populations in need of medical intervention. Surveillance schemes should be evaluated for effectiveness. Acute illnesses, such as chrome dermatitis, may signal current exposures to carcinogens. Experienced personnel in local and State agencies can encourage interest in cancer detection, reporting, and prevention. Record systems, such as those collected by the Internal Revenue Service, the Social Security Administration, and Workers' Compensation, may aid epidemiologists.

Surveillance of exposure: The long latency also makes difficult the directing of society's resources to workplaces with the greatest potential for exposure to carcinogens. Although data collected in OSHA and MSHA compliance programs may help identify the extent and level of exposure to both regulated and unregulated carcinogens, better systems of surveillance are needed.

Compliance activities: OSHA conducts some inspections in response to requests and others targeted to "high-risk" industries, based on high infraction rates. OSHA's current policy should be evaluated to determine whether it adequately covers all potentially exposed workers. A national system should also target inspections to plants using regulated or suspected carcinogens, since the effects of exposure will not be manifest for 20-40 years.

Education of workers and managers: NIOSH, OSHA, MSHA, NCI, and others should strengthen their educational programs for workers and employers. A broad hazard communication standard could be effective in

promoting worker awareness. The value of behavioral approaches and job-design factors in controlling cancer in the workplace should be established.

Free-market forces for prevention:

Economic incentives, such as ensuring coverage by the insurance industry and compensation for victims of occupationally induced cancer, will help to encourage measures that prevent such cancers. The difficulty of establishing a causal relationship between exposure and disease must, of course, be overcome.

SEVERE OCCUPATIONAL TRAUMATIC INJURIES

Severe occupational traumatic injuries, including those sustained in work-related motor vehicle accidents, comprise such serious and disabling injuries as amputations, fractures, severe lacerations, eye losses, acute poisonings, and burns and may result in worker deaths. Accidents, in general, and the adverse effects that result from them are the leading cause of loss of potential productive years of life in this country. The National Institute for Occupational Safety and Health (NIOSH) estimates that at least 10 million persons suffer traumatic injuries on the job each year; about three million (30%) injuries are severe, and at least 10,000 are fatal (CDC, 1984). Occupational injuries in 1983 resulted in 80 million lost workdays and an estimated \$33.4 billion in wage, insurance, medical, and administrative costs. These figures may even underestimate the total costs to industry and do not include the immeasurable toll in human suffering. Although rates of occupational fatalities and disabling injuries have fallen since the early 1970s, due partly to a growing workforce, the actual numbers have declined slowly, if at all, since 1945.

Intervention

Traditional approaches to preventing traumatic injuries or reducing their severity include removing hazards, placing barriers between hazards and workers, screening workers before employment, analyzing job hazards, improving job and tool design, complying with regulatory and consensus standards, and training workers to avoid hazards. The following strategy will take a dual approach, discussing the actions that can be taken immediately and then the long-term efforts for the future.

Epidemiology

In efforts to study the etiology of workplace injuries and fatalities, the discipline of epidemiology can serve as a common thread by helping to identify high-risk exposures and factors, evaluate both potential risk factors and appropriate control strategies, and assess progress in the control of traumatic injuries. As a key component in the epidemiologic process, surveillance must be applied both as an initial activity to establish baseline information and as a continuing activity to characterize how the national occupational safety experience is changing. Four basic aspects of occupational trauma must be considered: the task, the working environment, the machine, and the worker; modification of any one of these will affect the whole system. An overriding consideration must always be the needs of employers who manage these complex industrial systems.

What can we implement now?

Evaluation of effective safety programs has established that the most important component is management's commitment from the top down. Management accepts responsibility for tying all elements of the workplace together so that the interactions of task, environment, machine, and worker, as well as the energy releases associated with these interactions, can occur with the least possible unforeseen interruption.

Task-oriented strategies: Although safe work practices for hazardous operations and control methods for energy sources are available, failure to use them is responsible for a large number of occupational injuries and deaths.

Employers are either unaware of hazards and control strategies or unable or unwilling to implement them. Job-hazard analysis plus timely reassessment or monitoring can help employers anticipate rather than react to hazards and should have a major impact on reducing national injury and death rates.

Environment-oriented strategies: While the physical environment of the workplace is the most obvious and the most amenable to change, the psychosocial and political/economic environments warrant further study for their impact on injuries. Over the past 50 years, studies of illumination, temperature, noise, vibration, relative humidity, and the layout and condition of the facility have resulted in guidelines to control these potential physical stressors. Failure to apply the guidelines results from cost constraints, inadequate dissemination of information, and improper management of safety programs. Prevention programs in the private sector have demonstrated trauma reductions and should be encouraged in other companies.

Machine-oriented strategies: The various forms of energy associated with machines, if not adequately controlled, can result in traumatic injuries to workers. Regulatory and consensus standards now exist to protect workers from interaction with industrial machines. Many of these standards propose placing barriers between the worker and the energy sources, such as guards on moving parts of machinery or protective equipment worn by the workers. Manufacturers are now producing safer and more functional machines, and procurement procedures should require the purchase of machinery that meets current standards.

Human-oriented strategies: The worker is the most complex entity in the workplace system and, as the employer's most

valuable resource, should be carefully nurtured and protected. Effective information dissemination, education, and training of workers can have an immediate positive impact on the incidence of work-related injuries and deaths. As soon as hazards are identified, known intervention methods should be applied and workers should be supplied with the tools and knowledge to avoid traumatic injuries.

Knowledgeable, well-trained workers can avoid injury even during hazardous work, while untrained, uninformed workers can be injured under almost risk-free conditions. Thus, training is an integral component of trauma prevention. Although safety training begins in childhood, most job safety is learned on the job. Some regulatory agencies require training, but the degree and level of training vary widely. Model training programs could ensure more uniform and basic training in hazard awareness and trauma control. Employees in high-risk occupations should be the primary targets for such training, and retraining in different occupations will be important for workers who suffer permanent disabling injuries at work.

What knowledge do we need?

For management to select and operate safety programs efficiently, they must have access to cost-effective, scientifically proven methods that reduce injuries.

Task-oriented strategies: Although established countermeasures for occupational injuries may represent the best judgment of the trauma control community, they have not, through rigorous scientific studies, been demonstrated to be effective. Such measures would be more readily accepted if their effectiveness and cost benefit were known.

Environment-oriented strategies: The influence of certain physical agents on the incidence of occupational traumatic injuries should be more carefully defined. The psychosocial environment, as it influences the perception of hazard and risk taking, is amenable to modification through advertising, information dissemination, and social interaction. Messages through the mass media should be specific, supportable, and persuasive enough to alter public perception so that occupational traumatic injuries and deaths are no longer considered either morally acceptable events or "chance" occurrences that are beyond human control.

Changes in the workforce and workplace, e.g., increasing numbers of women and of certain ethnic minorities and the increased use of computers and automated or programmable machines (robots), present unique and dynamic challenges for the prevention of traumatic injuries. Past failures to anticipate potential hazards of "new" technologies must not be repeated. New techniques for recognizing, analyzing, and mitigating hazards and for managing risk are emerging and should be nurtured, perhaps by establishing a center for research into the non-mechanistic arena of safety.

Increasing attention is being paid to the complex economic forces that influence the incidence of occupational traumatic injury and fatality. This is evident from the creation of a Workers' Compensation Research Institute and from analyses of the economic incentives and disincentives associated with workers' compensation. Employers are beginning to recognize the negative economic impact of traumatic injuries in lost work-days, high medical costs, loss of productivity, and increased insurance rates and liability claims. Data specific for

industry and occupation would be helpful in these areas. Studies should be under-taken of the cost relationships of compensation, disability, and product-liability insurance from the perspective of occupational trauma.

Machine-oriented strategies: Although present safety concepts involve barriers around hazardous machine parts, workers continue to experience injuries. Further studies are needed on the efficacy of these barriers and on the motivational and behavioral factors involved in their use. Standards for machine safety should be re-evaluated, and the technical basis for each standard should be understood by users. As faster and more efficient machines are developed, care must be taken to design safe methods of feeding and removing stock from the machine and to limit the speed within human tolerances.

Human-oriented strategies: As the workforce ages, traumatic injuries may increase because older workers are slower to react, have reduced ranges of motion, and are less tolerant of environmental changes such as extreme heat or cold. Although older workers are more cautious, the decreasing supply of younger workers may force the older ones to remain longer in high-risk jobs, thus increasing exposure to the hazards of traumatic injury.

Technology can be viewed on four levels: (1) workers supply both power and control, (2) tools supply power, and workers control it, (3) both power and information are supplied, and workers direct; and (4) power, control, and information are supplied in self-monitoring systems, and workers only intervene if something goes wrong. As technology progresses toward levels 3 and 4, and as service jobs become more prominent, training will become increasingly

important. The adequacy of training policies and practices will require constant evaluation.

Little research has been directed to the relationship of human behavior to safe work activity, e.g., why workers circumvent safety devices or ignore safety rules when rescuing others. Most studies have focused on economic factors, but more attention to motivational issues is needed. Management should find ways to enlist the interest and cooperation of workers so that workers, unions, and management can work together to better understand and overcome hazards inherent in the workplace. The impact of such cooperation, e.g., quality circles in the automobile industry, needs further evaluation.

The roles of alcohol and drug abuse are well known in highway trauma but less understood in occupational settings. The work-related effect of these substances and their possible interaction with chemicals in the workplace require further study. NIOSH should cooperate with agencies that have responsibilities in areas of personal behavior and substance abuse and should increase their awareness of worker needs.

Risk-taking, a fundamental quality of the American spirit, is rewarded in society and the workplace, but must be tempered when it contributes to occupational trauma. Other aspects of human behavior, such as reactions to major life events (death, divorce, financial troubles), may also impact occupational safety. The increasing availability of employee counselors reflects the value employers are placing on the mental well-being of workers.

Rehabilitation of severely injured workers, while not preventive, can mitigate the severity of trauma by reducing

prolonged disability, loss of income, and the impaired quality of life. Such evidence of management's commitment to employee well-being lends credibility to its prevention-oriented programs. Better techniques for diagnosis of injuries are needed, and sufficient time must be allowed to ensure the mental, psychological, and physical conditioning of workers for return to the workplace.

Recommendations

What can be done now: Model programs can be developed for successful prevention of occupational trauma and implemented through a workplace-specific, self-evaluation approach. Self evaluation involves the work force in anticipating and identifying hazards, developing and discriminating among existing controls, and tailoring the tools to a specific industry. Such evaluation should be voluntary and focused on high-risk industries and specific worker populations that may be high risk and/or neglected by regulations.

Research on the prevention of occupational trauma, especially interdisciplinary research, should be stimulated by such means as national grant programs. The results of these and similar studies must be easily accessible, perhaps through broadened information centers, and should be available in both hard copy and through electronic access. A knowledge of injury-control methods should be brought to the attention of educational institutions, professional societies, accreditation bodies, and State and local agencies so that educational institutions will be influenced to adopt trauma-control courses or modules into their curricula. Education and training models for specialists, managers, supervisors, and workers should include techniques for identifying, evaluating, and controlling hazards, and ranking the

consequences of hazards; guidelines for selecting training materials and methods; and methods for evaluating training and post-training management.

Enforcement agencies should use their resources and authority to ensure that appropriate safeguards are installed and used, especially on mechanical power presses. All guards should be integral, non-removable parts of the machine design, and workers and managers alike should clearly understand the hazard posed by the machine and the value of the guard. Existing occupational consensus standards and codes should be reevaluated and a technical basis established for each so that new information can be easily incorporated as it emerges. The results of product liability litigation should be monitored for their influence on product designers and to identify potential increased risk to workers. Findings should be widely disseminated to responsible groups.

Longer term actions: Surveillance of occupational traumatic injury is currently limited by the inadequacies and the redundancies of existing documentation and reporting systems. A national surveillance system is needed that will include information on products, engineering controls, personal protective equipment, job title and tasks, worker characteristics (training, experience, and shift factors), compliance with standards, and location of accident--in short, the optimal elements to fulfill all current and anticipated uses of such data. All possible sources must be tapped, including reports from hospitals, medical examiners, and accident investigations. Until such a system is developed, existing systems can be expanded and the collection of industry-specific data can be explored. In addition, ways might be found to release--for trauma-control research--data that are currently

protected by the Privacy Act, while still protecting the sensitive nature of the data.

Epidemiologic studies are needed to describe the magnitude and characteristics of specific traumatic injuries and to evaluate the efficacy of specific prevention measures. These studies can reduce current information gaps, such as incorrect statistics on traumatic injury, unsubstantiated conclusions about what influences the risk of injury (training, worker behavior, experience, supervision), and data on the feasibility and success of prevention measures.

The continuing toll of occupational injuries suggests that current programs are not working, perhaps because resources are not available or because the personnel involved are not familiar with specific problems in specific industries. A possible solution to be explored is the formation of private, nonprofit, industry-specific associations for research (not regulatory) purposes (e.g., the Construction Safety Association of Ontario). Existing national programs could help promulgate regulations, develop scientific methods, and generate research tools for the associations.

Chemicals, medications, and other substances, encountered through both personal use and workplace exposure, may increase the risk of traumatic injury. These hazards must be identified, workers should be screened for susceptibility to them, and effective employee-assistance programs should be made available nationwide.

OCCUPATIONAL CARDIOVASCULAR DISEASES

Cardiovascular diseases, e.g., ischemic heart disease and hypertensive, cerebrovascular, and peripheral vascular diseases are the leading cause of disability and death in the United States, accounting for almost a million deaths (986,000) in 1984 (NCHS, 1986). Direct and indirect economic costs amounted to approximately \$102.4 billion in 1983. The 34 percent decline in coronary heart disease since 1972 demonstrates the potential effectiveness of programs directed at risk factors for such diseases. Coronary heart disease, hypertension, and related entities are included in this prevention strategy because of their high incidence, whereas the less common arrhythmias, cardiomyopathies, and other forms are more directly related to specific occupational exposures. These latter conditions are given specific emphasis here because of their vulnerability to intervention in the workplace.

Risks and the workplace

Millions of workers are currently exposed to work-related factors; chemical, physical, and psychosocial, associated with increased risk of cardiovascular disease. Many personal risk factors are also known. Some personal factors are unalterable, e.g., age, gender, and family history; others are alterable, e.g., cigarette smoking, dietary intake, hypertension, excessive alcohol intake, obesity, diabetes, inadequate physical activity, and behavioral pattern. Preventive programs directed at the alterable risk factors are effective in reducing the occurrence of cardiovascular disease, and the workplace is an excellent site for disseminating messages and programs designed to change these personal risk factors. Where possible, this strategy

will combine the two approaches: preventing work-related risk factors and enhancing the prevention of personal risk factors.

Cardiotoxic exposures in the workplace:

Several chemical and physical agents--such as carbon disulfide, carbon monoxide, halogenated hydrocarbons, nitroglycerine, heat, and noise--are known to increase the risk of cardiovascular disease. In addition, nearly 1,500 chemicals have been identified with possible cardiovascular effects. The complexity of the disease process, the long latency, and the diversity of workplace exposures during a given lifetime make the study of relationships between occupational exposures and cardiovascular disease difficult.

Reducing exposures to known cardiotoxins requires identifying the exposures, communicating with exposed workers, complying with current exposure criteria, implementing control technology and environmental control programs, improving monitoring, developing protective equipment, and adopting new or improved exposure standards. Ideally, these environmental efforts should be combined at the worksite with efforts to reduce such personal risks as smoking, elevated blood cholesterol, elevated blood pressure, and sedentary lifestyle. Individual situations, however, must dictate the balance between these two approaches.

Better medical, epidemiologic, and toxicologic studies will be needed to determine the specific effects of chemical and physical agents on the cardiovascular system and the interaction of these agents with personal lifestyle factors. An epidemiologic group for

cardiovascular disease could be formed within NIOSH to help focus that agency's studies and to coordinate a program with outside groups; coordination with the National Heart, Lung, and Blood Institute will be particularly important. New methods must be developed to screen chemical substances, delineate mechanisms of toxicity, monitor exposures, and assess the value of training, education, and information dissemination.

Psychosocial factors: Studies showing an association of work-related psychosocial factors with increased risk of cardiovascular disease have linked specific factors to specific manifestations of disease. Inconsistent results from some of these studies may be due to slightly different methodologies and to lack of control for other risk factors. Further research is sorely needed to determine the specific underlying factors that cause increased risk of cardiovascular disease, to assess workplace psychosocial factors, to determine the job-related stress of new technologies, and to evaluate the effectiveness of programs designed to correct the problems.

Health promotion: Even for occupational and industrial groups with increased risk *primarily* from personal factors, the prevention of cardiovascular disease related to these factors is a worthy goal. The workplace is a highly attractive site for delivering health promotion and employee-assistance programs. Success of such programs will require union and management cooperation, employee involvement, adequate allocation of resources, control at the local level, attention to ethical issues, confidentiality of medical information, and voluntary participation. These programs should be made increasingly available, especially to high risk groups. Structured follow-up and evaluations

should be included to assess the overall effectiveness of the efforts.

Summary

Although our knowledge of the relationship between workplace exposures and cardiovascular disease is incomplete, the morbidity and mortality resulting from cardiovascular disease in this country is extensive. Important steps should be taken now to help reduce this toll.

REFERENCES:

The Association of Schools of Public Health under a cooperative agreement with the National Institute for Occupational Safety and Health (1986): Proposed National Strategies for the Prevention of Leading Work-Related Diseases and Injuries, Part 1. Washington, D.C.

CDC (1983): Leading Work-Related Diseases and Injuries--United States (Occupational Lung Diseases). MMWR 32:24-6, 32.

CDC (1984): Leading Work-Related Diseases and Injuries--United States (Severe Occupational Traumatic Injuries). MMWR 33:213-5.

Danielson G, Edstrom R, Lindh G (1983): Ordinance Concerning Work Postures and Working Movements. Regulation (AFS 1983:6) issued by the National Board of Occupational Safety and Health. Stockholm, Sweden.

National Center for Health Statistics (1986): Monthly Vital Statistics Report. Advance Report of Final Mortality Statistics, 1984. Vol. 35, #6, Suppl. 2. Washington, D.C.

NIOSH (1978): Analysis of data gathered in the National Occupational Hazard Survey, 1972-1974 (unpublished).

U.S. Department of Health, Education, and Welfare, Public Health Service (1979): Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention. Washington, D.C.: Office of the Assistant Secretary for Health, and Surgeon General, DHEW (PHS) Publication No. 79-55071.

U.S. Department of Health and Human Services, Public Health Service (1980): Promoting Health/Preventing Disease: Objectives for the Nation. Washington, D.C.: U.S. Government Printing Office.

DISORDERS OF REPRODUCTION

Since antiquity, certain chemical and physical agents have been recognized as having detrimental effects on human reproduction. For example, the effect of industrial lead poisoning in inducing abortions was noted by the Romans and again in the first decade of this century (6). Evidence from more recent laboratory studies and clinical investigations indicates that a wide range of microbiologic, physical, and chemical agents, such as Brucella, rubella, ionizing and nonionizing radiation, heat and vibration, tobacco, alcohol, and certain drugs, can adversely affect reproductive outcomes. At least 50 chemicals--including heavy metals, such as lead and cadmium, glycol ethers, organohalide pesticides, organic solvents, and chemical intermediates, such as styrene and vinyl chloride--in widespread use in industry have been shown to produce impairment of reproductive functions in animals (7).

Until recently, the potential hazards to human reproduction posed by occupational exposures received little attention. However, adverse effects after thalidomide exposure in the 1960s and the occurrence in 1970 of methylmercury poisoning among residents of Minamata, Japan, dramatically demonstrated the teratogenic potential of chemical exposures. Those events and the increasing entry of women into the workforce focused greater attention on the potential hazards to female reproductive functions of occupational exposures. In the late 1970s, the demonstration of sterility among male workers exposed to dibromochloropropane was described; this drew attention to the concomitant potential for hazards to male reproductive function (8).

