

NATIONAL OCCUPATIONAL RESEARCH AGENDA

UPDATE *May, 2000*

21 Priorities for the 21st Century

The logo for the National Institute for Occupational Safety and Health (NIOSH). It features the word "NIOSH" in a bold, blue, sans-serif font. The "N" is significantly larger and more prominent than the other letters.

National Institute for Occupational Safety and Health



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



WORKPLACETM

National Occupational Research Agenda

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Bold type indicates team leaders

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

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WORKTM

National Occupational Research Agenda

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Message from NIOSH

Partnership continues to be the cornerstone of NORA. This is evident in the exciting NORA-related research partnerships, the continued support from partners on the Partnership Teams, the Liaison Committee and the Federal Liaison Committee, and the number of partners participating in the NORA extramural funding process.

The NORA extramural grants program has been hugely successful. The number of new NORA grants has increased from 11 in FY 1996 to 86 in FY 1999. Thanks to an \$11.3 million Congressional appropriation for NORA in FY 2000, the stage is set for this year's NORA grant cycle to surpass the FY 1999 level. The FY 2000 NORA appropriation has also allowed NIOSH to fund three large-scale intramural NORA projects (see page 8). NIOSH will continue to focus its intramural efforts, often in partnership with external partners, on large NORA-related research studies that can have a significant impact on specific areas of research.

I'd like to thank all of the NORA partners who have worked diligently to implement NORA over the past four years. NORA was conceived as an agenda for the entire occupational safety and health community. It is the remarkable degree of partnership support and collaboration that has truly made NORA an agenda for the Nation. In fact, the value of NORA as a model for research planning is being recognized well beyond the occupational safety and health community as international organizations, government agencies and, non-profit organizations use NORA as they undertake their own planning activities. This point is further illustrated in the remarks of Donna Shalala, Ph.D., Secretary, U.S. Department of Health and Human Services, at the NORA Symposium 1999: Partnership for Research. "From its [NORA's] beginnings, NIOSH and its partners have understood that a prerequisite to making workplaces safer in this new economy is making sure that no one is left out of the decision making process. That's really the genius of NORA. . . . I've encouraged all my staff to use NORA as a model for building strong research partnerships."

While we report NORA's 2000 successes in this document, we begin preparations for the 2001 NORA Symposium, which is not only NORA's fifth birthday but NIOSH's 30 anniversary. I hope you will all plan to attend the symposium and continue to help us make history with NORA.



Linda Rosenstock, M.D., M.P.H.

Director

National Institute for Occupational Safety and Health

NIOSH Vision

Delivering on the Nation's promise:
safety and health at work for all
people...through research and
prevention.

NORA Vision

No single organization has the resources necessary to conduct occupational safety and health research to adequately serve the needs of workers in the United States. These constraints mandate that the entire occupational safety and health community engage in collaboration and coordination of its resources. The National Institute for Occupational Safety and Health (NIOSH) and its public and private partners developed the National Occupational Research Agenda (NORA) to provide a framework to guide occupational safety and health research into the next decade—for NIOSH and the entire occupational safety and health community.

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Liaison Committee Perspective

As the reach and impact of NORA continue to grow, so to do the roles and responsibilities of the Liaison Committee. Page 24 of this *NORA Update* contains a summary of the 1999 survey conducted by the committee to determine the effectiveness and reach of NORA. While the survey revealed that NORA is well recognized, there is still room for improvement. The Liaison Committee is committed to further increasing the recognition and reach of NORA by continuing to work with NIOSH to guide and track NORA's progress and pursue new outreach opportunities.

Another new responsibility of the Liaison Committee is administering the NORA Partnership Award for Worker Safety and Health. The next award will be given at the NORA Symposium in 2001. We look forward to reviewing the partnership activities inspired by NORA. Watch for the nomination guidelines in the *NORA News* and on the NIOSH web page.

The Liaison Committee has seen the difference NORA has made in the field of occupational safety and health. We are proud to be part of this effort and will continue to work with the rest of the NORA partners to ensure that NORA continues to make a difference in protecting worker safety and health.



Bonnie Rogers, DrPH, COHN-S, FAAN

Chair, NORA Liaison Committee

University of North Carolina, Chapel Hill

Background - An Agenda for the 21st Century

In April 1996, NIOSH and its partners unveiled the National Occupational Research Agenda (NORA), a framework to guide occupational safety and health research into the next decade—not only for NIOSH but for the entire occupational safety and health community. Approximately 500 organizations and individuals outside NIOSH provided input into the development of the Agenda. Before NORA no national research agenda existed in the field of occupational safety and health, and no research agenda in any field had captured such broad input and consensus. The NORA process resulted in a remarkable consensus about the top 21 research priorities (see table below).

NORA arose out of the recognition that occupational safety and health research in both the public and private sectors would benefit from targeting limited resources. The creators of the Agenda also recognized the need to address changes in the U.S. workplace, as well as the increasingly diversified workforce. The distribution of jobs in our economy continues to shift from manufacturing to services. Longer hours, compressed work weeks, shift work, reduced job security, and part-time and temporary work are realities of the modern workplace. By the year 2005, the U.S. workforce will grow to an estimated 147 million, with minorities representing 28 percent of the workforce and with women representing approximately 48 percent.

NORA Priority Research Areas

CATEGORY	PRIORITY RESEARCH AREAS
Disease and Injury	<ul style="list-style-type: none"> Allergic and Irritant Dermatitis Asthma and Chronic Obstructive Pulmonary Disease Fertility and Pregnancy Abnormalities Hearing Loss Infectious Diseases Low Back Disorders Musculoskeletal Disorders of the Upper Extremities Traumatic Injuries
Work Environment and Workforce	<ul style="list-style-type: none"> Emerging Technologies Indoor Environment Mixed Exposures Organization of Work Special Populations at Risk
Research Tools and Approaches	<ul style="list-style-type: none"> Cancer Research Methods Control Technology and Personal Protective Equipment Exposure Assessment Methods Health Services Research Intervention Effectiveness Research Risk Assessment Methods Social and Economic Consequences of Workplace Illness and Injury Surveillance Research Methods

