

**1994 FACT BOOK:
National Program for
Occupational Safety and Health
in Construction**



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

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March 1994

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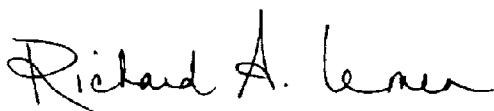
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FOREWARD

In 1990, the Congress directed the National Institute for Occupational Safety and Health (NIOSH) to undertake and lead a series of initiatives in surveillance, research, and intervention, which when sustained over a period of time, would significantly and measurably reduce diseases and injuries among construction workers in America. This program in occupational safety and health is dedicated to preventing Work-Related Diseases and Injuries that affect Americans who work in construction.

This document, *1994 Program Facts: The National Program for Occupational Safety and Health in Construction*, provides detailed information about this program. These facts are for use by the various partners with whom NIOSH works in the program. To assist our partners, *1994 Program Facts* provides a description and a directory of people involved in the program.

We hope that, with the aid of this document, our partners will be able to work more closely and collaboratively in preventing the Leading Work-Related Diseases and Injuries that affect American construction workers.

A handwritten signature in black ink, reading "Richard A. Lemen". The signature is fluid and cursive, with the first name "Richard" and last name "Lemen" clearly legible.

Richard A. Lemen, Ph.D.
Acting Director, National Institute for
Occupational Safety and Health

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INTRODUCTION

The vernacular of rule-making in occupational safety and health includes the terms, "horizontal" standards and "vertical" standards. Horizontal standards apply across industries with the premise that workers, regardless of where they work, should be protected to the same level of exposure. In contrast, vertical standards recognize that in the enforcement of standards, certain industries require interventions that are different from other industries because the nature of the work demands different prevention methods. Construction is one of those industries that is recognized as in need of vertical standards.

The reasons are many:

- The worksite changes continuously as construction progresses.
- Weather is an important factor since much of the work is outside.
- Construction engages multiple employers so the actions of one employer can impact upon the working conditions of workers of another employer.
- Construction work typically employs workers for brief periods of time; the worker then moves to another job and another employer. This can result in a worker having several employers for each year.
- Episodic, high-level exposures are common.

In response to these special needs, the Congress appropriated funds to NIOSH to initiate a program of surveillance, research, and intervention to improve the safety and health among construction workers.

THE MANDATE

In Fiscal Year (FY) 1990, the Congress provided funding for and directed NIOSH to "...develop a comprehensive prevention program directed at health problems affecting construction workers by expanding existing NIOSH activities in areas of surveillance, research, and intervention." The following are excerpts from the Congressional language, which is organized by these three areas of surveillance, research, and intervention.

"...develop a comprehensive prevention program directed at health problems affecting construction workers by expanding existing NIOSH activities in areas of surveillance, research, and intervention."

—The U.S. Congress, 1990

Surveillance

- In FY 1991, the Congress directed NIOSH to develop, "surveillance data to identify and monitor emerging hazards in the construction industry."

- In FY 1992, the Congress augmented the NIOSH budget for construction safety and health again and directed NIOSH to establish "a surveillance program."

Research

- In FY 1991, the Congress directed NIOSH to conduct "research regarding fatalities and injuries among construction workers."
- In FY 1992, the Congress directed NIOSH to examine "work practices and worker compensation records."
- In FY 1993, the Congress directed NIOSH to increase "intramural research capacity," to expand the "Health Hazard Evaluation Program," and to establish "research centers for construction safety and health to nonprofit universities to complement the intramural program."
- In FY 1994, the Congress directed NIOSH to provide research grants "at nonprofit universities and other nonprofit institutions directed at generating prevention initiatives."

Intervention

- In FY 1991, the Congress directed NIOSH to establish "training programs and demonstration projects to disseminate information concerning the prevention of injuries and illnesses in the construction industry."
- In FY 1992, the Congress directed NIOSH to establish "training programs and demonstration projects concluding with the eventual development of comprehensive intervention and prevention plans."
- In FY 1993, the Congress directed NIOSH to develop "Community-based intervention projects aimed at the prevention of construction-related diseases and disabilities."
- In FY 1994, the Congress directed NIOSH to establish "a new 5-year cooperative agreement with the construction trades to develop a center for prevention-oriented strategies and programs," and to allow for "the training in the construction industry for the removal of lead."

THE DIALOGUE

To address the special problems of occupational safety and health in construction and to respond to these mandates, NIOSH has sponsored a series of national conferences. The following describes some of the observations drawn from these conferences.

National Forum on Construction Safety and Health¹

On April 23-24, 1989, NIOSH sponsored a National Forum on Construction Safety and Health, which the Center for Excellence in Construction Safety of West Virginia University convened in Pittsburgh, Pennsylvania. The purpose of this forum was to

identify major health and safety problems confronting the construction industry and recommend means for reducing these problems. Eight topics were discussed at this forum. They included surveillance, construction team interface, education and training, engineering needs, legal and legislative issues, occupational health, and primary injury exposures. Cross-cutting problems identified included:

The purpose of this forum was to identify major health and safety problems confronting the construction industry and recommend means for reducing these problems.

- The need for education and training in safety and health at virtually every level and aspect of construction. This need applied to owners, architects, design engineers, management, site supervisors, foremen, and workers.
- The need to include in construction contracts safety and health aspects with necessary funding. These aspects include surveillance; defined roles for owner, engineer, construction manager, and contractor in safety and health; a mandatory program on every construction site; and mandatory training.
- In addition, primary injury exposures ranked high as a concern. Related to this concern, the Forum identified six problems; 1) lack of company programs and rules, 2) lack of training, 3) lack of a system of "planning, organizing, motivating, communicating, and controlling," 4) lack of a set of values, 5) poor work practices and procedures, and 6) lack of accountability and responsibility.

National Conference on Construction Safety and Health²

On September 25-27, 1990, NIOSH co-sponsored a National Conference on Construction Safety and Health, which the Northwest Center for Occupational Health and Safety of the University of Washington convened in Seattle, Washington. This conference met to identify leading causes of injuries and

This conference met to identify leading causes of injuries and illnesses among construction workers and focused on prevention.

illnesses among construction workers and focused on prevention. The participants broke into four workshops. These workshops included: standards setting and enforcement, education and training, safety and health programs, and safety and health research. Examples of recommendations made in the workshops were:

- Occupational safety and health should be incorporated into the curriculum of high schools, vocational schools, and apprenticeship programs.
- Construction-based health and safety program materials should be created that would give everyone access to materials.
- Each contractor should be required to have a site safety plan, program, and manager as a part of the construction permit process.

- More research is needed into the impact of standards and enforcement, education and training, and safety and health programs in reducing injuries (and diseases).
- Workers' compensation and health and safety programs in one agency, such as (those) in Washington and British Columbia, serve as models for combined surveillance and follow-up compliance.

The National Conference on Ergonomics, Safety, and Health in Construction³

On July 18-22, 1993, NIOSH supported a National Conference on Ergonomics, Safety, and Health in Construction, which the Center to Protect Workers' Rights convened in Washington, D.C. The purpose of this conference was to provide for the right of construction workers to safe and healthful working conditions

The purpose of this conference was to provide for the right of construction workers to safe and healthful working conditions while addressing the employer's need for economic viability.

while addressing the employer's need for economic viability. The driving force for this conference was to develop an agenda for change. Participants at the conference discussed roles of labor and management, owners, and government. The conference showed that worker safety and health in industrialized countries can "mesh" with profitability, and that safety pays "handsomely" through savings in workers' compensation and the reduction of suffering by injured workers and their families. Recommendations included:

- Workers' compensation carriers should require safety and health plans before underwriting any work involving major construction, particularly for multi-employer worksites.
- All workers in construction should be certified upon completion of accredited safety and health training.
- Surveillance systems should be structured so exposure data can be used to target the development and demonstration of interventions.
- Task-based approaches are needed to measure exposures. For exposures of greatest concern, devices should be developed that are real time, easy to use, and able to withstand conditions in the field. Industrywide studies are needed to determine the incidence or prevalence of disease by tasks or trade, identify exposures, develop dose-response information, and study the effect of short-term, high-level exposures.
- Special attention needs to be given to evaluating strategies for reintroducing injured workers back to the construction site without harming their future health.
- Economics research should be an integral part of efforts to improve safety and health in the construction industry.
- Research and demonstration projects are needed to gauge the role of workplace

culture on creating and preventing hazards in construction.

PREMISES

Several premises for operating the program for occupational safety and health in construction at NIOSH have evolved from the unique problems of the industry and from the conferences' dialogues. Among these are:

- The prevention focus in construction needs to be broadened beyond the traditional focus on employers and workers to also consider the roles of the owner, the design engineer, the means and methods engineer, the primary contractor, and the self-employed.
- Depending on employer records is problematic for conducting epidemiological research because construction workers routinely change employers several times a year, thus, a different approach is needed. Union records offer a different approach because of an opportunity for tracking workers over their career that is independent of employer records.
- Within the dynamics of the construction site certain tasks remain constant. These tasks include those performed by the different trades such as wiring or plumbing. A focus for research, thus, lies with investigating the exposures associated with tasks from which presumptive standards (like OSHA's interim lead standard)⁴ can be recommended.
- Ancillary to the focus on presumptive standards, is the need to design training programs that can assure an adequate supply of qualified persons in safety and health on the worksite.
- The Critical Path Method (CPM) is an instrument that can be used to integrate the planning and implementation of preventive actions. CPM provides a plan for construction activities or tasks against which presumptive standards and expert knowledge can be integrated. It also offers an opportunity for planning for occupational safety and health between the different subcontractors who concurrently operate on the construction site.
- Innovations in the onsite use of computer-aided design and construction may provide instruments for safety and health interventions into the means and methods used in construction.
- National and international coalitions need to foster the exchange of safety and health information, to identify interventions that are shown to be efficacious, and to encourage their effective adoption.⁵

PROJECT FACTS

The purpose of this document, *1994 Project Facts: The National Program for Occupational Safety and Health in Construction* is to provide a series of fact sheets for

each element of the program. This effort represents a budget that has grown in the last four years to \$11.6 million. This total is the sum of \$8,812,385 for intramural projects and cooperative agreements, \$2,250,000 for research grants, and \$500,000 for training (lead abatement).

1994 Project Facts presents information about each of the elements of this program. We have included 35 intramural projects, 8 cooperative agreements, and 8 research grants. These latter two categories and a new one, training grants, are enhanced with additional funding in Fiscal Year 1994. The 51 projects described in this document address one or more of the work-related diseases and injuries as shown in Table I.

The program overall has established a strong emphasis upon the control of silicosis and asbestos-related diseases. A substantial part of this effort is identifying feasible and safer substitutes for silica in abrasive blasting. In addition, the causes of occupational asthma as related to construction are being studied.

A major emphasis of this program is the control of musculoskeletal disorders. Ergonomics is emphasized as a strategy for control of the problem.

Preventing cancer is a focus of several projects. These projects range from the problems of exposure to asbestos, to the control of skin cancer, to the study of the effects and control of asphalt fumes.

Traumatic injuries are a target for control in a number of studies. The main focus for most of these studies is to prevent fatalities at construction sites. Cardiovascular disorders are dealt with in two projects. One attempts to deal with preventing heat-related disorders when wearing protective clothing, and another deals with the problem of carbon monoxide poisoning. Some projects address the problems of noise-induced hearing loss and dermatological conditions as well.

Studies into the control of lead and solvent exposure during painting target the prevention of neurological disorders, and the studies on lead have an impact on preventing reproductive disorders.

This book contains a fact sheet for each of the current 51 projects. Each grantee as well as the NIOSH project officers provided information on their respective project for these fact sheets. Each sheet addresses specific information including personnel and skills involved, the objective of the project, and the diseases, injuries, and hazards that are of concern; they also include an executive summary, prevention activities, and an "evaluability assessment."⁶ Under prevention activities, they identify linkages with other institutions and discuss surveillance, research, and intervention. The assessment of evaluability presents criteria for measuring the effectiveness, the impact on target

Table I. Work-Related Diseases and Injuries Addressed by Projects.

• 14	address occupational lung diseases
• 14	address musculoskeletal disorders
• 11	address cancer prevention
• 13	address serious occupational traumatic injuries
• 2	address cardiovascular diseases
• 15	address neurologic disorders
• 11	address reproductive disorders
• 3	address noise-induced hearing loss
• 4	address dermatological conditions

audiences, and associated outcome of their respective projects.*

Intramural projects are presented first, cooperative agreements (CA) second, and research grants (RG) third. Seven Divisions from NIOSH have provided fact sheets. These are the Division of Biomedical and Behavioral Science (DBBS), the Division of Physical Sciences and Engineering (DPSE), the Division of Safety Research (DSR), the Division of Surveillance, Hazard Evaluation and Field Studies (DSHEFS), the Division of Respiratory Disease Studies (DRDS), the Division of Standards Development and Technology Transfer (DSDTT), and the Division of Training and Manpower Development (DTMD). Finally, we have provided a list of acronyms used in this document and an index.

The determined efforts of Jan D. Basehart is acknowledged and commended for collecting the information in this document and formatting it for publication. Likewise, Tim W. Groza's organization of this effort is also acknowledged and commended as is an editorial review of this introduction by Elizabeth H. Dryden, Nancy J. Bollinger, David E. Fosbroke, Ronald L. Stanevich, and Dr. Lawrence J. Fine.

—Melvin L. Myers
March 30, 1994

REFERENCES

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2. *Proceedings of the National Conference on Construction Safety and Health*. Sponsored by the Northwest Center for Occupational Health and Safety, Department of Environmental Health, University of Washington, Cosponsored by the Laborer's National Health and Safety Fund, the Building and Construction Trades Department, AFL-CIO, and the National Institute for Occupational Safety and Health, September, 25-27, 1990.
3. *An Agenda for Change: Report of The National Conference on Ergonomics, Safety, and Health in Construction*. Sponsored by the Center to Protect Workers' Rights, the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, and the Department of Energy, Washington, D.C., July 18-22, 1993.
4. *Occupational Exposure to Lead in Construction, Interim Final Rule*. Occupational Safety and Health Administration, Title 29, Code of Federal Regulations, Part 1926.62, May 4, 1993.
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**Evaluability Assessment*: Assessing whether the program is ready to be managed for results, what changes are needed to do so, and whether the evaluation would contribute to improved program performance.⁶ For a discussion of evaluability assessment, see reference 6.

Directory of Construction Safety and Health Projects

Explanation

NIOSH Intramural Construction Safety and Health Projects are listed by Division.

1. Division of Biomedical and Behavioral Science (DBBS)
2. Division of Physical Sciences and Engineering (DPSE)
3. Division of Respiratory Disease Studies (DRDS)
4. Division of Safety Research (DSR)
5. Division of Standards Development and Technology Transfer (DSDTT)
6. Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS)
7. Division of Training and Manpower Development (DTMD)

NIOSH Extramural Construction Safety and Health Projects are listed by funding mechanism.

1. Cooperative Agreements
2. Research Grants

Division	Title of Project	Institution, Address	Project Director
DBBS NIOSH-1	Hearing Conservation Programs (HCPs) for Underserved Worker Groups	NIOSH, DBBS 4676 Columbia Parkway, MS: C-27 Cincinnati, Ohio, 45226 Phone: 513-533-8281 FAX: 513-533-8510	John R. Franks, Ph.D.
NIOSH-2	Job Assessment Protocol for Ergonomic Hazard	NIOSH, DBBS 4676 Columbia Parkway, MS: C-24 Cincinnati, Ohio, 45226 Phone: 513-533-8291 FAX: 513-533-8510	Vern Putz-Anderson, Ph.D.
DPSE NIOSH-3	Control of Health Hazards in the Construction Industry	NIOSH, DPSE 4676 Columbia Parkway, MS: R5 Cincinnati, Ohio 45226 Phone: 513-841-4221 FAX: 513-841-4506	R. Leroy Mickelsen
NIOSH-4	Control of Hazardous Particulate Exposures During New Construction (Drywall Sanding and Roofing Kettles)	NIOSH, DPSE 4676 Columbia Parkway, MS: R5 Cincinnati, Ohio 45226 Phone: 513-841-4221 FAX: 513-841-4506	Kenneth R. Mead, M.S.
NIOSH-5	Field Methods for the Analysis of Airborne Particulate Lead	NIOSH, DPSE 4676 Columbia Parkway, MS: R-7 Cincinnati, OH 45226 Phone: 513-841-4402 FAX: 513-841-4500	Kevin E. Ashley, Ph.D.
NIOSH-6	Chemical Characterization of Roofing Asphalt Fume	NIOSH, DPSE 4676 Columbia Parkway, MS: R-7 Cincinnati, OH 45226 Phone: 513-841-4241 FAX: 513-841-4500	R. Alan Lunsford, Ph.D.
NIOSH-7	Asphalt Fume Fractionation and Identification of Genotoxic Components	NIOSH, DPSE 4676 Columbia Parkway, MS: R-7 Cincinnati, OH 45226 Phone: 513-841-4269 FAX: 513-841-4500	Larry D. Olsen, Ph.D.
DRDS NIOSH-8	Development of Bioassays: Identify Health Risks of Asbestos Substitutes	NIOSH, DRDS 944 Chestnut Ridge Road, MS: 210 Morgantown, WV 26505-2888 Phone: 304-291-4591 FAX: 304-284-5467	Vincent Castranova, Ph.D., David G. Frazer, Ph.D., and William Jones, Ph.D.

Division	Title of Project	Institution, Address	Project Director
NIOSH-9	Hazard Surveillance in the Construction Industry	NIOSH, DRDS 944 Chestnut Ridge Road, MS: 126 Morgantown, WV 26505-2888 Phone: 304-291-4474 FAX: 304-284-5467	Alwin A. Dieffenbach, M.S.
NIOSH-10	Silicosis Risk in the Construction Industry	NIOSH, DRDS 944 Chestnut Ridge Road, MS: 121 Morgantown, WV 26505-2888 Phone: 304-291-4496 FAX: 304-284-5467	Kenneth Linch, M.S.
NIOSH-11	Assessment of Substitute Materials for Silica Sand in Abrasive Blasting	NIOSH, DRDS 944 Chestnut Ridge Road, MS: 121 Morgantown, WV 26505-2888 Phone: 304-291-4496 FAX: 304-284-5467	Mark F. Greskevitch
DSR NIOSH-12	Ergonomic Evaluation of Carpenter Tasks: Erection and Dismantling of Frame Scaffolds	NIOSH, DSR 944 Chestnut Ridge Road, MS: 119 Morgantown, WV 26554 Phone: 304-284-5806 FAX: 304-284-5877	Hongwei Hsiao, Ph.D.
NIOSH-13	Evaluation of Heat Stress in Hazardous Waste Abatement Workers	NIOSH, DSR 944 Chesnut Ridge Road, MS: 119 Morgantown, WV 26505-2888 Phone: 304-284-5812 FAX: 304-284-5877	Jean-Louis Bélard, M.D.
NIOSH-14	State Model Construction Safety and Health Program	NIOSH, DSR 944 Chestnut Ridge Road, MS: 1174 Morgantown, West Virginia 26554 Phone: 304-284-5805 FAX: 304-284-5877	Ronald L. Stanevich
NIOSH-15	Case-Control Study of Risk Factors for Falls In West Virginia Construction Workers	NIOSH, DSR 944 Chestnut Ridge Road, MS: 1133 Morgantown, WV 26505 Phone: 304-284-5830 FAX: 304-284-5877	Gwendolyn H. Cattledge
DSDTT NIOSH-16	Library Construction References	NIOSH, DSDTT 4676 Columbia Parkway, MS: Library C-21 Cincinnati, OH 45226 Phone: 513-533-8321 FAX: 513-533-8382	Colleen M. Herrington, M.S. in L.S.
NIOSH-17	Construction Health and Safety Dissemination	NIOSH, DSDTT 4676 Columbia Parkway, MS: C-20 Cincinnati, OH 45226 Phone: 513-533-8380 FAX: 513-533-8588	Charlene B. Maloney
NIOSH-18	Technical Inquiries - Construction	NIOSH, DSDTT 4676 Columbia Parkway, MS: C-19 Cincinnati, OH 45226 Phone: 513-533-8328 FAX: 513-533-8588	Rodger L. Tatken
DSHEFS NIOSH-19	Take-Home Lead in the Construction Industry	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-15 Cincinnati, OH 45226 Phone: 513-841-4411 FAX: 513-841-4486	Elizabeth A. Whelan, Ph.D.
NIOSH-20	Construction Union Study of Painters	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-15 Cincinnati, OH 45226 Phone: 513-841-4411 FAX: 513-841-4486	Robert J. Roscoe

Division	Title of Project	Institution, Address	Project Director
NIOSH-21	Proportional Mortality Ratio Study of the International Association of Bridge, Structural and Ornamental Ironworkers (IABSOI)	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-13 Cincinnati, Ohio 45226 Phone: 513-841-4519 FAX: 513-841-4486	Frank Stern
NIOSH-22	Proportional Mortality Study of the Laborers' International Union of North America (LIUNA)	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-13 Cincinnati, Ohio 45226 Phone: 513-841-4519 FAX: 513-841-4486	Frank Stern
NIOSH-23	Reducing Work-Related Musculoskeletal Disorders Among Construction Workers	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-13 Cincinnati, OH 45226 Phone: 513-841-4207 FAX: 513-841-4486	Marie Haring-Sweeney, Ph.D. and Laurie Piacitelli
NIOSH-24	Laborers' Union Health Program	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R42 Cincinnati, Ohio 45226-1998 Phone: 513-841-4475 FAX: 513-841-4486	Paul A. Schulte, Ph.D.
NIOSH-25	Tristate Construction Network	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R42 Cincinnati, Ohio 45226-1998 Phone: 513-841-4475 FAX: 513-841-4486	Paul A. Schulte, Ph.D. Marie Haring-Sweeney, Ph.D., Linda Goldenhar, Dennis D. Zaebs
NIOSH-26	Health Hazard Evaluations (HHE) in the Construction Industry	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-9 Cincinnati, Ohio 45226 Phone: 513-841-4386 FAX: 513-841-4488	Aubrey Miller, M.D., MPH
NIOSH-27	Construction Trades Surveillance: Carpenters' Union	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226-1998 Phone: 513-841-4217 FAX: 513-841-4489	Cynthia F. Robinson, Ph.D.
NIOSH-28	Construction Trades Surveillance: Electrical Workers' Union	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226-1998 Phone: 513-841-4217 FAX: 513-841-4489	Cynthia F. Robinson, Ph.D.
NIOSH-29	Construction Trades Morbidity Prevalence	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226-1998 Phone: 513-841-4217 FAX: 513-841-4489	Cynthia F. Robinson, Ph.D.
NIOSH-30	Prevention Through Health Insurance of Construction Trades Workers	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226-1998 Phone: 513-841-4217 FAX: 513-841-4489	Cynthia F. Robinson, Ph.D.
NIOSH-31	Construction Trades Surveillance: Bricklayers Union	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226 Phone: 513-841-4209 FAX: 513-841-4489	Joyce Saig, Ph.D.
NIOSH-32	Construction Trades Surveillance: Sheet Metal Workers	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226 Phone: 513-841-4210 FAX: 513-841-4489	Toni Alterman, Ph.D.