Occupational exposures can produce a wide range of adverse effects on reproduction. The effects of parental exposure before conception to agents toxic to reproductive functions may be evident as reduced fertility, unsuccessful fertilization or implantation, or an abnormal fetus. Maternal exposure after conception may result in death of the fetus or structural and functional abnormalities in the newborn. Other possible adverse outcomes include spontaneous abortions (both early and late), major and minor birth defects, perinatal death, low birth weight, altered sex ratio, developmental or behavioral disabilities, and transplacental exposure to carcinogen (9-11).

Estimates of the prevalence of adverse reproductive outcomes indicate that these events occur with considerable frequency in the U.S. population. For example, an estimated 560,000 infant deaths, spontaneous abortions, and stillbirths occur each year. The March of Dimes estimates that 200,000 live infants with some type of birth defect--benign or disabling--are born in the United States each year (9). The causes of most of these adverse outcomes are unknown. For example, 6%-30% of the infertile couples have no recognized anatomic or physiologic abnormalities to account for the infertility (10); neither the etiology of sperm abnormalities nor the cause of sister-chromatid exchange in spontaneous abortions has been established (11,12). The causes for as many as 65%-70% of the birth defects are not known (13).

Maternal Exposures: Studies of occupational reproductive hazards to date have consisted mainly of epidemiologic surveys of pregnancy outcomes following maternal exposures. Such studies have

shown increased rates of spontaneous abortions among laboratory and chemical workers (14,15) and among workers exposed to lead (16), ethylene oxide (17), and anesthetic gases (18,19). Studies of adverse outcomes of pregnancy, however, are subject to several methodologic limitations. For example, the detection of rare outcomes, such as birth defects, requires the study of several thousand pregnancies, and retrospective studies are subject to problems of recall and misclassification, both of reproductive events and of exposures (20,21). The timing, duration, and frequency of exposure before and during pregnancy may critically affect reproductive outcomes (22). For example, exposure to ionizing radiation during the first trimester may result in microcephaly and mental retardation, and exposure during the third trimester may produce low birth weight and neonatal death (11). Other studies have been limited by the selection of inadequate comparison groups or the failure to examine the influence of other factors, such as alcohol and tobacco consumption or maternal age, that affect reproductive outcomes.

Paternal Exposures: Since azoospermia (absence of living spermatozoa in the semen) and oligospermia (subnormal concentration of spermatozoa) were reported in 1977 among workers exposed to dibromochloropropane (8), at least 14 studies have examined the quality of semen in workers exposed to lead, carbon disulfide, anesthetic gases, ionizing radiation, toluenediamine, dinitrotoluene, carbaryl, and several other pesticides (10). Adverse effects on the quality of semen were reported in workers exposed to lead or ionizing radiation. In other studies, e.g., of exposures to ethylene dibromide, results were inconclusive because of problems in design of the study or inadequate numbers of

participants (10). CDC recently used data collected by the Metropolitan Atlanta Congenital Defects Program to examine the risk of serious structural birth defects among the children of male Vietnam veterans; no statistically excessive risks were noted (23). In general, relatively few studies have been conducted of reproductive outcomes associated with paternal exposures (9).

Extent of potential exposures: Estimates have been made of the number of workers potentially exposed to selected agents known or suspected to be toxic to reproductive function. NIOSH estimates that approximately 200,000 workers are potentially exposed to various glycol ethers (24), several of which exhibit marked testicular toxicity in animals (25). An estimated 9 million workers are exposed to radio-frequency/microwave radiation (26), which has been shown to cause embryonic death and impaired fertility in animals but which has yet to be studied adequately in humans. NIOSH has estimated that approximately 50,000 personnel in hospital operating rooms are potentially exposed to waste anesthetic gases, and 139,000 hospital and other industrial workers may be exposed to ethylene oxide (24); both agents have been linked to an increased risk of spontaneous abortions in humans.

The extent to which occupational exposures in American workers produce adverse reproductive outcomes is largely unknown. However, the information presented here suggests that the problem is both widespread and serious. Epidemiologic and toxicologic research into the reproductive effects of occupational exposures is in its infancy. There is a continuing effort to elucidate the etiology of adverse reproductive outcomes, such as fetal chromosomal abnormalities or abnormal

spermatogenesis and to develop improved animal models for screening agents for possible mutagenic and toxic effects related to human reproduction. Registries for the surveillance of outcomes of reproduction, such as CDC's Birth Defects Monitoring Program (9), and improved methodologies developed to evaluate such parameters as quality of semen (12) and outcomes of pregnancy (20), will permit further identification of specific occupational hazards to reproduction. When such hazards are identified and controlled in the workplace, the prevention of reproductive disorders in the population as a whole will be substantially improved.

Reported by Industrywide Studies Br,
and Surveillance Br, Div of Surveillance,
Hazard Evaluations, and Field Studies,
National Institute for Occupational
Safety and Health, CDC.

References

1. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1983;32:24-6, 32.
2. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1983;32:189-91.
3. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1984;33:125-28.
4. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1984;33:213-5.
5. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1985;34:219-22, 227.
6. Hamilton A. Women in the lead industries. Bureau of Labor Statistics Bulletin No. 253. Washington, D.C.: U.S. Department of Labor, 1919. In: Hunt V. Work and the health of women. Boca Raton, Florida: CRC Press, Inc. 1979.
7. Barlow SM, Sullivan FM. Reproductive hazards of industrial chemicals: an evaluation of animal and human data. London: Academic Press, 1982.
8. Whorton D, Krauss RM, Marshall S, Milby TH. Infertility in male pesticide workers. *Lancet* 1977;ii:1259-61.
9. Bloom AD, Paul NW, eds. Guidelines for studies of human populations exposed to mutagenic and reproductive hazards: proceedings of conference held January 26--27, 1981, in Washington, D.C. sponsored by Centers for Disease Control. White Plains, New York: March of Dimes Birth Defects Foundation, 1981.
10. Ratcliffe JM. Altered fertility. In: Review of occupational hazards to reproductive health. Geneva, Switzerland: World Health Organization (in press).
11. Strobino BR, Kline J, Stein Z. Chemical and physical exposures of parents: effects on human reproduction and offspring. *Early Hum Dev* 1978;1:371-99.
12. Wyrobek AJ. Methods for evaluating the effects of environmental chemicals on human sperm production. *Environ Health Perspect* 1983;48:53-9.
13. Wilson JG. Environment and birth defects. New York: Academic Press, 1973.
14. Strandberg M, Sandback K, Axelsson O, Sundell L. Spontaneous abortions among women in hospital laboratory. (Letter) *Lancet* 1978;ii:384-5.
15. Hemminki K, Franssilla E, Vainio H. Spontaneous abortions among female chemical workers in Finland. *Int Arch Occup Environ Health* 1980;45:123-6.
16. Nordstrom S, Beckman L, Nordenson I. Occupational and environmental risks in and around a smelter in northern Sweden. V. Spontaneous abortion among female employees and decreased birth weight in their offspring. *Hereditas* 1979;90:291-6.
17. Hemminki K, Mutanen P, Saloniemi I, Niemi ML, Vainio H. Spontaneous abortions in hospital staff engaged in sterilising instruments with chemical agents. *Br Med J* 1982;285:1461-3.
18. Cohen EN, Gift HC, Brown BW, et al. Occupational disease in dentistry and chronic exposure to trace anesthetic gases. *J Am Dent Assoc* 1980;101:21-31.
19. Cohen EN, Brown BW, Bruce DL, et al. Occupational disease among operating room personnel: a national study. *Anesthesiology* 1974;41:321-40.
20. Selevan SG. Design considerations in pregnancy outcome studies of

- occupational populations. *Scand J Work Environ Health* 1981;7:76-82.
21. Boffler PA. Some problems involved in recognizing teratogens used in industry. *Contributions to epidemiology and biostatistics* 1979;-1:118-37.
 22. Gordon JE. Assessment of occupational and environmental exposures. In: Bracken, MB, ed. *Perinatal epidemiology*. New York: Oxford University Press (in press).
 23. Erickson JD, Mulinare J, McClain PW, et al. Vietnam veterans' risks for fathering babies with birth defects. *JAMA* 1984;252:903-12.
 24. National Institute for Occupational Safety and Health. *National Occupational Hazard Survey. Projected estimates of potentially exposed workers*. Cincinnati, Ohio: National Institute for Occupational Safety and Health, December 1977 (DHEW) (NIOSH) publication no. 78-114).
 25. National Institute for Occupational Safety and Health. *Glycol ethers. Current Intelligence Bulletin No. 39*. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1983 (DHHS) (NIOSH) publication no. 83-112).
 26. Centaur Associates, Inc. final report; study of radiofrequency and microwave radiation (phase 1). Prepared for the Occupational Safety and Health Administration;1982.

NEUROTOXIC DISORDERS

Diseases of the nervous system resulting from toxic exposures in the workplace were known as early as the first century A.D., when Pliny identified palsy as a manifestation of lead poisoning among workers exposed to lead dust (7). In 1557, Jean Fernel linked gingival pigmentation, tremor, and behavioral changes to occupational mercury poisoning (8); in the nineteenth century, Delpech recognized rubber processing as the cause of the bizarre psychoses occurring among French workers who manufactured condoms and balloons in small cottage industries. Later, carbon disulfide was implicated as the specific neurotoxic agent (9).

Industrial hygiene practices have improved in the twentieth century, and some animal models of neurotoxic disease have been developed. In addition, workers who become ill often draw attention to outbreaks of neurotoxic diseases. Despite the prior identification of acrylamide as neurotoxic in animals, its neurotoxicity in humans was first recognized in the 1950s, when several Japanese workers involved in a pilot production project developed peripheral neuropathy (10). During the 1960s and early 1970s, dozens of cases of neuropathy occurred among Japanese and Italian workers exposed to solutions containing n-hexane during the manufacture of shoes (11). Subsequently, high doses of n-hexane were found to be neurotoxic in exposed animals. In the past 15 years alone, outbreaks of serious human neurotoxicity occurred among workers exposed to three substances not previously known to be neurotoxic: the chlorinated hydrocarbon, chlordecone, which caused opsoclonus, tremor, disturbances of gait, and changes in personality (12); and two hexacarbons,

methyl-n-butyl ketone and 2-t-butylazo-2-hydroxy-5-methylhexane, both of which caused a predominantly peripheral neuropathy (13,14).

Nature of Neurotoxic Disorders:

Neurotoxic disorders are on the NIOSH list of Ten Leading Work-Related Diseases and Injuries (1) because of their potential severity--as exemplified by the neurotoxicity of chlordecone--and because of the large number of workers potentially at risk. A conservative estimate of the workers exposed full time to one or more neurotoxic agents is 7.7 million (15). The number of potentially neurotoxic chemicals found in the workplace exceeds 850.

Clinically, symptoms and signs of neurotoxicity can be diverse. Depending on the intensity of exposure, the molecular configuration of the agent, and the mechanism of toxicity, either central or peripheral neurologic effects may predominate. Most neurotoxic chemicals, however, affect both the central and peripheral nervous systems. Because the symptoms of peripheral neuropathy are more specific and the nerves themselves more directly accessible to precise diagnostic examinations, the effects of neurotoxic agents on the peripheral nervous system are usually more easily identified than effects on the central nervous system (CNS). Early symptoms of peripheral neuropathy may include numbness, tingling, or pain in the feet or hands. As the disease progresses, clumsiness or incoordination due to both sensory and motor changes may develop. Production workers may find their ability to do usual work partially or fully impaired. Chemicals used extensively in industry, which cause peripheral neuropathy when present in sufficiently high and persistent

concentrations, include: lead, n-hexane, acrylamide, carbon disulfide, mercury, and methyl bromide (17,18). Several chemicals are known to cause selective impairment of cranial-nerve function, including dysfunction of the fifth cranial nerve (trichloroethylene) (18).

The effects of neurotoxic agents on the CNS present a far wider range of disturbances (16,18,19). At times, the most striking effects are changes in mood and personality (20). High levels of exposure to manganese or carbon disulfide produce psychoses and suicidal tendencies. Delusions and hallucinations may result from exposure to high concentrations of solvents, such as methylene chloride. Manifestations of cognitive dysfunction, such as reduced attention span, lack of alertness, and memory loss, are prominent neurotoxic effects that may occur in addition to personality changes after exposure to many solvents and to asphyxiants, such as carbon monoxide. Other neurologic effects occur under certain restricted conditions of exposure to unique chemical substances.

Although research into the neuro-behavioral effects of industrial chemicals is relatively new, early results suggest that occupational neurotoxicity may be a larger problem than previously suspected. Sensitive methods for evaluating subtle losses in cognitive function have only recently been applied to the evaluation of exposed workers. Because of the complexity of the nervous system and the variety of potentially neurotoxic exposures, the true scope of this health hazard in the workplace is unknown.

Studies of the neurotoxicity of workplace chemicals demonstrate the problems encountered in recognizing occupational disease in general. Despite occasional large and dramatic outbreaks of

neurotoxic disorders, such as those mentioned above, more often small numbers of workers in many workplaces are chronically exposed to neurotoxic agents that subtly and slowly alter nervous-system functions. Several neurotoxic syndromes mimic diseases of nonoccupational and "idiopathic" etiology, e.g., the toxic axonopathy associated with exposure to various metals and solvents, the parkinsonian syndrome of chronic intoxication with manganese, and the organic brain syndrome of chronic solvent intoxication. Because of these similarities to other nonoccupational diseases, such cases are frequently not identified as occupational in origin. In addition, many physicians are not trained to take an adequate occupational medical history (21). For these reasons, the prevalence of occupational neurologic disease is unknown, and important causal relationships between chemicals and disease remain obscure.

The prevention of neurotoxicity among workers will require strategies such as those suggested in the 1990 Objectives for improving the nation's health (22), developed by the U.S. Public Health Service: (1) analyses of structural analogues of known neurotoxic agents in an effort to predict the neurotoxicity of untested chemicals; (2) continuing search for animal models of disease; (3) ongoing research in establishing an acceptable human exposure level for identified neurotoxic agents; (4) epidemiologic evaluations of suspected neurotoxicity; (5) development of simple screening tools for use on asymptomatic populations exposed to known neurotoxic agents; and (6) premanufacturing and premarket testing of new chemicals as required by the Toxic Substances Control Act (23). As in the prevention of other work-related diseases, however, the most direct and effective method for preventing neurotoxic illness will

continue to be the environmental control of exposures to neurotoxic chemicals. Such efforts as the substitution of less toxic substances where possible, engineering controls, teaching appropriate work practices, and educating workers about the potential neurotoxicity of chemicals will aid a comprehensive prevention effort.

Reported by Div of Biomedical and Behavioral Science, and Div of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, CDC.

References

1. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1983;32:24-6, 32.
2. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1983;32:189-91.
3. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1984;33:125-8.
4. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1984;33:213-5.
5. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1985;34:219-22, 227.
6. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1985;34:537-40.
7. Hunter D. The diseases of occupations. Sixth edition. London: Hodder and Stoughton, 1978:251.
8. Chang LW. Mercury. In: Spencer PS, Schaumburg HH, eds. *Experimental and clinical neurotoxicology*. Baltimore, Maryland: Williams & Wilkins, 1980:508-26.
9. Seppalainen AM, Haltia M. Carbon disulfide. In: Spencer PS, Schaumburg HH, eds. *Experimental and clinical neurotoxicology*. Baltimore, Maryland: Williams & Wilkins, 1980:356-73.
10. Le Quesne PM. Acrylamide. In: Spencer PS, Schaumburg HH, eds. *Experimental and clinical neurotoxicology*. Baltimore, Maryland: Williams & Wilkins, 1980:309-25.
11. Spencer PS, Couri D, Schaumburg HH. n-hexane and methyl n-butyl ketone. In: Spencer PS, Schaumburg HH, eds. *Experimental and clinical neurotoxicology*. Baltimore, Maryland: Williams & Wilkins, 1980:456-75.
12. Taylor JR, Selhorst JB, Calabrese VP. Chlordecone. In: Spencer PS, Schaumburg HH, eds. *Experimental and clinical neurotoxicology*. Baltimore, Maryland: Williams & Wilkins, 1980:0407-21.
13. Allen N, Mendell JR, Billmaier DJ, Fontaine RE, O'Neill JO. Toxic polyneuropathy due to methyl n-butyl ketone. An industrial outbreak. *Arch Neurol* 1975;32:209-18.
14. Horan JM, Kurt TL, Landrigan PJ, Melius JM, Singal M. Neurologic dysfunction from exposure to 2-t-butylazo-2-hydroxy-5-methylhexane (BMMH): a new occupational neuropathy. *Am J Public Health* 1985;75:513-7.
15. National Institute for Occupational Safety and Health. National Occupational Hazard Survey, 1972-74. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977. (DHEW [NIOSH] publication no. 78-114).
16. Anger WK, Johnson BL. Chemicals affecting behavior. In: O'Donoghue JD, ed. *Neurotoxicity of Industrial and Commercial Chemicals*. Boca Raton, Florida: CRC Press (in press).
17. O'Donoghue JL, Nasr AN, Raleigh RL. Toxic neuropathy--an overview. *J Occup Med* 1977;19:379-82.
18. Baker EL. Neurologic and behavioral disorders. In: Levy BS, Wegman DH, eds. *Occupational health: recognizing and preventing work-related disease*. Boston: Little, Brown and Co., 1983: 317-30.
19. Johnson BL, Baker EL, Gilioli R, Xintaras C, eds. *Prevention of neurotoxic illness in working populations*. Geneva: World Health Organization (in press).

20. Baker EL, Bus JS, Cranmer JM, et al. Workshop on neurobehavioral effects of solvents--consensus summary. *Neurotoxicology* 1985;6:99-102.
21. Goldman RH, Peters JM. The occupational and environmental health history. *JAMA* 1981; 246:2831-6.
22. U.S. Public Health Service. Occupational safety and health. In: Promoting health/preventing disease: objectives for the nation. Washington, D.C.: U.S. Department of Health and Human Services, Fall 1980: 39-43.
23. Toxic Substances Control Act. Public Law No. 94-469, 90, Stat. 2003, 1976.

NOISE-INDUCED HEARING LOSS

Occupational deafness was first documented among metalworkers in the sixteenth century (8). Since then, workers have experienced excessive hearing loss in many occupations associated with noise. Noise-induced loss of hearing is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss higher than that resulting from the natural aging process; this is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.

While loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are rare. In most cases, noise-induced hearing loss is insidious. Typically, it begins to develop at 4,000 hertz (Hz, or cycles per second) in the hearing range of 20 Hz to 20,000 Hz and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized.

Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. Although the primary frequencies of human speech range from 200 Hz to 2,000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components. As a result, an average hearing threshold (lowest audible sound level) at separate frequencies of 1,000 Hz, 2,000 Hz, and 3,000 Hz is used widely to define material impairment caused by noise (10,11).

Recent estimates by the Occupational Safety and Health Administration (OSHA) indicate that about 9,400,000 U.S. production workers (7,900,000 active and 1,500,000 retired) either now work or have worked in industrial locations where noise-exposure levels are 80 decibels (dBA) or higher. This estimate includes most noisy workplaces in the United States, except agricultural, mining, construction, transportation, and government (11). At exposure levels below 80 decibels (weighted to the approximate response of the human ear), an increased risk of hearing loss caused by occupational noise has not been found. Based on the average hearing threshold level at 1,000 Hz, 2,000 Hz, and 3,000 Hz, OSHA estimates that 1,624,000 (17%) production workers have at least mild hearing loss resulting from their occupational noise exposures; 1,060,000 (11%) have material hearing impairment; and 473,000 (5%) have moderate to severe impairment (11). These estimates generally agree with NIOSH survey findings, which indicate that one-fourth of persons 55 years of age or older who have been exposed over their working lifetime to an average of about 90 dBA have developed a material hearing impairment caused by occupational noise exposure (10,12). An estimated \$835 million will be paid in workers' compensation claims for occupational hearing impairment for the 10-year period 1978-1987 (13).