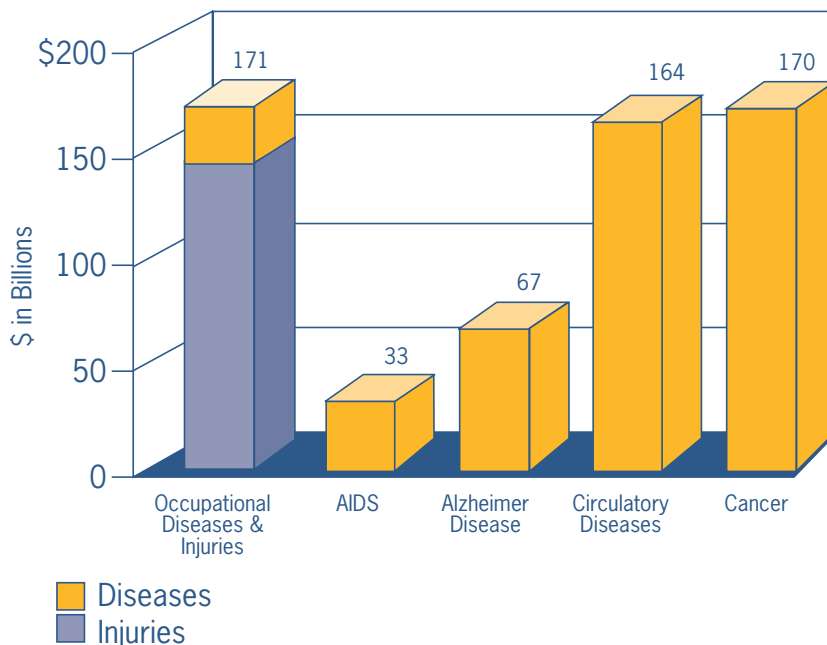
BACKGROUND

NORA also addressed the broadly recognized need to focus research in the areas with the highest likelihood of reducing the still significant toll of workplace illness and injury. Each day, an average of 9,000 U.S. workers sustain disabling injuries on the job, 17 workers die from an injury sustained at work, and 137 workers die from work-related diseases. The economic burden of this continuing toll is high. Data from a NIOSH-funded study reveal \$171 billion annually in direct and indirect costs of occupational injuries and illnesses (\$145 billion for injuries and \$26 billion for diseases). These costs compare to \$33 billion for AIDS, \$67.3 billion for Alzheimer’s Disease, \$164.3 billion for circulatory diseases, and \$170.7 billion for cancer (see graph below).

Developing NORA was only the first step in the collaborative effort between NIOSH and its many partners to guide and promote occupational safety and health research. Even at the time the Agenda was announced, there was a common commitment to work to implement the Agenda, namely, to increase activities and resources in the 21 priority areas. In the first four years of the implementation of NORA, NIOSH and its partners have demonstrated that NORA is generating funding and research activities in the 21 priority areas. The 20 partnership teams (the two musculoskeletal priority research areas are being addressed by one team) have been instrumental in this success.

Prior to NORA, research in occupational safety and health was fragmented, suffering from a “shotgun” approach to tackling major problems. Through NORA, the Nation is better positioned to address the toll of workplace injury and death.

Economic Burden of Disease and Injury (Direct and Indirect Costs)



Measuring the Success of NORA

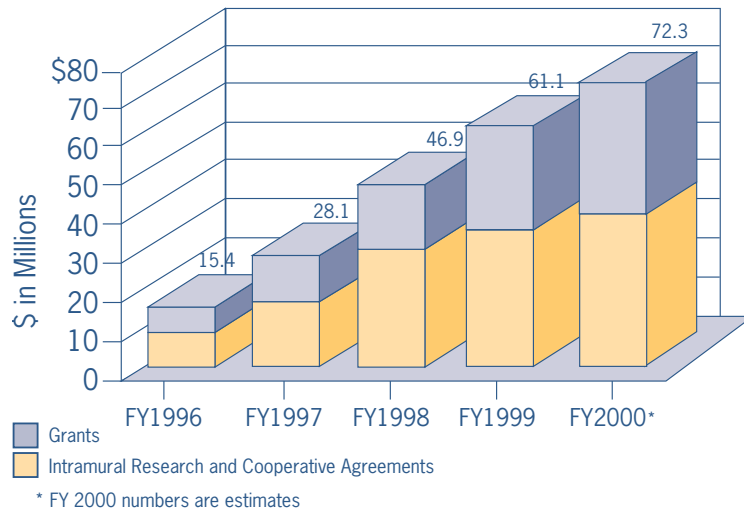
Tracking Research Funding in NORA Priority Areas

NIOSH Funding

As the only Federal agency with a mandate to conduct and fund occupational safety and health research, NIOSH made a commitment to redirect some of its resources to the 21 NORA priority areas. Data are available to track both the number of projects and total economic resources in each priority area.

In FY 1996, at the time the Agenda was unveiled, the NIOSH baseline investment in the NORA priority areas was \$15.4 million (approximately 9 percent of the FY 1996 budget). Of this, \$8.7 million was devoted to intramural research (NIOSH-conducted) and cooperative agreements (NIOSH-funded extramural research in which NIOSH directly participates), and \$6.7 million for research grants (extramural investigator-initiated projects). A redirection of resources in FY 1997 nearly doubled this investment to \$28.1 million. A new \$5 million special Congressional appropriation to NIOSH in FY 1998 for NORA, coupled with additional reinvestment of baseline monies into NORA priority areas, resulted in \$46.9 million of research (about 25 percent of the budget) in NORA priority areas for FY 1998.