Division	Title of Project	Institution, Address	Project Director
NIOSH-33	The Surveillance of Work-Related Diseases in the Construction Industry Using Workers' Compensation Data	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R-18 Cincinnati, OH 45226-1998 Phone: 513-841-4315 FAX: 513-841-4489	Carol A. Burnett, M.S.
NIOSH-34	Lead in Construction Program	NIOSH, DSHEFS 4676 Columbia Parkway, MS: R21 Cincinnati, OH 45213 Phone: 513-841-4353 FAX: 513-841-4489	Janie L. Gittleman, Ph.D.
DTMD NIOSH-35	Instructional Module on Construction Safety and Health	NIOSH, DTMD 4676 Columbia Parkway, MS: C-10 Cincinnati, Ohio 45226 Phone: 513-533-8241 FAX: 513-533-8560	John T. Talty
Cooperative Agreements CA-1	West Virginia Construction Safety and Health Program	West Virginia University 710 Knapp Hall Morgantown, WV 26506-6031 Phone: 304-293-4152 FAX: 304-293-3395	Paul Becker, M.S.
CA-2	Model Construction Safety and Health Program	Construction Safety Council of Illinois 4415 West Harrison Street, Suite 407 Hillside, IL 60510 Phone: 800-552-7744 or 708-449-0550 FAX: 708-449-0369	Thomas A. Broderick, M.S.
CA-3	Development of a Model Construction Safety and Health Program for the State of New York	State University of New York (SUNY) at Buffalo Department of Civil Engineering 228 Ketter Hall Buffalo, NY 14260 Phone: 716-645-5958/2214 FAX: 716-645-3733	Satish Mohan, Ph.D.
CA-4	Health and Safety Programs for Construction Work	Center to Protect Workers Rights (CPWR) 111 Massachusetts Avenue, NW Washington, DC 20001 Phone: 202-962-8490 FAX: 202-962-8499	Knut Ringen, Dr. PH
CA-5	Cumulative Trauma Disorders in Carpenters	Greater Cincinnati Occupational Health Center 10475 Reading Road, Suite 405 Cincinnati, OH 45241 Phone: 513-769-0561 FAX: 513-769-0766	Grace K. Lemasters, Ph.D.
CA-6	Connecticut Road Industry Surveillance Project (CRISP)	Yale University School of Medicine Occupational & Environmental Medicine Program 333 Cedar Street New Haven, CT 06510 Phone: 203-785-5885 FAX: 203-785-7391 CRISP/EEOH 150 Washington Street Hartford, CT 06106 Phone: 203-566-1454 FAX: 203-566-3048	Mark Cullen, M.D. and Kathleen F. Maurer, M.D., MPH
CA-7	Reducing Work-Related Musculoskeletal Disorders Among Carpenters or Related Construction Workers	Center to Protect Workers Rights (CPWR) 111 Massachusetts Avenue, NW Washington, DC 20001 Phone: 202-962-8490 FAX: 202-962-8499	Knut Ringen, Dr. PH

Division	Title of Project	Institution, Address	Project Director
CA-8	Reducing Work-Related Musculoskeletal Disorders Among Carpenters or Related Construction Workers	United Brotherhood of Carpenters Health & Safety Fund 101 Constitution Avenue, NW Washington, DC 20001 Phone: 202-546-6206 FAX: 202-546-7802	Richard Dwyre
Research Grants RG-1	Evaluation of Controls Protecting Lead Exposed Workers	Boston University School of Public Health 80 East Concord Street, T 3-C Boston, MA 02118 Phone: 617-638-4620 FAX: 617-638-4857	Lewis D. Pepper, M.D.
RG-2	Load Monitoring for Safe Construction	Department of Mechanical Engineering College of Engineering and Mathematics University of Vermont Votey Building, Room 201E Burlington, VT 05405-0156 Phone: 802-656-1922	Dryver R. Huston, Ph.D.
RG-3	Analysis of Construction Tasks for Overexertion Injuries	University of Michigan Department of Civil and Environmental Engineering 2352 G.G. Brown Lab Ann Arbor, MI 48109-2125 Phone: 313-764-8496 FAX: 313-764-4292	John G. Everett, Ph.D.
RG-4	Physiologic Sampler for Airborne Health Hazards	Department of Environmental Health, SC-34 University of Washington School of Public Health Seattle, WA 98195 Phone: 206-685-7243 FAX: 206-543-8123	Michael G. Yost, Ph.D.
RG-5	Development of a Construction Injury Predictive Model	Department of Building Construction College of Architecture & Urban Planning University of Washington 116 Architecture Hall, AL-15 Seattle, WA 98195 Phone: 206-685-1764 FAX: 206-685-1976	Kweku K. Bentil, Ph.D.
RG-6	Occupational Disease Among Carpenters	Community & Family Medicine School of Medicine Duke University Medical Center Box 2914 2200 West Main Street, Suite 700 Durham, NC 27710	John M. Dement, Ph.D., C.I.H.
RG-7	Elevated Blood Levels in the Iowa Construction Industry	The University of Iowa Department of Preventive Medicine and Environmental Health 100 Oakdale Campus - 136 AMRF Iowa City, IA 52240-5000 Phone: 319-335-4212 FAX: 319-335-4225	Stephen J. Reynolds, Ph.D., CIH
RG-8	Development of an Exposure Matrix for Construction Painters Based on Specific Work Tasks	Department of Environmental Health Occupational Health and Safety Section Colorado State University 110 Veterinary Science Building Fort Collins, CO 80523 Phone: 303-491-6151 FAX: 303-491-7778	Philip L. Bigelow, Ph.D., CIH

1. Division of Biomedical and Behavioral Science (DBBS)

(NIOSH-1)

Project Title: Hearing Conservation Programs (HCPs) for Underserved Worker Groups**Project Director:** John R. Franks, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Biomedical and Behavioral Science
4676 Columbia Parkway, MS: C-27
Cincinnati, Ohio, 45226
Phone: 513-533-8281 **FAX:** 513-533-8510

Personnel and Skills: One Ph.D. Audiologist, one Ph.D. Physical Scientist**Problems (diseases, injuries, hazards) Addressed:** Noise, noise-induced hearing loss, noise as a stressor, noise effects on productivity, noise effects on perceptions of warning signals.**Project Objective:** Determine key factors responsible for lack or ineffectiveness of HCPs for worker groups not receiving adequate protection from hearing loss, implement HCPs addressing those factors, evaluate program effectiveness, and establish model HCPs.**Executive Summary**

NIOSH estimates that many of the 30.5 million workers employed in construction and the trades are exposed to hazardous noise and are not covered by hearing conservation regulations. The very nature of the work, worker attitudes toward personal safety, and the work sites complicates hearing conservation programming. New methods for assessing noise, worker attitude, noise control methods, and hearing protectors will be amalgamated into a hearing conservation program for selected study populations at residential, commercial, and other types of construction work sites. Hearing conservation program implementation will be explored in many types of work environments in order to protect the hearing of those who must work in them, with the outcome being additional model hearing conservation programs.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Noise exposure characterization and job function characterization to identify unique and common exposure parameters.
2. *Research (etiology, methodology, control):* Develop new methods for collecting noise samples and for characterizing noise.
3. *Intervention (populations at risk, risk factors, control actions):* Implement specially designed HCPs, evaluate for effectiveness and observe outcome of controls implemented.

Evaluability Assessment

These outcomes will provide a basis to permit evaluation of the effectiveness of the implemented hearing conservation and noise control strategies.

(NIOSH-2)

Project Title: Job Assessment Protocol for Ergonomic Hazard Evaluations**Project Director:** Vern Putz-Anderson, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Biomedical and Behavioral Science
4676 Columbia Parkway, MS: C-24
Cincinnati, Ohio, 45226
Phone: 513-533-8291 **FAX:** 513-533-8510

Personnel and Skills: NIOSH, DBBS/DSHEFS: Ergonomist, Psychological Technician, Medical/Epidemiologist**Problems (diseases, injuries, hazards) Addressed:** Musculoskeletal disorders, back injuries, and ergonomic hazards.**Project Objective:** Prevent work-related musculoskeletal disorders among construction workers through the development of improved methods for identifying and assessing the presence of ergonomic hazards.**Executive Summary**

Proper hazard identification and assessment methods are needed to ensure the success of occupational health prevention programs. The construction industry, however, is unique in the variety and complexity of job hazards that pose a significant risk to the musculoskeletal systems of workers. Despite improvements in personal ergonomic monitoring equipment, few of these devices have proven sufficiently durable for construction workers. Video tape methods hold promise for exposure assessment in construction work, but until the advent of computerized image analyses, most analysis was done manually and required a high degree of technical skill. For this project, new hybrid video tape-computer image analysis systems will be adapted for use in a state-of-the-art hazard assessment protocol. Construction jobs that pose a risk to the upper extremity and trunk will be evaluated using the new technology and compared with traditional analysis methods. The application of the methods will be documented in a journal article and distributed for use to health and safety practitioners in the construction industry.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* In collaboration with the Greater Cincinnati Occupational Health Center and the local Carpenters' Union, project staff visited a series of construction sites to video-tape five work samples illustrating potential ergonomic hazards.
2. *Research (etiology, methodology, control):* This is a methods development project. To date, staff have evaluated existing hazard assessment methods to determine current technology for computer analysis of video imagery. Working with software producers, staff provided input on the specifications and needs for hazard assessment in the construction industry. A test trial was conducted in which the computerized-video system was compared with data generated from a dosimeter collected from a worker performing a series of preplanned movements. An analysis is being conducted to determine the accuracy of the computerized-video system to characterize repetitive movements and awkward postures, which serve as risk factors for musculoskeletal disorders.

3. *Intervention (populations at risk, risk factors, control actions):* The population at risk is construction workers with an emphasis on carpenters and general laborers. Primary ergonomic risk factors include forceful and repetitive motions involving awkward postures, often performed under adverse environmental conditions for durations that may exceed an 8-hr workday. The primary control action is the implementation of workplace modifications in the form of tools, workstations, and work methods which will reduce the magnitude of the exposure. This project provides a new computerized-video technology that can be used to evaluate the effects of workplace modifications in reducing the magnitude of the ergonomic hazards.

Evaluability Assessment

Initial results illustrate the feasibility of the technology and the need to train worksite investigators in the use of proper video recording techniques to capture ergonomic hazards that can be analyzed using this technology. Both written reports and video demonstrations of the technology should effectively serve to disseminate the findings and recommendations for assessing ergonomic hazards in the construction industry.

2. Division of Physical Sciences and Engineering (DPSE)

(NIOSH-3)**Project Title: Control of Health Hazards in the Construction Industry**

Project Director: R. Leroy Mickelsen

Institution, Address:

National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway, MS: R5
Cincinnati, Ohio 45226
Phone: 513-841-4221 **FAX:** 513-841-4506

Personnel and Skills: 2.2 FTE (FY-93), industrial hygiene, engineering, control design, project management, and technical assistance.

Problems (diseases, injuries, hazards) Addressed: Lead poisoning and silicosis.

Project Objective: Establish controls and good practices for renovation and maintenance of steel structures protected with lead-based paint.

Executive Summary

Six engineering control systems in current use to reduce worker exposure to lead and silica during non-residential lead-based paint removal were characterized. Breathing zone air sampling, inside the respirator air sampling, area air sampling, surface wipe sampling, and video monitoring techniques have been used. Most of the controls studied did not use silica as a component in the paint removal abrasive, thus, eliminating the silica hazard in those cases. For one control technique, abrasive blasting inside a ventilated containment, exposure to silica was greater than the OSHA Permissible Exposure Limit (PEL) even though the abrasive contained less than 1 percent silica. Three separate ventilated containment systems were evaluated during abrasive blasting, none of which resulted in lowering the lead concentration in the worker's breathing zone. Another technique in which water was mixed with abrasive to form a low-water slurry for abrasive blasting resulted in approximately a 10X reduction in the lead concentration in the worker's breathing zone. Results of lead paint removal using power tools have not been completed.

Prevention Activities

- 1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Abrasive blasters and painters have been recognized as worker populations at high risk to silicosis and lead poisoning. This study confirms this finding.
- 2. Research (etiology, methodology, control):* This study was conducted to evaluate existing controls and emerging controls. Existing engineering controls and practices evaluated in this study in and of themselves do not adequately control for hazards associated with lead-based paint removal processes.
- 3. Intervention (populations at risk, risk factors, control actions):* Finding and recommendations from this study will be disseminated through presentations and publications addressed to the industrial hygiene, painter, abrasive blaster, and steel structure facility owner communities.

Evaluability Assessment

The impact of the study results and recommendations on the reduction of silicosis and lead poisoning will be observed in the states health departments who are monitoring both silicosis and lead poisoning as part of the state based Sentinel Event Notification Systems for Occupational Risks (SENSOR) (or similar) program. The NIOSH evaluation of impact will be considered during the dissemination planning process which will start next year.

(NIOSH-4)

Project Title: Control of Hazardous Particulate Exposures During New Construction (Drywall Sanding and Roofing Kettles)**Project Director:** Kenneth R. Mead, M.S.**Institution, Address:**

National Institute For Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway, MS: R5
Cincinnati, Ohio 45226
Phone: 513-841-4221 **FAX:** 513-841-4506

Personnel and Skills: 1.5 FTE (FY 93), one industrial hygienist/mechanical engineer and one engineering technician.**Problems (diseases, injuries, hazards) Addressed:** Exposures to construction-related particulate that have potential for respiratory illness, irritation, and disease.**Project Objectives:** To research exposure data to workers performing new construction tasks (initially drywall, sanding, and asphalt roofing), test performance and applicability of existing engineering controls then design and field test new engineering controls as required.**Executive Summary**

NIOSH reportedly identified at least 77 toxic agents on construction sites. Additionally, NIOSH found elevated death rates as a result of cancer and other diseases among construction workers. Many, if not most, exposures to these agents occur through inhalation and historically, many of these exposures have gone undocumented. Recent efforts to quantify and document hazardous exposures related to new construction have led to the ongoing identification of suspect construction activities. This project intends to evaluate the application of engineering controls to reduce worker exposures during the identified suspect activities. The evaluation will include a review of existing engineering controls available "off-the-shelf" for both effectiveness and for ease of use by the professional contractor. Where the data indicates a need, engineering controls will be designed in the NIOSH laboratory and subsequently field tested.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Existing data will be analyzed to quantify extent of hazard. Additional sampling will be performed where insufficient field data is available.
2. *Research (etiology, methodology, control):* This project is part of a continuing response to the NIOSH initiative on hazardous exposures related to construction. As suspect construction activities are identified, engineering control optimization will be pursued in order to minimize exposures.
3. *Intervention (populations at risk, risk factors, control actions):* The data from this project will be directed towards reducing hazardous airborne particulate exposures to construction workers. Where effective and contractor-compatible commercial engineering controls are already available, information dissemination will be used to influence acceptance and use. When new engineering controls are required, successful engineering

control designs will be published.

Evaluability Assessment

Study results and control recommendations will impact the observed particulate exposures in the identified fields of new construction. Due to the synergistic effects between particulate exposures and various respiratory illnesses, impact may further occur in Upper Respiratory Infections (URI) monitoring programs.

(NIOSH-5)**Project Title: Field Methods for the Analysis of Airborne Particulate Lead**

Project Director: Kevin E. Ashley, Ph.D.

Institution, Address:

National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway, MS: R-7
Cincinnati, OH 45226
Phone: 513-841-4402 FAX: 513-841-4500

Personnel and Skills: NIOSH, DPSE, MRB: one analytical chemist

Problems (diseases, injuries, hazards) Addressed: Potential exposure to airborne lead-containing particulate.

Project Objective: This project will examine the use of chemical spot test kits, electroanalytical methods, and flow-injection analysis for the detection and determination of airborne particulate lead collected on filter media. If the method(s) prove to be useful for the analysis of airborne lead, other environmental matrices (e.g., paint, dust, and soil) may be tested.

Executive Summary

Spot test kits for lead have been evaluated on field (and some laboratory) samples. Preliminary results of these evaluations were presented at an EPA-sponsored workshop in Research Triangle Park, NC (January 1993) and the American Industrial Hygiene Conference in New Orleans (May 1993). These preliminary results have been published in an EPA report of the Test Kits Workshop (August 1993). Further data are required to complete the study; thus, many more samples are needed. Additional sample collection will take place during the fall of 1993.

A manuscript on the evaluation of wipe sampling materials for lead in surface dust has been accepted for publication in *American Industrial Hygiene Association Journal*. The results of this study were presented at the American Industrial Hygiene Conference and Exhibition in New Orleans (May 1993), and also at the annual meeting of the National Lead Abatement Council in Arlington, VA (July 1993).

A manuscript on the evaluation of cleaning methods in lead-contaminated buildings has been submitted for publication in *ASTM Special Technical Publications*. This paper is based on the results of a Health Hazard Evaluation report that was published recently. This study was presented at the ASTM Conference on Lead in Paint, Soil, and Dust in Boulder, CO (July 1993).

A manuscript on the applications of electroanalytical methods in occupational and environmental health has been accepted for publication in the journal *Electroanalysis*.

Prevention Activities

1. *Surveillance (problem, recognition, diagnostic criteria, reporting, linkage to response):* The monitoring methods being developed will be useful for workplace surveillance by industrial hygienists both within NIOSH and outside, and others after suitable training in the collection of workplace environment samples.

2. *Research (etiology, methodology, control)*: The methods are being developed to assess worker exposure to lead-containing aerosol, with emphasis being placed on the ability to perform accurate, precise analyses in the field.
3. *Intervention (populations at risk, risk factors, control actions)*: Workers who are involved in lead abatement and/or renovation of structures which are coated with leaded paint are at potential risk of lead exposure. Other groups are also at risk of lead exposure, e.g., law enforcement officers at firing ranges, workers performing battery recycling, etc. Accurate exposure data based on these monitoring method will help determine the need for controls, such as personal protective equipment.

Evaluability Assessment

Not addressed.

(NIOSH-6)

Project Title: Chemical Characterization of Roofing Asphalt Fume**Project Director:** R. Alan Lunsford, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway, MS: R-7
Cincinnati, OH 45226
Phone: 513-841-4241 **FAX:** 513-841-4500

Personnel and Skills: 0.2 FTE (FY-93), analytical chemistry**Problems (diseases, injuries, hazards) Addressed:** Potential for cancers in construction workers due to exposure to petroleum asphalt fumes.**Project Objective:** The ultimate goal of this effort is to contribute to the identification of specific chemical components in petroleum asphalt fume that may be potential carcinogens so that occupational exposure may be reduced or eliminated.**Executive Summary**

Previously, five petroleum asphalt fume fractions used in a mouse skin painting bioassay were chemically characterized by gas chromatography-mass spectrometry (GC-MS); the results of the chemical characterization were used to help interpret the results of a mouse skin painting bioassay. The current goal is to prepare a report on the chemical characterization for submission to the peer-reviewed literature.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Not applicable.
2. *Research (etiology, methodology, control):* The results of a mouse skin bioassay led the researchers to conclude that two of five petroleum asphalt fume fractions were associated with excess cancers and that no direct effect or cocarcinogenicity was observed for the other fractions, including the large, alkane-containing fraction. The chemical characterization tentatively identified more than 1000 compounds overall and about 500 in the active fractions. Together, the bioassay and the chemical characterization narrow the field of asphalt fume components that are potential carcinogens, setting the stage for more definitive studies (see *Asphalt Fume Fractionation and Identification of Genotoxic Components*; Larry Olsen, project director).
3. *Intervention (populations at risk, risk factors, control actions):* Not applicable.

Evaluability Assessment

The basic results of the chemical characterization have been included in the report of the bioassay work, which is available to the public. This results indicate that the petroleum asphalt fume studied was tumorigenic and that two of five fractions accounted for the observed tumorigenicity. Additional work needs to be done to identify specific causative agents in the fume.

(NIOSH-7)

Project Title: Asphalt Fume Fractionation and Identification of Genotoxic Components**Project Director:** Larry D. Olsen, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway, MS: R-7
Cincinnati, OH 45226
Phone: 513-841-4269 **FAX:** 513-841-4500

Personnel and Skills: 1 FTE (FY-93); analytical chemistry, chromatography, methods development, bioassay, and technical assistance.**Problems (diseases, injuries, hazards) Addressed:** Potential exposure to asphalt fume, a potential occupational carcinogen.**Project Objective:** To identify specific compounds or classes of compounds that may be associated with the observed carcinogenicity of the asphalt fumes used in previous NIOSH investigations.**Executive Summary**

A previous NIOSH investigation identified two fractions of asphalt fume that caused tumor formation; this was done by means of a mouse skin painting study. During the previous investigation some of each fraction was stored, I obtained these stored materials. The two fractions that caused tumor formation were profiled, and it was found that their chemical composition had not changed. Several short-term bioassays were used to investigate the genotoxic or mutagenic activity of these fractions; the Ames test identified the two fractions as mutagenic. These fractions will be fractionated, and the Ames test will be used to identify the mutagenic subfractions; this will continue until the individual compounds or classes of compounds that may be associated with the carcinogenic components in asphalt fume are identified.