Occupational noise-induced loss of hearing is preventable. In its 1990 Objectives for the Nation, the U.S. Public Health Service set an objective that "By 1990, the prevalence of occupational noise-induced hearing loss should be reduced to 415,000 cases" (14). This objective relates to the number of cases

of hearing loss that result in moderate to severe impairment. However, it is important to note that if the number of moderate to severe impairments is reduced, the number of mild hearing loss and of material impairments would be reduced proportionately. OSHA has estimated that within 10 years, the number of cases of noise-induced hearing impairment can be reduced by 20 percent if all workers exposed to noise levels higher than 85 dBA wear personal hearing protectors (earplugs or muffs) and receive on the average a 15 dBA noise reduction (11). However, this estimate hinges on effective use of hearing protectors to an extent that has not yet been demonstrated for all workers. NIOSH field investigations of industrial workers who routinely use earplugs indicate average noise reduction ranging from 7 dBA to 20 dBA, depending on the type of plug used (15).

A noise-control/hearing-conservation program is the most important step in eliminating occupational hearing loss. Such a program must include:

1. Reduction of noise through engineering controls, and the purchase of new, noise-engineered equipment.
2. Proper fit of personal hearing-protection devices.
3. Education of workers and managers about certain characteristics of noise-induced loss of hearing.
4. Proper periodic audiometric testing and notification of workers who are developing hearing loss.
5. Visible commitment of management and workers to the program.

The joint efforts of management, labor, and health-care providers are needed to establish effective hearing-conservation

programs in industry. All interested groups must work together to achieve the goal of protecting workers' hearing.

Reported by Physical Agents Effects Br,
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References

1. CDC. Leading work-related diseases and injuries--United States. MMWR 1983;32:24-6, 32.
2. CDC. Leading work-related diseases and injuries--United States. MMWR 1983;32:189-91.
3. CDC. Leading work-related diseases and injuries--United States. MMWR 1984;33:125-8.
4. CDC. Leading work-related diseases and injuries--United States. MMWR 1984;33:213-5.
5. CDC. Leading work-related diseases and injuries--United States. MMWR 1985;34:219-22, 227.
6. CDC. Leading work-related diseases and injuries--United States. MMWR 1985;34:537-40.
7. CDC. Leading work-related diseases and injuries--United States. MMWR 1986;35:113-6, 121-3.
8. Alberti (1591), cited by Bunch CC. Traumatic deafness. In: Fowler EP Jr, ed. *Medicine of the ear*, Chapter X (Reprinted, *Translations of the Beltone Institute for Hearing Research*, No. 23, 1970).
9. Michael PL. Physics of sound. In: NIOSH. *The industrial environment--its evaluation and control*. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1973.
10. NIOSH. Criteria for a recommended standard . . . occupational exposure to noise. Department of Health, Education, and Welfare, Health Services and Mental Health Administration, 1972; NIOSH publication no. HSM 73-11001.
11. Occupational Safety and Health Administration. Final regulatory analysis of the hearing conservation amendment. Department of Labor, 1981, GPO No. 723-860/752 1-3.
12. Schmidek ME, Layne MA, Lempert BL, Fleming RF. Survey of hearing conservation programs in industry. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1975; HEW publication no. NIOSH 75-178.
13. Ginnold RE. Occupational hearing loss. Workers compensation under state and federal programs. Environmental Protection Agency report no. EPA 550/9-79-101, 1979.
14. U.S. Public Health Service. Promoting health/preventing disease: objectives for the nation. Washington, D.C.: Department of Health and Human Services, 1980:39-43.
15. Lempert BL, Edwards RG. Field investigations of noise reduction afforded by insert-type hearing protectors. *Am Ind Hyg Assoc J* 1983;12:894-902.

DERMATOLOGICAL CONDITIONS

A worker's skin is directly exposed to the occupational environment and is susceptible to a large number of dermatological injuries and other conditions. Complete data on the extent and cost of dermatological injuries are not available; however, dermatological conditions other than injuries accounted for 37 percent of the 106,100 occupational illnesses recorded in 1983 in the Bureau of Labor Statistics (BLS) Annual Survey of Occupational Injuries and Illnesses (1). Results from the BLS Annual Survey for 1972-1976 indicated that 20-25 percent of all occupational dermatological conditions resulted in lost time from work (average 10-12 lost workdays) (2). Similar data based on workers' compensation claims have been reported from California and South Carolina (3,4). Assuming that only 2-10 percent of cases are actually reported, the annual cost of occupational dermatological conditions resulting from lost worker productivity, medical care, and disability payments may range between \$222 million and \$1 billion (5,6).

Because 10-15 percent of requests that NIOSH receives for health hazard evaluations involve skin complaints, and because the economic impact of work-related dermatological conditions is substantial, NIOSH has included dermatological conditions on its list of Ten Leading Work-Related Diseases and Injuries in the United States (7).

Dermatological Injuries: Dermatological injuries are usually described as the immediate adverse effects on skin that result from instantaneous trauma or brief exposure to toxic agents involving a single incident in the work environment (1). Skin injuries may constitute 23-35 percent of all injuries (8,9).

Thus, based on 4,748,000 injuries of all types, and a full-time worker population of 74,750,000 for 1983 (1), an estimated 1,070,000-1,650,000 dermatological injuries may occur yearly, with an estimated annual rate of skin injury of 1.4-2.2 per 100 full-time workers. The highest percentage of skin injuries are due to lacerations/punctures (82 percent), followed by burns (chemical and other) (14 percent) (8).

Other Dermatological Conditions: Other dermatological conditions, "illnesses of the skin," may also result from exposure to environmental factors or toxic agents associated with employment. However, they usually result from more sustained or cumulative exposures and involve longer intervals between exposure and occurrence of disease. These conditions include contact dermatitis, infection, acne, and skin cancer. Workers' compensation claims data from California suggest that 95 percent of these occupational skin conditions are either contact dermatitis (90 percent) or infections (5 percent) (3). Field investigations in the 1950s showed that at least 80 percent of occupational contact dermatitis cases may be caused by the irritating direct cytotoxic effects of causal agents rather than immunologically mediated allergic reactions (10). The highest number of other occupational skin conditions (23,017) in 1984 occurred in the manufacturing sector; the highest incidence rate (28.5/10,000 full-time workers) involved the combined agriculture/forestry/fishing division.

The clinical course for occupational contact dermatitis is relatively poor. In three studies, complete resolution occurred in 25 percent of workers affected; 50 percent improved but had

periodic recurrences; and 25 percent developed persistent dermatitis as severe as or worse than the original condition (11-13). Contact dermatitis often necessitates job changes or modifications. Despite these, however, complete resolution may occur in only a limited proportion of cases.

Prevention of Work-Related Dermatological Disorders: The most effective prevention measures are engineering controls that eliminate exposures of the skin to chemical, physical, or mechanical agents through isolation, containment, or redesign of industrial processes. Substitution of less toxic substances through chemical engineering may also be effective (14). Protective clothing should be selected on the basis of resistance to both chemical and physical hazards, as well as on the relative permeabilities to specific chemical exposures. Effective cleaning of skin and clothing is important, but workers should not wash vigorously or excessively with harsh soaps and detergents (15). Barrier creams have been suggested as alternatives, although their effectiveness has not yet been established (16). Prevention strategies should always include education of workers and management.

Expanded activities concerning occupational dermatological conditions include improved methods for surveillance of occupational skin disease and vigorous research in dermatotoxicology to identify preventable risk factors and facilitate effective interventions at early stages.

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References

1. Bureau of Labor Statistics. Occupational injuries and illnesses in the United States by industry, 1983. Washington DC: US Department of Labor, Bureau of Labor Statistics, June 1985.
2. Wang CL. Occupational skin disease continues to plague industry. *Monthly Labor Review* 1979; 102:17-22.
3. Occupational Disease Statistics Unit, Division of Labor Statistics and Research. Occupational skin disease in California (with special reference to 1977). San Francisco: California Department of Industrial Relations, 1979.
4. Keil JE, Shmunes E. The epidemiology of work-related skin disease in South Carolina. *Arch Dermatol* 1983; 119:650-4.
5. National Institute for Occupational Safety and Health, Office of Health Surveillance and Biometrics, National Occupational Hazard Survey. Pilot study for development of an occupational disease surveillance method. Rockville, Maryland: National Institute for Occupational Safety and Health, 1975, HEW (NIOSH) publication no. 75-162.
6. Mathias CG. The cost of occupational skin disease. *Arch Dermatol* 1985;121:332-4.
7. CDC. Leading work-related diseases and injuries--United States. *MMWR* 1983;32:24-6, 32.
8. Bureau of Labor Statistics. Supplementary data system. Unpublished data.
9. Consumer Product Safety Commission. National Electronic Injury Surveillance System. Unpublished data.
10. Schwartz L, Tulipan L, Birmingham DJ. Occupational diseases of the skin. 3rd ed. Philadelphia: Lea and Febiger, 1957.
11. Hellier FF. The prognosis in industrial dermatitis. *Br Med J* 1958; 1:196-8.
12. Burrows D. Prognosis in industrial dermatitis. *Br J Dermatol* 1972; 87:145-8.
13. Fregert S. Occupational dermatitis in a 10-year period. *Contact Dermatitis* 1975; 1:96-107.
14. Adams RM. Allergen replacement in industry. *Cutis* 1977;20:511-6.
15. Mathias CG. Contact dermatitis: when cleaner is not better. *Occup Health Saf* 1984; Jan:45-50.
16. Orchard S. Barrier creams. *Dermatol Clin* 1984; 2:619-29.

PSYCHOLOGICAL DISORDERS

There is increasing evidence that an unsatisfactory work environment may contribute to psychological disorders. Studies have shown that factors contributing to an unsatisfactory work environment may include work overload, lack of control over one's work, nonsupportive supervisors or co-workers, limited job opportunities, role ambiguity or conflict, rotating shiftwork, and machine-paced work (1-4). Psychological disorders that can result from such factors may be classified as a) affective disturbances, e.g., anxiety, irritability, b) behavioral problems, e.g., substance abuse, sleep difficulties, c) psychiatric disorders, e.g., neuroses, and d) somatic complaints, e.g., headache, gastrointestinal symptoms. In addition to psychological disorders, stressful working conditions may have a systemic influence, possibly affecting the etiology and/or prognosis of other disease states, as suggested by recent studies of stress-related immunologic suppression (5).

Although databases currently available for determining the extent of work-related psychological disorders are limited, several indicators suggest that these problems impose substantial health and financial costs in the United States.

A recent study in California showed that claims for the development of "work-related neuroses" more than doubled during 1980-1982; claims for all other disabling work-related injuries during the same period actually decreased by about one-tenth (6). A study of representative medical claims throughout the country showed that during 1980-1982 claims for "mental stress" that developed gradually, e.g., a chronic problem unrelated to a single traumatic incident or to any physical

work-related disorder accounted for about 11 percent of all occupational disease claims (7). Average medical costs and indemnity payments in 1981-1982 for these forms of mental stress actually surpassed the average amounts for other occupational diseases (7). The American Psychiatric Association now lists occupational stress in its Diagnostic and Statistical Manual as a subcategory of the major diagnostic axis of "psychosocial stress" (8).

There are increasing data on the relationship between specific working conditions and psychological disorders. For example, in a questionnaire survey of over 2,000 workers in 23 different occupations, strong occupational differences were found in psychosocial job stressors and in somatic and affective complaints (1). Ratings of boring, repetitive job tasks and role ambiguity were more prominent among several classes of blue-collar workers, e.g., assembly-line workers, fork-lift truck drivers, and machine operators than among white-collar professionals, e.g., professors and family physicians. The most satisfied occupational groups were physicians, professors, and white-collar supervisors. Groups experiencing the highest levels of job stressors and their resultant ill effects were assemblers and relief workers on machine-paced assembly lines. NIOSH investigators ranked 130 occupations by rate of admission to community mental health centers in Tennessee to determine the relative risk of psychological or stress-related disorders by occupation (9). Heading the list were jobs in health care, service occupations, and blue-collar factory work--which tend to be characterized by stress-producing conditions such as a lack of control over

the job by the worker, repetitive work, shift work, and a responsibility for others. In other studies, workers on night and rotating shifts (including the health-care occupations) reported more disturbances of sleep; altered eating habits; and higher rates of visits to clinics, absences due to sickness, and on-the-job injuries than did those on fixed day shifts (10-12).

Work environments characterized by technological innovation have also been investigated; a major focus has been on office work influenced by the introduction of computers (13,14). Adverse working conditions, e.g., poorer physical environment, reduced job control and social support tend to be reported more frequently by workers using new-technology office equipment such as video display terminals. Some of these conditions have been linked to chronic stress-related disorders (4,15).

Worksite studies by NIOSH have revealed that job stresses may contribute to acute disturbances among groups of workers, including those termed "mass psychogenic illness" (16). The sudden appearance of symptoms, usually in response to some "trigger factor" such as a strange odor, may result in spread of the apparent "illness" throughout the plant, with symptoms such as headaches, dizziness, and nausea. Investigations often fail to detect specific physical or chemical causative agents. However, factors such as heavy work load, strained labor/management relations, and physical discomfort at work may be present and related to the reporting of symptoms.

Emerging trends in technology, the economy, and demographic characteristics of the work force may lead to increased risk for psychological

disorders. For example, a 26 percent increase is projected for employment in the health services, an area that may be associated with elevated risk (9, 17). Computers and robots are expected to affect seven million factory jobs and 39 million office jobs (18). According to some forecasters (18), possible consequences may include job displacement, reduced skill requirements, and lower-paying jobs. It has been projected that in the next decade, nine of every ten new jobs will be in the service sector (19). Routine service jobs may not provide the compensation and benefits associated with the more traditional industrial and manufacturing jobs (18). Six of ten new jobs in the next decade will be filled by women (19), and dual job/home role demands and constrained occupational opportunities for women may result in an adverse impact on their mental health.

A prevention strategy for psychological disorders should take into account both the causal mechanisms and the factors that perpetuate these disorders. Work-related psychological disturbances are known to be influenced by both the physical and psychosocial characteristics of given job situations. Moreover, these factors operate in concert with factors unrelated to the job, such as life events; familial demands and support; and the traits, capacities, and needs of the workers themselves, e.g., personality, age, sex, experience/learning. The interaction of these variables is complex, and the relative influence of each is not thoroughly understood. Nevertheless, approaches to prevent work-related psychological disorders should still be taken using the information currently available.

Stress-reduction techniques, e.g., meditation, biofeedback, muscle relaxation, cognitive restructuring, and anxiety management have been taught to both

blue-and white-collar workers in work-site training sessions. Follow-up studies have shown decreases in psychophysiological activity, e.g., muscle tension and blood pressure levels, and reductions in subjective reports of anxiety, sleep disturbances, and other health complaints with each technique (20). However, improvement in all these parameters persisted less than 3 months after training ended.

Stress management treats only the symptoms of the problem--not the cause. Therefore, efforts to control risk factors at the worksite are also important. Some previously described suggestions for controlling worksite risk factors for psychological disorders are listed below (21). These suggestions appear to have merit for reducing work-related psychological disorders, but further evaluation and study are needed for a complete understanding of their impact.

Work schedule: Design work schedules to avoid conflict with demands and responsibilities unrelated to the job. Schedules for rotating shifts should be stable and predictable, with rotation in a forward (day-to-night) direction.

Participation/control: Allow workers to provide input for decisions or actions affecting their jobs.

Workload: Ensure assignments are compatible with the capabilities and resources of the worker, and allow for recovery from especially demanding physical or mental tasks.

Content: Design tasks to provide meaning, stimulation, a sense of completeness, and an opportunity to use skills.

Roles: Define work roles and responsibilities clearly.

Social environment: Provide opportunities for social interaction, including emotional support, and help directly related to one's job.

Future: Avoid ambiguity in matters of job security and career development.

In addition to evaluation of these suggested actions, efforts are needed to advance the understanding of work-related psychological disorders and of methods appropriate for their control, including:

1. Improving the systems for surveillance of psychological disorders in the work force as related to working conditions.
2. Improving research techniques for investigating stressful working conditions and their health consequences.
3. Improving training of occupational health professionals and workers in recognizing stressful workplace conditions and signs of worker stress and in effecting remedial measures.
4. Furthering the development of mental health components in occupational health and safety programs.

Reported by Div of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health, CDC.

References

1. Caplan RD, Cobb S, French JR, Harrison RV, Pinneau SR. Job Demands and Worker Health: main effects and occupational differences. Cincinnati, Ohio: National Institute for Occupational Safety and Health. (DHEW (NIOSH) publication no. 75-160), 1975.
2. Holt RR. Occupational stress. In: Goldberger L, Bresnitz S, eds. Handbook of Stress. New York: The Free Press, 1982.
3. Beehr TA, Newman JE. Job stress, employee health, and organizational effectiveness: a facet analysis, model, and literature review. Personnel Psychology 1978;31:665-99.
4. Karasek RA. Job demands, job decision latitude, and mental strain. Journal of Occupational Behavior 1979;24:285-307.
5. Kiecolt-Glaser JK. Stress and the immune function. In: Measures of job stress: a research methodology workshop. Workshop sponsored by NIOSH, New Orleans, Louisiana, 1985.
6. California Workers Compensation Bulletin, April 20, 1983.
7. National Council on Compensation Insurance. Emotional stress in the workplace--new legal rights in the eighties. New York 1985.
8. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 3rd ed. Washington, DC: American Psychiatric Association, 1980.
9. Colligan MJ, Smith MJ, Hurrell JJ Jr. Occupational incidence rates of mental health disorders. J Human Stress 1977;3:34-9.
10. Smith MJ, Colligan MJ, Frockt IJ, Tasto DL. Occupational injury rates among nurses as a function of shift schedule. Journal of Safety Research 1979;11:181-7.
11. Colligan MJ, Frockt IJ, Tasto DL. Frequency of worksite clinic visits and sickness absence among nurses as a function of shift. Applied Ergonomics 1979;10:79-86.
12. Smith MJ, Colligan MJ, Tasto DL. Health and safety consequences of shift work in the food processing industry. Ergonomics 1982;25:133-44.
13. Smith MJ, Cohen BG, Stammerjohn LW. An investigation of health complaints and job stress in video display operations. Human Factors 1981;23:387-400.
14. Sauter S, Gottlieb M, Jones C, Dodson V, Rohrer K. Job and health implications of VDT use: initial results of the Wisconsin-NIOSH study. Communications of the ACM 1983; 26:784-94.
15. House JS, Wells JA. Occupational stress, social support, and health. In: McLean A, Black G, Colligan M, eds. Reducing Occupational Stress: Proceedings of a Conference. Washington, DC, 1978. (DHEW publication no. 78-140.)
16. Schmitt N, Colligan MJ, Fitzgerald M. Unexplained physical symptoms in eight organizations: individual and organizational analyses. Journal of Occupational Psychology 1980;53:305-17.
17. Silvestri GT, Lukasiewicz JM. Occupational employment projections: the 1984-95 outlook. Monthly Labor Review, November 1985:42-57.

18. Bezold C, Carlson RJ, Peck JC. The future of work and health. Dover, Massachusetts: Auburn House, 1986.
19. Bureau of Labor Statistics. Bureau of Labor Statistics News. Washington, DC: Department of Labor, November 1985.
20. Murphy LR. Occupational stress management: review and appraisal. Journal of Occupational Psychology.
21. Levi L. Preventing Work Stress. Reading, Massachusetts: Addison-Wesley, 1981.



NIOSH PROJECTS BY PROGRAM AREAS

Occupational Lung Diseases

Musculoskeletal Injuries

Occupational Cancers

Severe Occupational Traumatic Injuries

Occupational Cardiovascular Diseases

Disorders of Reproduction

Neurotoxic Disorders

Noise-Induced Hearing Loss

Dermatological Conditions

Psychological Disorders

Assistance Requests

Administration

Other

OCCUPATIONAL LUNG DISEASES

EVALUATION OF MESOTHELIOMA PRODUCTION BY ASBESTOS SUBSTITUTES

Purpose: Two modified chrysotile products have been developed which are proposed as safe substitutes for asbestos. Using pleural implant animal models, the toxicity/carcinogenicity of these substitute materials will be evaluated and compared to the toxicity/carcinogenicity of the raw materials.