NIOSH NORA Investment

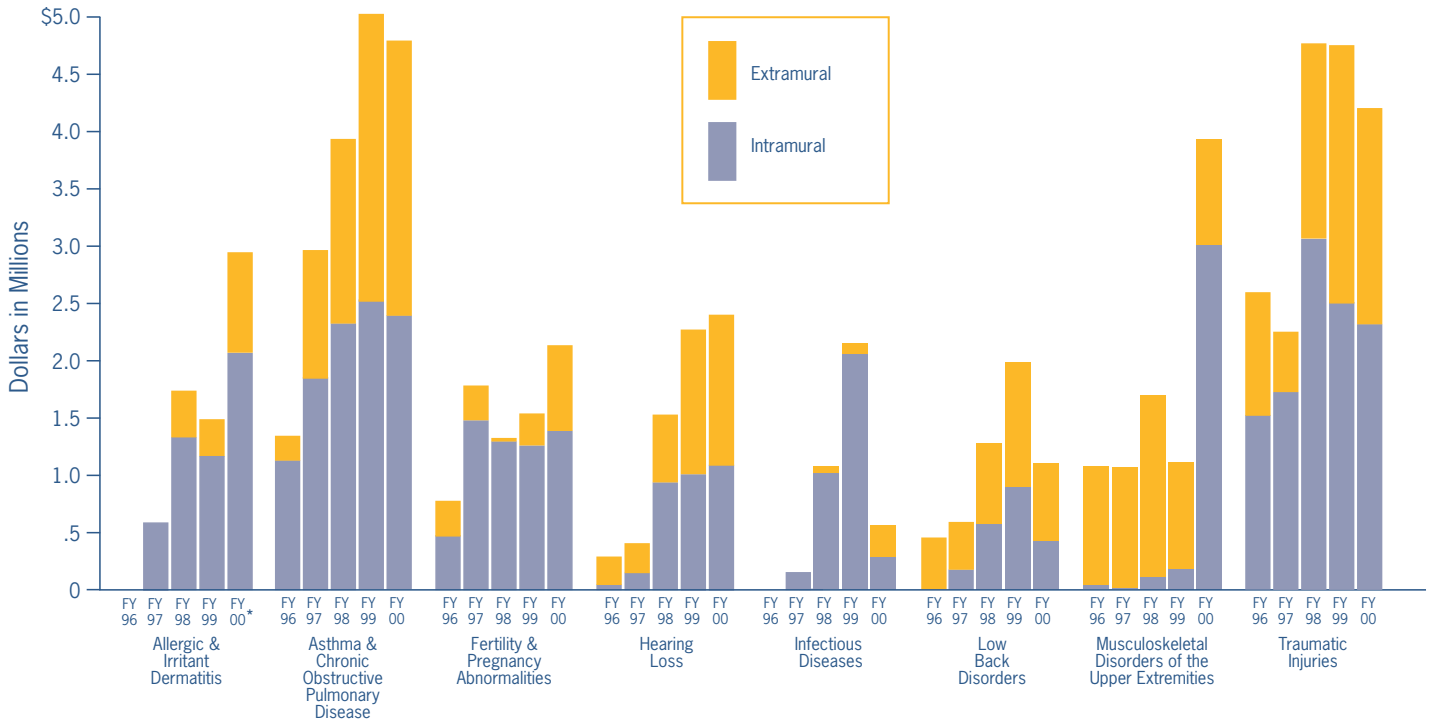


In FY 1999, continued Congressional support for NORA as well as ongoing internal resource allocation resulted in \$61.1 million of NIOSH research funds (31 percent of the budget) directed at NORA priority areas. In FY 2000, an \$11.3 million Congressional appropriation for NORA contributed to the estimated \$72.3 million allocated to NORA priorities (34 percent of the NIOSH budget).

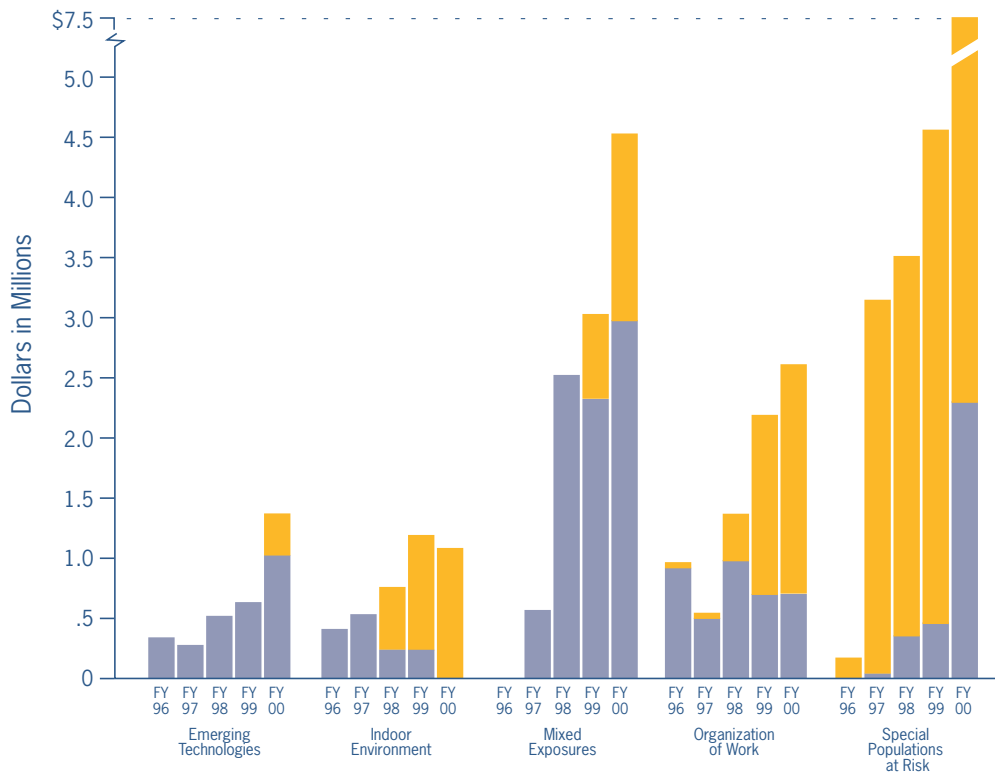
Such an increase is tangible evidence of NIOSH's commitment to NORA. This shift is particularly notable given existing Congressional mandates and obligations that limit how much of the NIOSH budget can be redirected. An ongoing effort has been in place since NORA's inception to assure that these shifts are "real" (rather than merely a reporting artifact) using consistent definitions and an independent evaluation team to assess projects for NORA-relatedness.