Prevention Activities*1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):*

Primarily, this is a laboratory investigation to identify the specific compounds or classes of compounds that are potential carcinogens in asphalt fume. Once these compounds or classes of compounds are known, field samples will be collected and analyzed to determine if the identified potential carcinogens are present in fumes from materials currently used in paving and roofing operations. The information collected will be useful in the development of sampling and analytical methods to assess the exposure to potential carcinogens in asphalt fume.

2. Research (etiology, methodology, control): A bioassay-directed fractionation will be conducted with the remaining materials from an earlier NIOSH investigation. Liquid chromatography will be used to separate these fractions into chemical classes; then the Ames test will be used to identify the mutagenic subfractions. The mutagenic subfractions will be characterized to determine their chemical composition. If the fractions are too chemically

complex to identify individual compounds or classes of compounds, then these fractions will be separated by liquid chromatography based on size or shape of the compounds in each fraction. These fractions will be bioassayed with the Ames test, and the mutagenic subfractions will be characterized. This process will continue until the individual compounds or classes of compounds can be identified.

3. *Intervention (populations at risk, risk factors, control actions):* The information from this investigation can be the basis for the production of asphalts or the introduction of controls that will minimize the potential for carcinogenic emissions.

Evaluability Assessment

Since the causative agents are unknown, and the composition of asphalt fumes is likely to vary, depending on petroleum source, conditions of production, etc., it would be impossible to develop any measure of exposure other than one of a nonspecific bulk type. This project will lead to the identification of specific compounds or classes of compounds that may be associated with the observed carcinogenicity of asphalt fumes. This information will be made available to all interested parties, both in and outside NIOSH. This information will provide the basis for the development of exposure monitoring methods, and it may be used for the production of asphalts or introduction of controls that will minimize the potential for carcinogenic emissions.

3. Division of Respiratory Disease Studies (DRDS)

(NIOSH-8)**Project Title: Development of Bioassays: Identify Health Risks of Asbestos Substitutes**

Project Director: Vincent Castranova, Ph.D., David G. Frazer, Ph.D., and William Jones, Ph.D.

Institution Address:

National Institute for Occupational Safety and Health
Division of Respiratory Disease Studies
944 Chestnut Ridge Road, MS: 210
Morgantown, WV 26505-2888
Phone: 304-291-4591 **FAX:** 304-284-5467

Personnel and Skills: One Ph.D. level cell physiologist/toxicologist, one Ph.D. level engineer/respiratory physiologist, one Ph.D. level industrial hygienist/particle scientists, one MS level electron microscopist, one MS level biochemist, one BS level physical scientist.

Problems (diseases, injuries, hazards) Addressed: Develop *in vitro* assays to evaluate the potential cytotoxicity of man-made fibers that could replace asbestos in construction and industrial applications.

Project Objective: The first objective of this study was to investigate the role of fiber chemistry vs dimension in the cytotoxicity and/or the potential fibrogenicity of fibrous minerals. A second objective was to monitor the effects of exposure of lung cells to an asbestos substitute, such as fiberglass.

Executive Summary

Crocidolite and riebeckite samples have been analyzed by x-ray diffraction and microscopy for purity, particle size, and particle count. Crocidolite fibers were long and thin while riebeckite (a polymorph of identical chemistry) was characterized by rectangular shaped particles. Alveolar macrophages have been cultured for 3 days in the absence or presence of asbestos and membrane integrity, viability, and ability to produce a respiratory burst after exposure to zymosan particles were measured. Data indicate that crocidolite, on a weight/ml basis, was more cytotoxic than riebeckite. On an equivalent surface area basis, the cytotoxicities of these two minerals were similar. Lastly, on an equivalent particle count basis, riebeckite was more toxic than crocidolite *in vitro*.

Experiments have also been conducted comparing two fiberglass samples of different dimensions. Manville Code 100 was 3.4 μm long and 0.2 μm wide, while Owens Corning insulation was 98 μm long and 7.3 μm wide. Both had aspect ratios of approximately 16-17:1. The thin fibers (Manville Code 100) were far more cytotoxic than the thick fiberglass fibers on a weight/ml or an equivalent surface area basis.

The results suggest that determination of exposure dose in mass units may not always be the best means to estimate risk.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The importance of determining exposure in particle counts/ m^3 in addition to mg/m^3 for risk assessment is highlighted.

2. *Research (etiology, methodology, control):* *In vitro* assays for fiber toxicity have been developed.
3. *Intervention (populations at risk, risk factors, control actions):* Data were presented at the Inhaled Particles Conference and is in press in the conference proceedings.

Evaluability Assessment

This project highlights the importance of equivalent surface area in additional chemistry in the expression of the relative cytotoxicity of particles. These concepts can be useful when evaluating the potential toxicity of man-made asbestos substitutes.

(NIOSH-9)

Project Title: Hazard Surveillance in the Construction Industry**Project Director:** Alwin A. Dieffenbach, M.S.**Institution Address:**

National Institute for Occupational Safety and Health
Division of Respiratory Disease Studies
944 Chestnut Ridge Road, MS: 126
Morgantown, WV 26505-2888
Phone: 304-291-4474 **FAX:** 304-284-54674

Personnel and Skills: NIOSH, DRDS, CIB, RDHETA: part-time effort of one industrial hygienist and one occupational health nurse.**Problems (diseases, injuries, hazards) Addressed:** Occupational respiratory disease resulting from exposure to toxic dusts including crystalline silica and asbestos.**Project Objective:** On a case-by-case basis determine occupational respiratory health hazards, illnesses, and exposures in the construction industry.**Executive Summary**

This project responds to requests for health hazard evaluations or technical assistance in the construction industry to investigate cases of occupational respiratory disease. Exposures are measured, medical records are reviewed, and recommendations are provided to control exposures and reduce or eliminate disease. Findings are summarized and disseminated as widely as possible.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Information is being collected to help recognize exposed worker populations and potential health risks.
2. *Research (etiology, methodology, control):* Information on effective controls will be disseminated through health hazard evaluation reports.
3. *Intervention (populations at risk, risk factors, control actions):* Workers will be notified of their exposures and individual medical results while companies and labor representatives will receive summary findings and recommended control techniques.

Evaluability Assessment

RDHETA conducted pulmonary function screening and administered a questionnaire to 747 participants at a national convention of carpenters. A total of 135 participants (18%) had abnormal spirometric patterns. RDHETA has several active investigations relating to construction including sandblasting of tanks and oil field equipment, plasma arc welding and cutting, shipyard repair work, and power plant construction.

(NIOSH-10)

Project Title: Silicosis Risk in the Construction Industry**Project Director:** Kenneth Linch, M.S.**Institution Address:**

National Institute for Occupational Safety and Health
Division of Respiratory Disease Studies
944 Chestnut Ridge Road, MS: 121
Morgantown, WV 26505-2888
Phone: 304-291-4496 **FAX:** 304-284-5467

Personnel and Skills: 1.8 FTE (FY93), Industrial Hygiene, Engineering, Epidemiology**Problems (diseases, injuries, hazards) Addressed:** Silicosis

Project Objective: The overall objective of this project is to advance the recognition of silica dust exposures during construction activities and to remind those in the construction industry that silica has not gone away and that workers are still developing silicosis and dying. Specifically the objectives are:

1. Identify industries and specific occupations in which an overexposure to respirable silica dust is likely.
2. Document respirable silica exposure levels in as many construction occupations and settings during which silica exposure is suspected to occur.
3. Disseminate the findings from this work to employees and employers in a manner that is understandable and instructive.

Executive Summary

Silica exposure surveillance for the construction industry is a formidable task because the construction industry is large and varied. In addition, the typical construction site provides an occupational environment which is constantly changing. Many construction trades often work in close proximity to one another thereby exposing each other. The physical environment changes as the work progresses and may be different from day to day, for example during the construction of a high-rise office building. The U.S. Bureau of Labor Statistics ES-202 system estimates that there were an average of 4.6 million construction workers in the United States during 1991. NIOSH, based on the National Occupational Exposure Survey (NOES), has estimated that approximately 700,000 construction workers are potentially exposed to silica dust. NIOSH (DSHEFS), in a review of death certificate data for primary cause of death for 72,000 construction workers in 19 states between 1984 and 1986, found the proportionate mortality ratio (PMR) for silicosis, with a p value of 0.01, to be 327, second only to that for asbestosis. The Occupational Safety and Health Administration (OSHA) Integrated Management Information System (IMIS) data indicates the following construction occupations may be exposed to high levels of silica: painters (associated with abrasive blasting); bridge, tunnel, and highway workers; and masonry workers. To date DRDS has surveyed 9 construction operations and have found that some construction workers may be exposed to short-term respirable silica levels in excess of 200 times the NIOSH Recommended Exposure Level (REL).

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* A major hurdle in the prevention of silicosis is education. Many workers who are exposed to silica in the construction industry do not recognize the danger of silicosis. Some workers may have the added burden of illiteracy or a language barrier. Others, even managers of construction firms may just not know of the hazard. Therefore knowledge of the hazard of respirable silica dust is the first step in prevention of silicosis. Identification of specific occupations and settings during which silica exposures occur through surveillance is very important. Unfortunately the OSHA Computerized Information System (OCIS) and the OSHA Integrated Management Information System (IMIS) are imperfect environmental surveillance tools due to inherent biases.
2. *Research (etiology, methodology, control):* In the publication *Proposed National Strategies for the Prevention of Leading Work-Related Diseases and Injuries*, NIOSH suggested that occupational lung diseases are the leading form of work-related illnesses and injuries. This was based on the frequency of occurrence of lung disease, the severity of the illness in the affected individuals, and the amenability of the problem to prevention. Considering the large number of potentially exposed workers this project addresses and the lack of data on these workers, this project is invaluable to the construction industry and the country. Though air sampling, data collection, information dissemination and cooperation within NIOSH and with labor, industry and other government agencies, major strides in the prevention of silicosis among construction workers can be accomplished.
3. *Intervention (populations at risk, risk factors, control actions):* The current OSHA construction regulation (CFR, Title 29, Part 1926.55) for respirable silica exposure is obsolete because it is based on the 1970 Threshold Limit Value (TLV), which relies on particle counting which is no longer done in this country. Updating the construction regulations and improved enforcement is needed.

Evaluability Assessment

Not addressed.

(NIOSH-11)

Project Title: Assessment of Substitute Materials for Silica Sand in Abrasive Blasting**Project Director:** Mark F. Greskevitch**Institution Address:**

National Institute for Occupational Safety and Health
Division of Respiratory Disease Studies
944 Chestnut Ridge Road, MS: 121
Morgantown, WV 26505-2888
Phone: 304-291-4496 **FAX:** 304-284-5467

Personnel and Skills: One industrial hygienist**Problems (diseases, injuries, hazards) Addressed:** Silicosis**Project Objective:**

To build a body of data regarding silica-substitute abrasive blasting agents, so as to persuade others to reduce/eliminate the use of silica in abrasive blasting.

Executive Summary

This project is designed to: (a) highlight the unnecessary continuing use of silica sand as an abrasive blasting agent, (b) inform others of the dangers of silica blasting and the existence of feasible substitutes, and (c) reduce the use of silica so as to reduce the incidence of silicosis among newly-exposed abrasive blasters. During FY93 the project contacted industry experts and obtained journal articles, technical literature, and sales data pertinent to silica substitutes. Findings were described in a national conference of industrial hygienists. Bulk samples of silica substitutes were obtained and analyzed for health-related constituents. FY94 work will focus on planning for a FY95 workshop and identifying other strategies for disseminating concerns regarding silica in abrasive blasting. FY95 will culminate in production of a workshop regarding abrasive blasting and proceedings from the workshop. The proceedings and other output from the project will aid NIOSH in forming policy for a formal ban or limitation on the use of silica in abrasive blasting.

Prevention Activities**1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):**

Information was gathered which estimates that over 100,000 sandblasters are at risk of developing silicosis and that abrasive blasters are exposed to silica dust for up to 60 million person-hours each year. This information has highlighted the unnecessary continuing use of silica sand as an abrasive blasting agent.

2. Research (etiology, methodology, control): This study was conducted to assess substitute materials for silica sand in abrasive blasting.**3. Intervention (populations at risk, risk factors, control actions):** Information pertinent to silica substitutes in abrasive blasting was gathered from industry experts and journal articles. These findings were presented at the American Industrial Hygiene Conference & Exposition. Further results will be presented at the Second International Symposium on Silica, Silicosis & Cancer and the 1994 National Steel Construction Conference. We

will also conduct a workshop to gather recommendations from experts in the abrasive blasting field and disseminate these findings in print.

Evaluability Assessment

Information gathered regarding silica-substitute abrasive blasting agents should effectively help to persuade others to reduce/eliminate the use of silica in abrasive blasting and thereby reduce silicosis in abrasive blasting. This information should also help in making recommendations to industry, labor, and other agencies regarding a ban or strict limitations on silica use in abrasive blasting.

4. Division of Safety Research (DSR)

(NIOSH-12)

Project Title: Ergonomic Evaluation of Carpenter Tasks: Erection and Dismantling of Frame Scaffolds**Project Director:** Hongwei Hsiao, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Safety Research
944 Chestnut Ridge Road, MS: 119
Morgantown, WV 26554
Phone: 304-284-5806 **FAX:** 304-284-5877

Personnel and Skills: 2 FTE, ergonomics, engineering controls.**Problems (disease, injuries, hazards) Addressed:** musculoskeletal disorders, severe occupational traumatic injuries.**Project Objective:** This project will evaluate carpenters' tasks during erection and dismantling of frame scaffolds to identify activities with high risk of fall and/or overexertion injuries, and assess work methods as risk reduction techniques.**Executive Summary**

A field study to identify high risk activities and associated hazards during the tasks has been initiated. Twelve construction sites (approximately 30 subjects) have been visited to observe and videotape worker tasks. Video analyses will be performed to analyze work methods, tool operations, and posture patterns during each task/job cycle. Computer and/or laboratory simulations will be followed to evaluate existing work techniques. The recommendations for ergonomic redesign/research of work techniques (methods/devices) will be developed.

Prevention Activities

1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):

Information has been collected to classify work steps and work methods of scaffolding tasks, which will help recognize potential musculoskeletal injury risks of scaffolders

2. Research (etiology, methodology, control): In the first phase of the project, biomechanically stressful activities were identified through field evaluation. Computer simulations will be followed to quantify the exposure of biomechanical stresses of different work techniques. In the follow-on laboratory study, more parameters will be examined to evaluate selected work techniques. These parameters are workers' response time to overcome expected and unexpected events, posture patterns, muscle activities, and discomfort rating etc. Ergonomic redesign of work techniques (methods/devices) will be developed.

3. Intervention (populations at risk, risk factors, control actions): Carpenters have been identified as one of top research targets due to high injury frequency and injury rate. Erection and dismantling of frame scaffolds tasks are listed by the national contractors association as two of the top six high risk carpenter tasks. The study results will directly benefit scaffolders in reducing fall and overexertion injuries.

Evaluability Assessment

Preliminary video analyses indicated that removing end frames, removing decks, removing scaffold ties, carrying scaffold parts, erecting end frames, and installing decks are some of the most stressful/risky activities. Work technique evaluation and redesign is incorporated into the project plan. It is anticipated that when the study is completed, NIOSH will make the data available to all interested parties. The study results will directly benefit scaffolders in reducing fall and overexertion injuries.

(NIOSH-13)

Project Title: Evaluation of Heat Stress in Hazardous Waste Abatement Workers**Project Director:** Jean-Louis B  lard, M.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Safety Research
944 Chesnut Ridge Road, MS: 119
Morgantown, WV 26505-2888
Phone: 304-284-5812 **FAX:** 304-284-5877

Personnel and Skills: 1.3 FTE (FY 93), physiologist, statistician, safety engineer, project management.**Problems (diseases, injuries, hazards) Addressed:** Severe Occupational Traumatic Injuries, Heat Stress.**Project Objective:** The objective of this project is to assess the heat stress experienced by the construction trades workers performing hazardous waste abatement work. The unique features of this occupation include not only a high level of energy expenditure, often in hot environments, but also the mandatory use of fully encapsulating protective clothing.**Executive Summary**

This project has been designed to measure the time it takes to raise the body core temperature of 30 waste abatement workers by 1  C when performing two different levels of work. These tests will take place in a controlled environment and workers will wear a fully encapsulating chemical protective suit. Core temperature, skin temperatures (in four locations), and heart rate will be continuously monitored during the tests and during the resting period until these parameters return to resting value. This research will help design work/rest cycles for waste abatement specialists working in complete chemical protection.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):*

This project does not have a specific surveillance component.

2. *Research (Etiology, Methodology, Control):* By obtaining figures on the time it takes to reach a threshold temperature and return to a normal at rest value, it will be possible to define a work/rest cycle for two different workloads (moderate and heavy) in a given environment. This is the first phase of a project that must be complemented in follow-on phases to evaluate 1  C rise in core body temperature in different temperature settings, assess the consequences of cumulative heat stress in the modification of work/rest cycles, and design and evaluate of state-of-the-art engineering controls for preventing heat stress.

3. *Intervention (Populations at risk, Control Actions):* Data obtained through this research will benefit more than 150,000 waste abatement workers. The design of scientific work/rest cycles tables will allow these workers to more safely perform work in hot environments.

Evaluability Assessment

To date, no information is available for dissemination from this pilot study. It is anticipated that upon completion of the different phases, NIOSH will make the reports on the research findings and statistical analyses available to members of the construction trades, owners, and employers involved in waste abatement work. Unions have already indicated their strong support for this evaluation. The impact of the dissemination of these results on this specific population will be measured by the decrease of heat-related illnesses on the job site.

(NIOSH-14)

Project Title: State Model Construction Safety and Health Program**Project Director:** Ronald L. Stanevich**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Safety Research
944 Chestnut Ridge Road, MS: 1174
Morgantown, West Virginia 26554
Phone: 304-284-5805 **FAX:** 304-284-5877

Personnel and Skills: 1.0 FTE (FY-93), Safety Engineer, Epidemiologist, Project Management, and Technical Assistance from DSR

Problems (diseases, injuries, hazards) Addressed: Severe Occupational Traumatic Injuries, Musculoskeletal Injuries

Project Objective: This project, which began in FY90, launched a cooperative agreement program for establishing state-based model construction safety and health programs. Program objectives and activities were developed to support several of the PHS *Healthy People 2000*, as CDC, and NIOSH objectives: namely, reduce construction fatalities and injuries, increase safety and health awareness among workers and employers, influence the existence of safe and healthful construction worksites, and implement state-based occupational safety and health programs. The goal of these programs is to reduce the toll of occupational injuries and illnesses among construction workers in each state. The objective of the State Model Construction Safety and Health Program is to reduce the toll of occupational injuries and illnesses within the participating states' construction industry. The objective is to be accomplished by identifying the leading work-related diseases and injuries, assisting in the application of controls at work sites, promoting and providing safety and health training, promoting safety and health program management techniques, and establishing a construction safety and health association within the state to continue the effort of preventing injuries and illnesses.

Executive Summary

The U. S. construction industry, even though a big business, is basically a small employer industry. The majority of construction industry employers (81%) employ less than 8 employees while 96% employ 50 or less. Many of these employers do not perceive construction as a hazardous industry, because as individual units they rarely experience a lost-time injury much less a fatality. Therefore, they do not place emphasis on managing company specific safety and health programs, which involve such activities such as worker training, developing job hazard analyses, developing written company safety and health policies and programs, or hiring safety and health consultants. Three model construction safety and health programs are currently funded; West Virginia University Research Corporation (WVURC), Chicagoland Construction Safety Council (CCSC) and The Research Foundation of State University of New York (SUNY) at Buffalo. West Virginia was funded in FY90 while funding for Chicagoland and SUNY was delayed until July of FY91. Therefore, these state-based programs are at different phases of implementing the objectives and activities of the cooperative agreement.

Even though these programs are in different phases, they are all involved with: (a) working closely with their respective state agencies to obtain injury/illness data and employer data, (b) promoting the program throughout each state's construction industry through contacts with

owner, employer, and employee organizations, (c) developing and beginning to conduct employee and employer training programs related to hazardous work operations, (d) assisting employers with development of written safety and health programs, (e) providing safety and health consultative assistance to employers and workers, (f) organizing committees of concerned industry constituents to assist with the direction and implementation of their proposed program, (g) compiling a list of construction employers doing business in the state, (h) publishing and disseminating periodic construction safety and health newsletters, and (i) cooperating with various national construction labor organizations to determine if areas of collaboration exist between national and state safety and health issues.

Prevention Activities

1. Surveillance (Problem Recognition, Diagnostic Criteria, Reporting, Linkage to Response):

The model programs primarily focus on injury surveillance conducted by the state worker's compensation programs. The main goal of the surveillance effort is to identify the prevalent injuries and illnesses that have occurred in the state's construction industry. This data is being used to guide the safety and health training offered through the state programs as well as promotion efforts to increase hazard awareness among employers and employees.

2. Research (Etiology, Methodology, Control): The concept of the model programs envisioned that these programs would be used by NIOSH researchers, from all Divisions, to conduct specific studies related to the construction industry. However, minimal safety and health research has evolved from this cooperative effort. Currently, one DSR research project involves collaboration with the West Virginia program. This project is CAN 825 "Quantification of Risk Factors for Falls from Buildings Under Construction." A new project entitled "Case Control Study of Risk Factors for Falls among West Virginia Construction Workers" is proposed to start in FY94.

3. Intervention (Populations at risk, risk factors, Control Actions): All three state programs have placed an emphasis on worker and management safety and health training. The Construction Safety Council of Illinois provided training to more than 5,000 construction workers. Training courses covered topics such as first aid and CPR, excavation safety, fire and safety inspection, emergency planning, flagger safety, OSHA inspection program, OSHA 10-Hour construction safety course for workers, OSHA 30-Hour construction course for managers, and the OSHA 500 Train-the-Trainer construction safety course. Additionally, the Illinois program has sponsored two annual conferences on construction safety and health. Attendance at these conferences has grown from less than 500 persons in 1992 to well over 700 in 1993. Persons from 25 different states attended the 1993 conference.