DBBS, Stanley F. Platek
CAN 376 Dates: 10/84-09/91

CONTROL TECHNOLOGY FOR NIOSH SURVEILLANCE ACTIVITIES

Purpose: This project will disseminate control information directly to plants with cases of silicosis.

DPSE, Phillip A. Froehlich
CAN 404 Dates: 10/88-09/91

DUST CONTROL FOR FALLING SOLIDS

Purpose: Free-falling powders generate dust. The physical parameters of the free-fall (drop height, mass flow rate, bulk density of the powder) are affected by equipment design. The project will investigate how these parameters affect dust generation. Guidelines will be developed for equipment designers' use to predict and minimize the generation of dust.

DPSE, William A. Heitbrink
CAN 406 Dates: 01/86-12/89

ASBESTOS REMOVAL CONTROL TECHNOLOGY ASSESSMENT

Purpose: This work evaluates glove bags, a control to prevent asbestos release into the work environment during removal of pipe lagging. Limitations of this control and ways to overcome them are identified and will be disseminated to personnel doing asbestos abatement work.

DPSE, Bruce A. Hollett
CAN 408 Dates: 10/84-09/89

ASBESTOS ANALYSIS SURVEILLANCE PROGRAM

Purpose: This project represents a cooperative arrangement with AIHA to establish an Asbestos Analyst Registry (AAR). The objective of the AAR is to improve the quality of analyses done on-site during asbestos clearance operations.

DPSE, Martin T. Abell
CAN 412 Dates: 10/86-09/90

ANALYTICAL METHODS FOR INORGANIC SUBSTANCES

Purpose: In response to needs arising from NIOSH prevention strategies, analytical methods for inorganic substances in air or other matrices will be developed. Also, new analytical chemistry techniques will be evaluated for application to industrial hygiene sampling and analytical needs.

DPSE, Kevin J. Mulligan
CAN 413 Dates: 01/86-C

OCCUPATIONAL LUNG DISEASES

HALOGEN GASES S/A METHODS

Purpose: Development of new monitoring methods for toxic oxidizing gases will aid in preventing occupational lung diseases, neurotoxic disorders and dermatological conditions. The development of a sampler capable of collecting all the free halogen gases and an analytical technique capable of separating and measuring each halogen are proposed.

DPSE, Mary E. Cassinelli
CAN 414 Dates: 10/87-12/89

TECHNOLOGY TRANSFER FOR DPSE PROJECTS

Purpose: This project will transfer the technology developed in DPSE so that control and monitoring innovations are widely available for adoption and patentable discoveries are commercialized to ensure the widest possible usage.

DPSE, Theodore F. Schoenborn
CAN 416 Dates: 10/87-C

CONTROL OF CHLORINE RELEASES IN WATER PURIFICATION PLANTS

Purpose: This project will identify and recommend preventive measures for chlorine releases in water purification systems.

DPSE, Michael G. Gressel
CAN 419 Dates: 10/88-12/89

MINING AND RESPIRATORY DISEASE RESEARCH ANALYTICAL SUPPORT

Purpose: This project will provide analytical chemistry support to mining investigations, respiratory disease studies, and safety research. Analytical chemistry support will be given to NOHS mining studies and to studies of fibrous minerals combined with other mineral dust.

DPSE, Donald D. Dollberg
CAN 426 Dates: 10/84-C

PILOT STUDY: EVALUATION OF PROCESS CONTAINMENT FOR BIOAEROSOLS

Purpose: This project will identify improved methods of evaluating bioprocess containment and identify specific equipment for evaluation.

DPSE, Kenneth Martinez
CAN 429 Dates: 10/86-12/89

ANALYTICAL METHODS FOR ORGANIC COMPOUNDS

Purpose: Analytical methods for organic compounds in workplace air and other matrices of industrial hygiene interest will be developed. New analytical-chemistry techniques will be evaluated for application to industrial hygiene problems. This will advance the state of the art of identifying and quantifying worker exposure to toxic chemicals.

DPSE, Alexander W. Teass
CAN 437 Dates: 10/82-C

OCCUPATIONAL LUNG DISEASES

DETERMINATION OF FORMALDEHYDE CONTENT OF AIRBORNE DUST

Purpose: Provide data on exposure of workers to dust that contains formaldehyde through sampling and analytical method developed. This information will be used to study an excess of cancer in exposed populations. These studies will provide recommendations for exposure reduction and subsequent reduction of disease.

DPSE, Eugene R. Kennedy
CAN 439 Dates: 10/88-03/90

REVISION OF THE NIOSH MANUAL OF ANALYTICAL METHODS

Purpose: This project provides a collection of current NIOSH analytical methods for use in health hazard evaluations, industry-wide studies, and control technology assessments.

DPSE, Peter M. Eller
CAN 445 Dates: 10/82-C

ANALYTICAL METHODS FOR ASBESTOS FIBERS

Purpose: The project will investigate Methods 7400 and 7402 and suggest improvements if needed. Improved fiber counting strategies will be investigated. Image analysis techniques to automate asbestos fiber counting will be investigated.

DPSE, Paul A. Baron
CAN 448 Dates: 10/84-09/89

QUALITY ASSURANCE (EXTERNAL)

Purpose: NIOSH will continue to rate laboratories in the PAT Program, a joint project of NIOSH and AIHA. Proficiency ratings are based on the analytical results reported for quality audit samples that include carcinogens (e.g., asbestos and benzene). In addition, laboratory performance will be documented in publications.

DPSE, Martin T. Abell
CAN 458 Dates: 10/82-C

MAINTENANCE AND CALIBRATION

Purpose: This project will: (1) provide repair, calibration of field and direct-reading equipment (DPSE ECTB, DSHEFS OWSB, DTMD, and some State labs); (2) provide electronic repair and fabrication support for direct-reading instrument development; (3) develop a system for wireless transmission of environmental data in the workplace.

DPSE, Jensen H. Groff
CAN 459 Dates: 10/82-C

DEVELOPMENT OF PREDICTIVE MODELS FOR DETERMINING CONTROL EFFECTIVENESS

Purpose: This project develops predictive models for local exhaust ventilation systems used to control sources of contaminants. The end product will be a series of models which help the designer to design effective control systems applicable to all disease categories associated with airborne contaminants.

DPSE, Mazen Y. Anastas
CAN 494 Dates: 10/85-03/89

OCCUPATIONAL LUNG DISEASES

GAS AND VAPOR MEASUREMENT TECHNIQUES

Purpose: The photo-optical study may lead to a very versatile system for surveillance of airborne pollutants in the workplace, producing real time mapping of pollutants, improving estimates of personal exposure, and evaluating effectiveness of control methods.

DPSE, Harley V. Piltingsrud
CAN 496 Dates: 10/84-09/89

DEVELOPMENT OF EMISSION CONTROLS FOR LASER PROCESSES

Purpose: This project will develop guidelines for the control of gaseous and particulate emissions from industrial and medical processes involving lasers. Emissions from processes will be identified and quantified to assess their potential hazard. Smoke evacuators and other controls will be studied.

DPSE, Jerome P. Smith
CAN 843 Dates: 10/88-09/90

PULMONARY RESPONSE TO COTTON DUST

Purpose: This project will validate and extend an animal model for byssinosis, develop more sensitive measurements of human response, and determine the effectiveness of various treatments of cotton in removing the etiologic agent.

DRDS, Vincent Castranova
CAN 102 Dates: 10/88-09/91

ENDOTOXIN DETECTION IN COTTON DUST

Purpose: Knowledge related to which endotoxins are the most toxic will lead to standard development based on measurement of precise biologic/etiologic agents. Relative toxicity of the most likely etiologic agent (endotoxin) will be studied and defined so that intervention techniques can be applied at cultivation or processing.

DRDS, Stephen A. Olenchock
CAN 104 Dates: 10/88-09/91

COMPARATIVE RESEARCH IN ANALYTICAL PATHOLOGY

Purpose: The results obtained from the autopsy program and related DRDS research project support will aid in evaluating the effectiveness of the coal mine dust standard.

DRDS, Val Vallyathan
CAN 105 Dates: 10/71-C

DEVELOPMENT OF A LUNG-CELL MODEL FOR STUDYING WORKPLACE GENOTOXICANTS

Purpose: This project will develop and characterize short-termed assay systems which will provide useful methods for the detection and monitoring of toxic chemicals and organic dusts in the workplace environment, and for the detection of potential health hazards (occupational cancer) to workers.

DRDS, Wen-Zong Whong
CAN 113 Dates: 10/86-12/89

OCCUPATIONAL LUNG DISEASES

PULMONARY RESPONSE TO INHALED FIBROGENIC MINERALS

Purpose: Short-term, high-dose inhalation experiments designed in these studies will provide valuable information on the toxicity and pathogenesis of selected fibrogenic minerals. This study will contribute to our knowledge of anticipated occupational lung disease.

DRDS, Val Vallyathan
CAN 114 Dates: 10/86-09/89

DEFENSE MECHANISMS OF ALVEOLAR PNEUMOCYTES AGAINST OCCUPATIONAL AGENTS

Purpose: This project will determine the effects of various occupationally related agents (such as diesel particulates and silicates) on the ability of alveolar Type II cells and alveolar macrophages to produce interferon, a cellular defense mechanism.

DRDS, Vincent Castranova
CAN 116 Dates: 10/87-09/89

OCCUPATIONAL ASTHMA ROLE OF AIRWAY EPITHELIUM

Purpose: This project will develop and evaluate animal in vitro models to detect early cellular changes in airway epithelium and smooth muscle associated with exposure to selected irritant vapors. It will help identify early signs of disease.

DRDS, Jeffrey S. Fedan
CAN 119 Dates: 02/87-09/90

ANIMAL AND EXPOSURE FACILITY SUPPORT FOR DRDS

Purpose: This project provides animals to NIOSH researchers for the purposes of defining etiologic agents, animal models of ORD, pathogenetic and defense mechanisms and naturally occurring variability in exposures which cause or influence occupational lung disease.

DRDS, Kenneth C. Weber
CAN 123 Dates: 10/80-C

VALIDATION STUDIES OF IN SITU ASSAY SYSTEM IN OCCUPATIONAL SETTING

Purpose: This project will develop and characterize a biological assay system to provide methods for the detection and monitoring of genotoxic agents and potential carcinogens in workplace environments, and for the detection of potential health hazards to workers.

DRDS, Tong-Man Ong
CAN 124 Dates: 07/86-09/91

AGRICULTURE: CHRONIC BRONCHITIS STUDIES

Purpose: This project will address the isolation, characterization, and description of the potentially toxic agents in agricultural (organic) dusts. The evaluation of the effects of these agents in animals and humans will provide the basis for the development of appropriate prevention strategies.

DRDS, Stephen A. Olenchock
CAN 126 Dates: 01/87-09/90

OCCUPATIONAL LUNG DISEASES

ANIMAL MODEL VALIDATION STUDIES

Purpose: This project will develop/evaluate sensitive pulmonary function tests, lung cell techniques, and blood tests for detecting byssinosis.

DRDS, David G. Frazer
CAN 127 Dates: 10/84-09/89

ENDOTOXINS IN BULK COTTONS AND AIRBORNE DUSTS--ERC, INC.

Purpose: This study will provide the opportunity to examine prospective endotoxin data in active cotton mills that operate in the Peoples Republic of China (PRC) without the benefit of the U.S. Cotton Dust Standard, in order to determine whether increased incidence of disease (byssinosis) correlates with elevated endotoxin levels.

DRDS, Stephen A. Olenchock
CAN 128 Dates: 03/88-09/89

NCWAS: DATA ANALYSIS AND RELATED RESEARCH

Purpose: This project will assess the accuracy and the adequacy of the review of pathology specimens submitted through the NCWAS and will then compare these findings with actual radiographic interpretations for the same individuals. This process will serve to evaluate the effectiveness of the procedures used in both programs.

DRDS, Kenneth C. Weber
CAN 129 Dates: 03/88-09/91

NHANES III SUPPORT

Purpose: This project will provide support to the respiratory disease part of NHANES. Pulmonary function equipment will be maintained, training provided, and quality control performed to insure a uniform approach to data collection.

DRDS, John L. Hankinson
CAN 135 Dates: 10/87-09/90

PREVENTION OF SILICOSIS IN FOUNDRY WORKERS

Purpose: This project will provide support to a State health department (Ohio) in the development of a model program for surveillance and prevention of silicosis in foundry workers.

DRDS, Thomas B. Richards
CAN 137 Dates: 03/88-09/90

LABORATORY ANIMAL ALLERGY STUDY--NIEHS

Purpose: The objective of this project is to develop a sensitive method to quantitate airborne allergen levels. With such technology, the effects of engineering control or work practices on allergen levels can be monitored, and allergen concentration needed for sensitization or reaction can be estimated.

DRDS, Daniel M. Lewis
CAN 147 Dates: 05/86-09/89

OCCUPATIONAL LUNG DISEASES

PROSPECTIVE EPIDEMIOLOGIC STUDY OF COTTON TEXTILE WORKERS IN INDIA

Purpose: This project will evaluate both acute and chronic respiratory effects of cotton dust exposure, as measured gravimetrically and in terms of endotoxin contamination.

DRDS, Edward L. Petsonk
CAN 148 Dates: 10/86-09/93

EMERGING TECHNOLOGY FOR RESPIRATORY DISEASE EVALUATIONS

Purpose: This project will refine current technologies and develop new tools to allow more efficient and sensitive detection of ORD. Field studies of airway responsiveness permit identification of risk factors for the sensitization of workers.

DRDS, J. L. Hankinson
CAN 152 Dates: 10/88-09/91

EPIDEMIOLOGIC REVIEW OF COTTON MILL SURVEILLANCE DATA

Purpose: This project will evaluate the role of endotoxin as an etiologic agent in cotton dust.

DRDS, M. C. Townsend
CAN 154 Dates: 02/85-09/89

STATE-BASED SURVEILLANCE: MEDICAL TECHNICAL SUPPORT

Purpose: This project provides medical technical support to the Sentinel Event Notification System for Occupational Risks (SENSOR) and to States developing surveillance systems for occupational respiratory diseases.

DRDS, Thomas B. Richards
CAN 155 Dates: 10/84-09/89

PNEUMOCONIOSIS X-RAY INTERPRETATION USING COMPUTED IMAGE MODIFICATION

Purpose: Effective research and medical surveillance require accurate detection methods, primarily x-ray interpretation. This project is designed to improve both the consistency and the accuracy of x-ray interpretation, and improve coal and asbestos research/surveillance, by implementing new processing technology in the reading of chest x-rays.

DRDS, Thomas K. Hodous
CAN 156 Dates: 10/87-09/90

SINO-AMERICAN CHEST X-RAY INTERPRETATION TRIALS

Purpose: Appropriate evaluation of the Chinese pneumoconiosis data and comparison to analogous American data will help both countries determine areas of needed control actions. Previously unknown associations may also become apparent. Importantly, the project will also involve coal and asbestos workers.

DRDS, Thomas K. Hodous
CAN 157 Dates: 05/86-09/89

OCCUPATIONAL LUNG DISEASES

EMERGING PROBLEMS IN OCCUPATIONAL RESPIRATORY DISEASE

Purpose: This project will relate Chinese/U.S. dust and radiographic change measurements.

DRDS, Michael A. McCawley
CAN 158 Dates: 10/85-09/90

SILICOSIS SURVEILLANCE: MORTALITY AND MORBIDITY TRENDS

Purpose: This project will explore and analyze existing data sources to develop estimates of trends in morbidity from silicosis and respiratory conditions.

DRDS, Thomas B. Richards
CAN 159 Dates: 11/87-09/91

SURVEILLANCE OF LUNG DISEASE AGENTS IN SMALL BUSINESSES

Purpose: This project will characterize exposures to lung disease agents, safety hazards, and use of engineering controls and protective equipment in selected potentially hazardous small businesses.

DRDS, Paul Hewett
CAN 162 Dates: 11/87-09/90

NATIONAL OCCUPATIONAL HEALTH SURVEY OF MINING

Purpose: This project will collect and disseminate data on the mining work force and their potential exposures to fibers, asbestos, silica, and various chemical exposure agents. The project will identify worker groups, jobs and industries at risk from exposure to toxic substances or harmful physical agents.

DRDS, Dennis W. Groce
CAN 164 Dates: 10/82-09/91

EFFECTIVE SILICA INDICES FOR RESPIRABLE MINERAL DUSTS

Purpose: This project will evaluate dust properties which affect the fibrogenic potential of silica bearing dust.

DRDS, William E. Wallace
CAN 167 Dates: 10/84-09/91

NORTH CAROLINA DUSTY TRADES FILE

Purpose: This project will provide estimates of silica-silicosis dose-response relationships.

DRDS, Harlan E. Amandus
CAN 172 Dates: 10/84-09/90

OCCUPATIONAL LUNG DISEASES

ENVIRONMENTAL HAZARD SURVEILLANCE

Purpose: This project will collect, analyze, and disseminate exposure data of dust contaminants in mining and manufacturing industries. High risk occupations and industries will be determined.

DRDS, A. L. Dieffenback
CAN 173 Dates: 10/82-C

CASE CONTROL STUDY OF SILICA, SILICOSIS, AND LUNG CANCER

Purpose: This project will attempt to determine if there is an association between silica, silicosis, and lung cancer.

DRDS, Joseph Costello
CAN 179 Dates: 10/84-09/89

MEDICAL FIELD TEAM TECHNICAL SUPPORT

Purpose: This project will provide technical support in the collection of data from actual work sites throughout the country to enable accurate determination of the prevalence or progression of respiratory occupational health problems, and provide in-house technical support services.

DRDS, Gregory C. Spransy
CAN 182 Dates: 10/87-C

NATIONAL STUDY OF CWP AND RELATED RESEARCH

Purpose: With the NSCWP, trends in exposure to coal mine dusts (dust level, composition, size distribution, and mining methods) will be identified and their relationship to lung diseases will be determined. In addition, the effectiveness of the current x-ray surveillance program will be determined.

DRDS, Michael D. Attfield
CAN 183 Dates: 10/83-09/90

ANALYSIS OF RECEIVING CENTER DATA

Purpose: This project evaluates secondary prevention strategies for coal workers' pneumoconiosis (CWP) such as the use of chest radiographs to identify miners with simple CWP, and the transfer of miners with CWP to low dust environments.

DRDS, Rochelle B. Althouse
CAN 184 Dates: 10/87-09/89

COAL MINER MEDICAL SURVEILLANCE: MORTALITY AND MORBIDITY TRENDS

Purpose: This project will explore and analyze existing data sources to develop estimates of trends in national mortality and morbidity from CWP.

DRDS, Rochelle D. Althouse
CAN 185 Dates: 11/87-09/91

OCCUPATIONAL LUNG DISEASES

MORBIDITY/MORTALITY STUDY OF INDUSTRIAL SAND INDUSTRY

Purpose: This project will provide data to estimate exposure-response relationship and progression of silicosis and association with lung cancer.

DRDS, Harlan E. Amandus
CAN 187 Dates: 10/83-09/89

MEDICAL TECHNICAL SUPPORT

Purpose: By providing medical technical support, this project enables other research projects as well as health hazard evaluations to collect high quality data for use in their respective studies.

DRDS, John L. Hankinson
CAN 202 Dates: 10/87-C

BYSSINOSIS PREVENTION

Purpose: Project provides consultation to the government/industry/union task force for byssinosis prevention. Consultation includes developing reports, summarizing existing data, as well as reviewing of draft reports and developing research proposals for task force consideration. Information developed may be pertinent to OSHA rulemaking.