NIOSH NORA Investment by Priority Research Area, FY 96-99

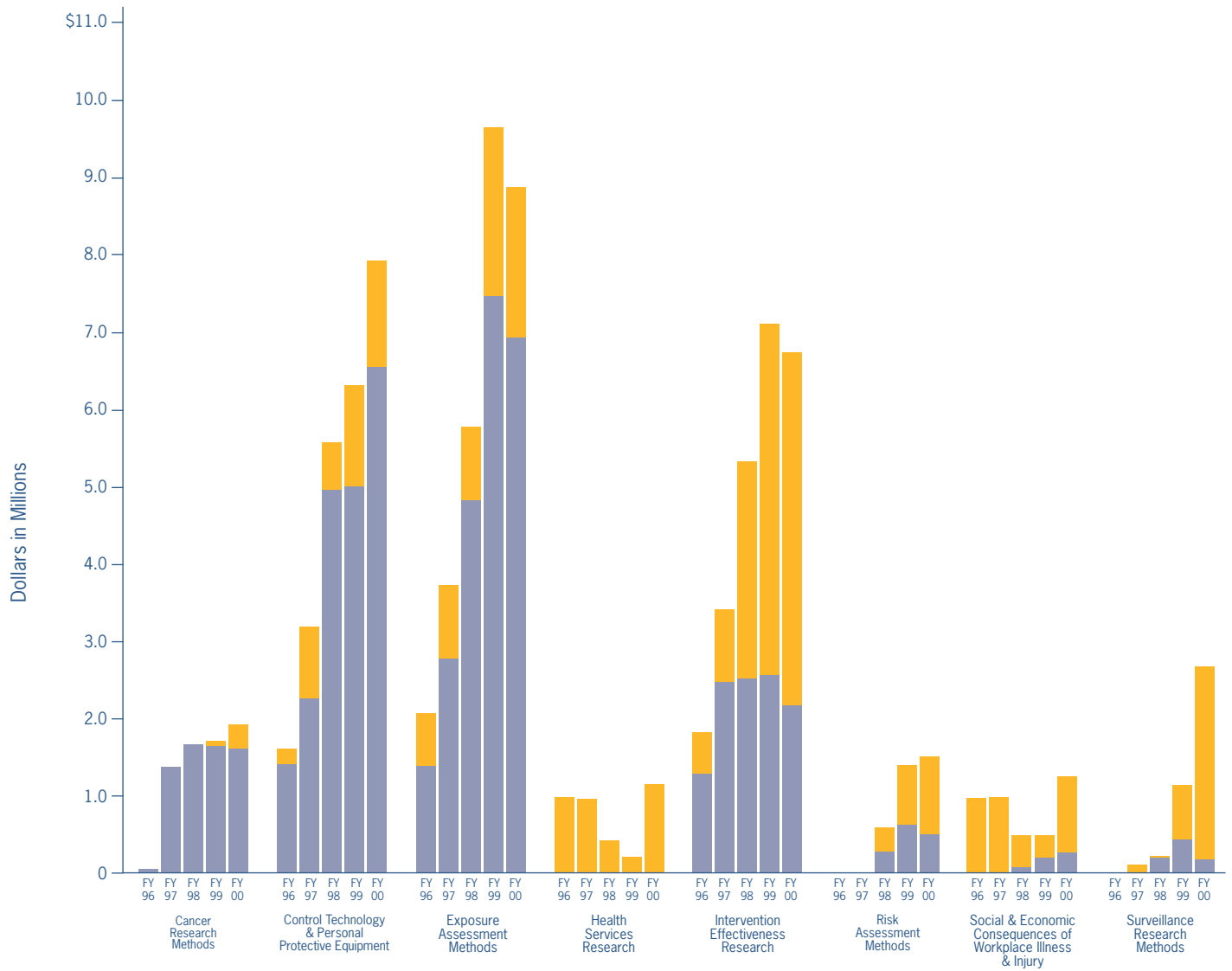
Disease and Injury



Work Environment and Workforce



Research Tools and Approaches



*FY 00 numbers are estimates.

Intramural Initiatives

Recognizing its unique position to conduct large studies that can have a significant impact on a particular area of research, in March 1999, NIOSH encouraged its intramural researchers to join together to compete for new FY 2000 NORA funding with large scale proposals in selected NORA priority areas. The proposals underwent multiple steps of internal review, with three areas subsequently chosen for further development – musculoskeletal disorders, allergic and irritant dermatitis, and asthma and chronic obstructive pulmonary disease. NIOSH funded three interdisciplinary cross-divisional priority program areas for a total of about \$3 million, following an external peer review process. The funded projects include an exposure-response and intervention program for the prevention of work-related musculoskeletal disorders, development of a dermal policy based on laboratory and field studies, and research for occupational asthma reduction.

This effort generated considerable enthusiasm, both internally and externally. For FY 2001, NIOSH is encouraging similar efforts in six NORA-related areas: work organization and cardiovascular disease; injury; work organization and depression; control technology; noise and hearing loss; and health care (a sector relevant to all NORA priority areas).

NORA Research: What Counts?

NIOSH has set a high bar to determine which studies are designated as NORA research. Efforts to ensure that NIOSH does not “over count” NORA research have resulted in an actual under representation of research in the 21 priority areas. A Quality Assurance Committee of senior NIOSH scientists reviews all intramural and extramural research proposals to determine whether they indeed qualify as NORA research. To track and report funding of NORA research, NIOSH counts only studies that devote at least 80% of the research effort to a designated NORA topic. This strict definition provides a valid and consistent method of tracking NORA progress over time. Some important activities in occupational safety and health, such as surveillance programs, have research elements but may not be primarily research. Likewise, some research (e.g., an occupational cancer epidemiology study) may involve a NORA subject (e.g., cancer research methods), without the NORA subject being the primary emphasis. In addition, a project that is distributed equally between two NORA areas such as 50 percent in hearing loss and 50 percent in control technology would not be counted by this definition in either NORA area. Data are available, however, to count projects with as little as 20% dedicated to a priority area.

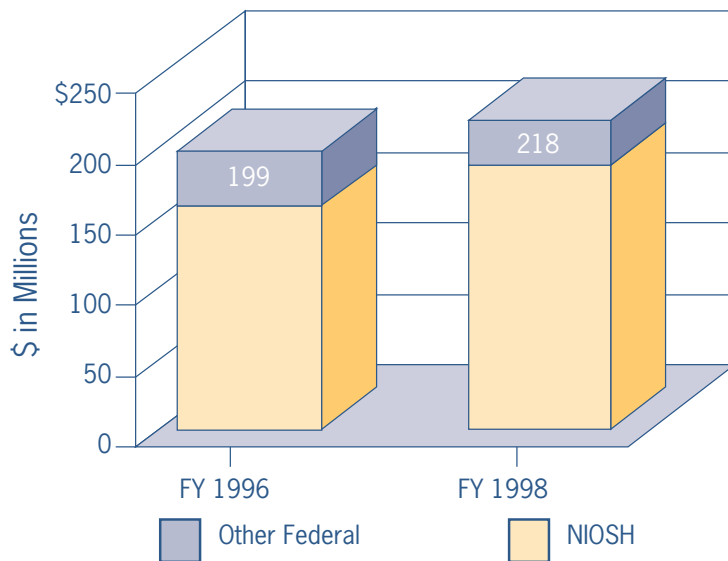
One example of how the high threshold NORA definition excludes important contributions to NORA research is the Fatality Assessment Control and Evaluation (FACE) Program. NIOSH and 20 state partners evaluate incidents in which workers have been fatally injured. This information is used to improve and promote the use of prevention strategies. FACE contributes importantly to the NORA Traumatic Injuries priority area, but since surveillance and education are a large component, investments in FACE are not included in the routine tracking of NORA research spending.

Other Federal Funding

As part of NORA, a survey of federal occupational safety and health research is conducted biennially. The first survey, covering FY 1996, provided a baseline identifying a total of only \$39 million spent for all occupational safety and health research outside of NIOSH for a total federal investment of \$199 million. The second survey identified the total spending in occupational safety and health research by federal agencies as \$218 million in FY 1998 (NIOSH at \$187 million and other federal agencies at \$31 million).