The West Virginia Construction Safety and Health Program trained more than 500 construction workers in various topics of construction safety and health. Training includes topics such as excavation safety for competent persons, fall protection, safety compliance, highway work zone safety, hazard communication, right-to-know, welding hazards and general health hazards of construction work. The West Virginia program sponsored their first Construction safety and health conference in 1993. More than 200 construction constituents attended.

The Construction Safety and Health Institute of New York began to offer construction safety and health courses. During the last quarter of the year, they trained nearly 100 construction workers. Subjects included lead-based paint abatement, excavation and trenching safety, and ergonomic applications for safe construction. Numerous courses are scheduled for the coming year.

Evaluability Assessment

Since the initiation of the program, evidence exists that: (a) individual state construction-related occupational fatality and injury surveillance activities have increased, (b) the industry's awareness of the occupational safety and health hazards related to construction are on the rise in the states, and (c) the need for collaborative efforts by all industry constituents is required and that this collaboration is being fostered within the states.

(NIOSH-15)

Project Title: Case-Control Study of Risk Factors for Falls In West Virginia Construction Workers**Project Director:** Gwendolyn H. Cattledge**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Safety Research
944 Chestnut Ridge Road, MS: 1133
Morgantown, WV 26505
Phone: 304-284-5830 **FAX:** 304-284-5877

Personnel and Skills: 0.9 FTE (FY94-95), epidemiology, biostatistics, engineering, project management, and technical assistance.**Problems (diseases, injuries, hazards) Addressed:** Severe Occupational Traumatic Injuries, Falls from Elevated Work Surfaces.**Project Objectives:** The objective of this study is to identify and quantify risk factors associated with falls from buildings or structures in the construction industry.**Executive Summary**

The primary objective of this project is to determine risk factors associated with falls from buildings or structures in the construction industry. Risk factors under investigation will include work-related and personal issues. This effort will allow us to start focusing on creating a safe and healthy work environment for construction workers. Based on the findings of this study, intervention methods will be identified and evaluated. The protocol for this project is scheduled to be submitted to the Office of Management and Budget by May 1994.

Prevention Activities

1. *Surveillance (Problem Recognition, Diagnostic Criteria, Reporting, Linkage to Response):* Information will be collected on all workers' compensable fall injuries in the high risk counties of the West Virginia construction industry.

2. *Research (etiology, methodology, control):* This case-control study will address both personal and work-related risk factors for fall injury from an elevated work surface. Although the importance of wearing fall protection devices has been recognized, other contributing factors such as fatigue, occupational stressors, life stressors, daily commuting distance, job experience, job training and/or education, age, weather conditions, surface conditions, behavioral factors, medical problems, social habits, and company safety and health programs will be investigated via personal interview. Cases will be selected from the West Virginia workers' compensation records and controls will be selected from company records.

3. *Intervention (populations at risk, risk factors, control actions):* The data from this study will identify and quantify the risk factors needed to assist in the development and implementation of injury prevention strategies.

Evaluability Assessment

It is anticipated that at the completion of this study, NIOSH will make the results available to all interested parties. The main recipients of these results will be safety and health professionals working in the area of construction safety and health, unions, and trade associations.

5. Division of Standards Development and Technology Transfer (DSDTT)

(NIOSH-16)

Project Title: Library Construction References**Project Director:** Colleen M. Herrington, M.S. in L.S.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer
4676 Columbia Parkway, MS: Library C-21
Cincinnati, OH 45226
Phone: 513-533-8321 **FAX:** 513-533-8382

Personnel and Skills: Four professional librarians who are proficient in library collection development techniques.**Problems (diseases, injuries, hazards) Addressed:** Any type of occupational disease, injury, or hazard associated with construction work.**Project Objective:** The objective of this project is to acquire library collection materials that support construction-related research. These materials include journals, reference sources, monographs, and other research materials.**Executive Summary**

The three NIOSH libraries located at the Taft, Hamilton, and Morgantown facilities work cooperatively to develop a list reference materials that support construction projects conducted throughout the Institute. The library staff develops this list by consulting with researchers working on construction projects to determine their information requirements, and by consulting standard acquisition sources such as *Books in Print*, publisher's catalogs, and specialized bibliographies in the field of construction.

Prevention Activities

The construction reference materials placed in the library collection support prevention activities related to Institute construction projects.

Evaluability Assessment

The dissemination of construction information obtained from library reference materials will be achieved through reports and publications issued by NIOSH staff working on construction projects.

(NIOSH-17)

Project Title: Construction Health and Safety Dissemination**Project Director:** Charlene B. Maloney**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer
4676 Columbia Parkway, MS: C-20
Cincinnati, OH 45226
Phone: 513-533-8380 **FAX:** 513-533-8588

Personnel and Skills: Publication Management Specialist and Administrative Assistant.**Problems (diseases, injuries, hazards) Addressed:** Any type of occupational disease, injury, or hazard associated with construction work.**Project Objective:** The objective of this project is to provide an effective means for disseminating information to the construction industry through a comprehensive NIOSH outreach program.**Executive Summary**

The NIOSH Exhibit Program provides a forum for the dissemination of NIOSH research results and policy determinations. It targets professional associations and groups who have the capability to further distribute NIOSH materials, thus widening our distribution effort. This project identifies appropriate construction industry professional meeting and conferences and provides for the NIOSH Exhibit Program to be in attendance. NIOSH construction-related and other relevant materials are distributed.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The NIOSH Exhibit Program offers a chance for dialogue and opportunities to "listen" to construction worker safety and health concerns. New contacts are established as secondary disseminators.
2. *Research (etiology, methodology, control):* This project does not have a research component.
3. *Intervention (populations at risk, risk factors, control actions):* Continue to educate and provide training materials to those at risk by selectively identifying the appropriate target groups.

Evaluability Assessment

NIOSH outreach will continue to target audiences to increase awareness and improve knowledge. Redistribution of NIOSH information will be encouraged.

(NIOSH-18)

Project Title: Technical Inquiries - Construction**Project Director:** Rodger L. Tatken**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer
4676 Columbia Parkway, MS: C-19
Cincinnati, OH 45226
Phone: 513-533-8328 **FAX:** 513-533-8588

Personnel and Skills: This activity is staffed by four Technical Information Specialists and one clerical position who are knowledgeable in construction safety and health.

Problems (diseases, injuries, hazards) Addressed: Any type of occupational disease, injury, or hazard associated with construction work.

Project Objective: The objective of this project is to provide technical information support to the occupational safety and health community regarding construction safety and health issues.

Executive Summary

This project improves the delivery of construction safety and health information to researchers, employers and employees by publicizing the availability of the information through the NIOSH 800-number and disseminating the information as requested.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* This project has no surveillance component.
2. *Research (etiology, methodology, control):* This project has no research component.
3. *Intervention (populations at risk, risk factors, control actions):* Callers to the 800-information service are provided with materials which, when used, can assist the caller in making positive improvements in their work situation.

Evaluability Assessment

Assessments of the 800-number service have indicated that callers are satisfied with the information received.

6. Division of Surveillance, Hazard Evaluation and Field Studies (DSHEFS)

(NIOSH-19)

Project Title: Take-Home Lead in the Construction Industry**Project Director:** Elizabeth A. Whelan, Ph.D.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
4676 Columbia Parkway, MS: R-15
Cincinnati, OH 45226
Phone: 513-841-4411 **FAX:** 513-841-4486

Personnel and Skills: 1.5 FTE (FY 93), epidemiology, industrial hygiene, public health advisors.**Problems (diseases, injuries, hazards) Addressed:** Potential exposure to lead taken home by construction industry workers from the worksite.**Project Objectives:** Characterize the extent of lead exposure in the construction industry and the potential for, and extent of, lead taken home from the worksite.**Executive Summary**

A local of the International Brotherhood of Painters and Allied Trades of America (IBPATA) requested that NIOSH conduct a health hazard evaluation of lead exposure during renovation of bridges in and around Connecticut. Because the construction industry is currently exempt from the OSHA lead standard, the levels of lead to which bridge workers are exposed may be dangerously high. However, few studies have examined the influence that current construction work practices have on the extent of lead taken home from the workplace. Because of the short-term and transient nature of many construction job sites, proper hygiene programs may not be available to minimize the potential for workers to inadvertently take lead home on their clothing.

This study will characterize the potential for, and extent of, take-home lead exposure in the children of bridge workers. The primary objective of this study is to evaluate the extent of lead taken home from the workplace. Eligible bridge workers will be identified through union records. Households of workers with children between the ages of 9 months and 6 years will be compared to an equal number of neighborhood control households with children of the same age range. Eligible control households will be those in which none of the family members work in a lead industry. A quantitative assessment of lead contamination in each home will be made by obtaining vacuum and wipe samples of various surfaces inside and outside the home, and by obtaining lead levels in drinking water, interior paint, and soil outside the home. Venous blood samples for blood lead will be collected from the worker and from all children over 9 months of age in the exposed and unexposed households. Each household will be reimbursed \$50.00 for their time and inconvenience.

The primary hypothesis to be tested is whether children of bridge workers have significantly higher blood lead levels than neighborhood children of the same age whose parents are not employed in a lead-related industry. A secondary hypothesis concerns to what degree workplace hygiene practices (e.g., use of showers, changing facilities) influence the extent of lead taken home from the worksite.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The

study is a response to a union request to evaluate the potential problem of take-home lead exposure, and ongoing local worker lead surveillance programs have been consulted in aspects of project design.

2. *Research (etiology, methodology, control)*: This study will evaluate the extent of lead taken home from the worksite by bridge workers.

3. *Intervention (populations at risk, risk factors, control actions)*: The investigators will provide to each participating household member and, upon request, their physician, the results of their blood lead analyses. Interpretation of children's blood lead levels and recommendations for follow-up activities will be based in general on current guidelines published by the Centers for Disease Control and Prevention (CDC 1991). For individuals with blood lead levels over 10 $\mu\text{g}/\text{dl}$, results will be reviewed by a physician with appropriate training to draft a letter informing the individual (or parent/guardian) of the health significance of the results and the follow-up recommended. If the test results require immediate follow-up, the physician will telephone the individual (or parent/guardian) and inform him or her by telephone. A Fact Sheet describing the health effects of lead exposure will also be included with the notification letter.

The notification letter to the head(s) of household will also include a summary of the sampling results for each housing unit surveyed. These data will provide information about the amount of lead found in samples of dust, paint, water, and soil taken in or around the home. A lead safety brochure will also be included with this letter.

Each household will be sent a summary of the final report, which will include the results of grouped data analyses. A final report will also be sent to the union and to the appropriate government agencies as specified in Title 42 CFR Part 85a. Each bridge worker will also be sent a copy of NIOSH publications concerning lead in construction, including the NIOSH Alert "Request for Assistance in Preventing Lead Poisoning in Construction Workers" (NIOSH 1991).

Evaluability Assessment

The proposed study is the first comprehensive examination of the extent of take-home lead exposure in the construction industry. Previous studies have examined the association between work in other lead industries and blood lead levels in children of workers, but many are limited by the method of blood collection or by lack of a comparison population. This study will examine the extent of take-home lead exposure using rigorous environmental and biological sampling and a neighborhood control group to account for background lead exposures. A finding of elevated blood levels in children of workers compared to controls would provide further evidence for the need to protect construction workers from lead exposure.

(NIOSH-20)

Project Title: Construction Union Study of Painters**Project Director:** Robert J. Roscoe**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
4676 Columbia Parkway, MS: R-15
Cincinnati, OH 45226
Phone: 513-841-4411 **FAX:** 513-841-4486

Personnel and Skills: 1.5 FTE (FY 93), epidemiology, clerical support, technical assistance.**Problems (diseases, injuries, hazards) Addressed:** Hodgkin's disease, other cancers and chronic diseases, solvents and other exposures associated with construction painting.**Project Objective:** Estimate the incidence and mortality risks for Hodgkin's disease and other cancers among construction painters.**Executive Summary**

From 1976 to 1982 a mortality, medical, and industrial hygiene study of painters was performed by Dr. Genevieve Matanoski and others at the Johns Hopkins University School of Hygiene and Public Health and was funded through an Interagency agreement between NIOSH and the National Cancer Institute. The Matanoski study assembled a cohort of 57,175 painters from the states of California, Missouri, Texas and New York and followed their mortality from 1975 through 1979. The results of the Matanoski study suggested that some painters experienced an elevated risk of mortality from lung cancer, from lymphatic malignancies, and from several other cancer sites. In 1989, the International Agency for Research on Cancer stated that the overall exposure as a painter is carcinogenic to humans. Chief among the safety and health interests expressed by the International Brotherhood of Painters and Allied Trades is the risk for Hodgkin's disease among painters. The current study includes: (1) a standardized incidence ratio study for Hodgkin's disease and other cancers for painters who worked in the state of New York, and who were covered by the New York State Cancer Registry, and (2) a standardized mortality ratio analysis as an evaluation of noncancer causes of death, and a check on migration and incomplete cancer registry coverage. Elements of the Matanoski cohort study which will be re-used include the extensive work done to classify exposures by membership in specific local unions, the basic criteria for inclusion in the cohort, and the members of the Matanoski cohort from New York. Cancer incidence and mortality will be followed up from 1975 through 1991 among painters from New York.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):*

Information will be collected which will help recognize exposed worker populations and potential health risks.

2. *Research (etiology, methodology, control):* This study will test for possible associations between solvent and other exposures inherent in construction painting and the incidence and mortality risks for Hodgkin's disease and other cancers.

3. *Intervention (populations at risk, risk factors, control actions):* Results from this study will be

considered in assessing the adequacy of current regulations governing exposures for construction painters.

Evaluability Assessment

Results from the current study are not yet available for dissemination. Data collection is underway.

(NIOSH-21)

Project Title: Proportional Mortality Ratio Study of the International Association of Bridge, Structural and Ornamental Ironworkers (IABSOI)**Project Director:** Frank Stern**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
4676 Columbia Parkway, MS: R-13
Cincinnati, Ohio 45226
Phone: 513-841-4519 **FAX:** 513-841-4486

Personnel and Skills: 0.5 FTE (FY 94), epidemiology**Problems (diseases, injuries, hazards) Addressed:** The main health and safety issues among members of the IABSOI include lead poisoning from lead exposure, toxic fumes from metal and welding operations and injuries due to falls.**Project Objective:** The objective of proportional mortality ratio (PMR) analyses of the IABSOI workers is to examine the general proportional mortality of approximately 15,000 members of the IABSOI for the period 1984-1991, adjusting for age, sex, race and calendar-time using the United States proportional mortality as a comparison group. This will give an overview of cause-specific mortality and provide information for generating hypotheses. Additional analyses will be done to examine the relationship between the PMR and the duration of union membership and the time since first becoming a member of IABSOI. If increased mortality is observed for particular causes, additional studies and/or prevention activities may be designed.**Executive Summary**

Lead exposure, which is one of the greatest health hazards among IABSOI workers, results from cutting through lead-painted metal with an oxyacetylene torch. The vaporization of the red lead oxide (Pb_3O_4) (red lead is used as a weather-resistant coating for metals) leads to the production of lead fume that, when inhaled, results in acute or sub-acute lead poisoning. Common symptoms of acute lead poisoning include loss of appetite, nausea, vomiting, stomach cramps, constipation, headache, anemia, damage to the central nervous system and in severe cases, death. Members in the construction industry, however, are exempt from the Occupational Safety and Health Administration (OSHA) lead standard. The OSHA construction standard specifies a permissible exposure level (PEL) of 200 $\mu g/m^3$ of air, four times that specified in the OSHA lead standard. Furthermore, unlike the lead standard for general industry, the construction standard does not mandate routine environmental or medical surveillance.

Our study population consists of all deceased IABSOI members from local unions classified as construction by IABSOI who were active paying dues members at the time of their death (current workers or retirees), who had achieved a year of active service and who had died between January 1, 1984 and December 31, 1991 ($N = @ 15,000$). IABSOI is one of 15 unions within the Building and Construction Trades Department of the AFL-CIO. The membership includes bridge, structural, ornamental, and reinforced concrete ironworkers, machinery movers, stone derrick; and ship and navy yard riggers. The membership is composed of approximately 160,000 workers within 116 locals. There is no national health insurance program among the members, but there is a national death benefit fund which all working members are required to participate but which is optional for laid off and retired workers.

Prevention Activities*1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):*

Information has been collected which will assist in determining proportional cause-specific mortality excesses of members from IABSOI. It is anticipated that the IABSOI will continue to monitor the mortality experience of their workforce following the completion of our study.

2. Research (etiology, methodology, control): This proportional mortality ratio (PMR) analysis will supply cause-specific results with regard to health and safety concerns of members from IABSOI. The results will be useful in further, more specific on-going research projects regarding construction ironworkers.

3. Intervention (populations at risk, risk factors, control actions): The information obtained from this study of the health risks of members from IABSOI can be used by construction ironworkers and safety and public health professionals to set up intervention programs to help reduce morbidity and mortality from job-related causes among construction ironworkers.

Evaluability Assessment

It is anticipated that when the study results are completed, NIOSH will make the results available to all interested parties, including IABSOI, the Center to Protect Workers' Rights, safety and health professionals working in the area of construction, etc. An article will be prepared for a construction journal and the results will be published in the scientific literature.

(NIOSH-22)

Project Title: Proportional Mortality Study of the Laborers' International Union of North America (LIUNA)**Project Director:** Frank Stern**Institution, Address:**

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Division of Surveillance, Hazard Evaluations, and Field Studies
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Phone: 513-841-4519 **FAX:** 513-841-4486

Personnel and Skills: 0.5 FTE (FY 94), epidemiology

Problems (diseases, injuries, hazards) Addressed: Because laborers perform many varied duties, they have potential for exposure to numerous physical and chemical agents. Often these exposures can be episodic in nature. In addition, because laborers work side by side with other trade craftspersons, they may be also exposed to hazardous materials from working in close proximity to these other activities. Potential exposures at the job site include asbestos, inorganic lead, solvents, carbon monoxide, noise, and many other physical and chemical agents.

Project Objective: The basic objective is to evaluate the mortality experience of members from the Laborers' International Union of North America (LIUNA) who are employed in the construction industry and determine what excess health and safety risks they may encounter.

Executive Summary

Little research has been done to characterize either the general health or the occupational safety risks which laborers employed in the construction industry are known to experience. Because of this lack of research and in response to concerns from the general office of LIUNA and from the Centers to Protect Workers' Rights, we embarked upon a study to evaluate patterns of mortality among deceased members of LIUNA who died in the years 1985-1988 and who had worked in the construction industry.

Our study population consisted of all deceased laborers from local unions classified as construction workers by LIUNA who were active paying dues members at the time of their death (current workers or retirees), who had achieved one year of active service and who had died between January 1, 1985 and December 31, 1988 (N = 11,685). The analysis of study results has been completed and an interpretation of the findings is being made. A preliminary draft report should be finalized by December 31, 1993.

Prevention Activities

1. Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):

Information has been collected which will assist in determining proportional cause-specific mortality excesses of members from LIUNA. It is anticipated that LIUNA will continue to monitor the mortality experience of their workforce.

2. Research (etiology, methodology, control): This proportional mortality ratio (PMR) analysis will supply cause-specific results with regard to health and safety concerns of members from LIUNA. The results will be useful in further, more specific on-going research projects regarding construction laborers.

services and the problems that arise from these implementation.

(NIOSH-25)

Project Title: Tristate Construction Network

Project Director: Paul A. Schulte, Ph.D., Marie Haring-Sweeney, Ph.D., Linda Goldenhar, Dennis D. Zaebst

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Personnel and Skills: 0.4 FTE (FY 93), epidemiology, industrial hygiene, behavioral research

Problems (diseases, injuries, hazards) Addressed: Cancer, musculoskeletal disease, neurological and respiratory diseases, traumatic injuries.

Project Objectives: This project is designed to reduce occupational diseases and injuries through research, exposure assessment and intervention.

Executive Summary

NIOSH is establishing a network in the Cincinnati tristate (Ohio, Kentucky, Indiana) area for projects involving the health and safety of construction workers. The objectives of the network will be to conduct research and demonstration projects, to provide information, health education and technology transfer and to foster collaboration among organizations in construction. A four phase plan is envisioned. The plan involves the following steps: 1) characterization of the construction industry in the Cincinnati tristate area; 2) assessment of health and safety needs of employers and employees; 3) development of collaborative projects; and 4) industrywide dissemination and utilization of results.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The Tristate Construction Network will build on surveillance and needs assessment of construction participants in the Cincinnati area. Surveillance data will be obtained in conjunction with state health departments in Ohio, Kentucky, and Indiana. Needs assessments of construction trade unions and contractor associations will be conducted.
2. *Research (etiology, methodology, control):* On the basis of the surveillance and needs assessments, research and intervention projects will be developed. These projects will be collaborative with governmental, labor and industry groups. A broad range of research on such topics as musculoskeletal disease, cancer and exposure assessment will be conducted.
3. *Intervention (populations at risk, risk factors, control actions):* The intervention projects will be designed to test efficacy of various types of behavioral, engineering and administrative interventions. Ultimately, information will be disseminated throughout the network and beyond. Risk communications will be targeted to specific groups as information is developed.

Evaluability Assessment

To date no information is available for dissemination from the network. It is anticipated that the surveillance and needs assessment will be the first data to disseminate. It will be used to stimulate collaborative research.