DRDS, E. L. Petsonk
CAN 205 Dates: 10/81-09/91

ANALYSIS OF DATA FROM AN EGYPTIAN SILICA STUDY

Purpose: This project provides technical support to Egypt in determining the prevalence of silicosis and exposure-response relationships in Egyptian industries.

DRDS, Martin R. Petersen
CAN 214 Dates: 10/86-03/90

MORB/I.H. STUDY ANTHRACITE SURFACE MINERS/BITUMINOUS HIGHWALL DRILLERS

Purpose: This project will provide data to help determine the extent of the health problems among anthracite surface miners.

DRDS, Martin Petersen
CAN 217 Dates: 10/83-09/89

INDUSTRIAL HYGIENE TECHNICAL SUPPORT

Purpose: This project quantifies levels of exposure to toxins, allergens, pathogens, hazardous dusts, and carcinogens. It provides repair and maintenance services for division environmental sampling equipment.

DRDS, Jerry L. Clere
CAN 223 Dates: 10/82-C

OCCUPATIONAL LUNG DISEASES

COMPUTER SUPPORT

Purpose: Computer support in terms of Parklawn Computer Center charges, data entry, and programming support will be provided to all DRDS projects.

DRDS, John L. Hankinson
CAN 232 Dates: 10/87-C

AUTOPSY PROGRAM: PROGRAM OPERATION

Purpose: This project will provide data for assessing the effectiveness of the coal mine dust standard and provide autopsy services in accordance with P.L. 91-173, Section 203(d) (amended).

DRDS, Mitzie L. Martin
CAN 233 Dates: 05/71-C

COAL MINER MEDICAL SURVEILLANCE PROGRAM PARTICIPATION

Purpose: This project will provide opportunities to visit mine sites, unions, coal miners, company officials, hospitals and other interested people to learn first-hand why people do and do not participate in the program. Recommendations for corrective action will be formulated.

DRDS, R. W. Wheeler
CAN 234 Dates: 10/88-09/89

COAL MINER MEDICAL SURVEILLANCE: RECEIVING CENTER OPERATION

Purpose: This project will annually identify exposure trends for coal mine dust-related disease occurrence for evaluation of coal mine dust standard through the operation of the x-ray surveillance program and by providing support to film reading trials.

DRDS, Mitzie L. Martin
CAN 235 Dates: 08/70-C

DIESEL PARTICULATE MEASUREMENTS

Purpose: The project will determine, using side-by-side field tests, the precision of a sampler designed by NIOSH to measure a miner's exposure to diesel particulate and show that a significant portion of the submicrometer-sized particles in a mine are due to diesel equipment.

DRDS, Rebecca Stanevich
CAN 236 Dates: 10/88-09/90

RESPIRABLE GENOTOXIC PARTICULATE EXPOSURE MONITORING

Purpose: This project will develop and apply methods to collect and measure the genotoxic dose associated with respirable particulate exposures in a manner predictive of their fate in the lung.

DRDS, William E. Wallace
CAN 237 Dates: 10/88-09/91

OCCUPATIONAL LUNG DISEASES

WHERE'S THE ENDOTOXIN?

Purpose: This project will identify characteristics of cotton dust which are consistent with disease development by measuring what size particulates are associated with endotoxin content.

DRDS, William G. Jones
CAN 238 Dates: 10/88-09/91

SILICA EXPOSURES OF NSCWP SELECTED MINES

Purpose: This project will determine the variability of silica levels based on increased MSHA analysis for silica in a group of selected coal mines.

DRDS, Brian Kovak
CAN 239 Dates: 10/88-09/90

ACCESS TO OSHA INSPECTION DATA

Purpose: This project provides estimates of level of exposure for hazards observed, but not measured, in NIOSH hazard surveys. The purpose of the surveys is to help identify occupational hazards throughout the U.S.

DSHEFS, Joseph A. Seta
CAN 504 Dates: 10/83-C

ANALYSIS OF HEALTH INTERVIEW SURVEY DATA

Purpose: This project will continue the surveillance of employment-related morbidity to help achieve the goal of identifying and monitoring employment-related health effects in the U.S. worker population and to help establish priorities for NIOSH research.

DSHEFS, Virginia Behrens
CAN 508 Dates: 10/83-06/89

NATIONAL REPORTING OF SELECTED OCCUPATIONAL DISEASES

Purpose: This project will provide for the successful implementation of State-based reporting of occupational diseases and will allow for direct monitoring of occupationally related disease, disability, and death. This will improve our surveillance capability.

DSHEFS, Paul J. Seligman
CAN 514 Dates: 10/83-C

COHORT MORTALITY STUDY OF ANTIMONY SMELTER WORKERS

Purpose: This epidemiologic study will assess the association between exposure to antimony and the risk of developing lung cancer.

DSHEFS, Teresa M. Schnorr
CAN 533 Dates: 10/83-09/89

OCCUPATIONAL LUNG DISEASES

MORTALITY STUDY OF WORKERS EXPOSED TO TOLUENE DIISOCYANATE

Purpose: This epidemiologic study will assess the association between exposure to TDI and the risk of developing respiratory cancer.

DSHEFS, Teresa M. Schnorr
CAN 534 Dates: 06/83-06/90

CASE-CONTROL STUDY OF LUNG CANCER IN TEAMSTERS UNION

Purpose: This epidemiologic and industrial hygiene study will assess the association between lung cancer in teamsters and exposures, especially to diesel exhaust. (Bladder cancer also will be evaluated).

DSHEFS, Nelson K. Steenland
CAN 539 Dates: 10/83-03/90

PNEUMONIA AND DUSTY TRADES

Purpose: This project will evaluate whether occupational dust exposure is associated with an increased risk of pneumonia.

DSHEFS, Victoria E. Wells
CAN 549 Dates: 10/88-09/91

LABORER'S UNION HEALTH PROGRAM

Purpose: This project will develop specific programs for health promotion and disease prevention for laborers. NIOSH and other Centers in CDC will serve as resources to assist the Laborers' National Health and Safety Fund in developing and implementing these programs.

DSHEFS, Paul Schulte
CAN 558 Dates: 10/88-09/91

MORTALITY AND I.H. STUDY OF WORKERS EXPOSED TO LEAD CHROMATE PAINTS

Purpose: This epidemiologic study will assess the association between exposure to lead chromate paints and the risk of developing lung cancer.

DSHEFS, James T. Walker
CAN 559 Dates: 10/82-03/91

URANIUM MINERS--LOW DOSE INVESTIGATION

Purpose: This epidemiologic study will assess the association between exposure to low levels of radon daughters and the risk of developing lung cancer.

DSHEFS, Robert J. Roscoe
CAN 567 Dates: 10/82-09/90

OCCUPATIONAL LUNG DISEASES

BERYLLIUM RETROSPECTIVE COHORT INVESTIGATION

Purpose: This epidemiologic study will assess the association between exposure to beryllium and the risk of developing lung cancer and other respiratory/cardiovascular diseases.

DSHEFS, Elizabeth M. Ward
CAN 583 Dates: 10/81-12/89

SENTINEL HEALTH EVENT LIST MAINTENANCE

Purpose: Continued surveillance of the scientific literature will enable us to identify and direct surveillance efforts at those diseases, disabilities, and deaths which have been established as occupationally related.

DSHEFS, Leela I. Murthy
CAN 627 Dates: 10/82-C

INDUSTRIAL HYGIENE AIR SAMPLING SURVEY--EPA SUPERFUND SITES

Purpose: Characterization of toxic airborne and skin exposures among cleanup employees will allow selection of personal protective equipment based upon the degree of the measured exposure.

DSHEFS, R. Hartle/M. Newman
CAN 664 Dates: 10/88-10/89

RETROSPECTIVE COHORT INVESTIGATION OF NON-ASBESTOS WELDERS

Purpose: This epidemiologic study will assess the association between exposures among welders and the risk of developing lung cancer.

DSHEFS, Nelson K. Steenland
CAN 683 Dates: 10/84-12/89

DEVELOPMENT OF NIOSH INDOOR AIR QUALITY QUESTIONNAIRE

Purpose: Publish an Indoor Air Quality (IAQ) questionnaire to be used by NIOSH and others in IAQ studies.

DSHEFS, Mitch Singal
CAN 685 Dates: 10/88-09/89

FOLLOWUP ACTIVITY TO DETERMINE EFFECTIVENESS OF CURRENT HETAB INDOOR AIR QUALITY

Purpose: The project will evaluate our current methods for conducting Indoor Air Quality (IAQ) investigations and recommend improvements.

DSHEFS, Richard W. Gorman
CAN 689 Dates: 10/88-09/89

OCCUPATIONAL LUNG DISEASES

FIRESMOKE/FEMA

Purpose: This project will measure the performance of pressure demand self-contained breathing apparatus during actual firefighting activities. Real time facepiece pressure data will be recorded and carbon monoxide samples will be collected for later analysis.

DSR, Gary P. Noonan
CAN 784 Dates: 10/85-09/90

INJURY PREVENTION RESEARCH BRANCH MANAGEMENT

Purpose: This project will provide management and guidance for the implementation of national prevention strategies involving investigative laboratory field research with all types of respirators, chemical and other protective clothing and equipment, and associated physiological responses to such equipment.

DSR, IPRB Acting Chief
CAN 785 Dates: 10/85-C

SIMULATED WORKPLACE PROTECTION FACTORS

Purpose: This project will develop more accurate methods of measuring respirator performance which will improve NIOSH respirator certification and respirator performance. This, in turn, will reduce worker exposure to toxic chemicals.

DSR, Donald L. Campbell
CAN 786 Dates: 01/88-09/89

INHALATION VALVE LEAKAGE

Purpose: This project will investigate the extent to which worker exposure to toxic chemicals can be reduced by eliminating inhalation valve leakage in respirators.

DSR, Donald L. Campbell
CAN 787 Dates: 10/87-06/89

FIBROUS AEROSOL RESEARCH

Purpose: This project will develop test methods for the evaluation of particulate filters against fibrous aerosols, and will evaluate the effect these aerosols have on the performance of particulate air-purifying respirator filters.

DSR, Gregory A. Stevens
CAN 806 Dates: 07/86-09/89

WORKPLACE PROTECTION FACTOR (WPF) STUDY

Purpose: This project will develop more accurate methods for measuring WPFs for negative pressure respirators. The relationships between WPF and QNFT will be determined. This study will lead to improved methods for use in the NIOSH respirator certification program and for development of respirator selection criteria.

DSR, Barry G. Pallay
CAN 832 Dates: 10/86-09/90

OCCUPATIONAL LUNG DISEASES

FILTER LOADING EFFECTS WITH A "WORST CASE" DOP AEROSOL

Purpose: This project will develop improved performance standards for respirators and will enable respirator manufacturers to produce respirators that will give better protection to workers from airborne contaminants.

DSR, Ernest S. Moyer
CAN 835 Dates: 10/87-03/90

ANALYSIS OF RESOURCES NECESSARY FOR REVISED REGULATIONS

Purpose: This project will increase worker protection from airborne contaminants by developing procedures to implement improved standards which can help assure better safety and reliability of respirators.

DSR, Nancy J. Bollinger
CAN 836 Dates: 04/88-09/89

EVALUATION OF CHEMICAL CARTRIDGE RESPIRATORS FOR PMN SUBSTANCES

Purpose: This project will increase worker protection from airborne contaminants by developing (1) a standard service life test protocol for cartridge testing (2) a decision logic for EPA to use for selecting candidate substances and (3) a field monitoring method for cartridge breakthrough.

DSR, Nancy J. Bollinger
CAN 837 Dates: 10/87-09/89

PROMULGATION OF 42 CFR 84

Purpose: This project will increase worker protection from airborne contaminants by upgrading the certification standards and increasing the safety and reliability of respirators.

DSR, Nancy J. Bollinger
CAN 839 Dates: 01/87-09/89

EVALUATION, CERTIFICATION, AND COORDINATION ACTIVITIES

Purpose: This project will provide judgment and guidance to the legislatively mandated respirator and coal mine dust personal sampler certification programs which will help to increase worker protection from airborne contaminants.

DSR, Nancy J. Bollinger
CAN 852 Dates: 05/72-C

AIR PURIFYING RESPIRATOR TESTING

Purpose: This project will increase worker protection from airborne contaminants by (1) approving respirators in accordance with regulations, (2) through the audit and complaints program assuring that respirators in the marketplace comply with regulations, and (3) providing expert advice on respirator applications.

DSR, Christopher C. Coffey
CAN 853 Dates: 05/72-C

OCCUPATIONAL LUNG DISEASES

ATMOSPHERE SUPPLIED RESPIRATOR TESTING

Purpose: This project will increase worker protection from airborne contaminants by (1) approving respirators in accordance with regulations, (2) through the audit and complaints program assuring that respirators in the marketplace comply with regulations, and (3) provide expert advice on respirator applications.

DSR, Samuel L. Terry
CAN 854 Dates: 05/72-C

COAL MINE DUST PERSONAL SAMPLER UNIT

Purpose: This project will increase worker protection from airborne contaminants by certifying CMDPSU which will provide more accurate measurements of particulate levels for MSHA compliance purpose.

DSR, John M. Dower
CAN 855 Dates: 05/72-C

QUALITY ASSURANCE DOCUMENTATION CONTROL

Purpose: This project will increase worker protection from airborne contaminants by (1) evaluating quality assurance of respirator manufacturers, and (2) through in-plant audit programs assuring that respirators are reliable.

DSR, Theodore A. Pettit
CAN 857 Dates: 05/72-C

IMPLEMENTATION OF REVISED REGULATIONS AND LABORATORY UPGRADE

Purpose: This project will implement improved test criteria which will increase the safety and reliability of certified respirators and increase worker protection from airborne contaminants.

DSR, Nancy J. Bollinger
CAN 859 Dates: 10/88-09/89

FILTER EFFICIENCY W/NACL, SEPARATION OF CHARGE AND RH EFFECTS

Purpose: This project will develop improved performance standards for respirators and will enable respirator manufacturers to produce respirators that will better protect workers.

DSR, Gregory A. Stevens
CAN 885 Dates: 10/88-09/89

EPA/NIOSH IAG--WPF LABORATORY SUPPORT

Purpose: This project will conduct laboratory studies to solve technical problems associated with the development of methodologies for measuring WPFs.

DSR, Gary P. Noonan
CAN 889 Dates: 10/88-09/90

OCCUPATIONAL LUNG DISEASES

INDOOR AIR QUALITY TRAINING INITIATIVE

Purpose: Informational materials, lectures, courses, and other training materials will be developed, tested, and used in NIOSH/ERC continuing education programs.

DTMD, P. G. Rentos
CAN 769 Dates: 10/88-09/91

SMALL BUSINESS INITIATIVE

Purpose: Instructional materials will be provided that will create an awareness and knowledge of occupational hazards, their health effects, and control strategies to reduce the hazards.

DTMD, James B. Walters
CAN 774 Dates: 10/88-09/91

CONTINUING EDUCATION

Purpose: This project specifically conducts education and training programs to implement information dissemination strategies in occupational lung diseases, musculoskeletal injuries, psychological disorders, and disorders of reproduction.

DTMD, Michael Colligan
CAN 766 Dates: 10/88-C

PROJECT MINERVA COOPERATIVE AGREEMENT

Purpose: The cooperative agreement will allow NIOSH to work closely with an external academic-based organization to expedite the implementation of Project Minerva into the business school curriculum.

DTMD, Walter M. Haag
CAN 772 Dates: 10/88-09/91

AUDIO VISUAL/GRAPHICS SUPPORT SERVICES

Purpose: Numerous educational curriculum modules and technical documents, both written and video, require information to be provided in the form of graphic illustration of other visual presentations. This project will produce such materials in support of the dissemination of the NIOSH strategies.

DTMD, Glenda M. White
CAN 777 Dates: 10/88-C

MUSCULOSKELETAL INJURIES

ERGONOMIC INTERVENTIONS FOR REDUCING GRIP FORCES

Purpose: The efficacy of using certain ergonomic interventions (training, information feedback, and use of special gloves) to control the use of excessive grip force in manual tasks will be determined.

DBBS, Linda J. Frederick
CAN 244 Dates: 10/87-09/91

LOWER EXTREMITY DISORDERS OF OCCUPATIONAL ORIGIN

Purpose: Investigations concerning the nature of musculoskeletal disorders of the lower extremities will be conducted using a biomechanical model of the lower extremity, a kinematic analysis system, and image processing techniques.

DBBS, Daniel J. Habes
CAN 245 Dates: 10/83-09/89

INTERVENTIONS FOR REDUCING EXCESSIVE FATIGUE FROM EXTENDED WORKDAYS

Purpose: Intervention strategies will be developed and evaluated in the laboratory which will minimize the fatigue of time-intensive work schedules in order to reduce the risk of musculoskeletal injury.

DBBS, J. Roger R. Rosa
CAN 246 Dates: 10/87-09/89

OCCUPATIONAL INCIDENCE OF ERGONOMIC HAZARDS

Purpose: Sources and types of ergonomic hazards will be extracted from existing NIOSH occupational exposure surveys (NOES II, NOHSM) to identify industries where workers are at high risk for musculoskeletal disorders.

DBBS, Frank J. Winn
CAN 250 Dates: 10/87-09/89

APPRAISAL/EXPANSION OF MANUAL MATERIALS HANDLING LIMITS

Purpose: A multidisciplinary strategy will be used to develop lifting guidelines. The guidelines will provide needed job design information for intervention programs to prevent low back pain, a common form of musculoskeletal disorder.

DBBS, Vern Putz-Anderson
CAN 252 Dates: 10/84-09/89

SHOULDER/NECK MUSCLE TENSION FOR REPETITIVE WORK

Purpose: Control techniques in the form of work-rest ratios for reducing shoulder and neck fatigue from overhead work will be developed. Control techniques for reducing the biomechanical stress associated with lifting activities of seated workers will also be developed and demonstrated in laboratory studies.

DBBS, Vernon Putz-Anderson
CAN 260 Dates: 10/85-09/91

MUSCULOSKELETAL INJURIES

FATIGUE EFFECTS OF EXTENDED WORKDAYS AND WORKLOAD

Purpose: Increased risk of physical and psychological fatigue from extended 12-hour work shifts is being evaluated as a factor contributing to musculoskeletal injuries.

DBBS, Roger R. Rosa
CAN 263 Dates: 10/82-09/89

BIOMOLECULAR MARKERS OF CHRONIC TRAUMA

Purpose: Biomolecular markers will be used to detect the development of occupationally-related joint injury at an early, preclinical stage. Those workers most vulnerable to this condition can potentially be identified before irreversible damage occurs.

DBBS, James P. Mastin
CAN 344 Dates: 10/88-09/92

DEVELOPMENT OF AN INTERVENTION MODEL FOR MUSCULOSKELETAL INJURIES

Purpose: This project will involve an intervention program or plan to reduce identified musculoskeletal problems.

DPSE, Phillip A. Froehlich
CAN 422 Dates: 10/88-10/90

SENTINEL HEALTH EVENT FOLLOW-UP

Purpose: Project will provide a surveillance system to identify where preventable occupational disease is occurring which will assist in direct prevention and help prioritize further research.

DSHEFS, Paul J. Seligman
CAN 518 Dates: 10/85-09/89

P.C. VERSION OF LIFE TABLE ANALYSIS SYSTEM

Purpose: This project will improve the overall research program by providing state-of-the-art methods.

DSHEFS, Kyle N. Steenland
CAN 526 Dates: 10/88-09/90

DISABILITY SURVEILLANCE OF OCCUPATION AND INDUSTRY

Purpose: The project provides unique data on permanent disability that relates to occupation and industry subgroups of American workers. The project's database is a building block for the branch's effort to develop a nationwide system for the surveillance of occupationally related morbidity and mortality.

DSHEFS, Robert M. Brackbill
CAN 629 Dates: 10/80-C

MUSCULOSKELETAL INJURIES

NIOSH ATLAS OF LOW BACK TESTS/MEASURES: CLINICAL TRIALS

Purpose: The NIOSH Low Back Atlas has established a series of standardized diagnostic tests/measures which have the potential to classify low back musculoskeletal injuries. The clinical trials proposed in this study will serve to develop and validate a classification system for assessing low back injuries.