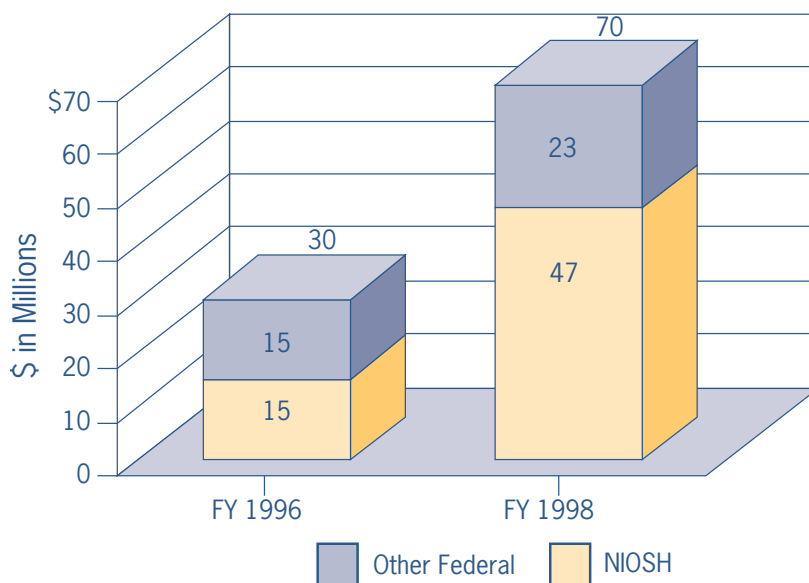
The FY 1996 baseline for NORA-related research from non-NIOSH federal sources was about \$15 million, increasing in FY 1998 to \$23.4 million.

Federal OS&H Spending FY 1996 and FY 1998



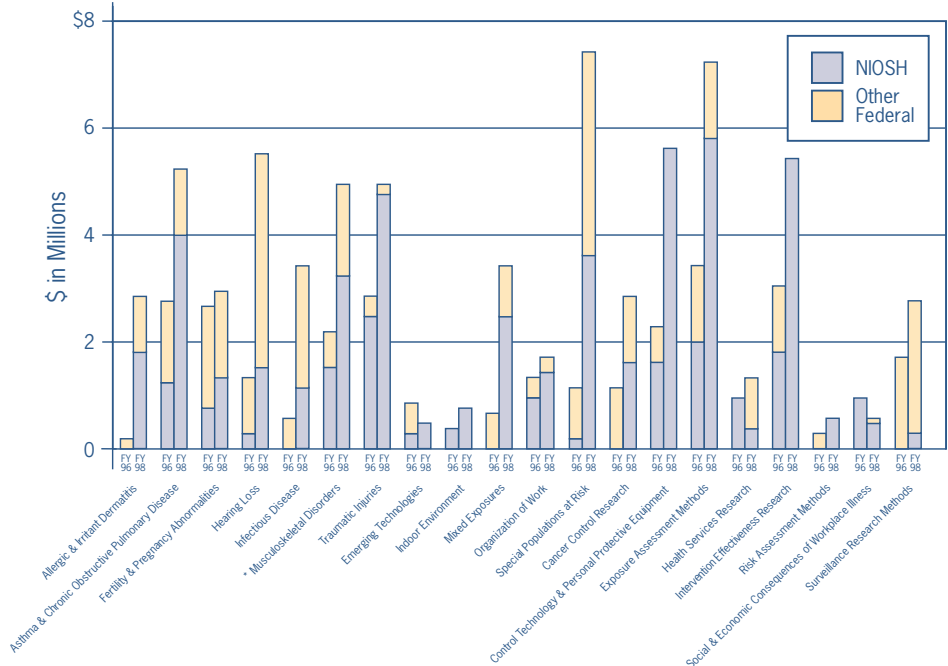
For the purposes of this analysis, the total NIOSH budget is attributed to occupational safety and health research.

Federal NORA Spending FY 1996 and FY 1998



In FY 1998 as in FY 1996, there was no reported spending by federal partners in the priority area of Indoor Environment. There are reported decreases in spending by non-NIOSH federal agencies in some priority areas, e.g. Fertility & Pregnancy Abnormalities and Traumatic Injuries and increased spending is seen in others, e.g. Allergic & Irritant Dermatitis and Hearing Loss (see graph below). In sum, there has been an increase overall at the federal level in NORA-related research. However, for non-NIOSH federal sources, this increase is the result of a redirection of existing resources to NORA, as opposed to new investments in the priority areas. Federal partners will continue to perform the survey biennially, with the next survey assessing FY 2000 expenditures.

Federal NORA Spending by Priority Area



NORA Priority Areas

* Combines two NORA priority areas, Low Back Disorders and Musculoskeletal Disorders of the Upper Extremities

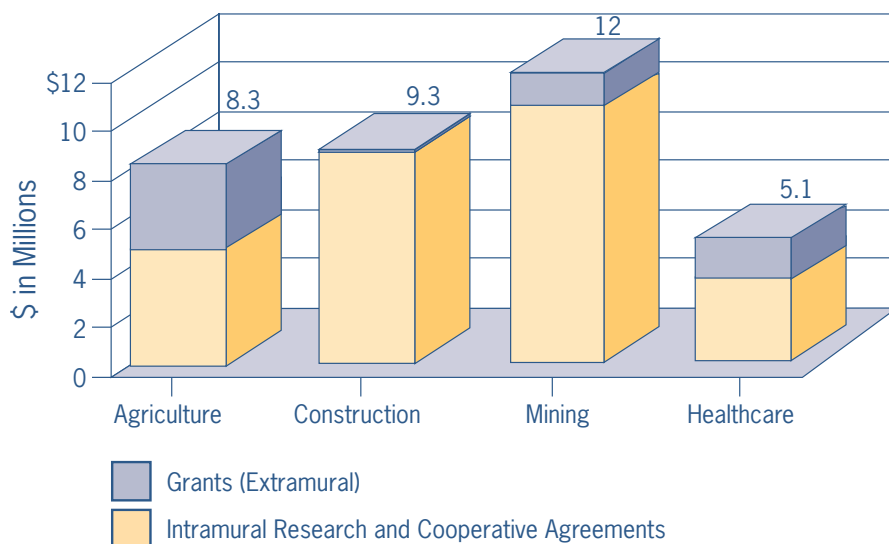
Due to the scale of this graphic the following investments are not visible:

NIOSH FY 1996	
Cancer Research Methods:	\$44,000
Other Federal FY 1998	
Control Technology & PPE:	\$38,000
Intervention Effectiveness Research:	\$43,000

Sector-Specific Funding

During the development of NORA, the importance of sector-specific research was consistently raised. It was finally decided that the most effective way to integrate consideration of research efforts within specific sectors (such as construction, mining, agriculture, and health care) was to apply a matrix approach of coordinated research in some or all of the 21 priority areas, as appropriate for each sector. As such, it is clear that NORA is having an impact on sector-focused research. In FY 2000, within NIOSH, nearly \$35 million is being allocated to NORA research in agriculture (\$8.3 million), construction (\$9.3 million), mining (\$12 million), and health care (\$5.1 million).