(NIOSH-26)

Project Title: Health Hazard Evaluations (HHE) in the Construction Industry**Project Director:** Aubrey Miller, M.D., MPH**Institution, Address:**

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Personnel and Skills: 4.0 FTE (FY 93), industrial hygiene, exposure assessment, occupational physicians, medical evaluations, epidemiology.**Problems (diseases, injuries, hazards) Addressed:** Health hazards associated with exposures to chemical agents, physical hazards, and working conditions in the construction environment.**Project Objective:** This effort supports the development of descriptive materials (pamphlets, videotapes, speech texts, e.g.) on the HETA program targeted to the construction industry. Existing communication channels, including trade unions and councils would be utilized to distribute these materials. Additional industrial hygienists and occupational health personnel will be added to the HETA program to permit a timely response to additional requests for HHEs received from the construction industry. Findings from individual investigations which have implications for employees at other sites will be made available for distribution through existing communication channels.**Executive Summary**

The NIOSH Health Hazard Evaluations and Technical Assistance (HETA) program, mandated under Section 20(a)(6) of the OSH Act, responds to requests for assistance from employers, employees, employee representatives, other Federal agencies, and State and local agencies. The typical HETA response to a request for assistance results in a determination of whether chemical, biological, physical, or other agents are hazardous as used or found in the workplace, and recommendations for controls, work practices, or medical programs to prevent adverse health effects.

The HETA program is perhaps uniquely suited to the evaluation of certain health hazards associated with the construction industry. Because the program is accustomed to responding to hazards of immediate concern, HETA investigators are generally able to mobilize to the field quickly if the situation warrants such a response. Industrial hygienists and occupational health professionals are available to assess both exposures and effects. The goal is to reach conclusions and provide recommendations which are timely and appropriate; interim reports and recommendations are frequently provided to all relevant parties in advance of a final report. All HETA final reports are sent to OSHA headquarters and appropriate area and regional offices.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, linkage to response)*: Typically, the HETA program uses standard industrial hygiene and medical techniques to identify site-specific health hazards. Comparison of environmental and biological samples or tests with recognized evaluation criteria forms the basis for determining whether a health hazard exists. Recommendations to address health hazards which are identified are tailored to the site evaluated and reported to employees and employer, as well as appropriate OSHA and state health agencies, as well as being available to the general public.
2. *Research (etiology, methodology, control)*: Many HHEs are providing a service to the requesters through the use of well-accepted evaluation techniques, and as such, do not involve extensive research. Occasionally the exposures being evaluated will necessitate the development of novel assessment methods or techniques; in these cases, other appropriate NIOSH Divisions are typically involved.
3. *Intervention (populations at risk, risk factors, control actions)*: The populations at risk are those at the individual construction sites for which HHE requests are received by NIOSH. Employees at other facilities may be similarly affected, and could benefit from findings and recommendations developed for a specific site. Recommendations frequently reference a number of actions designed to control any health hazards identified during the HHE. These recommendations are based on sound industrial hygiene and occupational health principles and are consistent with NIOSH policy.

Evaluability Assessment

NIOSH has responded to approximately 100 requests for Health Hazard Evaluations (HHEs) in the construction industry since the inception of the program in 1970; including 27 requests in FY93 (see attached list). These HHEs have dealt with a wide variety of exposure agents in the construction setting, including asbestos, asphalt roofing compounds, lead compounds, noise, silica, isocyanates, and other organic compounds, and have developed recommendations for the control of exposures. Each of these reports have been sent to the employer, employees, OSHA, and other appropriate state health agencies. To date, however, there has not been a continuing, systematic effort to advise employers, employees, and their representatives within the construction industry of the existence and availability of the HETA program. There has also not been a systematic effort to summarize the findings of relevant completed HHEs and disseminate appropriate information throughout the construction industry.

Construction HHEs in FY 1993

	HETA #	COMPANY NAME	CITY / STATE
1	930439	SHARP Committee Alliance to End Childhood Lead Poisoning Lead, residential childhood lead exposures, lead paint abatement	Washington, DC
2	930035	American Buildings Co. Manufacture and erection of steel buildings	El Paso, IL
3	930047	University of Colorado Health Sciences Center Silica sand, cement dust, mortar, plaster; facilities maintenance	Denver, CO
4	930270	Meridian Township IAQ, poor indoor air, new construction in area	Okemos, MI
5	930436	Trus Joint MacMillan MDI, diphenyl methane diisocyanate, dust, wood dust; manufacture of construction products	Deerwood, MN
6	930441	Marcus Hook Corporation (EPA & ATSDR Project) Asbestos	Philadelphia, PA
7	930502	Painters and Allied Trades of America - Goldstar Bridge Lead, take-home toxins; bridge repair and painting	Hartford, CT
8	930551	US Navy, Bureau of Medicine and Surgery Silica, dust; grinding decks of aircraft carriers	Washington, DC
9	930562	Ohio University Organic vapors, tile mastic removers; floor tile removal	Athens, OH
10	930580	26069 Highway 72 Glass fibers	Golden, CO
11	930700	2335 Silver Mountain Enterprises, Inc. Wood shop dust and exposures	Montrose, CO
12	930760	US Fish and Wildlife Service - US Department of the Interior IAQ, indoor air, new construction, solvents, formaldehyde, carpet	Hadley, MA
13	930771	Alaskan AIDS Assistance Association TB, tuberculosis, AIDS, HIV; renovation of homes for AIDS victims	Anchorage, AK
14	930818	People Working Cooperatively Lead dust, lead-based paint abatement; low-income housing renovation	Cincinnati, OH
15	930839	Paramount Parks Noise; construction of props and costumes for amusement park	Cincinnati, OH
16	930844	Private Residence Lead, solvents, N-methyl pyrrolidone; floor refinishing	Atlanta, GA
17	930887	Newburgh-Walsh, Joint Venture, Boston Tunnel Project Sewage plant; construction	Deer Island, MA
18	930898	US Department of Housing and Urban Development (HUD) Lead paint abatement	Washington, DC
19	930913	Veterans Hospital Mold on drywall	West Palm Beach, FL
20	930959	Abilities Services, Inc. Sheltered workshop, noise, dust; shredding pallets	Crawfordsville, IN
21	930997	Supreme Court of Pennsylvania Asbestos abatement	Pittsburgh, PA
22	931005	Department of Transportation Lead, solvents	Helena, MT
23	931019	Tri-County Health Department Dust sample analysis; construction at Denver International Airport	Denver, CO
24	931037	Johnson Brothers Silica; sandblasting prior to repainting	Pittsburgh, PA
25	931093	ABB Plant PCB, polychlorinated biphenyls, decomposition products; decommissioning capacitor plant	Bloomington, IN
26	931110	Martin County Courthouse Microorganisms, aspergillus, stachybotrys; renovation of building	Stuart, FL
27	931119	St. Leon Church Bat droppings; renovation	St. Leon, IN

(NIOSH-27)

Project Title: Construction Trades Surveillance: Carpenters' Union**Project Director:** Cynthia F. Robinson, Ph.D.**Institution, Address:**

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Personnel and Skills: 1 FTE, epidemiology

Problems (diseases, injuries, hazards) Addressed: All causes of death will be evaluated for this group of workers in a study of excess risks conducted by NIOSH at the request of the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) Building and Construction Trades. Particular attention will be paid to work-related and/or occupational mortality thought to be associated with the potential exposures of construction industry workers at the construction worksite.

Project Objectives: This project will identify excess risks of death experienced by the United Brotherhood of Carpenters and Joiners of America during the period 1987-90. About 27,000 deaths experienced during this time interval will be evaluated in order to estimate the magnitude of any excess risk. Also, this project will assist the national union with the development of an in-house ongoing mortality surveillance program.

Executive Summary

A Proportionate Mortality Ratio study is being conducted on about 27,000 deaths of members of the United Brotherhood of Carpenters and Joiners of America who died 1987-90. Using the Carpenters' union's death benefit and membership records, proportionate mortality ratio analyses will be conducted, adjusted for age, race, sex, and smoking. The study will use the mortality experience of the U.S. population. Analyses will be done to examine duration of union membership and time since first becoming a Carpenter. The project will assist the national union with the development of an in-house mortality surveillance program, per a request from the AFL-CIO, Building and Construction Trades Department. In FY 94, a meeting with the Carpenters union is anticipated to discuss results of the study. Further analyses will be completed and a report will be written and submitted for publication in a peer-reviewed journal.

The Carpenters are one of the largest of fifteen unions within the Building and Construction Trades Department of the AFL-CIO. The Carpenters are involved in residential, commercial, and industrial construction, demolition, renovation and repair. The members include carpenters, cabinet-makers, furniture makers, latherers, joiners, log scalers, lumber-sawmill-plywood mill workers, marine divers, millwrights, pile drivers, floor-layers and tile, marble and terrazzo workers.

Prevention Activities*1. Surveillance (problems recognition, diagnostic criteria, report, linkage to response):*

The study is a mortality surveillance project. Its main goal is to identify excess risks, particularly new risks occurring among the Carpenters union members who were employed in the U.S. Construction industry. A primary purpose of the study is to identify excess risks for death in Carpenters' union members that could be targeted for prevention strategies, including further research.

2. Research (etiology, methodology, control): The project lies at the interface of surveillance and research. The results of this project may be used to direct further surveillance and research. The research might include etiologic studies of new problems or worksite hazards, to develop methodologic approaches for studying blue collar workers, or to prevention and control of workplace exposures. Construction workers similar to other small businesses, are studied with difficulty due to the lack of centralized employee record-keeping systems that are found in large corporations.

3. Intervention (populations at risk, risk factors, control actions): The results of this project might be used to assist or direct intervention activities, by clarifying skill classifications of local unions within the national Carpenters' union membership that are at greatest risk. This will assist public health professionals and safety professionals to decide where intervention programs are needed. It will also provide the basis for evaluation of the usefulness of intervention and prevention programs by providing a structure to evaluate mortality data over time, allowing for the assessment of changes at the national and local union level.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-28)

Project Title: Construction Trades Surveillance: Electrical Workers' Union**Project Director:** Cynthia F. Robinson, Ph.D.**Institution, Address:**

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Personnel and Skills: 2 FTE, epidemiology

Problems (diseases, injuries, hazards) Addressed: All causes of death will be evaluated for this group of workers in a study of excess risks conducted by NIOSH at the request of the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) Building and Construction Trades. Particular attention will be paid to work-related and/or occupational mortality thought to be associated with the potential exposures of construction industry workers at the construction worksite.

Project Objectives: This project will identify excess risks of death experienced by the International Brotherhood of Electrical Workers (IBEW) during the period 1982-89. About 30,000 deaths experienced during this time interval will be statistically analyzed in order to estimate the magnitude of any excess risks. Also, this project will assist the national union with the development of an in-house ongoing mortality surveillance program.

Executive Summary

A Proportionate Mortality Ratio study is being conducted on about 30,000 deaths of members of the International Brotherhood of Electrical Workers who died 1982-89. The purpose of the study is to identify excess risks for death in Electrical Workers that can be targeted for prevention strategies and/or further research. Using the Electrical Workers' Union death benefit records, proportionate mortality ratio analyses will be conducted, adjusting for age, race, sex, and smoking. The study will use the mortality experience of the U.S. population for comparison. Analyses will be done to examine duration of union membership and time since first becoming an Electrical Worker. Members of the Electrical Workers' Union are employed in commercial, residential, and industrial construction/electrical installation, maintenance and repair. Tasks to be done in FY 94 include conducting the analysis of the data and writing a report.

Prevention Activities

1. Surveillance (problems recognition, diagnostic criteria, report, linkage to response):

The study is a mortality surveillance project. Its main goal is to identify excess risks, particularly new risks occurring among the Electrical Workers' Union members who were employed in the U.S. Construction industry. A primary purpose of the study is to identify excess risks for death in Carpenters union member that could be targeted

for prevention strategies, including further research.

2. *Research (etiology, methodology, control)*: The project lies at the interface of surveillance and research. The results of this project may be used to direct further surveillance and research. The research might include etiologic studies of new problems or worksite hazards, to develop methodologic approaches for studying blue collar workers, or the prevention and control of workplace exposures. In general, construction workers, similar to other small businesses, are studied with difficulty due to the lack of centralized employee record-keeping systems that are found in large corporations.

3. *Intervention (populations at risk, risk factors, control actions)*: The results of this project might be used to assist or direct intervention activities, by clarifying locals within the national Electrical Workers' Union membership that are at greatest risk. This will assist public health professionals and safety professionals to decide where intervention programs are needed. It will also provide the basis for evaluation of the usefulness of intervention and prevention programs by providing a structure to evaluate mortality data over time, allowing for the assessment of changes at the national and local union level.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-29)

Project Title: Construction Trades Morbidity Prevalence**Project Director:** Cynthia F. Robinson, Ph.D.**Institution, Address:**

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Personnel and Skills: 0.2 FTE, epidemiology

Problems (diseases, injuries, hazards) Addressed: The occupational diseases and disorders that were included in the Health Interview Survey (HIS) conducted by the National Center for Health Statistics will be examined for excess prevalence among construction workers for lung, skin and other cancers, skin conditions, upper respiratory conditions and musculoskeletal disorders.

Project Objectives: The objective of the project is to identify any excess risk for occupational disease or disorder being experienced by construction workers and to provide an estimate of its magnitude.

Executive Summary

Published data about patterns of work-related morbidity among persons employed in the construction trades occupations is limited. However, proportionate mortality ratios (PMRs) based on death certificate data from fourteen states 1984-86 suggested increased risk of large construction trade occupations such as carpenters for lung, skin and other cancers, skin conditions, upper respiratory conditions and musculoskeletal disorders. This project will use data from the 1987 Health Interview Survey (HIS) Cancer Supplement, the 1988 HIS Occupational Health Supplement and the Alcohol Supplement to compute risk ratios, based on population prevalences, for these disorders. Using fourfold tables, analyses will be stratified by reported smoking and alcohol use. This will suggest the role of smoking or alcohol use for the elevated risk. A report will be written in FY 94.

Prevention Activities

1. Surveillance (problems recognition, diagnostic criteria, report, linkage to response):

The morbidity prevalence project is a surveillance study to provide problem recognition for occupational diseases and disorders occurring among construction industry workers. This includes the evaluation and reporting of currently available data on worker health.

2. Research (etiology, methodology, control): The results of this project may be used to direct further research and surveillance activities.

3. *Intervention (populations at risk, risk factors, control actions):* A primary purpose of the study is to identify excess risks for morbidity in construction industry workers that could be targeted for prevention or intervention strategies. Results might be used to direct intervention activities by identifying construction occupations at greatest risk.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-30)

Project Title: Prevention Through Health Insurance of Construction Trades Workers**Project Director:** Cynthia F. Robinson, Ph.D.**Institution, Address:**

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Personnel and Skills: 0.2 FTE, epidemiology**Problems (diseases, injuries, hazards) Addressed:** Occupational diseases and disorders among construction workers.**Project Objectives:** This project addresses the question of the potential usefulness of health insurance claims data for surveillance activities. The current state of the art methods for the epidemiologic use of this data will be described and its usefulness as a surveillance tool evaluated.**Executive Summary**

Health insurance coverage is a growing problem, particularly for blue collar workers such as Construction Trades Workers. Neither health nor morbidity incidence data are available for this large working population who perform risky jobs and have potential exposures to many hazardous substances. Health and illness data is not generally available because personnel records do not exist for construction workers. (Union hall records are the work records of construction workers.) Health insurance claims data is one of the few available sources of morbidity data for construction workers. Site visits conducted at the request of the AFL-CIO to fourteen national construction trade unions revealed that four of the unions had current national or regional self-insured plans with mandatory participation. Claims analysis was used recently by Park et al. as a surveillance tool to describe the prevalence of occupational health problems for auto workers. This project would obtain claims data for several construction trade union locals for a pilot study to explore the feasibility of analysis of this data. Occupation or trade would be obtained from the person's union membership record. For example, a cabinet-maker local might be the case group, and some other locals such as log scalers may be the comparison group. In 1994, a workshop will be held to evaluate the epidemiologic uses of health insurance claims data. The project will be reassessed for continuation at the end of FY 94.

Prevention Activities

1. *Surveillance (problems recognition, diagnostic criteria, report, linkage to response).*
The health insurance project is a surveillance methods study of a potentially new approach to provide problem recognition for occupational diseases and disorders

occurring among construction industry workers. This includes the evaluation and reporting of currently available data on worker health.

2. *Research (etiology, methodology, control)*: The results of this project may be used to direct further research and surveillance activities. The project has several components. First, to evaluate the potential use of this data as a surveillance tool. Second, the additional research and surveillance activities might include etiologic studies of new hazards, or evaluation of prevention and control activities.

3. *Intervention (populations at risk, risk factors, control actions)*: A purpose of the study is to identify excess risks for morbidity in construction industry workers members that could be targeted for prevention or intervention strategies. Results might be used to direct intervention activities by identifying construction occupations with the greatest risk.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-31)

Project Title: Construction Trades Surveillance: Bricklayers Union**Project Director:** Joyce Salg, Ph.D.**Institution, Address:**

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Personnel and Skills: 0.5 FTE, epidemiology**Problems (diseases, injuries, hazards) Addressed:** All occupational diseases and hazards will be considered in this group of workers.**Project Objective:** This project will identify excess risks for death in construction workers that can be targeted for intervention strategies and those that need further research. The project will also involve assistance to a national union for the development of an in-house mortality surveillance program per a request from the Occupational Health Foundation of the AFL-CIO.**Executive Summary**

A union-based proportionate mortality ratio (PMR) study will be conducted using a national construction union's computerized death benefit and membership records. Data from the International Union of Bricklayers and Allied Craftsmen (IUBAC) will form the basis of the study. This study will include all deaths identified by the IUBAC occurring during the period 1986-1991. Death certificates will be obtained from the union and corresponding states. Underlying and contributory causes of death will be coded by a certified nosologist. These data will then be analyzed by a NIOSH lifetable program that will compare the proportion of deaths from specific causes in bricklayers with the proportion of deaths in the U.S. population. Identification of disproportionate numbers due to specific causes of death may suggest areas for further investigation and ultimately lead to recommendations for preventive measures.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The results of this study will be used to identify the causes of death among bricklayers that can be targeted for intervention strategies.
2. *Research (etiology, methodology, control):* The results of this project may be used to direct further research activities.
3. *Intervention (populations at risk, risk factors, control actions):* The data from this study may be used to direct intervention activities. Consultation will be provided during the study to enable the union to conduct its own future occupational mortality

surveillance and research activities.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-32)

Project Title: Construction Trades Surveillance: Sheet Metal Workers**Project Director:** Toni Alterman, Ph.D.**Institution, Address:**

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Personnel and Skills: 2 FTE, epidemiology**Problem (diseases, injuries, hazards) Addressed:** All occupational diseases and hazards that cause death will be considered in this group of workers.**Project Objective:** This project will identify excess risks for death in construction workers that can be targeted for intervention strategies and those that need further research. The project will also involve assistance to a national union with the development of an in-house mortality surveillance program per a request from the Occupational Health Foundation of the AFL-CIO.**Executive Summary**

A union-based proportionate mortality ratio (PMR) study of sheet metal worker deaths is being conducted. Data from the Sheet Metal Workers' International Association (SMWIA) will form the basis of the study. This study will include all deaths identified by the SMWIA occurring during the period 1980-1991. The primary data sources are dues and death benefit records maintained by the union. Death certificates are being obtained from union files and corresponding states. A certified nosologist has been coding the underlying and contributing causes of death. Data are being entered into the computer and verified. These will then be analyzed by a NIOSH lifetable program that will compare the proportion of deaths from select causes in sheet metal workers with the proportion of deaths in the U.S. population. Identification of disproportionate numbers due to specific causes of death may suggest areas for further investigation and ultimately lead to recommendations for preventive measures.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The results of this study will be used to identify the causes of death among sheet metal workers that can be targeted for intervention strategies.
2. *Research (etiology, methodology, control):* The results of this project may be used to direct further research activities.
3. *Intervention (populations at risk, risk factors, control actions):* The data from this study may be used to direct intervention activities. Consultation will be provided

during the study to enable the union to conduct its own future occupational mortality surveillance and research activities.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-33)

Project Title: The Surveillance of Work-Related Diseases in the Construction Industry Using Workers' Compensation Data**Project Director:** Carol A. Burnett, M.S.**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
4676 Columbia Parkway, MS: R-18
Cincinnati, OH 45226-1998
Phone: 513-841-4315 **FAX:** 513-841-4489

Personnel and Skills: 0.5 FTE, epidemiology**Problems (diseases, injuries, hazards) Addressed:** All non-injury diseases and conditions will be considered for construction workers.**Project Objective:** The project will describe work-related diseases and conditions for the construction industry using the Bureau of Labor Statistics' Supplemental Data System (SDS). This will be followed by selecting one or more states that will provide Workers' Compensation claims records for high risk conditions identified in the SDS analysis. The claims records will be reviewed to provide descriptive information about risk factors and medical diagnoses.**Executive Summary**

The SDS data for 1977 through 1988 have been obtained for analysis.

Prevention Activities

- 1. Surveillance (problems recognition, diagnostic criteria, report, linkage to response):* The intent of this project is to identify conditions for which construction workers are at high risk and to describe the known risk factors.
- 2. Research (etiology, methodology, control):* This project will allow future expansion of these methods and resources to study other industries.
- 3. Intervention (populations at risk, risk factors, control actions):* The results of this project may be used to direct intervention activities.

Evaluability Assessment

Dissemination will be evaluated by the effectiveness of publication of findings and their use in targeting selected areas/conditions of concern for intervention and program activities.

(NIOSH-34)**Project Title: Lead in Construction Program****Project Director:** Janie L. Gittleman, Ph.D.**Institution Address:**

National Institute for Occupational Safety and Health
Division of Surveillance Hazard Evaluations and Field Studies
4676 Columbia Parkway, MS: R21
Cincinnati, OH 45213
Phone: 513-841-4353 **FAX:** 513-841-4489

Personnel and Skills: NIOSH, DSHEFS (2.0 FTE), California Public Health Foundation, (FY 93 & 94), IL DOH, WA DLI, CT DOH, NJ DOH.

Problems (diseases, injuries, hazards) Addressed: Potential exposure to inorganic lead at the workplace and home environment.

Project Objectives: The new Lead in Construction Program will contain several projects focused on different problems associated with the use of lead in construction. This program will provide support for a combination of Cooperative Agreements and contracts with State and Local Health Departments. These include:

a. Lead Poisoning Prevention In Collaboration with Local Health Departments.