DSR, Roger M. Nelson
CAN 815 Dates: 10/87-09/91

SURFACE ELECTROMYOGRAPHY PROCEDURES MANUAL FOR USE IN THE INDUSTRIAL SETTING

Purpose: This project will develop and publish a standardized technical procedures manual describing surface electromyographic instrumentation, application, interpretation, and analysis for industrial biomedical and engineering personnel.

DSR, Roger M. Nelson
CAN 816 Dates: 10/87-09/89

DEVELOPMENT OF NORMAL MOTOR AND SENSORY NEURONAL CONDUCTION IN HUMANS

Purpose: This project will develop normal nerve conduction values and procedural guidelines for the standardized, objective evaluation of neuromusculoskeletal injuries among workers.

DSR, David E. Nestor
CAN 817 Dates: 10/85-09/89

ERGONOMIC TECHNICAL ASSISTANCE/RESEARCH IDENTIFICATION

Purpose: This project will reduce biomechanical stress to the musculoskeletal system by providing recommendations for improving task, tool, and workstation design on selected jobs.

DSR, Roger C. Jensen
CAN 822 Dates: 10/87-09/90

DEPARTMENT OF LABOR/LOW BACK INJURY INVESTIGATION

Purpose: Current Department of Labor (DOL) claims procedures do not address issues of quality or quantity of medical care for low back injuries. This project will help to define the musculoskeletal assessment procedure used in low back injuries to enable high quality of care.

DSR, Roger M. Nelson
CAN 824 Dates: 10/87-09/89

HEALTH CARE INDUSTRY--LOW BACK--EPIDEMIOLOGIC STUDY

Purpose: This project will identify high risk jobs in health care industries. Using a cohort study, the effectiveness of an intervention method for reducing back injury among nursing personnel in a nursing home will be assessed.

DSR, Roger C. Jensen
CAN 838 Dates: 10/84-09/89

MUSCULOSKELETAL INJURIES

BIOMECHANICAL EVALUATION OF PATIENT HANDLING DEVICES

Purpose: This project will evaluate stresses to the musculoskeletal system during patient transfer activities while using mechanical patient handling devices. A model will be developed for manufacturers to use to analyze the effects of patient handling devices on mechanical stress to the lower back of nursing personnel.

DSR, David E. Nestor
CAN 845 Dates: 10/88-09/91

DEVELOPMENT OF A BIOMECHANICAL ANALYSIS LIFTING LABORATORY

Purpose: This project will develop laboratory facilities suitable for conducting biomechanical analyses of load handling tasks simulated in a laboratory. Facilities will be used in future projects concerned with finding the least stressful technique for performing heavy load handling tasks.

DSR, Roger C. Jensen
CAN 873 Dates: 10/88-09/90

EDUCATIONAL RESOURCE DEVELOPMENT--PROJECT SHAPE

Purpose: This project will increase OS&H awareness through instructional materials in the engineering profession. This, in turn, will result in engineering efforts to prevent occupational hazards through engineering design and other engineering functions.

DTMD, John T. Talty
CAN 775 Dates: 10/88-C

OCCUPATIONAL CANCERS

HEALTH INTERVIEW SURVEY METHODOLOGY IMPROVING HEALTH RISK MESSAGES TO WORKERS--FIELD TRIALS

Purpose: Improved worker understanding of health risks from toxic/carcinogenic agents found in their job environs and adherence to safe work practices as a result of applying NIOSH guidelines to company hazard information programs will be tested. Positive results would verify efficacy of guidelines in achieving program aims.

DBBS, Alexander L. Cohen
CAN 253 Dates: 10/85-01/89

INHIBITION OF INTERCELLULAR COMMUNICATION BY WORKPLACE CHEMICALS

Purpose: Methods for measuring Inhibition of Intercellular Communication (ICC) in human keratinocytes and rodent hepatocytes will be developed, and responses to tumor promoters evaluated. The hypothesis that inhibition of ICC is a mechanism of teratogenesis will be tested in the V79 cell metabolic cooperation assay.

DBBS, Mark A. Toraason
CAN 288 Dates: 10/88-09/91

TEMPORAL FACTORS INFLUENCING CARCINOGENICITY OF INDUSTRIAL CHEMICALS

Purpose: Information needed to justify short-term exposure limits for rapid acting carcinogens will be provided by this dose-rate study.

DBBS, William J. Moorman
CAN 313 Dates: 10/85-09/91

BIOLOGICAL MONITORING FOR ARYL AMINES

Purpose: This project will explore, tailor, and develop, through investigation, a more sensitive, accurate, and feasible method for biomonitoring in the workplace. The ultimate goal is the development of a routine analytical procedure which indicates exposure and relates qualitatively and/or quantitatively to carcinogenesis.

DBBS, Kenneth L. Cheever
CAN 314 Dates: 10/85-09/91

ASSESSMENT OF COCARCINOGENIC ACTIVITY OF ASPHALT FUMES

Purpose: Identification of the active components of asphalt fumes will lead to the development of industrial hygiene indicators for assessing exposure and ultimately reducing the carcinogenic risk.

DBBS, Dennis W. Lynch
CAN 327 Dates: 10/82-09/89

IN VITRO TESTS FOR WORKPLACE COCARCINOGENS

Purpose: This project will result in the development and evaluation of the V79 cell metabolic cooperation assay as a screening test to determine the cocarcinogenic potential of chemicals.

DBBS, Jeffrey S. Bohrman
CAN 343 Dates: 10/80-09/89

OCCUPATIONAL CANCERS

INHALATION TOXICOLOGY AND RESEARCH SUPPORT

Purpose: Resources will be managed through this project to develop generation techniques, measurement methods, and quality control procedures for inhalation chamber exposure atmospheres for NIOSH inhalation toxicology research, and to provide the actual conduct of the inhalation exposures required for DBBS research.

DBBS, Robert D. Hull
CAN 379 Dates: 10/80-C

ANIMAL HUSBANDRY SERVICES

Purpose: Resources will be managed and utilized through this project to provide efficient animal husbandry and effective health surveillance for experimental animals used for DBBS research programs.

DBBS, Frances M. Reid
CAN 385 Dates: 10/76-C

DIAGNOSTIC AND RESEARCH PATHOLOGY

Purpose: Gross and microscopic examination and diagnoses for experimental animal tissues and consultative pathology services for NIOSH research studies will be provided.

DBBS, Richard A. Salomon
CAN 386 Dates: 10/76-C

CONTROL OF FORMALDEHYDE EXPOSURES IN EMBALMING PROCEDURES

Purpose: This project will develop improved methods for the control of formaldehyde during the embalming process.

DPSE, Michael G. Gressel
CAN 417 Dates: 10/88-09/91

CONTROL TECHNOLOGY FOR GALLIUM ARSENIDE PROCESSING

Purpose: The electronics industry is expanding the use of gallium arsenide. This expansion will require more controls than similar silicon processing because of increased potential arsenic exposure. The most effective controls are more likely to be included during construction than during retrofit. The best opportunity to intervene in this expanding industry is now.

DPSE, James H. Jones
CAN 427 Dates: 05/86-09/89

CHEMICAL CHARACTERIZATION OF ROOFING ASPHALT FUME

Purpose: The project will provide analytical chemistry support for the identification of carcinogens in petroleum asphalt fume.

DPSE, Robert A. Lunsford
CAN 433 Dates: 01/83-09/89

OCCUPATIONAL CANCERS

ANALYSIS OF EXHALED BREATH

Purpose: As a result of this project, a unified device for sampling solvents in both mixed and alveolar breath has been developed. Sidestream and mainstream sampling options are provided. The device is being modified to permit continuous sidestream alveolar sampling. The sampler will be evaluated in a study of solvent uptake by humans.

DPSE, Robert A. Glaser
CAN 435 Dates: 10/83-01/90

ENGINEERING CONTROL ASSISTANCE

Purpose: The project will provide engineering control design and support to DSHEFS, and will develop control research projects consistent with Institute goals. Engineering support of DSHEFS projects will provide control recommendations to solve worker exposure problems.

DPSE, Robert T. Hughes
CAN 446 Dates: 01/88-C

SENSOR DEVELOPMENT

Purpose: Develop gas or vapor monitors based on both micro-electronic Surface Acoustic Wave (SAW) sensors and on color-changing selective films (chromo-films).

DPSE, David L. Bartley
CAN 447 Dates: 10/86-09/89

ANALYTICAL SUPPORT TO DBBS RESEARCH AND IWSB/DSHEFS

Purpose: Analytical support to DBBS and IWSB/DSHEFS will be provided in the areas of (1) inhalation studies of toxic substances; (2) chemical characterization of complex mixtures such as asphalt, diesel emissions, and newsprint inks; and (3) industry-wide studies of dye workers and ethylene oxide in hospitals.

DPSE, John L. Holtz
CAN 483 Dates: 10/85-C

CONTROL OF PARTICULATE AND GASEOUS AGENTS BY AIR CURTAIN TECHNOLOGY

Purpose: Control design criteria will be developed for processes where contaminants are emitted over a large area or where local exhaust is not feasible. While focused on reduction of wood dust, adhesive joining, or other gaseous or vaporous emissions, technology will be generically applicable to a number of other processes.

DPSE, Vladimir Hampl
CAN 492 Dates: 10/85-09/89

OCCUPATIONAL CANCERS

DEVELOPMENT OF MONITORING NETWORKS AND CONTROL MONITORING TECHNIQUES

Purpose: Continuous monitoring methods and proper communication of monitoring results provide timely feedback to the control of chemical agents and thereby improve industrial hygiene methods and environmental monitoring. This project examines the development of continuous monitoring methods and the proper communication of the data.

DPSE, Jerome P. Smith
CAN 495 Dates: 10/85-09/89

CASE-CONTROL SURVEILLANCE TO TEST HYPOTHESES GENERATED BY COMPUTER MAPS

Purpose: This project will help build death certificate based case-control studies as a new, in-house surveillance capability. These hypothesis testing activities facilitate the Institute's setting of research priorities.

DSHEFS, Cynthia Robinson
CAN 509 Dates: 10/83-C

INDUSTRYWIDE STUDY OF WORKERS EXPOSED TO 4,4', METHYLENE DIANILINE

Purpose: This study will use several innovative techniques and new analytical methods to sample for MDA. These new procedures will be compared to routine methods.

DSHEFS, Mark F. Boeniger
CAN 512 Dates: 10/84-03/90

MORTALITY AND I.H. STUDY OF AUTOMOTIVE WOOD DIE AND MODEL MAKERS

Purpose: This epidemiologic study will assess the association between exposure in the automotive wood die and model making industry and the risk of developing cancer.

DSHEFS, Robert J. Roscoe
CAN 516 Dates: 10/87-09/89

REGISTRY OF DIOXIN WORKERS AND MORTALITY STUDY

Purpose: This epidemiologic study will assess the association between exposure to dioxin and the risk of developing cancer, especially soft tissue sarcoma.

DSHEFS, Marilyn A. Fingerhut
CAN 525 Dates: 10/79-09/90

EPIDEMIOLOGIC METHODS DEVELOPMENT

Purpose: This epidemiologic methods project will improve the overall research program being conducted as part of the Industrywide Studies Program by maintaining state-of-the-art methods.

DSHEFS, Nelson K. Steenland
CAN 532 Dates: 10/84-C

OCCUPATIONAL CANCERS

MORTALITY STUDY OF WORKERS EXPOSED TO HALOWAX

Purpose: This epidemiologic study will assess the association between exposure to halowax and the risk of developing cancer.

DSHEFS, Elizabeth M. Ward
CAN 536 Dates: 10/83-03/91

EPIDEMIOLOGICAL STUDY OF BLADDER CANCER AMONG WORKERS EXPOSED TO O-TOL. & O-ANILINE

Purpose: This study will assess the association between exposures at a chemical manufacturing plant and the occurrence of bladder cancer and heart disease.

DSHEFS, Arvin V. Carpenter
CAN 537 Dates: 10/88-09/92

UPDATE OF COMPLETED COHORT MORTALITY STUDIES

Purpose: These are epidemiologic studies that assess the association between exposure and the risk of developing disease (primarily cancer).

DSHEFS, Andrea H. Okun
CAN 542 Dates: 10/82-C

MEDICAL, BIOMETRIC AND I.H. STUDY OF EMERGING PROBLEMS

Purpose: Provide management and guidance for the implementation of the national prevention strategies involving epidemiologic research.

DSHEFS, Marilyn M. Fingerhut
CAN 543 Dates: 10/79-C

EXPOSURE ASSESSMENT OF WORKERS EXPOSED TO ACRYLONITRILE

Purpose: This project will help establish the link between acrylonitrile and cancer in humans and develop new methods for historical exposure assessment.

DSHEFS, John Zey
CAN 545 Dates: 10/88-09/90

TESTICULAR CANCER SCREENING IN LEATHER FINISHERS

Purpose: The screening program will assess the prevalence of testicular cancer among a population of leather finishers and characterize work histories in workers with and without testicular cancer.

DSHEFS, Geoffrey M. Calvert
CAN 548 Dates: 10/88-09/90

OCCUPATIONAL CANCERS

SOFT TISSUE SARCOMA VALIDATION STUDY

Purpose: This project will assess misclassification of soft tissue sarcomas based on ICD coding of underlying cause of death in the dioxin and halowax mortality studies.

DSHEFS, Elizabeth M. Ward
CAN 552 Dates: 10/88-06/91

BERYLLIUM CASE CONTROL STUDY

Purpose: This study will assess the relationship between level and type of beryllium exposure and risk of lung cancer.

DSHEFS, Wayne Sanderson
CAN 553 Dates: 10/88-09/91

WORKER NOTIFICATION

Purpose: Notification of workers regarding their risk of disease results in prevention of the disease by encouraging screening, health promotion, and better awareness (education).

DSHEFS, Paul A. Schulte
CAN 554 Dates: 03/85-C

MULTIPLE CAUSE OF DEATH

Purpose: The multiple cause of death project will improve the overall research program being conducted as part of the industrywide studies program by maintaining state-of-the-art methods.

DSHEFS, Kyle Steenland
CAN 555 Dates: 10/88-09/91

FEASIBILITY ASSESSMENTS FOR NEW TOPICS

Purpose: This project will contribute to the resolution of the goal by (1) filling in data gaps on exposure to agents, (2) locating suitable cohorts for epidemiologic investigation, and (3) determining the feasibility of epidemiologic investigations on exposure of interest.

DSHEFS, Charles S. McCammon
CAN 556 Dates: 10/88-09/91

ETHYLENE OXIDE MORTALITY STUDY

Purpose: This epidemiologic study will assess the association between exposure to ethylene oxide and the risk of developing leukemia.

DSHEFS, Nelson K. Steenland
CAN 557 Dates: 10/82-09/90

OCCUPATIONAL CANCERS

MORTALITY STUDY OF CHEMICAL PLANTS IN KANAWHA VALLEY, WEST VIRGINIA

Purpose: This epidemiologic study will assess the association between exposures in a large chemical plant and the risk of developing cancer and other chronic diseases.

DSHEFS, Elizabeth M. Ward
CAN 560 Dates: 10/79-09/91

INVESTIGATION OF WORKERS EXPOSED TO MBOCA

Purpose: This study will assess the presence of biological markers of bladder cancer in exposed workers.

DSHEFS, Elizabeth M. Ward
CAN 572 Dates: 10/82-06/90

SUPPORT OF EPA'S ENVIRONMENTAL EPIDEMIOLOGIC PROGRAM

Purpose: This study will assess the role of biological markers among workers who have been exposed to ethylene oxide which is of interest to the EPA and NIOSH.

DSHEFS, Paul A. Schulte
CAN 607 Dates: 10/85-09/90

SURVEILLANCE COOPERATIVE AGREEMENTS BETWEEN NIOSH AND STATES (SCANS)

Purpose: This project tests the ability of States to develop and maintain occupational health and safety surveillance programs through information exchange and routine occupational health data submissions.

DSHEFS, Nina R. Lalich
CAN 624 Dates: 10/79-C

JOB/EXPOSURE MATRIX

Purpose: To provide researchers with a technique for assessing 1971-1983 change in workers' exposure to potential hazards through computerization of an industry/occupation/hazard matrix.

DSHEFS, William K. Sieber
CAN 637 Dates: 10/85-C

ACCESS TO NOHS DATABASE, PROFILE DEVELOPMENT

Purpose: Prepare trend analyses for the period spanned by NOHS (1972-74) and NOES (1981-83) by comparing key variables common to both surveys to identify potential occupational hazards.

DSHEFS, Joseph A. Seta
CAN 662 Dates: 10/78-C

OCCUPATIONAL CANCERS

TRADENAME INGREDIENTS, NATIONAL OCCUPATIONAL EXPOSURE SURVEY (NOES)

Purpose: This project will result in development of an updated occupational hazard file as a necessary prerequisite for a national database that can be used to assess industry hazard changes during the period 1971-1983.

DSHEFS, David S. Sundin
CAN 663 Dates: 10/77-C

LIBRARY OF CONGRESS

Purpose: Analysis of the data collected may identify associations between symptoms/complaints and environmental conditions thereby suggesting potential causes that can be eliminated through manipulation of environmental systems.

DSHEFS, Richard W. Gorman
CAN 684 Dates: 10/88-12/89

BENZENE UPDATE

Purpose: An update of this study will provide additional data needed for a risk assessment of interest to EPA.

DSHEFS, Robert Rinsky
CAN 686 Dates: 10/88-09/89

DRAKE REGISTRY AND SCREENING PROJECT

Purpose: This study will develop a structure for identifying workers at high risk of disease and provide the opportunity for the delivery of services.

DSHEFS, Paul Schulte
CAN 894 Dates: 10/88-05/91

PERCUTANEOUS ABSORPTION TO EVALUATE THE STANDARD CPC PERMEATION METHOD

Purpose: This project will evaluate chemical protective clothing permeation and will complement the DBBS studies which evaluate human and animal percutaneous absorption.

DSR, Ronald L. Mickelsen
CAN 880 Dates: 10/88-09/91

GASEOUS CHALLENGE AGENTS, WPF

Purpose: This project will produce methodology and hardware for assessing the performance of respirators when challenged with a gas or vapor. Such assessment will be conducted and the assigned protection factors modified as appropriate.

DSR, (Vacant) Industrial Hygienist
CAN 896 Dates: 10/88-09/91

OCCUPATIONAL CANCERS

QUANTITATIVE RISK ASSESSMENT

Purpose: QRA efforts will be conducted to understand the basic mechanism of disease causation, evaluate the metabolic pathways of and variation in response to a particular substance, estimate the adverse health risks to humans, provide a basis for prioritizing the issues for regulatory recommendations, and provide a component for decision making.

DSDTT, Theodore J. Meinhardt
CAN 085 Dates: 10/70-C

AN INVESTIGATION OF THE SCIENTIFIC BASIS FOR AND OF THE LEGAL AND ETHICAL ISSUES ARISING FROM MONITORING OF COMMUNITIES AND WORKERS EXPOSED TO TOXIC WASTE

Purpose: Refer to CAN 085 above.

DSDTT, Theodore J. Meinhardt
CAN 895 Dates: 10/87-07/90

CURRICULUM DEVELOPMENT, COURSES/MODULES

Purpose: Training materials developed will be disseminated to the OSH practitioner and other target audiences identified in the prevention strategy documents through the continuing education network of NIOSH and the ERCs.

DTMD, Norbert J. Berberich
CAN 765 Dates: 10/88-C

HAZARDOUS SUBSTANCE TRAINING PROGRAM

Purpose: Project will increase the OS&H knowledge base of State, local, and other health professionals to carry out their responsibilities in the management of hazardous substance activities. This will help prevent the major health and safety environmental problems nationwide.