NORA Investments by Sector, FY 2000*



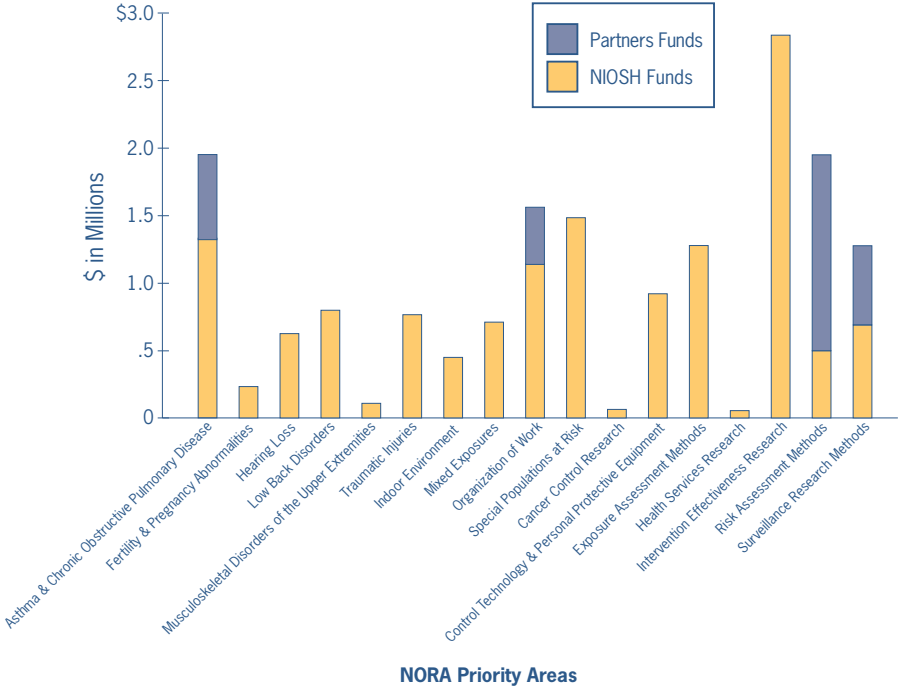
*FY 2000 numbers are estimates

NORA Grant Funding

NORA has been successful in stimulating new research needed to address the problem of workplace injuries and illnesses. A major initiative was started in FY 1998 when NIOSH and three federal partners awarded about \$8 million in grants in ten NORA priority research areas, which was the largest infusion of funding ever by the federal government for extramural occupational safety and health research. NIOSH built on these partnerships in FY 1999 and jointly announced two Requests for Applications (RFA) with six other federal agencies: National Cancer Institute (NCI); National Heart, Lung, and Blood Institute (NHLBI); National Institute on Aging (NIA); National Institute on Deafness and Other Communication Disorders (NIDCD); National Institute of Environmental Health Sciences (NIEHS), and the Environmental Protection Agency (EPA).

A total of about \$9 million was awarded to support 33 grants in eight NORA priority areas. In addition to these RFAs, NIOSH awarded another 53 grants that address NORA priority areas under the Institute's general grants Program Announcement (PA). A graph of the NORA funding of new grants in FY 1999 is shown below, by NORA area (also see listing on page 14).

FY 1999 NORA Grant Awards



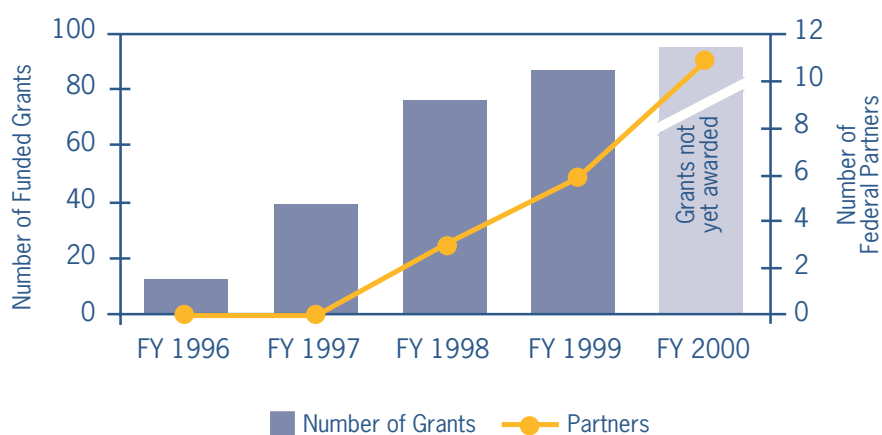
The grant figures presented above represent new grants each year in the NORA priority areas. A more complete picture of the NORA grants program includes both new and continuing NORA grants. When both categories are included, the total grant funding for FY 1998 is \$16.8 million and \$26.7 million for FY 1999.

In FY 2000, NIOSH and eight NIH partners have solicited applications in all 21 NORA priority areas under a general PA. The amount of grant funding will depend on the number of quality applications received. The NIH Institutes included in the announcement are NCI, NHLBI, NIA, National Institute on Alcohol Abuse and Alcoholism (NIAAA), National Institute of Allergy and Infectious Diseases (NIAID), National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), NIDCD, and NIEHS.

In addition to the PA, NIOSH and seven co-sponsors announced about \$10 million for research related to Special Populations at Risk and Mixed Exposures. NIOSH is also targeting about \$8 million for additional RFAs which focus on 11 of the NORA priority areas. NIOSH is inviting applications that will:

- Reduce agriculture-related injuries to children through the development of new and improved hazard control technologies and the evaluation of educational materials and training.
- Evaluate the effectiveness of new intervention methods for controlling workplace hazards.
- Strengthen surveillance methods for work-related injuries and illnesses, particularly those involving high-risk occupations and industries.
- Provide exploratory research in the NORA priority areas of allergic and irritant dermatitis, social and economic consequences of workplace injury and illness, health services research, and pregnancy and fertility abnormalities.
- Study upper-limb and low-back musculoskeletal disorders at varying levels of exposure to job stressors.
- Develop new data on incidence of needlestick injuries and availability of safer needle devices among health care workers.
- Foster multidisciplinary research on the adverse pulmonary effects of mixed dusts, such as welding fume, boiler ash, and diesel exhaust particles.

NORA Grants/Partners FY 1996 – FY 2000



FY 1999 Grant Awards Related to the National Occupational Research Agenda (NORA) Grouped by NORA Priority Area

Asthma and Chronic Obstructive Pulmonary Disease

Chemokine Biomarkers of Diisocyanate Induced Occupational Asthma – University of Cincinnati

Occupational Lung Disease in a Flocking Plant – University of Washington

Iron Calcium and Oxidative Stress in Lung Injury – New York University

Irritant-Induced Asthma: Epidemiology and Pathogenesis – Hopital du Sacre-Coeur

Occupational Asthma Associated with Seafood Processing – University of Michigan

Peak Exposures in Aluminum Smelting – University of Washington

*A Novel Mouse Model of Isocyanate-Induced Asthma – Yale University

*Murine Models of Occupational COPD – University of Cincinnati

Cancer Research Methods

Antibodies to Hemoglobin Adducts in Butadiene Exposed Workers
Biomosaics, Inc.