This Cooperative Agreement will support the design, implementation, and evaluation of a model program to prevent lead poisoning among residential painters and lead abatement workers in the City of San Francisco. It is funded in FY 1993 and FY 1994 out of CDC PRDP monies at a level of \$11,000 per annum.

b. Evaluating Prevention Strategies for Lead Poisoning. Four separate research projects will be supported through contracts with State Health Departments. These include projects to: evaluate the effectiveness of lead abatement certification/training programs; characterize exposure among home painters occupationally exposed to lead; monitor compliance with contract specifications for construction jobs; and evaluate the potential for take-home exposures to lead. The four projects are funded in FY 1993 and FY 1994 out of NIOSH Construction funds at the level of \$95,000 per annum.

Executive Summary

The five new lead in construction projects will provide important preliminary data on lead exposures, compliance with contract language, medical monitoring, and take-home exposures for workers and their family members in the construction trades. This group of workers was not previously covered under the OSHA Lead Standard for general industry, but are now newly included under the OSHA Interim Final Rule on Construction (Lead in Construction Standard). The California Painters' Project will evaluate the effectiveness of an intervention to educate workers and monitor the effectiveness of the program by documenting changes in blood lead levels both prior to and post intervention. The other four projects cover a variety of issues concerning lead

in construction (e.g compliance with contract language for bridge and steel superstructures, lead certification training protocols, and exposures among painters). These projects will provide insight into the nature and magnitude of lead exposures among construction workers. The projects were awarded in September of 1993. Final Reports will provide crucial data for future targeting efforts among this worker population.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Information will be collected to characterize exposures and monitor blood lead levels in construction trades.
2. *Research (etiology, methodology, control):* These projects will assess the nature and extent of exposures in construction trades.
3. *Intervention (populations at risk, risk factors, control actions):* Program participants will receive training on adverse health effects, control practices, and appropriate hygiene practices. Reports from the five construction projects will disseminate results to the wider public health community, and trade associations.

Evaluability Assessment

Results from the construction projects will evaluate intervention methodology and its impact on reducing blood lead levels in painters. The approach for targeting family members with outreach materials, and exposure characterization in painters and lead abatement workers will also be reported.

7. Division of Training and Manpower Development (DTMD)

(NIOSH-35)

Project Title: Instructional Module on Construction Safety and Health**Project Director:** John T. Talty**Institution, Address:**

National Institute for Occupational Safety and Health
Division of Training and Manpower Development
4676 Columbia Parkway, MS: C-10
Cincinnati, OH 45226-1998
Phone: 513-533-8241 **FAX:** 513-533-8560

Personnel and Skills: two engineers and two industrial hygienists; American Society of Civil Engineers; Wayne State University.**Problems (diseases, injuries, hazards) Addressed:** Occupational injuries and illnesses in the construction industry.**Project Objectives:** Develop an instructional module to assist civil engineering and other engineering faculty members to enhance the education of engineering students in the safety and health field as it applies in the construction industry.**Executive Summary**

This instructional module is designed to present an overview of the nature and magnitude of safety and health problems in the construction industry, and to emphasize the need for proper education and training on this topic, particularly for civil engineers.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Not addressed.
2. *Research (etiology, methodology, control):* Not addressed.
3. *Intervention (populations at risk, risk factors, control actions):* This project was initiated as a task within Project SHAPE (Safety and Health Awareness for Preventive Engineering) to focus on the development of curriculum materials that would assist engineering faculty to provide instruction to engineering students in the safety and health field. A draft module has been developed that has undergone extensive review within NIOSH and by engineering faculty who are potential users. A final draft is in preparation and is scheduled for completion early in 1994.

Evaluability Assessment

Occupational illnesses and injuries in the construction industry are known to be excessive and civil engineers are deeply involved in the design and construction process. Wide dissemination of this module to civil engineering faculty should result in increased knowledge transfer to civil engineering students and application in the field to prevent

occupational exposures in the future.

EXTRAMURAL: Cooperative Agreements

West Virginia (CA-1)**Project Title: West Virginia Construction Safety and Health Program**

Project Director: Paul Becker, M.S.

Institution, Address:

West Virginia University
710 Knapp Hall
Morgantown, WV 26506-6031
Phone: 304-293-4152 **FAX:** 304-293-3395

Personnel and Skills: 1.25 FTE (FY94), Construction safety, occupational health hazards in construction, worker training, industrial hygiene, consultation.

Problems (diseases, injuries, hazards) Addressed: Safety and health hazards to West Virginia construction workers.

Project Objectives: Create a model construction safety and health program that can sustain itself while providing services that lead to a decrease in work-related injuries and illnesses in the West Virginia construction industry.

Executive Summary

NIOSH and West Virginia University have entered into a Cooperative Agreement for a Model State Construction Safety and Health Program. This joint effort of the two organizations seeks to create a state based model for a self sustaining program that can provide services that will lower the incidence of work related injuries and illnesses in the West Virginia construction industry.

The construction industry is notable for its high incidence of injuries, its lack of attention to occupational health issues, and its lack of an infrastructure for carrying out safety and health functions. Its problems in addressing safety and health concerns are made more serious by the industry's decentralization, the prevalence of small employers, and the constantly changing nature of construction work sites, personnel, equipment, and conditions.

The West Virginia Construction Safety and Health Program (WVCSHP) is staffed out of the Institute for Labor Studies at West Virginia University, but is guided by an Advisory Board including decision making persons from state government, construction employer organizations, unions, and construction users groups.

The program carries out research into injury and illness causation, hazard information dissemination, construction safety and health training, and consultation services to employers and workers in West Virginia's construction industry.

Through the organization of the Advisory Board and through credibility gained by delivery of the above mentioned programs, WVCSHP will build a mechanism for delivery of needed programs on an ongoing basis that can become independent of

NIOSH funding.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The project is carrying out an analysis of five years of WV Workers' Compensation claims for the construction industry. This surveillance activity will serve to identify priorities for intervention and document the need for services. Over the long run, the claims database will be used to determine the impact of the WVCSHP. The project is also assessing the level of employer interest, knowledge, and program activity in the construction industry through a survey of all WV state construction contractors.
2. *Research (etiology, methodology, control):* None.
3. *Intervention (populations at risk, risk factors, control actions):*
 - a. *Hazard Information Dissemination:* The program publishes a twice a year newsletter call "Safety on Site", fact sheets and tool box talks on construction safety issues, and holds an annual safety conference for the construction community.
 - b. *Training:* The WVCSHP emphasizes training through the delivery of 10 and 30 hour OSHA construction safety awareness courses. It also offers training leading toward the preparation of people to function as "competent persons" in the areas of trenching and excavation, scaffolding, fall protection, asbestos abatement, lead abatement, and confined space entry. The WVCSHP carries out management training helping employers to create and implement company safety programs.
 - c. *Consultation:* The WVCSHP conducts consultations to employers and construction sites which range from safety management issues such as creating safety programs to specific site audits.

Evaluability Assessment

The success of this program can be evaluated in three ways:

1. A long term decrease in the injury and illness rate in the WV construction industry as measured by claims to the WV Compensation system. (It is unlikely that such a trend will show up in the funded period of four years.)
2. An improvement in safety awareness and programs in WV construction companies as measured by a readministration of the employer survey.
3. Achievement of a self-sufficient West Virginia Construction Safety and Health Program will show that the model developed in West Virginia for delivery of the preventive services can be viable.

Current resources do not permit more rigorous evaluation of the efficacy of specific

preventive interventions undertaken by the WVCSHP.

Illinois (CA-2)**Project Title: Model Construction Safety and Health Program**

Project Director: Thomas A. Broderick, M.S.

Institution, Address:

Construction Safety Council of Illinois
4415 West Harrison Street, Suite 407
Hillside, IL 60510

Phone: 800-552-7744 or 708-449-0550 **FAX:** 708-449-0369

Personnel and Skills: 2 FTE (FY93) construction safety and health training and education, telephone consultation, dissemination of printed information, safety and health promotional activities.

Problems (diseases, injuries, hazards) Addressed: Above normal incidence of occupational injury and disease in the construction industry.

Project Objectives: Identify the prevalent injuries/illnesses from construction activities in the state; promote hazard awareness among all construction employers and employees; 50% of employers and employees should be capable of identifying risks and state means to avoid or reduce those risks by the end of the project period; promote worksite implementation of injury/illness prevention measures throughout the construction industry for the prevalent types of injury/illness producing incidents; promote implementation of safety and health program management techniques by all construction employers; target employers with fewer than 50 employees; implement risk communication techniques throughout the construction industry statewide; and establish a statewide construction safety and health association with self funding capabilities by project end.

Executive Summary

Construction workers die as a result of work-related trauma at a rate that is 3 times the annual rate for workers in all other industry sectors (24.1 deaths per 100,000 construction workers, as compared to 7.9 deaths per 100,000 workers in all other industry sectors). Construction workers also experience a higher incidence of nonfatal injuries of varying severity, than workers in other industries. Workplace exposures cause lung disease, hearing loss, Cumulative Trauma Disorders (CTD) and musculoskeletal disorders, and dermatologic conditions among construction workers.

About 7 million persons work in the construction field. Many jobs are of short duration and workers often must move considerable distance from job to job (the average turnover rate is 78% per year). Employers are typically small (96% of construction employers employ fewer than 50 employees). Often, multiple employers engage in work at the same site where a large population of workers perform very hazardous work over a short period of time.

All of these factors contribute to the above average incidence of fatal and nonfatal work injuries in the construction industry. It is difficult to locate workers and projects, to

create and implement intervention strategies, and to measure outcomes.

The Chicagoland Construction Safety Council (CCSC) was created in 1989 through a cooperative effort by Chicago area construction firms, trade associations, and local building and construction trade unions. This unique organization reaches all union construction firms in three counties which comprise "Chicagoland". Even those employing one or two workers receive a quarterly newsletter and the full range of services offered by CCSC. The CCSC responded to a request for proposals from NIOSH for a cooperative agreement to create a model statewide construction safety and health program. In 1990, CCSC created the Construction Safety Council of Illinois and began to offer statewide, the programs and services associated with the Chicagoland group.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The Construction Safety Council of Illinois (CSCI) has performed a study of fatality reports collected in OSHA's integrated management information system (IMIS) for construction related deaths in Illinois between 1986 and 1990. an update was subsequently performed for 1991-1992. The data was based on trauma produced construction deaths in the seven years. Prevention efforts are multifaceted and address all occupational injury and illness causes but place specific emphasis on these based on the percentage of fatal accidents caused:

Falls	44%
Caught in/between	17%
Electric shock	16%
Struck by	14%

2. *Research (etiology, methodology, control):* None.

3. *Intervention (populations at risk, risk factors, control actions):*

a. Video Loan Program. A substantial library of safety and health related video tapes are offered free of charge on a loan basis to contractors, unions, and trade associations for training and education purposes.

b. Newsletter. A quarterly newsletter *Construction Safety News*, is distributed throughout the Illinois Construction Community. Currently, the circulation is at 16,000.

c. Dissemination of Printed Material. The CSCI disseminates various booklets, posters, manuals, and other printed media to assist contractors and unions with their safety and health programs.

d. Training and Education. Safety courses are conducted at CSCI's training center in Hillside, Illinois and at outreach locations throughout the state. Topics range from lead in construction to an OSHA 10 hour Hazard Recognition Course. The Annual Construction Safety Conference has become a national event and draws over 1,000 attendees to learn about

current construction safety and health issues.

e. Telephone Consultations. A toll-free Watts line allows contractors and unions to access CSCI during normal working hours with questions regarding safety and health issues.

f. Consultant Referral. The credentials of consultants representing numerous specialized areas of expertise are maintained by CSCI. A staff safety professional will assist a contractor or union by analyzing the requirements and selecting a consultant(s) with the requisite background.

g. Site Visits. The CSCI staff members are available to visit jobsites and deliver safety talks, meet with labor and management to discuss issues and provide support for the site safety program.

Evaluability Assessment

Not addressed.

New York (CA-3)**Project Title: Development of a Model Construction Safety and Health Program for the State of New York**

Project Director: Satish Mohan, Ph.D.

Institution, Address:

State University of New York (SUNY) at Buffalo
Department of Civil Engineering
228 Ketter Hall
Buffalo, NY 14260
Phone: 716-645-5958/2214 **FAX:** 716-645-3733

Personnel and Skills: 1.5 FTE (FY91, 92, 93), construction engineering and management, building architecture, training consultants in the areas of: lead abatement, ergonomics, excavations and trenching, confined space entry, OSHA regulations and standards, and hazard communication.

Problems (diseases, injuries, hazards) Addressed: Overall safety and health of construction workers, construction safety management plans for small and medium (<50 employees) contractors.

Project Objectives:

1. Identify the prevalent injuries and illnesses resulting from construction activities in the State of New York.
2. Promote hazard awareness among construction employers and employees.
3. Promote implementation of safety and health program management techniques by construction employers, especially those with fewer than 50 employees.
4. Establish a Construction Safety and Health Institute within the State of New York.

Executive Summary

The National Institute for Occupational Safety and Health (NIOSH) entered into a cooperative agreement with the State University of New York at Buffalo in July 1991 with the primary objective of developing a model statewide construction safety and health program for the State of New York. To accomplish the NIOSH objectives, a Construction Safety and Health Institute (CSHI) was established in the Department of Civil Engineering, State University of New York at Buffalo. The following activities are presently being conducted at the institute:

1. Safety and Health training.
2. Publishing a newsletter, 'SAFE CONSTRUCTION'.
3. Establishing a statewide Construction Safety and Health Association.

4. Maintaining construction injuries/illnesses database.
5. Developing construction safety management plans for small to medium size contractors.
6. Conducting construction safety research.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Data on 91,953 construction accidents that occurred in the State of New York, and were compensated during the years 1980-1988 by the New York State Workers' Compensation Board, has been analyzed and the following two reports have been produced:

1. Analysis of Construction Accidents in the State of New York, 1980-88.
2. Development of a Safety Risk Measure for Construction Accidents.

2. *Research (etiology, methodology, control):* Not addressed.

3. *Intervention (populations at risk, risk factors, control actions):* During the year 1992-93, several safety and health training courses were taught to construction professionals throughout the state. The training courses covered various areas including:

1. Abatement of Lead-Based Paint.
2. Managing OSHA Inspections and Selecting Worksite Safety Programs.
3. Hazard Communications for Construction Management.
4. OSHA Outreach Program.
5. Excavation & Trenching Safety.
6. Confined Space Entry.
7. Ergonomic Applications for Safe Construction.
8. Fall Protection and Trenching.

About 600 construction professionals took the courses at various locations throughout the State of New York.

A statewide Construction Safety and Health Association is in the process of formulation. A steering committee consisting of members from the labor unions, contractor associations, owner groups, regulatory agencies, insurance companies, and some consulting groups has been formed, which meets twice a year to advise the CSHI

personnel.

A safety management plan for small to medium employers is being prepared. Several research projects in the areas of: *designing for safety*, and *hand tools* have been completed. Some others in the areas of: *work-zone safety* and *construction scheduling for safety* are in progress.

Evaluability Assessment

The major emphasis of this project is to create an awareness for safety in the minds of construction employers through the medium of a newsletter, and expose them to various safety training programs. It is expected that a fraction of employers who will benefit from this project will include safety while planning for construction. The cost savings realized through safety management will then lead others to think, plan and implement safety to stay in the competitive market.

Washington, DC (CA-4)**Project Title: Health and Safety Programs for Construction Work**

Project Director: Knut Ringen, Dr.P.H.

Institution, Address:

Center to Protect Workers Rights
111 Massachusetts Avenue, NW
Washington, DC 20001
Phone: 202-962-8490 **FAX:** 202-962-8499

Personnel and Skills: Not addressed.

Problems (diseases, injuries, hazards) Addressed: The focus on construction has been needed because occupational safety and health in construction -- compared with other industries -- in the United States and Canada have been largely ignored and appear to lag substantially behind conditions for the industry in several other industrialized nations. For instance, in 1988 U.S. government safety research funding totaled \$0.08 per construction worker and \$2.16 per manufacturing employee. And the U.S. rate of deaths from injuries on the job is 14 per 100,000 full-time employees, or 900 deaths yearly. That rate is more than three times the rate for manufacturing and appears to be significantly higher than rates for construction in the Netherlands, Sweden, and the province of Ontario, Canada.

The more than 240,000 serious injuries among construction workers in the United States -- requiring time off to recover -- waste lives, hurt productivity, and increase payroll costs by an average of 30 percent (in workers' compensation costs).

Project Objectives:

- Survey current construction safety and health activities around the country;
- Perform clinical evaluations of construction workers;
- Create systematic computer reporting systems that will document specific occupational injuries, diseases, and work histories of individual workers, as well as report findings to affiliates, government and NIOSH;
- Utilize occupational health clinics to identify construction health hazards through case reporting and the NIOSH Sentinel Event system;
- Perform onsite evaluations of construction projects to determine hazards responsible for injury and illness;
- Provide consultation, develop educational materials and facilitate occupational safety and health training for employees and employers;
- Implement intervention programs with a focus on joint labor-management cooperative approaches;
- Collect and analyze data, and submit information to industry and appropriate agencies;
- Disseminate information resulting from the project to local and international unions, contractors, academia, and government;
- Build expertise in pilot local and international unions; and

- Facilitate national and international networks for the purposes of developing coordinated approaches to construction safety and health.

Executive Summary

The Center to Protect Workers' Rights (CPWR) overall goal is to conduct a nationally-coordinated effort that will lead to better occupational health and safety protection for construction workers. With a focus on research and development, CPWR's program consists of three primary elements: 1) research to provide needed health and safety information where gaps exist; 2) collection and analyses of data; and 3) dissemination of findings.

The Center to Protect Workers' Rights is a nonprofit research arm of the AFL-CIO's Building and Construction Trades Department, whose fifteen unions represent approximately 4 million construction workers in the United States and Canada. Robert A. Georgine, president of the Building and Construction Trades Department, serves also as president of CPWR.

The CPWR serves union leaders, construction contractors, and training and health and welfare programs. Its overriding goal is to produce and disseminate useful knowledge about construction safety and health -- to help the industry pinpoint such needs as training, protective gear, and legislation standards. The CPWR defines issues of concern, garners resources, and enlists experts -- from government, the private sector, and universities -- to cooperate on research. Using research results and information gained from exchanges with foreign union-employer organizations, CPWR produces major conferences and publications.

The CPWR collaborates closely with the National Institute for Occupational Safety and Health (NIOSH). In 1990, CPWR began a five-year cooperative agreement to target occupational safety and health research and data collection for construction.

Center-supported research uses existing data bases (mainly in construction union files), new surveys, and clinical and worksite observation. The research projects examine such topics as health knowledge and practices, patterns of deaths and illnesses among specific trades, ergonomics (how equipment design or work practices affect musculoskeletal injuries), and exposures to chemicals and other hazards on a building site and a huge highway/tunnel project.

The studies are being conducted by the following institutions, among others:

- George Washington University (Occupational Medicine Program), Washington, DC
- Harvard University/Massachusetts General Hospital
- Mount Sinai Medical Center, New York City
- University of Iowa College of Medicine
- University of Maryland
- University of Massachusetts at Lowell
- University of Washington

Prevention Activities: CPWR Projects

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to*

response):

- a. **Boston Central Artery/Harbor Tunnel Construction.** Identifying and reducing work-related safety and health hazards on the 10-year project.
 - b. **Second New Construction Project.** Following up study of worker chemical exposures and musculoskeletal hazards on building sites -- and of efforts to reduce them.
 - c. **Bridge Rehabilitation Workers.** Assessing risks and health on the job site and in clinics.
 - d. **National Leadership Survey.** Surveying more than 10,000 local unions, building trades councils, and contractors to identify safety and health activities by unions, employers, and health activities by unions, employers, and government.
 - e. **Morbidity Survey.** Using health claims data and workers' compensation claims to find illness and injury trends that may be work-related.
 - f. **Surveillance and Clinical Evaluations.** Developing referral systems, data collection, and health event reporting systems for work-related illness and injuries.
 - g. **Construction Exposure Surveillance Model.** Developing standardized ways to measure worker exposures to hazards -- which, in construction, are often transitory and complex -- using instruments and data reporting procedures.
 - h. **Employer-Based Reporting System.** Enabling contractors to report safety and health data to a central registry and developing guidelines based on experience of contractors with the best safety and health performance.
2. **Research (etiology, methodology, control):**
 - a. **Exposure Assessment for Renovation.** Developing a model to identify chemical exposure levels or ranges for worker tasks.
 - b. **Proportionate Mortality.** Studying death patterns among 15 BCTD affiliate unions.
 - c. **Four Regional Conferences.** Following up July 1993 National Conference on Ergonomics, Safety and Health in Construction with 1½ to 2 day sessions to exchange information with unions, contractors, and scientists. Regional conferences are planned for May 1994 in Boston; June 1994 in Atlanta; June/July 1994 in Cincinnati; and September 1994 in Seattle.
 - d. **Small Studies Program.** Using small studies to support opportunistic and pilot studies.
 3. **Intervention (populations at risk, risk factors, control actions):**
 - a. **Painter Training.** Comparing training and its effects on behavior and knowledge of professional painters and contractors in Alaska, Oregon, and Washington.

b. *Lead Exposure and Contract Specifications.* Developing model contract specifications for worker protection on U.S. Department of Transportation-funded projects.

c. *Critical Path Management.* Developing a computer software program for safety and health management that can be used onsite.

Evaluability Assessment

Not addressed.

Ohio (CA-5)**Project Title: Cumulative Trauma Disorders in Carpenters**

Project Director: Grace K. Lemasters, Ph.D.

Greater Cincinnati Occupational Health Center
10475 Reading Road, Suite 405
Cincinnati, OH 45241
Phone: 513-769-0561 **FAX:** 513-769-0766

Personnel and Skills: 6.5 FTE (FY93), epidemiology, ergonomics, industrial hygiene, occupational medicine, health education, curriculum development.