DTMD, Bernadine B. Kuchinski
CAN 779 Dates: 10/88-C

SEVERE OCCUPATIONAL TRAUMATIC INJURIES

CARPAL TUNNEL STUDY

Purpose: This study will give an estimate of the incidence of work-related carpal tunnel syndrome seen in the offices of primary care doctors, and provide insight into the operation of provider-based surveillance of work-related disease and injury.

DSHEFS, Paul Seligman
CAN 507 Dates: 11/88-12/89

DISSEMINATION

Purpose: This project will provide coordination of DSR dissemination planning, document and information product development, and program information, as well as investigate methods of evaluating the impact of information products as interventions.

DSR, Herbert I. Linn
CAN 693 Dates: 10/87-09/90

LOCAL AREA NETWORK DEVELOPMENT

Purpose: This project will improve division information handling systems by enabling data, software, and equipment sharing, and by promoting a work group approach to information management. The LAN will enhance division generation of reports and graphics, speed the performance of administrative tasks, and improve communications throughout the division.

DSR, Herbert I. Linn
CAN 694 Dates: 10/88-09/90

SAFETY IN HAZARDOUS MATERIALS INCIDENTS

Purpose: This project will develop on-line data base and criteria for selection and use of personal protective equipment, spill control equipment, and equipment decontamination procedures for emergency response personnel.

DSR, Richard M. Ronk
CAN 803 Dates: 10/81-C

OCCUPATIONAL FATALITY INJURY SURVEILLANCE

Purpose: This project will identify the number of occupational fatalities occurring in the nation through establishment of a national occupational injury fatality database.

DSR, Nancy Stout-Wiegand
CAN 805 Dates: 10/84-C

FATAL ACCIDENT CIRCUMSTANCES AND EPIDEMIOLOGY--TECHNICAL ASSISTANCE

Purpose: This project will identify personal, organizational, and circumstantial risk factors contributing to occupational fatalities and injuries.

DSR, Carol S. Conroy
CAN 807 Dates: 10/83-C

SEVERE OCCUPATIONAL TRAUMATIC INJURIES

OCCUPATIONAL INJURY DATA BASE MANAGEMENT

Purpose: This project will provide for the management of DSR's occupational injury databases.

DSR, Patricia M. Cutlip
CAN 808 Dates: 10/87-C

MACHINE SAFETY TECHNICAL ASSISTANCE/RESEARCH IDENTIFICATION

Purpose: This project will reduce traumatic injuries and fatalities on industrial machinery by providing research-based recommendations for safe machine workstations, concentrating on encouraging the implementation of existing technology, and on surveillance to compare effectiveness in applications for machine safety.

DSR, John R. Etherton
CAN 819 Dates: 09/87-09/89

ANALYSIS OF SITE--SPECIFIC CONSTRUCTION INJURIES

Purpose: This project will evaluate the utility of two self-evaluation instruments for identifying safety program strengths/weaknesses on a construction site, and pursue the feasibility of collecting worker characteristic data, occupational denominator data, and injury circumstance data for descriptive analysis.

DSR, Ronald L. Stanevich
CAN 825 Dates: 10/87-09/91

OCCUPATIONAL TRAUMATIC INJURY SURVEILLANCE OF FARMERS

Purpose: This project will promote a uniform agricultural surveillance system through extension safety specialists in various States, evaluate data acquired specifically from the agricultural industry, and perform analyses in support of intervention to reduce fatalities and traumatic injuries.

DSR, John R. Myers
CAN 827 Dates: 10/87-C

GENERAL SURVEILLANCE

Purpose: This project will provide integrated statistical and epidemiologic support service to DSR. Also, data for determining national and State occupational injury research priorities will be developed.

DSR, Carol S. Conroy
CAN 834 Dates: 10/79-C

FIELD TEST OF MODEL FOR ROBOT SAFE SLOW SPEED REQUIREMENTS

Purpose: This project will begin to provide a scientific basis for the current consensus standard of 25 cm/sec as a safe slow speed for robot maintenance and programming tasks.

DSR, John R. Etherton
CAN 842 Dates: 10/88-09/91

SEVERE OCCUPATIONAL TRAUMATIC INJURIES

INJURY SURVEILLANCE BRANCH MANAGEMENT

Purpose: The goal of this project is to coordinate, evaluate, and facilitate the merging of musculoskeletal and traumatic injury research and surveillance programs into a coordinated research initiative which will address the recommendations of the national strategies for prevention of the leading work-related diseases and injuries.

DSR, Timothy J. Pizatella
CAN 847 Dates: 10/85-C

DISSEMINATION OF FACE

Purpose: This project will use various methods of dissemination of FACE-related information to enable intervention strategies to be developed that reach industry and labor organizations concerned with the causes of work-related fatalities.

DSR, Carol S. Conroy
CAN 864 Dates: 10/86-C

STATE-BASED FATALITY SURVEILLANCE USING THE FACE MODEL

Purpose: This project will enable individual States to perform occupational epidemiologic research through fatality accident investigations. This pilot study will evaluate the fatality notification system, data collection procedures, and costs involved in developing and conducting fatality investigation programs within State agencies.

DSR, Carol S. Conroy
CAN 870 Dates: 10/88-09/91

DEVELOPMENT OF AN OCCUPATIONAL MOTOR VEHICLE SAFETY CENTER

Purpose: This project will support development of an appropriate research program in occupational transportation safety within an existing transportation research center.

DSR, Julie C. Russell
CAN 874 Dates: 10/88-09/91

STUDY OF LINEMAN-RELATED FATALITIES AND INJURIES

Purpose: This project will identify potential injury risk factors for utility linemen and develop recommendations to reduce the risk of injury.

DSR, James W. Collins
CAN 878 Dates: 10/86-09/90

CENTER FOR EXCELLENCE IN CONSTRUCTION SAFETY

Purpose: This project will establish a central clearinghouse for construction safety information which includes a computerized database, and will develop training courses to address the need for integrating safety and health topics into engineering curricula, and for training other professionals within the construction industry.

DSR, Ronald L. Stanevich
CAN 882 Dates: 09/86-09/90

SEVERE OCCUPATIONAL TRAUMATIC INJURIES

IDENTIFICATION OF RISK FACTORS FOR ROBOTIC WORKSTATIONS

Purpose: This project will provide design information for the location and configuration of emergency stop buttons on robot teach pendants. Results of this research will be used to develop improved guidelines for the design of robot teach pendants.

DSR, James W. Collins
CAN 884 Dates: 10/86-09/89

PROJECT MINERVA

Purpose: The cooperative agreement will allow NIOSH to work collaboratively with an external academic-based organization to expedite the implementation of Project Minerva into the business school curriculum.

DTMD, David S. Thelen
CAN 776 Dates: 10/88-C

CURRICULUM DEVELOPMENT, VIDEO

Purpose: This project will provide media to train workers at risk and others on how to recognize, evaluate, and control subject diseases and conditions.

DTMD, Raymond C. Sinclair
CAN 778 Dates: 10/88-C

OCCUPATIONAL CARDIOVASCULAR DISEASES

CELLULAR AND MOLECULAR CARDIAC TOXICOLOGY

Purpose: In vitro methods will be developed and tested as alternatives to using whole animals for studying potential cardiotoxins and for evaluating mechanisms of action of known cardiotoxins. Methods developed will be suitable for assessing heart function in adult as well as fetal and neonatal cardiac tissue.

DBBS, Mark Toraason
CAN 285 Dates: 10/86-09/90

EXPANSION OF DIRECT READING INSTRUMENTATION CAPABILITIES

Purpose: The project will assess the value and usability of various direct-reading instruments, promote on-site measurements through training of personnel and publication of studies of real-time monitors, and broaden the application of equipment to analyze biological samples and bulk materials.

DPSE, Guy E. Burroughs
CAN 497 Dates: 10/88-09/91

MORTALITY AND I.H. STUDY OF BRIDGE & TUNNEL OFFICERS EXPOSED TO CARBON MONOXIDE

Purpose: This study will determine whether the current OSHA standard is adequate to protect the working population from cardiovascular disease.

DSHEFS, Frank B. Stern
CAN 505 Dates: 10/88-09/91

CASE-CONTROL MORTALITY STUDY OF NITROGLYCERIN-EXPOSED WORKERS

Purpose: This epidemiologic study will assess the association between exposure to nitroglycerin and the risk of developing cardiovascular disease.

DSHEFS, Leslie T. Stayner
CAN 513 Dates: 10/84-09/90

CARDIOVASCULAR INITIATIVE:

Purpose: This initiative will identify and develop research projects on the association between workplace exposures and cardiovascular disease.

DSHEFS, Leslie T. Stayner
CAN 538 Dates: 10/88-03/90

CASE-CONTROL STUDY OF TBTA WORKERS EXPOSED TO CARBON MONOXIDE

Purpose: This epidemiologic study will assess the association between occupational exposures to carbon monoxide and the risk of developing heart disease.

DSHEFS, Frank B. Stern
CAN 546 Dates: 10/88-09/90

OCCUPATIONAL CARDIOVASCULAR DISEASES

MORTALITY SURVEILLANCE OF OCCUPATION AND INDUSTRY

Purpose: By the latter part of this decade, occupational health researchers will have the data resources necessary to monitor U.S. occupational and industrial mortality differentials to assist in implementation of the national strategies.

DSHEFS, Carol A. Burnett
CAN 633 Dates: 10/80-C

DISORDERS OF REPRODUCTION

METHODS FOR ASSESSING REPRODUCTIVE POTENTIAL IN FEMALES

Purpose: The potential of currently available methods to assess reproductive function in females will be evaluated for incorporation into a battery which can be used to assess the reproductive potential of female workers in occupational settings.

DBBS, James S. Kesner
CAN 287 Dates: 10/87-09/90

METHODS FOR DETERMINING EVIDENCE OF MUTATIONS DURING SPERMATOGENESIS

Purpose: Currently available methods to detect germ cell mutations will be evaluated and the most useful method(s) will be incorporated into the current DBBS semen profile so that both male reproductive impairment and germ cell mutations can be assessed using a single semen sample.

DBBS, Steven M. Schrader
CAN 289 Dates: 10/87-09/90

SEMEN ANALYSIS IN ANIMAL, LONGITUDINAL AND FIELD STUDIES

Purpose: This project will provide baseline data on semen characteristics of healthy, unexposed men which will be used to interpret reproductive effects observed in occupational groups. Animal studies will test for interspecies extrapolation of exposure effects.

DBBS, Steven M. Schrader
CAN 307 Dates: 10/84-09/89

IN VITRO SYSTEMS FOR HUMAN BIOLOGICAL MONITORING

Purpose: This project will evaluate and implement an in vitro human tissue culture method for the determination of metabolic profiles of occupationally relevant chemicals. These metabolic profiles will be utilized to expedite development of biological monitoring methods to determine worker exposure to suspected occupational toxicants.

DBBS, Donald E. Richards
CAN 317 Dates: 10/87-09/90

AMELIORATION OF RF EXPOSURES IN THE DIELECTRIC HEATING INDUSTRY

Purpose: New and innovative engineering controls will be developed to reduce emissions from radiofrequency (RF) heaters. RF radiation is a proven reproductive hazard in animals and a suspected reproductive hazard in humans. These prototype controls should significantly reduce exposures and the level of reproductive hazard.

DBBS, William E. Murray
CAN 356 Dates: 10/88-09/90

DISORDERS OF REPRODUCTION

EPIDEMIOLOGIC STUDY OF RADIOFREQUENCY HEATER OPERATORS

Purpose: Radiofrequency radiation is a demonstrated reproductive hazard in animals, but human epidemiologic data are both limited and inadequate. This project will determine if occupational radiofrequency radiation exposure is related to reduced semen quality in men or adverse reproductive outcomes in women.

DBBS, Clinton Cox
CAN 358 Dates: 10/84-09/91

RF-INDUCED BODY CURRENT AND ABSORBED POWER DETERMINATIONS

Purpose: NIOSH has documented that radiofrequency (RF) heaters generate operator exposures exceeding recommended guidelines. Improved methodology for RF heater operator exposures will be developed. This methodology will contribute to programs that monitor RF exposure and reproductive health of exposed workers.

DBBS, David L. Conover
CAN 363 Dates: 10/87-09/90

INTERACTION OF CHEMICAL AGENTS WITH RF RADIATION EXPOSURE

Purpose: Many workers are exposed to both chemicals and radiofrequency (RF) radiation. Temperature elevations in animals substantially increase the toxicity of several chemicals. Since RF radiation can cause hyperthermia and is strongly teratogenic in mammals, it is likely that RF may act synergistically with teratogenic chemicals.

DBBS, David L. Conover
CAN 365 Dates: 10/87-09/89

REPRODUCTIVE EFFECTS OF LOW FREQUENCY RF RADIATION IN RATS

Purpose: Of the approximately 3.4 million workers exposed to radiofrequency (RF) radiation, many U.S. workers are exposed to low frequency RF fields which may be a reproductive hazard as clearly demonstrated at higher frequencies. The study will help predict the nature and extent of this reproductive hazard in man.

DBBS, William E. Murray
CAN 368 Dates: 10/83-12/91

DISORDERS OF REPRODUCTION

PARTICULATE AND TISSUE ANALYSIS RESEARCH AND SERVICE

Purpose: Electron microscopy and microprobe analysis will be used to evaluate lead deposition in human sperm to investigate the relationship between sperm lead content and reproductive disorders. In addition, electron microscopy and particle analysis support will be provided to other NIOSH research programs as requested.

DBBS, Stanley F. Platek
CAN 387 Dates: 10/76-C

CONTROL OF ANESTHETIC GASES IN DENTAL OPERATORIES

Purpose: The project will evaluate and/or develop and recommend controls for reducing persistent over-exposures to anesthetic gases in dental operatories. This information will be disseminated through the American Dental Association and other professional organizations.

DPSE, James D. McGlothlin
CAN 405 Dates: 10/86-03/90

MONITORING REPRODUCTIVE OUTCOMES

Purpose: This project will establish a limited flow of birth and fetal death data to DSHEFS. These data will be used to support the measurement of selected reproductive outcomes and the setting of priorities for NIOSH research.

DSHEFS, Joyce A. Salg
CAN 506 Dates: 10/83-09/90

REPRODUCTIVE INITIATIVE

Purpose: This project will set priorities for future research and outline areas requiring methodologic development for reproductive epidemiologic research.

DSHEFS, Teresa M. Schnorr
CAN 544 Dates: 10/88-03/90

I.H. EXPOSURE ASSESSMENTS IN SELECTED INDUSTRIES

Purpose: This project will fill in data gaps on exposure to agents and locate suitable cohorts for epidemiologic investigations.

DSHEFS, Charles S. McCammon
CAN 547 Dates: 10/88-C

REPRODUCTIVE STUDY OF FEMALE VIDEO DISPLAY TERMINAL (VDT) OPERATORS

Purpose: This epidemiologic study will assess the association between working with video display terminals and the risk of adverse reproductive outcomes.

DSHEFS, Teresa M. Schnorr
CAN 687 Dates: 10/84-12/90

NEUROTOXIC DISORDERS

HUMAN NEUROBEHAVIORAL EFFECTS OF COMBINATION CHEMICAL EXPOSURES

Purpose: Neurological and behavioral dose-effect characteristics of pairs of common industrial solvents will be evaluated using controlled human exposures. Primary interest will center on the neurotoxic and pharmacokinetic properties.

DBBS, Robert B. Dick
CAN 243 Dates: 10/87-03/92

METHODOLOGIES FOR WORKSITE NEUROTOXICITY EVALUATIONS

Purpose: Neurobehavioral screening and diagnostic methods for use in worksite research and hazard assessment and monitoring will be developed and evaluated for validity and reliability in laboratory and field settings.

DBBS, W. K. Anger
CAN 248 Dates: 10/83-09/89

NEUROBEHAVIORAL ASSESSMENT OF PESTICIDE APPLICATORS

Purpose: Lawn care pesticide applicators will be evaluated for neurobehavioral impairment using test batteries/methods developed by NIOSH and others. The project will identify and characterize exposures and associated neurotoxic disorders among this occupational group.

DBBS, W. K. Anger
CAN 249 Dates: 10/88-09/91

NEUROTOXICITY OF ETHYLENE AND PROPYLENE OXIDE (TERMINATION)

Purpose: Primates, previously exposed to ethylene oxide and propylene oxide, will be further evaluated for delayed nervous system impairment using correlative neurodiagnostic and neurohistological techniques.

DBBS, James V. Setzer
CAN 277 Dates: 10/86-09/89

FACTORS AFFECTING SKIN PENETRATION OF M-DET

Purpose: Quantitative procedures for MDET (the active ingredient in commercial insect repellents) in blood and urine, validated in a developmental study, will be used to assess factors which affect the skin penetration of MDET and hence use of the method for field studies.

DBBS, Anthony W. Smallwood
CAN 347 Dates: 10/86-09/90

CONTROL OF METHYLENE CHLORIDE IN FURNITURE STRIPPING

Purpose: Recommend controls for methylene chloride, a neurotoxin, carcinogen, and reproductive toxin, in furniture stripping. This is an industry made up mostly of small businesses with no occupational health expertise. DSHEFS reports current exposures are very high.

DPSE, Paul A. Jensen
CAN 418 Dates: 10/87-09/90

NEUROTOXIC DISORDERS

ANALYTICAL METHOD FOR TOTAL HYDROCARBONS ON CHARCOAL

Purpose: The project will provide improved environmental monitoring methods needed to support exposure surveillance and evaluation studies.

DPSE, Robert A. Lunsford
CAN 438 Dates: 07/88-09/90

MONITORING TECHNIQUES FOR CHEMICAL AGENTS

Purpose: Improved sensitivity monitoring techniques will be evaluated/developed. This includes evaluating/comparing existing methodologies and optimization of analytical procedures. Particular attention will be paid to sampling high relative humidity atmospheres.

DPSE, Judd C. Posner
CAN 449 Dates: 03/87-09/89

CONTROL OF LEAD EXPOSURES IN INDOOR FIRING RANGES

Purpose: The project will define the exposure control problems that occur under the present recommendations and then demonstrate the reduction or elimination of these problems, using known principles of ventilation design. Work will be done in the field and in laboratory model studies in order to generalize the results.

DPSE, Keith G. Crouch
CAN 844 Dates: 10/88-09/90

METHANOL EXPOSURES IN TRANSIT VEHICLES (UMTA)

Purpose: To assess the health and safety aspects of using pure methanol as a fuel in transit buses.

DSHEFS, Charles S. McCammon
CAN 502 Dates: 10/88-09/91

AN ASSESSMENT OF THE EFFECTIVENESS OF OSHA'S LEAD STANDARD

Purpose: By identifying industries with current problems controlling lead exposure, surveillance efforts and prevention strategies can be focused to eliminate occupational lead poisoning.

DSHEFS, Paul J. Seligman
CAN 515 Dates: 10/86-09/89

DIOXIN MORBIDITY AND REPRODUCTIVE STUDY OF U.S. CHEMICAL WORKERS

Purpose: This epidemiologic study will assess the association between exposure to dioxin and the risk of developing disease, including neurologic disorders, and dermatological conditions.

DSHEFS, Marie Haring Sweeney
CAN 849 Dates: 10/84-09/90

NOISE-INDUCED HEARING LOSS

MONITORING OF INDUSTRIAL HEARING LOSS

Purpose: Many articles have been written on the legal requirements for a Hearing Conservation Program (HCP) but there are few on the necessary procedures for an effective HCP. Guidelines will be published on the essential elements of an effective HCP along with the proceedings of a conference on Critical Issues in Industrial Hearing Conservation.

DBBS, Derek E. Dunn
CAN 352 Dates: 10/84-09/89

OCCUPATIONAL IMPACT NOISE: EXPOSURE, EFFECT, AND CONTROL

Purpose: This project will provide a direct comparison of hearing between groups of workers exposed to impact noise or continuous noise. The results will determine whether separate criteria are needed to adequately protect the hearing of workers exposed to impact noise versus continuous noise.