Control Technology and Personal Protective Equipment

System for Measuring Workplace Protection Factors – University of Iowa

Respirator Efficacy for Tuberculosis Aerosols – Johns Hopkins University

Improving the Work Environment in Livestock Buildings – Kansas State University

Ergonomic Solutions for Furniture Manufacturers – North Carolina State University

Electronic Safety Devices for Construction Workers – Technological Systems Research Design & Education

Ventilation Control to Reduce Airborne Contaminants – University of Iowa

Statistical Modeling of Respirator Penetration Data – University of California

CFD Analysis of Mine Face Ventilation Systems – University of Kentucky

Hearing Protector Allowing Acoustic Communication – Sensimetrics Corporation

Exposure Assessment Methods

Reconstruction of Doses for Chernobyl Liquidators – International Agency for Research on Cancer

Temporal and Impulsive Characteristics of Hand Tools – University of Connecticut

Tools for Exposure Assessment of Physical Risk Factors in VDT Work – Harvard University

A Simple Device for Measuring Personal Exposures to UV – Riverbend Instruments, Inc.

A Model for Predicting CTDs Due to Repetitive Loading – University of Massachusetts

Airborne Heavy Metal Monitor – Physical Sciences, Inc.

Methods for Assessing Synthetic Textile Dust Exposure – University of Massachusetts
Uncertainty Analysis for Characterizing Plutonium Exposure to Improve Lung Cancer Risk Estimates – University of Colorado

Pollution Prevention and Worker Toxic Exposures: A Method – Johns Hopkins University

Laser Hazard Sensor with Recorder – Princeton Scientific Instruments, Inc.

An Ergonomics Assessment Methodology for Work-Worker Systems – North Carolina State University

Fertility and Pregnancy Abnormalities

Portability of Biochemical Markers of Sperm Maturity – Yale University

Health Services Research

Developing Community-based Research with Immigrants – University of Massachusetts

Hearing Loss

Epidemic Occupational Hearing Loss in Washington State – University of Washington

Hearing Damage Among Newly-Hired Construction Workers – University of Washington

Indoor Environment

Health Effects of Exposures to VOCs, Ozone and Stress – University of Medicine & Dentistry of New Jersey – Robert Wood Johnson

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

Intervention Effectiveness Research

Wisconsin Production Agriculture Intervention Evaluation – University of Wisconsin

WMSD: Evaluating Interventions Among Office Workers – Institute for Work and Health

Healthy Work Organization: Intervention Effectiveness – University of Georgia

Reducing Violence Against Nursing Home Caregivers – University of Cincinnati

Preventing Musculoskeletal Disorders Among VDT Operators – Emory University

Outcomes of the Revised CA Bloodborne Pathogens Standard – University of California

Prevention of Upper Extremity Cumulative Trauma Disorders – University of Maryland

Evaluating Exposures Under OSHA's 1984 EtO Standard – Dana-Farber Cancer Institute

Effects of OSHA Guidelines on Violence Prevention in Mental Health – University of Maryland

The Impact of OSHA Inspections on Manufacturing Injuries – University of Pittsburgh

Evaluation of Dust Control Technologies in Construction Tasks – University of Washington

OSH Program Evaluation in Manufacturing and Small Business – Dana-Farber Cancer Institute

Claims-Based Surveillance to Identify Injury Precursors – MCP Hahnemann University

Low Back Disorders

Predictors of Low-Back Injury and Disability in the U.S. Army – Johns Hopkins University

Low Back Pain: A Multicenter Randomized Trial – Dartmouth Medical School

Mixed Exposures

Diesel Exhaust and Occupational Lung Cancer Risk – VA Medical Center

Metalworking Fluids and Aerodigestive Cancer Risk – University of Massachusetts

Role of O₃ in Modulating CR Toxicity in the Lung – New York University

Combined Effect of Radiation and Asbestos in Producing Pulmonary Fibrosis – University of Washington

Musculoskeletal Disorders of the Upper Extremities

A Model for Occupational Epicondylitis – University of California

Carpal Tunnel Syndrome Among Construction Workers – University of Iowa

Organization of Work - Sleep Disorders

Work Schedules and Health in Women Health Professionals – Brandeis University

Practical Circadian Interventions for Night Shift Work – Rush-Presbyterian-St. Luke's Medical Center

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

Work Schedules and Workplace Injuries – National Opinion Research Center

Caffeine and Naps: Practical Shiftwork Interventions – St. Luke's Hospital

*Circadian Adaptation to Night Work in Older People – Brigham & Women's Hospital

Risk Assessment Methods

Measurement Error Methods for Underground Miner Studies – University of Southern California

Dermal Absorption Enhancers Affect Organotropism – University of Cincinnati

Correcting for Measurement Errors in Radiation Exposure – New York University

*Carcinogenesis Modeling for Livers and Liver Tumors of Mice Treated with DCA or TCA – Battelle Memorial Institute

*Mechanism of Nongenotoxic Occupational Carcinogens – Medical College of Ohio

*Cytogenetic Models for Assessing Low Dose Radiation Risk – University of California

Special Populations at Risk/Aging Workforce

Work Related Risk Factors Associated with Falls During Pregnancy – University of Cincinnati

* Funded by Partner Agencies

Ergonomic Aspects of Older Workers' Postural Balance – University of Cincinnati

Injury and Musculo-Skeletal Disorders Among Aging Workers in an Industrial Workforce – Yale University

Work Injuries and Illnesses in Older Workers: Causes, Consequences and Prevention – University of Massachusetts

Children's Injuries on Kentucky Beef Cattle Farms – University of Kentucky

Work and Social Environments: Urban Youth and CVD Risk – Johns Hopkins University

Surveillance Research Methods

Injury and Illness Surveillance in Migrant Farmworkers – University of Texas

Laboratory Reporting for Pesticide Illness Surveillance – Public Health Institute

Surveillance of Serious Work-Related Trauma – Minnesota Department of Health

*Multi-State Migrant Farmworker Surveillance Study – Northeast Center for Agricultural & Occupational Health (NEC)

*Development and Validation of a Mail Survey of Chemical Exposure – New Jersey Department of Health

*Distributed Occupational Knowledge System – University of California

Traumatic Injuries

Postural Stability Effects in Low Seam Mining Tasks – University of Cincinnati

Electrical Arc Injury Parameters and Prevention – University of Chicago

Homicide During Robbery: A Case Control Study – University of North Carolina

Slip, Trip and Fall in Construction and Transportation – University of Maine

Occupational Knee Injury and Disability in the U.S. Army – University of Massachusetts

Effects of Musculoskeletal and Sensory Degradation due to Aging on the Biomechanics of Slips and Falls – Texas Tech University



Grant Funding Success

The success of NORA in attracting research talent to occupational safety and health continues to outstrip the ability of NIOSH to fund high-rated research proposals. The NIOSH success rate for grants funding (the percentage of qualified research proposals that are funded) still lags substantially behind the rate at NIH (23 percent vs. 32 percent in FY 1999). One consequence of a disparately low success rate is loss of interested investigators to research fields with a higher probability of funding. NIOSH has worked hard through NORA to continue to generate enthusiasm among the research community despite low success rates, and has experienced a dramatic increase in submitted and approved grants, particularly in NORA priority areas.