Problems (diseases, injuries, hazards) Addressed: Exposure to work practices, methods and tool use that lead to the development of work-related musculoskeletal disorders among carpenters.

Project Objectives: Characterize the prevalence of work-related musculoskeletal disorders in carpenter; conduct ergonomic analyses of carpentry tasks that lead to the development of these disorders; and develop and implement recommendations to decrease exposures among this population.

Executive Summary

The Greater Cincinnati Occupational Health Center, in conjunction with the Southwest Ohio District Council of Carpenters and the Allied Construction Industries has undertaken a study of the ergonomic risks carpenters are exposed to while performing their job activities.

The first component of the study was an ergonomic walkthrough evaluation of construction sites. Initial visits included videotaping, still photography, completion of an ergonomic checklist by an observer, and administration of a self-reported ergonomic and symptom survey. Next, a telephone survey of a random sample of members of the three local unions affiliated with the Southwest Ohio District Council of Carpenters was completed. The survey instrument asked questions concerning the health and work history of the respondents. A case definition for a cumulative trauma disorder was developed and a prevalence rate for the population is being estimated.

To validate the questionnaire, a subsample of respondents was randomly selected and recruited for a physical examination of the shoulders, hands/wrists, and knees. In addition, those subjects recruited for self-reported hand/wrist problems were given nerve conduction studies.

Based on analysis of the ergonomic and telephone survey data, three carpentry specialties with potential for very high ergonomic hazard exposure were selected for further study. Currently, the specialties of drywall, form work, and ceiling installation are being evaluated by collecting and analyzing video and dosimetry data.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response)*: This study is designed to determine the prevalence of work-related musculoskeletal disorders in carpenters and the ergonomic hazards to which this population is exposed.
2. *Research (etiology, methodology, control)*: This study uses several research methodologies including statistical analysis of primary survey data, observer ratings of videotape data and statistical analysis of angle measurements of joints.
3. *Intervention (populations at risk, risk factors, control actions)*: After analysis of all data, a series of recommendations concerning work practices, training, and tool use and design will be developed. A labor-management committee will be formed to evaluate the practicality of the recommendations and to choose some for implementation. Those implemented will be evaluated after a trial period of use by selected contractors.

Evaluability Assessment

While data is still being collected and analyzed, preliminary findings have been, and will be disseminated through paper presentations and publications, meetings with NIOSH personnel, carpenters and contractors, and through newsletters to the study population. Results from the first year ergonomic walkthrough evaluations were presented at the 1992 annual meetings of the American Industrial Hygiene Association (AIHA). Presentations were made to the National Conference on Ergonomics, Health and Safety in Construction in July of 1993. It is anticipated that papers will be presented at the AIHA annual meetings and at the American Occupational Health Conference, both in 1994. Papers are also being prepared for publication.

Connecticut (CA-6)**Project Title: Connecticut Road Industry Surveillance Project (CRISP)**

Project Director: Mark R. Cullen, M.D. and Kathleen F. Maurer, M.D., MPH

Institution, Address:

Yale University School of Medicine
Occupational and Environmental Medicine Program
333 Cedar Street
New Haven, CT 06510
Phone: 203-785-5885 **FAX:** 203-785-7391

Office Location:

CRISP/EEOH
150 Washington Street
Hartford, CT 06106
Phone: 203-566-1454 **FAX:** 203-566-3048

Personnel and Skills: physician, project coordinator, industrial hygiene, data management.

Problems (diseases, injuries, hazards) Addressed: Lead toxicity, occupational dermatitis, and musculoskeletal injuries in workers involved in bridge and road rehabilitation projects in Connecticut.

Project Objective: The project is designed to control lead toxicity in bridge workers in Connecticut through aggressive medical surveillance, industrial hygiene intervention and close cooperation with the Connecticut Department of Transportation (CONNDOT).

Executive Summary

In 1991, Yale clinicians, with state public health officials, several unions, the road construction industry, and the state Department of Transportation developed bid specifications for a "Lead Health and Safety Program" to be incorporated into every CONNDOT bridge repair contract. These specifications provided a model for several important new provisions of the construction lead standard and they are tailored specifically to the problem of lead exposure in the construction industry on bridge sites. Medical surveillance with blood lead level (BLL) and zinc protoporphyrin (ZPP) testing occurs for all workers at least annually and is updated monthly. In addition, certain protective equipment is mandated for given job classifications. These specifications are enforced through the CONNDOT contract enforcement mechanism, not through OSHA or a health agency. Since CONNDOT has an inspector on every job daily, and since payment to contractors is contingent upon proper fulfillment of contract specifications, this encourages adequate enforcement of these provisions. CONNDOT began to enforce these provisions on all bridge sites in January of 1993.

Under the CRISP protocol, the problem of lead control is approached from two directions. First, it offers a coordinated statewide program for medical evaluation and

screening for lead-exposed workers. An on-line information system allows workers to be seen at any one of our current thirteen CRISP clinics since all lead-related records are available on a timely basis. This is exceedingly important as workers move from work site to work site around the state. Further, all medical decisions are made through the CRISP Central office in conjunction with the employer to ensure consistency.

Second, CRISP provides technical advice and assistance to companies with workers who have elevated lead levels. This service is offered by the CRISP industrial hygienist and is available when a worker with an elevated blood lead level (BLL) is identified or a company requests assistance. The work done by the industrial hygienist contributes to controlling lead exposures to bridge workers and their families by providing data on a variety of job classifications and sites. Furthermore, this person is critical in identifying sources of contamination and providing information essential to controlling lead exposures to workers. This is an important preventive mechanism for lead poisoning and continues to furnish valuable information. The training, both formal and informal, of workers and companies to the importance of controlling lead exposure and lead toxicity is supplied through the industrial hygienist component of CRISP.

CRISP provides for four basic medical evaluations for workers. They include:

Entry/Annual Evaluation - equivalent to the annual physical examination required by the OSHA Lead Exposure in Construction rule. It includes a section on demographic data (including work site and employer information), occupational and medical history, physical examination findings, laboratory values, and recommendations. The physical examination for the initial evaluation is meant to examine and report findings on those organ systems that are known to be subject to harm from elevated lead exposures.

Interval Evaluation - conducted on a variable protocol. For all workers entered into the system (those seen at a participating CRISP clinic) monthly BLL and zinc protoporphyrin (ZPP) testing is required for the first four months. If after four months of testing, the BLL remains below 25 $\mu\text{g}/\text{dl}$, the worker is switched to a quarterly schedule and BLL and ZPP are drawn every three months. If at any time in the quarterly schedule, the BLL exceeds 25 $\mu\text{g}/\text{dl}$, the worker is switched to a monthly testing interval. When a year has elapsed, an annual evaluation is done and the process of every month for four months begins again.

Exit Evaluation - completed for all workers no longer working in a lead-exposed environment. The format is similar to the Interval Evaluation, but does not require information on recommendations for working conditions. A BLL and ZPP are performed.

Comprehensive Evaluation - completed for all workers found to have BLLs greater than or equal to 40 $\mu\text{g}/\text{dl}$. The format closely parallels the Entry/Annual Evaluation except that the occupational history is more detailed. These workers continue on a monthly BLL and ZPP testing interval and their laboratory and examination results initiate an intervention by the industrial hygienist. If a lead-toxicity related finding is detected on this or other evaluations, the worker is

referred for specialty follow-up to one of the academic occupational medical clinics for specialist evaluation.

The Connecticut model is in its fourth year of a five year grant. There are currently over 700 workers enrolled in the CRISP medical surveillance system who represent approximately 1500 visits to clinics in the database. For the past 8 months (at this time, the Lead Health and Safety specification is incorporated into the contracts for 16 CONNDOT sites), preliminary data show that there is evidence of clear decreases in blood lead levels in workers on active bridge sites.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* CRISP has developed a broad-based network of occupational and industrial medicine clinics across the state who see all of the bridge workers enrolled in the medical surveillance system. Each clinic agrees to use the CRISP medical surveillance protocol, developed in conjunction with the CRISP Medical Advisory Committee, abide by a fee agreement, utilize one laboratory for testing, report results in a timely manner, and participate in the development of a statewide database. This single statewide database and the broad network of clinics ensures that construction workers who tend to be quite mobile and work in many places for different employers are adequately served by medical care. A critical component of the surveillance component is the existence of the single, statewide database that is managed by medical and public health personnel. Because CRISP requires clinics to deal with one laboratory only, the CRISP database receives the blood lead data rapidly and is able to identify sites where elevations of worker blood lead levels are occurring.

2. *Research (etiology, methodology, control):* With the introduction of the Lead Health and Safety Specifications into contract bids by CONNDOT starting January 1993, CRISP has increased its enrollment. The specification requires industrial hygiene presence on bridge sites, comprehensive worker training, personal hygiene equipment including shower facilities, personal protective equipment, appropriate site lead control plans and programs, medical surveillance program and other related matters.

3. *Intervention (populations at risk, risk factors, control actions):* CRISP developed intervention protocols early-on to guide these activities. In general, when a blood lead level greater than 25 $\mu\text{g}/\text{dl}$ appears in the database, the CRISP-employed industrial hygienist intervenes at the work site. This intervention may consist of a single telephone contact, a site walk through, or a comprehensive lead sampling industrial hygiene investigation. Worker training is one of the most important components of the activities of the industrial hygienist because common causes of elevated blood lead levels on work sites are inappropriate uses of protective equipment, using cigarettes in lead exposure areas, and lack of proper personal hygiene procedures.

Evaluability Assessment

Evidence obtained from blood lead level data and industrial hygiene monitoring on

bridge sites in Connecticut suggests that iron workers, blasters, painters, and other bridge workers are at great risk from lead exposure. The risk appears to be related more to the specific bridge site and the work being undertaken on that site than to the trade or activity practiced by the particular worker. CRISP expects to be able to identify the most important variables in lead-exposure work and predict exposure based on those variables. A job-exposure matrix will evolve from this data.

Washington, DC (CA-7)**Project Title: Reducing Musculoskeletal Disorders Among Construction Workers**

Project Director: Knut Ringen, Dr.P.H.

Institution, Address:

Center to Protect Workers Rights
111 Massachusetts Avenue, NW
Washington, DC 20001
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Personnel and Skills:

Problems (diseases, injuries, hazards) Addressed: The focus on construction has been needed because occupational safety and health in construction -- compared with other industries -- in the United States and Canada have been largely ignored and appear to lag substantially behind conditions for the industry in several other industrialized nations. For instance, in 1988 U.S. government safety research funding totaled \$0.08 per construction worker and \$2.16 per manufacturing employee. And the U.S. rate of deaths from injuries on the job is 14 per 100,000 full-time employees, or 900 deaths yearly. That rate is more than three times the rate for manufacturing and appears to be significantly higher than rates for construction in the Netherlands, Sweden, and the province of Ontario, Canada.

The more than 240,000 serious injuries among construction workers in the United States -- requiring time off to recover -- waste lives, hurt productivity, and increase payroll costs by an average of 30 percent (in workers' compensation costs).

Project Objectives: This population-based project, which intends to achieve national impact on work-related musculoskeletal disorders (WMD) among construction workers, has as its aims, the following:

- . To define what is meant by WMD among construction workers;
- . To identify the magnitude of WMD among construction workers;
- . To identify WMD hazards in construction settings;
- . To create awareness among decision makers and workers about the magnitude of WMD and prevention strategies;
- . To develop training and intervention programs aimed at reducing worksite exposures to WMD hazards; and
- . To reduce the incidence of WMD in construction workers.

Executive Summary

The Center to Protect Workers' Rights is a nonprofit research arm of the AFL-CIO's Building and Construction Trades Department, whose fifteen unions represent approximately 4 million construction workers in the United States and Canada. Robert A. Georgine, president of the Building and Construction Trades Department, serves also

as president of CPWR.

The CPWR serves union leaders, construction contractors, and training and health and welfare programs. Its overriding goal is to produce and disseminate useful knowledge about construction safety and health -- to help the industry pinpoint such needs as training, protective gear, and legislation standards. The CPWR defines issues of concern, garners resources, and enlists experts -- from government, the private sector, and universities -- to cooperate on research. Using research results and information gained from exchanges with foreign union-employer organizations, CPWR produces major conferences and publications.

The CPWR collaborates closely with the National Institute for Occupational Safety and Health (NIOSH). In 1990, CPWR began a five-year cooperative agreement to target occupational safety and health research and data collection for construction.

Center-supported research uses existing data bases (mainly in construction union files), new surveys, and clinical and worksite observation. The research projects examine such topics as health knowledge and practices, patterns of deaths and illnesses among specific trades, ergonomics (how equipment design or work practices affect musculoskeletal injuries), and exposures to chemicals and other hazards on a building site and a huge highway/tunnel project.

This project consortium is headed by CPWR. The consortium members include the University of Massachusetts at Lowell, the University of Iowa, the George Washington University Division of Occupational and Environmental Medicine and Biostatistics Center.

Prevention Activities

National Conference on Ergonomics, Safety and Health in Construction. To define the state of knowledge and exchange information, in July 1993 CPWR held the first in Washington, DC. Cosponsors included NIOSH, the U.S. Occupational Safety and Health Administration, the U.S. Department of Energy, and leading organizations from industry and the nonprofit sector. More than 750 decision makers in construction, public health, and public policy -- from the United States, Europe, and the Pacific -- participated.

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Collect and use data on the prevalence of WMD in construction to help identify high risk groups and tasks for further study and intervention.
2. *Research (etiology, methodology, control):* Longitudinal study to begin assessing the feasibility of doing a longitudinal health study of work-related musculoskeletal disorders among a cohort of construction workers.
3. *Intervention (populations at risk, risk factors, control actions):* Identify hazardous trades and tasks through a review of the literature, field work, qualitative and quantitative job tasks analyses and focus groups with workers and to pilot interventions in the workplace and monitor their efficacy.

Evaluability Assessment

Not addressed.

Washington, DC (CA-8)

Project Title: Reducing Work-Related Musculoskeletal Disorders Among Carpenters or Related Construction Workers

Project Director: Edward J. Gorman, III

Institution, Address:

Carpenters Health & Safety Fund of North America
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Washington, DC 20001
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Personnel and Skills: 3.0 FTE; ergonomics, industrial engineering, curriculum development, and worker training.

Problems (diseases, injuries, hazards) Addressed: Work-related musculoskeletal disorders (WMD) or Cumulative Trauma Disorders (CTD) among carpenters.

Project Objectives: Reduce WMDs among carpenters through the development and implementation of ergonomics training for, initially, apprentices, and eventually employers and journey-level carpenters; identify ergonomic stressors associated with CTDs in selected high risk carpentry sub-trades.

Executive Summary

Work-related musculoskeletal disorders now account for about 60% of all work-related diseases. Work-related musculoskeletal disorders affect many occupations - from office work to poultry processing. Although WMDs among construction workers has not been thoroughly studied, recent research shows that construction workers are at high risk for WMDs. For example, the Washington State Department of Labor and Industries, based on an analysis of its exclusive workers' compensation State Fund system, reported that construction (SIC 15-17) is a high risk group for these disorders. The incidence rates in construction for WMDs during 1988-91 were consistently over 10 per 200,000 work-hours, while the overall incidence rate was 6.01 per 200,000 work-hours.

This three-year project is a cooperative agreement between NIOSH and the United Brotherhood of Carpenters (UBC) Health and Safety Fund. The project seeks to: (i) identify ergonomic stressors in carpentry work that may lead to WMDs, (ii) assess the prevalence of WMDs in specific carpentry sub-trades through symptom survey questionnaires, and (iii) develop and implement an ergonomics training program that will be integrated into the existing carpenters apprenticeship training program.

The effectiveness of training will be evaluated by measuring changes in carpenters' behavior patterns and attitude to ergonomics. Two apprenticeship schools in western Washington will participate in this project - one will serve as the experimental group and the other as the control group. Periodic surveys will be conducted with both groups to investigate if any differences in behavior patterns are stable over time. Eventually, differences in injury patterns may be noticed. However, because such differences may take many years to show up, it is likely that by then the sample size will be too small to

yield statistically significant differences. Hence, behavior data may be more important than injury data in evaluating the effectiveness of training.

It is hypothesized that carpenters who undergo training will be more likely to recognize ergonomic stressors in their workplaces and be better equipped to solve ergonomic problems than those in the control group.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Very little is known about the magnitude and severity of WMDs among carpenters. Symptoms surveys will be administered to carpenters working in specific sub-trades and the information obtained from the surveys will be used to develop and improve the training program.
2. *Research (etiology, methodology, control):* Training is an integral part of any ergonomics program. However, to date, very little research has been done in evaluating the effectiveness of training in reducing WMDs. This study will examine the effectiveness of training in bringing about changes in behavioral patterns and attitudes. Ultimately, it is anticipated that training will lead to a reduction in WMD.
3. *Intervention (populations at risk, risk factors, control actions):* The project has assembled a "focus group" consisting of contractor safety representatives, union officials, apprenticeship school instructors, and State of Washington representatives. Focus group contractors provide access to key contractor associations, and several ergonomics workshops/seminars were presented to these groups in the first year of the project. Similarly, through the union, ergonomics workshops were conducted for union representatives and members.

Evaluability Assessment

The project is conducting train-the-trainer sessions for instructors in apprenticeship schools so that they can conduct ergonomics training on an on-going basis in their respective programs.

An ergonomics awareness manual, along with an instructors' guide, has been developed during the first year of the project. All apprentice participants in the experimental group will receive copies of this manual.

The study description and results of surveys will be published in news letters and the Carpenter Magazine, received by UBC membership nationwide. The study results will be reported in peer reviewed scientific journals.

EXTRAMURAL: Research Grants

Massachusetts (RG-1)**Project Title: Evaluation of Controls Protecting Lead Exposed Workers**

Project Director: Lewis D. Pepper, M.D.

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Personnel and Skills: 0.7 FTE (FY93), occupational medicine, epidemiology, industrial hygiene, and medical anthropology.

Problems (diseases, injuries, hazards) Addressed: Not addressed. Blood lead levels and airborne lead levels.

Project Objectives: The overall objective of this project is to determine why high blood lead levels continue to occur in bridge construction workers despite government regulations and industry recommendations.

Executive Summary

This project is a cross-sectional survey of bridge repair and maintenance workers at worksites in Massachusetts. The project staff will visit fifteen worksites, and randomly select five workers at each site each year for two years. This will result in a total sample of 150 bridge workers in the survey. Workers will be interviewed using structured and unstructured techniques and they will also be asked to keep a work task diary during a two-week period. In addition, blood samples and air samples will be taken to determine individual-level exposures and biological markers of effect. Other information on environmental conditions and work practices will be gathered by project staff and used to construct a personal exposure score which will be used in the analysis. Blood lead levels at the beginning of the two week observation period will be compared with levels at the end. Changes in blood lead levels during the time period and, if so, to examine changes in job assignments or work tasks that might be associated with the changes. The mean blood levels for all workers will be compared at the beginning and at the end of the two week observation period. The analysis of the data collected over the two year period will be focused on associations between specific work activities and environmental factors and blood lead levels and airborne lead levels for bridge repair and maintenance workers.

The main goal will be met through the following aims: 1. Measure lead particle exposure in three particle size fractions and perform surface wipe measurements for 150 Massachusetts bridge construction workers working in a variety of state Highway Department sites; there will be three to five exposure measurements during a two week study period at each site. 2. Perform a set of structured observations of work practices and the use of personal protective devices and control technologies at times coinciding with exposure measurements. These observations will be combined into ordinal index

variables representing containment, ventilation, personal protection, and similar variables. 3. Perform a project baseline blood lead on this group followed by a second measurement 14 days later. 4. use ethnographic techniques (observation, questionnaires, and semi-structured interviews) to assess worker and management awareness of lead poisoning issues associated with bridge repair work practices at each site. 5. Develop predictors of blood lead and air concentrations using industrial hygiene controls, work practice, training, and company and worker attitude variables.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* The study is a response to the persistent reports of elevated blood and air lead levels in bridge construction and maintenance activities and it represents an attempt to determine why high blood levels continue to occur despite government regulations and industry recommendations.
2. *Research (etiology, methodology, control):* This project is designed to evaluate which work processes, controls, and practices contribute most to the lead overexposures and to determine whether and why the recommendations that have been made are or are not being implemented. Air and surface sampling as well as blood lead and changes in blood lead over a 2 week period will be done as measures of the effectiveness of the lead exposure control programs in use at each job site. The lead exposure control programs will be evaluated through examination of background on the company; the controls in place at the worksite; the processes and work practices used on the worksite; and the knowledge and attitudes of the workers themselves.
3. *Intervention (populations at risk, risk factors, control actions):* The researchers will provide the results of the blood lead tests to each study subject, and upon request, their physician. All blood test results will be reviewed by an occupational physician who will send a letter informing the individual of the health significance of the results and the recommended medical follow-up. Subjects will also be provided with a fact sheet describing the health effects of lead exposure.

Project participants will be provided a project summary at the end of the study. Information to be included will be summary blood lead levels, environmental sampling data, study conclusions, and recommendations.

The final report, which will be completed at the end of the study, will be provided to appropriate agencies and institutions, e.g. OSHA and EPA.

Evaluability Assessment

This study is one of the first evaluations of structural steel paint abatement activities following the extension of OSHA's Lead Standard to the construction industry. The study, which uses innovative evaluation methods including the measurement of lead particle exposure in three particle size fractions, the creation of an ordinal index variables representing containment, ventilation, personal protection, and similar variables using structured observations of work practices and the use of personal protective devices and control technologies, the use of blood lead observations over a defined interval, the use of ethnographic techniques (observation, questionnaires and semi-structured

interviews) to assess worker and management awareness of lead poisoning issues associated with bridge repair work practices at each site, and the development of blood lead and air concentrations using industrial hygiene controls, work practice, training, and company and worker attitude variables, will permit an early assessment of the impact of federal regulatory requirements and the barriers to optimal worker protection.

Vermont (RG-2)**Project Title: Load Monitoring for Safe Construction**

Project Director: Dryver R. Huston, Ph.D.