DBBS, John R. Franks
CAN 359 Dates: 10/88-09/91

OPTIMIZATION OF SPEECH FOR COMMUNICATIVE/PROTECTIVE DEVICES

Purpose: This project will lay the basic groundwork for the development of innovative hearing protectors that promote better communication. Communication interference is a primary reason workers refuse to wear hearing protection.

DBBS, John R. Franks
CAN 364 Dates: 10/87-09/90

DERMATOLOGICAL CONDITIONS

TRANSPORT OF LIQUIDS THROUGH POLYMERS

Purpose: This project will evaluate the parameters involved in transport of organic liquids through nitrile rubber and will determine the correlation of these measurements as they relate to the polymer composition (percent of monomer) and polymer fabrication process.

DSR, Ronald L. Mickelsen
CAN 789 Dates: 01/88-07/89

SAFETY COMPONENTS OF SMALL BUSINESS INITIATIVE

Purpose: DSR will collaborate with other NIOSH divisions to identify hazards associated with the mortuary industry and develop strategies for intervention to form the basis for recommendations for ways to reduce dermal and respiratory exposures and minimize musculoskeletal injuries.

DSR, Alfred A. Amendola
CAN 804 Dates: 10/88-C

PHYSIOLOGICAL RESPONSES TO THE WEARING OF PROTECTIVE EQUIPMENT

Purpose: This project will develop functional relationships between the physiological responses to environmental conditions, work rates, and protective equipment ensembles. These relationships will be used to define safe work practices for the use of protective equipment and measures.

DSR, (Vacant) Res. Physiologist
CAN 812 Dates: 10/86-C

SEMI-AUTOMATIC VAPOR PERMEATION TEST SYSTEM

Purpose: This project has permitted construction and preliminary evaluation of a semi-automated system to monitor and evaluate vapor permeation through Chemical Protective Clothing (CPC).

DSR, Stephen P. Berardinelli
CAN 823 Dates: 10/86-09/89

CHARACTERIZATION OF HOLES IN GLOVES

Purpose: This project will produce and characterize small holes in the range of 1 to 100 microns in protective materials and determine the relationship of penetration rate of chemicals as a function of hole size. Latex gloves have been shown to have defect (pin hole) rates of 1.7 to 9 percent among brands/styles.

DSR, Ronald L. Mickelsen
CAN 886 Dates: 10/88-09/91

PERMEATION THROUGH STRESSED CPC

Purpose: This project will develop a test method to simulate permeation through stressed CPC materials. The results will be used to correlate laboratory data to industrial applications.

DSR, Michael M. Roder
CAN 888 Dates: 10/88-09/89

DERMATOLOGICAL CONDITIONS

URBAN MASS TRANSPORTATION ADMINISTRATION/NIOSH IAG ON METHANOL FUEL

Purpose: This project will provide guidance to workers and employers for the safe handling of methanol and methanol-gasoline fuels used to replace diesel and gasoline fuels.

DSR, Michael M. Roder
CAN 890 Dates: 10/88-09/90

EDUCATIONAL RESOURCE DEVELOPMENT--GRANTS PROGRAM MANAGEMENT

Purpose: This project specifically addresses Section 21 of the OSH Act which calls for an adequate supply of qualified personnel to carry out the purposes of the Act. It supports academic programs by building the OSH professional work force for implementation of the NIOSH strategies.

DTMD, John T. Talty
CAN: 764 Dates: 10/88-C

PSYCHOLOGICAL DISORDERS

OCCUPATIONAL INCIDENCE OF STRESS DISORDERS

Purpose: The suitability of Social Security disability databases for surveillance of occupational psychological disorders will be determined.

DBBS, Lawrence R. Murphy
CAN 240 Dates: 10/83-09/89

METHODS FOR RATING JOB STRESS/STRAIN

Purpose: Improved methods for assessing stress factors for purposes of detecting stressful job conditions and promoting more uniform approaches to assessing job stress and strain will be developed.

DBBS, Joseph J. Hurrell
CAN 242 Dates: 10/83-09/90

ELECTRONIC PERFORMANCE MONITORING: STRESS PREVENTION STRATEGIES

Purpose: Job/organizational factors that contribute to stress in Electronic Performance Monitoring (EPM) will be investigated and work design solutions will be formulated.

DBBS, Lawrence M. Schleifer
CAN 247 Dates: 10/88-09/92

DEFINITION OF SUCCESSFUL INTERVENTIONS FOR STRESS CONTROL

Purpose: Project will convene a workshop to evaluate the merits of industry interventions to control stress arising in computer-mediated information/office work.

DBBS, Steven L. Sauter
CAN 254 Dates: 10/87-09/89

STRESS REDUCTION FOR NURSING HOME STAFF

Purpose: The potential for musculoskeletal and stress-related disorders in geriatric residential nursing care facilities will be identified and the potential for intervention explored.

DBBS, Naomi G. Swanson
CAN 255 Dates: 10/87-09/89

STRESS CONTROL STRATEGIES IN COMPUTER-MEDIATED WORK

Purpose: The potential of rest breaks and exercise for reducing stress will be evaluated in laboratory studies and used to recommend improved rest break designs for field testing prior to their implementation in the workplace.

DBBS, Steven L. Sauter
CAN 256 Dates: 10/85-09/91

PSYCHOLOGICAL DISORDERS

DEVELOPMENT OF SURVEY ASSESSMENT INSTRUMENT FOR INDOOR AIR QUALITY

Purpose: An item pool for defining self-report measures of job demands and environmental work conditions will be developed. Such items will be proposed for inclusion in protocols for studying indoor air quality problems where apparent health complaints may be due to interaction among perceived job stressors and air quality factors.

DBBS, Joseph J. Hurrell
CAN 257 Dates: 10/88-09/91

IMMUNOTOXICOLOGY RESEARCH AND SUPPORT

Purpose: Immunoassays can provide powerful molecular and cellular probes for use in pathogenesis studies of cancer and neuroendocrine-based disorders, and in determining the relevance of immune competence to disease resistance. These assays will be applied to NIOSH research and support projects requiring immunology input.

DBBS, Gerry M. Henningsen
CAN 342 Dates: 10/88-C

ASSISTANCE REQUESTS

TECHNICAL ASSISTANCE AND PROGRAM SUPPORT (PSYCHOLOGY/ERGONOMICS)

Purpose: This project assures program planning, budget management, and staff development to conduct research, methods development, control studies, consultations, and evaluations as prescribed in prevention strategies in work-related musculoskeletal injuries, neurotoxic, and psychological disorders.

DBBS, Robert J. Biersner
CAN 284 Dates: 10/80-C

TECHNICAL ASSISTANCE AND PROGRAM SUPPORT (TOXICOLOGY)

Purpose: Effect plans and manage resources for toxicology research and methods development which implement the National Prevention Strategies and NIOSH initiatives. Furnish support to NTP and other public health programs requiring toxicology expertise.

DBBS, Russell E. Savage
CAN 348 Dates: 10/86-C

TECHNICAL ASSISTANCE AND PROGRAM SUPPORT (PHYSICAL AGENTS)

Purpose: This project will provide management and guidance for the implementation of the National Prevention Strategies as well as consultation involving investigative research, instrument/methods development, and personal protective equipment.

DBBS, James M. Smith
CAN 374 Dates: 10/83-C

TECHNICAL ASSISTANCE AND PROGRAM SUPPORT (BIOLOGY/CHEMISTRY)

Purpose: Provide technical assistance and support for research, methods development, and biological and immunological assay activities related to the implementation of the National Prevention Strategies, and plan/manage branch programs and resources directed to such needs.

DBBS, Lloyd E. Stettler
CAN 390 Dates: 10/80-C

QUALITY ASSURANCE OF ANALYTICAL MEASUREMENTS

Purpose: This project will expand the internal quality assurance program to insure the quality of analytical data generated internally and by MRSB contract laboratories.

DPSE, Peter M. Eller
CAN 420 Dates: 10/85-C

HHE ANALYTICAL CHEMISTRY SUPPORT

Purpose: Provides timely analytical chemistry services to the HHE program by assuring rapid turnaround of requests for sample analyses and method development. It is projected that 5,900 HHE field samples will be analyzed and 4 sampling/analytical methods will be developed or modified under this project during FY 1989.

DPSE, John L. Holtz
CAN 425 Dates: 10/85-C

ASSISTANCE REQUESTS

METHODS FOR EVALUATING INDOOR AIR VENTILATION SYSTEMS

Purpose: This project will develop and document procedures to effectively evaluate building ventilation systems and to provide the necessary information to correct the problems.

DPSE, Mazen Y. Anastas
CAN 442 Dates: 10/88-09/91

COMPREHENSIVE ANALYTICAL CHEMISTRY SERVICES

Purpose: This project coordinates requests from NIOSH researchers for analytical chemistry support for all NIOSH projects which require chemical analyses. The project also provides overall laboratory administration of sample analyses performed either on contract or in NIOSH laboratories.

DPSE, Donald D. Dollberg
CAN 482 Dates: 10/83-C

CENTRAL AMERICAN DETAINEE HEALTH SCREENING

Purpose: This project provides emergency assistance through provision of mobile x-ray screening for tuberculosis and other radiologically identified diseases of the chest to the State Department and to the Division of Quarantine, CDC.

DRDS, Gregory Spransy
CAN 106 Dates: 10/88-09/89

MINING HEALTH HAZARD EVALUATION AND TECHNICAL ASSISTANCE

Purpose: This project responds to health concerns of miners in coal, metal and non-metal mines, and of workers in general industry with respiratory-related complaints. This project will address the division objective to increase the number of completed HHE/TAs by effectively responding to requests for health hazard evaluations.

DRDS, John E. Parker
CAN 153 Dates: 10/87-C

ESTIMATION OF EXPOSURES AND RELEASES FROM UNIT OPERATIONS

Purpose: This project will help define historical exposures around unit operations increasing our understanding of process modeling.

DSHEFS, Thomas F. Bloom
CAN 519 Dates: 10/88-09/91

HEALTH HAZARD EVALUATIONS AND TECHNICAL ASSISTANCE

Purpose: Investigations result in recommendations relating to the National Prevention Strategies.

DSHEFS, Robert A. Rinsky
CAN 688 Dates: 10/80-C

ASSISTANCE REQUESTS

HEALTH HAZARD ASSESSMENT AT SUPERFUND SITES

Purpose: Characterization of toxic airborne and skin exposures among persons employed at hazardous waste sites will aid ATSDR/EPA in resolving the related public health issues.

DSHEFS, Richard Gorman
CAN 897 Dates: 10/88-09/89

ADMINISTRATION

DBBS ADMINISTRATION

Purpose: Expedition, intervention, or reallocation of expenditures by four branches is provided. Personnel utilization is evaluated and considered when assigning special tasks and allocating positions. Responses to requests for technical assistance are assigned to available personnel and expedited through a tracking system.

DBBS, Janet C. Haartz
CAN 303 Dates: 10/76-C

ADMINISTRATIVE SUPPORT FOR DPSE RESEARCH

Purpose: This project will, in addition to providing strategy implementation, develop criteria for monitoring and assess control technology through research and development. Provides for the Institute's chemical analysis needs and operates a quality control reference program for analytical laboratories.

DPSE, Philip J. Bierbaum
CAN 402 Dates: 10/85-C

APPLIED CONTROL TECHNOLOGY STUDIES

Purpose: This project provides for dissemination of the results of control technology studies to industry, labor, and other agencies. It also provides for the investigation of emerging problems and control techniques. These may include substances for which regulatory action is considered, new processes or manufacturing technologies, etc.

DPSE, James A. Gideon
CAN 403 Dates: 10/80-C

OFFICE OF THE DIRECTOR, DIVISION MANAGEMENT

Purpose: Provide management and guidance for the implementation of the National Prevention Strategies involving investigative research, environmental and medical surveillance.

DRDS, Laurence J. Doemeny
CAN 103 Dates: 10/86-C

TECHNICAL MANAGEMENT, DSHEFS (OD)

Purpose: This project provides management and guidance for the implementation of the National Prevention Strategies involving investigative research, surveillance systems, and health evaluations.

DSHEFS, Larry J. Fine
CAN 522 Dates: 10/80-C

TECHNICAL MANAGEMENT

Purpose: This project supports statistical and data processing aspects of DSHEFS' industrywide studies, health hazard evaluations, and surveillance activities. It also provides biomedical instrumentation support to all Cincinnati NIOSH operations.

DSHEFS, Lawrence R. Catlett
CAN 680 Dates: 10/87-C

ADMINISTRATION

DIVISION MANAGEMENT

Purpose: Provide management and guidance for the implementation of the National Prevention Strategies. This project is primarily directed toward increasing the number and quality of documents and other NIOSH policy statements produced annually through management of resources and disseminating information.

DSDTT, Richard W. Niemeier
CAN 082 Dates: 10/70-C

TECHNOLOGY TRANSFER

Purpose: This project will extend access to NIOSH developed databases worldwide by monitoring memoranda of agreements and memoranda of understanding for NIOSH information services.

DSDTT, Vivian K. Morgan
CAN 084 Dates: 10/83-C

CONSULTATION AND BRANCH ADMINISTRATION: DOCUMENT DEVELOPMENT BRANCH

Purpose: Provide administrative, consultative, statistical, and technical assistance for implementation of the National Prevention Strategies.

DSDTT, Bryan D. Hardin
CAN 094 Dates: 10/84-C

DIVISION ADMINISTRATION AND COLLABORATIVE PROJECTS

Purpose: Provide management and guidance for the implementation of the National Prevention Strategies involving work force development, health promotion, and support to academic programs.

DTMD, Thomas C. Purcell
CAN 763 Dates: 10/88-C

OTHER

STATISTICAL SUPPORT TO DBBS

Purpose: Support personnel, equipment, and training are provided to increase the quality and quantity of support given to division project officers in design, implementation, and analyses of planned projects.

DBBS, Stephen D. Simon
CAN 305 Dates: 10/85-C

BIOLOGICAL MONITORING RESEARCH AND SUPPORT

Purpose: Expanded biological monitoring support, including the development of new methods, will be provided by in-house staff and contract labs to implement research strategies in DSHEFS and DBBS. Biological monitoring methods will be evaluated in the field in cooperation with DSHEFS. Clinical lab support will be provided to in-house studies.

DBBS, Larry K. Lowry
CAN 378 Dates: 10/80-C

STATISTICAL SUPPORT FOR DPSE RESEARCH

Purpose: Experiments will be designed using statistics, and data will be statistically analyzed to support DPSE research projects.

DPSE, Stanley A. Shulman
CAN 407 Dates: 10/85-C

IMPLEMENT ASBESTOS CONTROLS DURING BRAKE SHOE REPLACEMENT

Purpose: This project will disseminate NIOSH evaluated asbestos controls for the brake shoe replacement industry through the use of technology transfer agents in the Ohio Community College System.

DPSE, Theodore F. Schoenborn
CAN 409 Dates: 01/88-09/90

CONTROL TECHNOLOGY FOR SMALL BUSINESS

Purpose: Develop and disseminate control technology information to a selected small business.

DPSE, John W. Sheehy
CAN 415 Dates: 10/88-09/91

ANALYTICAL CHEMISTRY SUPPORT TO DPSE RESEARCH

Purpose: This project provides for chemistry support to DPSE research activities. Sampling and analytical support will be given to the control technology program's attempts to prevent the exposure of workers to hazardous levels of chemical agents. New measurement methods for asbestos will also be implemented.

DPSE, Donald D. Dollberg
CAN 484 Dates: 10/85-C

OTHER

CASE CONTROL STUDY OF RENAL DISEASE AND OCCUPATIONAL EXPOSURE

Purpose: This project will study factors that contribute to end-stage renal disease such as occupational and life style factors.

DSHEFS, Nelson K. Steenland
CAN 524 Dates: 02/83-03/89

INDUSTRIAL HYGIENE AIR SAMPLING SURVEY

Purpose: Characterization of toxic airborne and skin exposures among cleanup employees will allow selection of personal protective equipment based upon the degree of the measured exposure.

DSHEFS, R. Hartle/M. Newman
CAN 665 Dates: 10/88-09/90

SAFETY DIVISION MANAGEMENT

Purpose: This project will provide management and guidance for the implementation of the National Prevention Strategies involving investigative research, information dissemination/document development, respirators, surveillance, and other epidemiological studies.

DSR, Thomas R. Bender
CAN 802 Dates: 06/77-C

LIBRARY SERVICES

Purpose: This project improves the quality of the collection and the effectiveness of services of the Cincinnati Facilities Library.

DSDTT, Larry Q. Foster
CAN 083 Dates: 10/83-C

DOCUMENT DEVELOPMENT II

Purpose: Critical evaluations of information are developed through criteria documents for recommended standards, current intelligence bulletins, and other appropriate NIOSH policy statements. Criteria for occupational standards will be developed and recommendations made for the prevention/control of OS&H chemical and physical hazards.

DSDTT, Burt J. Cooper
CAN 086 Dates: 10/86-C

DOL (OSHA/MSHA/EPA) REGULATORY RESPONSES

Purpose: This project provides for coordination of activities by NIOSH, DOL/EPA standards development staff in making recommendations for workplace standards through the DOL/EPA rulemaking process. The most current information developed by or available to NIOSH is used to develop public testimony and make recommendations to DOL/EPA.

DSDTT, Laurence D. Reed
CAN 087 Dates: 10/83-C

OTHER

DOCUMENT DEVELOPMENT II

Purpose: Critical evaluations of information are developed through criteria documents for recommended standards, current intelligence bulletins, and appropriate NIOSH policy statements. Recommendations are made for prevention/control of occupational safety and health chemical and physical hazards.

DSDTT, Howard R. Ludwig
CAN 088 Dates: 10/86-C

DOCUMENT DEVELOPMENT III

Purpose: Critical evaluations of information are developed through criteria documents for recommended standards, current intelligence bulletins, and appropriate NIOSH policy statements. Recommendations are made for prevention/control of occupational safety and health chemical and physical hazards.

DSDTT, David M. Votaw
CAN 089 Dates: 10/70-C

SENIOR REVIEW ACTIVITIES

Purpose: A multi-disciplinary team of senior scientists will evaluate scientific and policy issues to ensure the accuracy and scientific quality of documents and the appropriate consideration of policy implications. This review will provide for the implementation of the National Prevention Strategies.

DSDTT, William D. Wagner
CAN 092 Dates: 10/87-C

NIOSH INFORMATION SYSTEMS

Purpose: This project provides for availability of technical information through current, computerized data bases to NIOSH personnel and the OS&H community. Principal systems include the Document Information System (DIDS), and the NIOSH mailing list (NMLS).

DSDTT, Rolland R. Rogers
CAN 095 Dates: 10/70-C

REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS)

Purpose: This project is designed to deliver toxicological data to serve the information needs of the occupational safety and health community and to produce innovative changes to assist users.

DSDTT, Doris V. Sweet
CAN 096 Dates: 10/70-C

NIOSHTIC

Purpose: The NIOSHTIC computerized information retrieval system is designed to assist the research and technical assistance activities of NIOSH and the occupational safety and health community as a whole. This system currently contains over 150,000 citations derived from the world's occupational safety and health literature.

DSDTT, William D. Bennett
CAN 097 Dates: 10/70-C

OTHER

PUBLICATION AND DISSEMINATION OF NIOSH PUBLICATIONS

Purpose: This project provides for the dissemination of occupational safety and health information in support of NIOSH research and in response to public inquiries. In addition, NIOSH-developed technologies will be presented through the exhibit program.

DSDTT, Charlene C. Maloney
CAN 098 Dates: 10/83-C

INFORMATION RETRIEVAL AND ANALYSIS

Purpose: This project provides technical information services to Institute personnel in support of research and public hearings, and to the public requesting information on OS&H issues. Included in the latter is the staffing of the information and HETA toll-free telephone number. It also provides for the development of chemical and process-specific information profiles.

DSDTT, Rodger L. Tatken
CAN 099 Dates: 10/70-C

NIOSH PROJECTS BY DIVISION

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