Institution, Address:

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College of Engineering and Mathematics
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Votey Building, Room 201E
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Personnel and Skills: University of Vermont: one mechanical/structural engineer, one electrical engineer, and two graduate students; Purdue University: two structural engineers and two graduate students.

Problems (diseases, injuries, hazards) Addressed: Injuries to construction workers due to the collapse of concrete formwork and shoring.

Project Objectives: To measure the vertical and lateral loads on shoring members during the construction of multistory reinforced concrete buildings and to use the data for the development and refinement of existing construction codes.

Executive Summary

The collapse of formwork and shoring during the construction of concrete structures is a very dangerous and recurring problem. This project will take construction site data that can be used to prevent such accidents. The project is in its initial stages. The planned activities are to take real-time measurements of the vertical and lateral loads experienced by shoring members on a concrete building while it is being built. Eight or more shoring members will be instrumented with three-axis load cells. The load data will be acquired at two rates: one for the measurement of dynamic loads as may be caused by construction activities, the other for the measurement of long-term loads (several days) as occur due to the curing of concrete. The load data will then be used to develop rational shoring construction codes.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* Information will be gathered that will determine the actual loads that are experienced by shoring members during construction. Very little of such data is presently available.
2. *Research (etiology, methodology, control):* This study will provide a critical examination of the existing construction codes.
3. *Intervention (populations at risk, risk factors, control actions):* The data gathered in this study will be used to develop rational, and presumably safer,

construction codes and practices that will lead to fewer collapses of formwork and shoring on construction sites.

Evaluability Assessment

To date, no information has been gathered on this project. However, preliminary previous work by the investigators has indicated that it is possible to take both static and dynamic shoring load measurements during construction.

Michigan (RG-3)**Project Title: Analysis of Construction Tasks for Overexertion Injuries**

Project Director: John G. Everett, Ph.D.

Institution, Address:

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Personnel and Skills: 1.5 FTE (FY93), ergonomic job analysis, construction.

Problems (diseases, injuries, hazards) Addressed: Overexertion injuries in construction.

Project Objectives: Analyze construction tasks for the presence of seven generic risk factors for overexertion injuries. Identify high risk tasks for ergonomic or administrative intervention.

Executive Summary

Overexertion injuries are the single largest classification of injury in construction, accounting for about 24% of all injuries. The Bureau of Labor Statistics and OSHA define overexertion injuries as "nonimpact cases in which the injury resulted from excessive physical effort, as in lifting, pulling, pushing, welding, or throwing the source of injury. Includes conditions resulting from repetitive motion in the use of hand tools."

Overexertion injuries generally occur as a result of performing a given task as planned. While overexertion injuries are not intentional, the underlying causes of the injuries are built into the prescribed tools and work methods. If the causes can be identified, it should be possible to engineer them out of the work. Once afflicted with an overexertion injury, many construction craft workers can be excessively challenged by the physical demands of their jobs. If the worker has the requisite skills and if alternative less-demanding employment is available, the worker can seek a different job where demands are better matched to physical capacity and ability. If alternative work cannot be found, the injured worker faces the dilemma of continuing at a job that causes excess fatigue or discomfort, or perhaps dropping out of the workforce.

Construction injuries have been categorized in many ways, including by trade (e.g. carpenters, electricians, laborers, etc.) but no attempt has been made to identify a causal relationship between specific tasks within a trade and the associated overexertion injuries. For example, carpenters account for 17% of all injuries and illnesses, but carpenters perform many fundamentally different tasks such as erecting concrete formwork, installing suspended ceilings, hanging drywall, etc. Carpenters who install formwork for concrete experience high rates of tendinitis in their elbows from banging the forms and connectors with hammers, carpenters who install suspended ceiling systems experience neck and shoulder problems from constantly looking and reaching up, and

estimate absorbed dose. A high concentration between absorbed dose from breath samples and the physiologic sampler measurement will demonstrate the effectiveness of the new method.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response)*: Many construction activities such as painting, scaling, and floor laying involve exposures to volatile organic solvents. Construction jobs also usually require moderate to high levels of sustained work activity during periods in which contaminants are released. Such periods of increased work activity could significantly enhance respiratory ventilation rates and increase contaminant uptake leading to higher exposures. Presently, no methods exist to measure or account for the impact of worker activity on inhalation exposures.
2. *Research (etiology, methodology, control)*: This study aims to develop a physiologic sampling device that accounts for individual changes in respiratory ventilation rates during work activities. Changes in heart rate and chest expansion will be used to monitor the effect of work activity on respiration, and to adjust the sampling rate in proportion to estimated minute volume. Continuous data logging of the respiration and heart rate provide a time history of work activity. A field study of construction painters and floor layers will evaluate the potential impact of work activity on inhalation exposures to solvents as assessed by physiologic sampling and by biological monitoring using exhaled breath samples.
3. *Intervention (populations at risk, risk factors, control actions)*: The application of physiologic sampling should help identify situations where potentially high exposures occur as a result of contaminant release during periods of high work activity. Applying respiratory protection during these critical periods is one appropriate intervention strategy to test in the field study that will focus on inhalation exposures. In addition to respiratory protection, barrier clothing will be used to exclude skin exposures in the field study. The effectiveness of this strategy will be gauged by the results of the biological monitoring program.

Evaluability Assessment

This study among construction workers is the first to use physiologic sampling for exposure assessment and the first to use respiratory monitoring to measure work activity. Physiologic sampling should provide insight into exposure factors affecting contaminant uptake and body burden. In addition, the biological monitoring results should provide an indication of the effectiveness of this method as a screening tool to evaluate exposure reduction measures.

Washington (RG-5)**Project Title: Development of a Construction Injury Predictive Model**

Project Director: Kweku K. Bentil, Ph.D.

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College of Architecture & Urban Planning
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Seattle, WA 98195
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Personnel and Skills: One civil engineer with over 15 years of Construction Industry experience, two epidemiologists with injury prevention research experience, one statistician and two graduate students.

Problems (diseases, injuries, hazards) Addressed: Traumatic injuries occurring at commercial construction sites.

Project Objective: The purpose of this research is to develop knowledge that can be used in preventing traumatic injuries at commercial construction sites. The main objective of this study is to develop a parsimonious empirical model that will have good capabilities of predicting the incidence of traumatic injuries requiring medical care among construction workers employed by commercial construction contractors. The first aim is to investigate and identify the most significant risk factors that can influence the occurrence of injuries at commercial construction sites. The general categories of risk factors to be addressed are characteristics of commercial construction contractors, projects and workers. The second aim is to analyze these categories of risk factors and understand the relationship between them and the number of traumatic injuries at commercial construction sites requiring medical treatment by a licensed caregiver. The third aim is to utilize these factors and their functions in a model that will have good capabilities of predicting the incidence of injuries at given construction sites before the commencement of that project.

Executive Summary

The construction industry experiences a high rate of injuries in general, and a high rate of fatal and disabling injuries in particular. The ability to predict injuries can help control and prevent them. However, because of the dynamic nature of the industry and the unique nature of each contractor and project, traditional methods of prediction, such as historical averages, can provide inaccurate and misleading information. The purpose of this research is to develop knowledge that can be used in preventing traumatic injuries at commercial construction sites. This study will develop a model for predicting the risk of construction injuries as a function of the characteristics of contractor, project, and construction worker. The main outcome of interest will be the rate of traumatic injuries occurring at commercial construction sites that require medical treatment by a licensed caregiver. Data will be collected for a minimum of 100 commercial construction

contractors and 400 projects from commercial construction contractors and the State of Washington Department of Labor and Industries.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* This project is primarily a commercial construction site injury surveillance project. The main outcome of interest will be the rate of traumatic injuries occurring at commercial construction sites that require medical treatment by a licensed caregiver. The injuries studied will be the same as those that are required to be reported by OSHA. In addition, characteristics of construction contractors (size, experience, etc.) project (size, type, scope, duration, number of manhours, etc.) and injured workers (age, race, gender, trade number of manhours prior to injury) are requested. Reporting is done from a survey instrument which requests information from contractors for three previous calendar years. Data collection is done on site (contractors offices) in order to facilitate the process.

2. *Research (etiology, methodology, control):* Data analysis will involve fitting Poisson regression models, with adjustment for overdispersion, and for shared contractor and project effects. Model fitting will be accomplished using the GLIM Computer Software, developed by the Royal Statistical Society. The characteristics of commercial construction contractors, projects and workers will be investigated as explanatory variables in order to determine their significance in predicting injuries. Rate of injuries will be calculated as injuries/FTE. Relative risks and corresponding confidence intervals will be estimated for combined injuries, and for individual types of injury. Standard likelihood methods of generalized linear models will be used for testing the effect of each explanatory variable on the injury rate, both alone, and adjusted for the confounding effects of other explanatory variables.

3. *Intervention (populations at risk, risk factors, control actions):* Analysis of previous injury data has been used to prevent injuries in other industries (such as manufacturing and transportation) in the past. The ability to analyze accident data and predict the number of injuries that can be expected can make it possible for safety programs to be narrowly tailored to each specific construction project and contractor in order to make existing safety programs more effective in preventing injuries. Therefore, the results of this study can greatly expand available knowledge about safety in the construction industry and lead to lower injury rates. The results of this research will provide the construction safety research community, contractors, insurance companies, risk managers, and OSHA a tool that can help measure the effectiveness of safety programs. Specifically, it will also enable OSHA to target projects with high risk factors for inspection and more aggressive programs. Finally, the results can also serve as the basis for future research on developing injury predictive models for other categories of construction (residential, industrial, heavy, and highway).

Evaluability Assessment

This grant commenced on September 30, 1993. Therefore, no information is available for dissemination or publication at this time. It is however, anticipated that at the

completion of this project in 1995, the results will be disseminated by NIOSH to all interested parties including OSHA, the major construction contractor organizations (such as the Associated General Contractors, Associated Builders and Contractors, Mechanical Contractors Association, and the National Electrical Contractors Association) for distribution to their membership, the Center for Excellence in Construction Safety and the major insurance companies. The results of this study will also be published in the relevant journals (such as the Journal of Safety Research, Occupational Health and Safety, and Journal of Occupational Accidents) as well as construction trade publications (such as the "Constructor" and "Builder and Contractor").

North Carolina (RG-6)**Project Title: Occupational Disease Among Carpenters**

Project Director: John M. Dement, Ph.D., C.I.H.

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Personnel and Skills: 0.75 FTE (FY93), epidemiology, industrial hygiene, biostatistics.

Problems (diseases, injuries, hazards) Addressed: Occupational lung diseases and respiratory cancer among carpenters. Occupational asthma a primary focus.

Project Objectives: Not addressed.

Executive Summary

The National Institute for Occupational Safety and Health (NIOSH) has identified occupational lung diseases as one of the ten leading occupational health problems in the United States. The construction industry has been identified as one of the "Special Population Targets" in the Healthy People 2000 document due to the high rate of work-related deaths and work-related injuries among this population. Additionally, occupational respiratory disease surveillance data for 1973-1988, calculated from Bureau of Labor Statistics data, demonstrate annual incidence rates to range from 1.8 to 3.7 cases per 10,000 full-time workers for the construction industry.

Surveillance is the first step in development of prevention strategies for leading work-related diseases and injuries. Unfortunately, no single comprehensive data base is available to study occupational illness/disease/injury. With no surveillance mechanism in place, a number of avenues have been explored including the use of pre-existing data bases such as state worker's compensation files and health insurance claims.

The use of data bases for epidemiologic research that were developed for other purposes raises a number of issues. Morbidity information relative to occupational injuries and illness can be collected from worker's compensation data and from health insurance claims. Collectively, use of both of these data sources is necessary to fully characterize occupational morbidity and the interaction of occupational and other risk factors. This project will explore the use of medical claims data for study of occupational lung disease among carpenters in Washington State.

Occupational lung diseases to be studied include malignant neoplasms (ICD-9 158, 162, 163), obstructive pulmonary diseases (ICD-9 406-496) and pneumoconioses (ICD-9 500-508). Case definition criteria using ICD-9 codes will be used to identify existing and new cases of each target lung disorder using both worker's compensation data and insurance

data. In order to calculate rates, estimates of the populations covered will be derived from computer tapes of all eligible members covered by the insurance Funds for the chosen study years. Analysis will include generation of conventional descriptive statistics as well as more refined internal comparisons. Age, race and sex specific incidence and period prevalence rates with confidence limits based on Poisson statistics will be calculated for each target lung disease. For identification of high risk populations, further analyses will include calculation of age-adjusted incidence and period prevalence rates for each lung disease for various carpenter trades and industries in Washington.

The proposed case definition of asthma for the case-control study will be a primary ICD-9 diagnosis code of 493. The case-control study will include newly diagnosed cases of asthma during 1988-1992 (estimated to be 100-150) from the medical claims file or the State of Washington Worker's Compensation files. Three controls for each case, group matched on age (within 2 years), sex and race will be randomly selected from the population of carpenters who do not file a medical or compensation claim for lung diseases of interest during the study period.

Cases and controls will be contacted by mail and asked to complete a self-administered questionnaire soliciting information concerning respiratory symptoms as well as information concerning specific occupational exposures possibly associated with occupational asthma. The occupational/environmental exposure questionnaire will include questions concerning exposures to wood dusts, isocyanates, anhydrides, metals, soldering fluxes, paints, solvents plants, animal products and other biological and chemical materials. Stratified analyses will be used to control for possible confounders such as age, race, sex, smoking, etc. Multiple logistic regression will be used to analyze the association between asthma diagnosis, respiratory symptom data (and combinations of symptoms) and occupational exposures after adjustment for potential confounders.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* This project will integrate several existing data bases in order to develop a comprehensive surveillance data system useful for study of work-related respiratory disorders among carpenters. These data bases include: a) medical claims data, b) worker's compensation data, c) United Brotherhood of Carpenters (UBC) national membership file data, and d) disability and pension data. This study is being conducted using data for Washington State.
2. *Research (etiology, methodology, control):* Epidemiological methods will be developed for analyses of medical claims data. This includes development of appropriate case definitions for purposes of surveillance and etiologic epidemiology of respiratory diseases. These analyses will have the objective of identifying high risk industries and carpenter sub-trades. An asthma case-control study of carpenters will be conducted for purposes of identifying possible etiologic associations with specific occupational exposures.
3. *Intervention (populations at risk, risk factors, control actions):* Data are being analyzed with respect to incidence and prevalence of occupational lung diseases among carpenters in Washington State. The asthma case-control study will further

construction standard for lead will also be ascertained. The primary objectives of data analysis will be to describe the distribution of blood lead concentrations, test the null hypothesis that there are no differences in blood lead factors, symptoms, and blood lead concentrations. Results will also be used to evaluate the efficacy of the Iowa Department of Public Health's adult Blood Lead Surveillance Program, and University of Iowa Hospitals and Clinics database for identification and control of occupational exposure to lead in the Iowa construction industry. Information generated in this project will be incorporated into the National Hazard Communication Resource Center database, as well as presented to construction workers. The data generated will be used to plan future projects to quantitatively evaluate occupational exposure, and to develop intervention strategies.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response):* This study is a response to sentinel data from case reports and surveillance systems that have identified lead exposure as a serious occupational hazard for construction workers. Blood lead concentrations measured in this study will be incorporated into the Iowa Department of Public Health's Adult Blood Lead Surveillance Program. The prevalence and severity of elevated blood lead concentrations determined in this project will be compared to estimates for the construction trades calculated using data from the Iowa Department of Public Health's Adult Blood Lead Surveillance Program, and the efficacy of this program for identification and mitigation of lead poisoning in construction will be evaluated.
2. *Research (etiology, methodology, control):* This study will characterize the distribution of blood lead concentrations in Iowa construction workers; identify and evaluate risk factors; evaluate Iowa's current surveillance system; evaluate compliance with the new OSHA standard; organize and disseminate information on lead hazards and control; and generate strategies for intervention.
3. *Intervention (populations at risk, risk factors, control actions):* All blood lead results will be reported to the Iowa Department of Public Health and incorporated in the Adult Blood Lead Surveillance Program. Individuals will be notified of their results by letter, and those with levels exceeding 25 ug/dL will be provided with specific suggestions for followup. In cases with elevated blood levels, the Iowa Department of Health will notify the consultation section of the Iowa Occupational Safety and Health Bureau to perform investigation of potential workplace environmental problems. Results of the study will be disseminated to users in government, academia, and the construction industry via the National Hazard Communication Resource Center database, and a series of presentations. Results of this project will be used to identify potential intervention strategies. A final report, containing aggregate data, will be sent to construction unions, and to appropriate government agencies.

Evaluability Assessment

Dissemination effectiveness will be measured by number of users accessing information in the National Hazard Communication Resource Center database, and by numbers of

presentations and audience numbers. Effectiveness of presentations will be evaluated by audience participation, and by evaluation forms completed by audience members.

Colorado (RG-8)**Project Title: Development of an Exposure Matrix for Construction Painters Based on Specific Work Tasks**

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Personnel and Skills: 1.0 FTE (FY94), industrial hygiene, epidemiology.

Problems (diseases, injuries, hazards) Addressed: Potential for exposure to air contaminants during painting, focusing on solvent vapors and their potential for behavioral and neurological effects.

Project Objectives: To determine the nature and extent of exposures in construction and to develop methods of estimating exposure to air contaminants through self reports of work activity.

Executive Summary

Construction painters are exposed to a wide variety of substances that may cause acute and chronic adverse health effects. Relatively little work has focused on this occupational group despite the extent of exposure, the large population of workers, and the potential for severe effects - neurotoxicity, increased accident rates, cancer, reproductive disorders, and respiratory disease. This investigation will provide much needed quantitative information on exposures in construction painting. By focusing on specific work tasks, new methods will be developed in which exposures can be accurately estimated on the basis of self reports of work activity. This exposure assessment technique will be valuable when dealing with workers who perform tasks at different job sites or who perform a variety of activities. The new technique will enhance the capabilities of health scientists in the assessment of exposure of individuals that in the past have been difficult to characterize.

Video exposure monitoring will be used to link specific work tasks to exposure levels. A database of tasks and exposure levels will be developed for later use in the characterization of exposure on the basis of information from self reported activities. The statistical relationships between variables that characterize the work (tasks and environment) and exposure levels will be determined. Information obtained at the job sites will be used to develop and modify the task history questionnaire and statistical analyses will be performed to assess its utility in developing overall exposure profiles. A short questionnaire will be administered in order to assess the relationship of exposures to airborne contaminants and the incidence of specific symptoms. The statistical

associations between peak and time weighted average exposure levels and symptom scores will be determined.

Prevention Activities

1. *Surveillance (problem recognition, diagnostic criteria, reporting, linkage to response)*: Data will provide information on occupational exposures for construction painters. The self reported incidence of symptoms that may be related to solvent exposure will be evaluated in the study population.
2. *Research (etiology, methodology, control)*: This study will evaluate exposures to a wide variety of contaminants generated during painting. The development of methods to estimate exposure to construction painters based on self reported work activity will be useful in future epidemiologic investigations.
3. *Intervention (populations at risk, risk factors, control actions)*: Upon completion of the data collection at a particular job site, the investigators will provide to each participant, on request, information regarding their exposures. If consent is obtained from the employee and the employer, detailed information and recommendations to minimize exposures will be provided.

Evaluability Assessment

Construction painters are potentially exposed to a wide variety of chemical contaminants but as a group have not been extensively studied due to the intermittent nature of exposure, the variety of work tasks, and changing environmental conditions. This study will attempt to link the many factors affecting this complex occupational exposure. Statistical models will be developed which will attempt to explain the relationship of work tasks and environmental conditions on personal exposures to specific air contaminants. The study will identify tasks which provide the greatest contribution to overall contaminant exposure and reductions in these exposures may reduce the risk of adverse health effects.

ACRONYM LIST

AFL-CIO	American Federation of Labor and Congress of Industrial Organizations
AIHA	American Industrial Hygiene Association
BLL	blood lead level
CCSC	Chicagoland Construction Safety Council
CDC	Centers for Disease Control and Prevention
CONNDOT	Connecticut Department of Transportation
CPR	Cardio Pulmonary Resuscitation
CSCI	Construction Safety Council of Illinois
CSHI	Construction Safety and Health Institute
CTD	Cumulative Trauma Disorders
DBBS	Division of Biomedical and Behavioral Science
DSHEFS	Division of Surveillance, Hazard Evaluations, and Field Studies
DPSE	Division of Physical Sciences and Engineering
DSR	Division of Safety Research
DRDS	Division of Respiratory Disease Studies
DSDTT	Division of Standards Development and Technology Transfer
DTMD	Division of Training and Manpower Development
EPA	Environmental Protection Agency
FTE	Full Time Employee
FY	Fiscal Year
GC-MS	gas chromatography-mass spectrometry
HCP	Hearing Conservation Program
HETA	Health Hazard Evaluations and Technical Assistance
HHE	Health Hazard Evaluations
HIS	Health Interview Survey
IABSOI	International Association of Bridge, Structural and Ornamental Ironworkers
IBEW	International Brotherhood of Electrical Workers
IBPATA	International Brotherhood of Painters and Allied Trades of America
IMIS	Integrated Management Information System (OSHA's)
IUBAC	International Union of Bricklayers and Allied Craftsmen
LIUNA	Laborers' International Union of North America
LNHSF	Laborer's National Health and Safety Fund
NIOSH	National Institute for Occupational Safety and Health
OCIS	OSHA's Computerized Information System
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PHS	Public Health Service
PMR	proportional mortality ratio
RDHETA	Respiratory Disease Health Hazard Evaluations and Technical Assistance
REL	Recommended Exposure Level
SDS	Supplemental Data System
SENSOR	Sentinel Event Notification Systems for Occupational Risks
SMWIA	Sheet Metal Workers' International Association
SPRG	Statistical Peer Review Group
SUNY	State University of New York (at Buffalo)

TLV	Threshold Limit Value
UBCJA	United Brotherhood of Carpenters and Joiners of America
WVCSHP	West Virginia Construction Safety and Health Program
WVURC	West Virginia University Research Corporation
ZPP	zinc protoporphyrin

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