NIOSH Grant Funding Success, FY 1990 - FY 1999



Shifting the Balance

Another NORA success has been in shifting the spectrum of occupational safety and health research to achieve more balance between etiologic research, i.e., problem identification and characterization, and problem-solving research. Highlighting this trend is the growth of intervention effectiveness research grants supported by NIOSH, from \$500,000 in FY 1996 to \$4.6 million in FY 1999. Current grants for intervention research address many subjects of high concern among the general public and policy makers. These include projects that will evaluate:

- Training in lifting techniques to prevent back injuries
- Preventing hearing loss among construction workers
- Preventing silica exposure among construction workers
- A joint strategy by OSHA and the construction industry to prevent fatalities, injuries, and illness among home builders
- Reducing musculoskeletal disorders and traumatic injuries among dairy and vegetable produce farmers
- Preventing back and shoulder injuries among nursing home workers
- Ergonomic interventions to reduce musculoskeletal disorders among office workers

These studies provide crucial information to employers, workers, and others on the effectiveness of specific strategies for the prevention of injury and illness. For example, a recently published NIOSH-funded study documented great reductions (as much as 93%) in sharps and needlestick injuries achieved by a highly replicable intervention strategy integrating administrative, engineering, and behavioral elements.

Tracking Partnership Products

Requests for Applications (RFAs)

Through targeted RFAs, NORA has been successful in directing resources into the priority research areas. In FY 1998, NIOSH and NIH awarded 50 grants through a NORA RFA spending a total of about \$8 million dollars in ten NORA priority research areas. In FY 1999, through two RFAs, NIOSH and NIH awarded 33 grants in 17 priority research areas totaling about \$9 million. NIOSH also awarded another 53 NORA grants through the Institute's general grants Program Announcement. In FY 2000, NIOSH and NIH partners are targeting \$10 million for an RFA on research related to Special Populations and Mixed Exposures and NIOSH has announced another \$8 million available for additional RFAs focused on 11 NORA priority areas. Moreover, beginning in FY 2000, NIOSH is partnering with eight NIH institutes to seek proposals in all NORA priority areas on an ongoing basis.

Team Products

In addition to leveraging resources, as mentioned above, partnership teams are an integral part of implementation. Team products are also being tracked as a measure of NORA's success. The teams have been very active and as expected, each is proceeding somewhat differently. Many teams are writing white papers, documents that use variable approaches to advance issues in each priority area, such as summarizing the research in a priority area, defining gaps, and laying out opportunities for collaboration. In some areas, a well-defined research agenda currently exists (e.g., asthma), so a white paper was deemed not necessary. The following 16 NORA teams (covering 17 priority areas) have completed or are currently working on white papers:

- Allergic and Irritant Dermatitis
- Cancer Research Methods
- Emerging Technologies
- Exposure Assessment Methods
- Fertility and Pregnancy Abnormalities
- Health Services Research
- Hearing Loss
- Infectious Diseases
- Indoor Environment
- Intervention Effectiveness Research
- Mixed Exposures
- Musculoskeletal Disorders (includes Upper Extremity and Low Back)
- Organization of Work
- Social and Economic Consequences of Workplace Illness and Injury
- Surveillance Research Methods
- Traumatic Injuries

Partnership Team activity can also be measured through conferences and workshops. From September 1996 through June 1999, NIOSH and its partners have sponsored 34 major meetings related to NORA as a whole or to specific priority areas (one in 1996, four in 1997, 10 in 1998, eight in 1999, and 11 scheduled through October 2000). A list of the NORA meetings follows. In addition to white papers, conferences, and workshops, teams are also developing surveys, establishing graduate-level training programs, participating in continuing medical education workshops, and developing other documents.

NORA Meetings, September 1996 through November 2000

Comparing and Contrasting Reproductive Toxicity Testing for Males and Females: November 9-11, 2000

Enhancing Working Conditions and Patient Safety: Best Practices: October 25, 2000

National Occupational Research Injury Symposium 2000: October 17-19, 2000

Future Research for Improving Risk Assessment Methods: August 15-18, 2000

RESNA 2000 (Rehabilitation Engineering and Assistive Technology Society of North America): July 28, 2000

Occupational Infectious Disease Research Needs – American Occupational Health Conference: May 18, 2000

Third International Conference on Measuring the Burden of Injury: May 15-16, 2000

Workplace Violence Intervention Research Workshop: April 5-7, 2000

Preventing Hearing Loss in the Construction Trades: A Best Practices Conference: March 30-31, 2000

Third Annual Applied Ergonomics Conference: March 14-16, 2000

Donald J. Birmingham Occupational Skin Diseases Session at the 11th Annual Meeting of the American Contact Dermatitis Society Annual Meeting: March 9, 2000

Musculoskeletal Meeting to Set a Research Agenda (Houston, TX - fourth in a series): March 8, 1999

Best Practices in Hearing Loss Prevention: October 29, 1999

Working Conditions and Quality of Care: October 12-13, 1999

Functional, Economic, and Social Outcomes of Occupational Injuries and Illnesses: Integrating Social, Economic, and Health Services Research: June 13-15, 1999

Experimental Contact Dermatitis Research Group Meeting: May 21-22, 1999

NORA Symposium 1999: Partnership for Research: May 14, 1999

Work, Stress, and Health 99: Organization of Work in a Global Economy: March 11–13, 1999

Developing a National Occupational Research Agenda for Prevention of Musculoskeletal Disorders: March 8, 1999

Research Workshop on the Risks and Benefits of Exposure to Ultraviolet Radiation and Tanning: September 16-18, 1998

Hazardous Substances and Male Reproductive Health: May 14-15, 1998

Natural Rubber/Latex Allergy: Recognition, Treatment, and Prevention, Satellite Downlink Teleconference: May 5, 1998

Occupational Asthma: In and Out of the Workplace: April 30-May 2, 1998

Round Table Discussion on the Organization of Work at the Society for Industrial and Organizational Psychology Conference: April 24-26, 1998

Three Musculoskeletal Meetings to Set a Research Agenda

- April 20, 1998 - Seattle, WA
- April 27, 1998 - Washington, DC
- March 25, 1998 - Chicago, IL

Control of Workplace Hazards for the 21st Century: March 10-12, 1998

1998 Applied Workshop on Occupational and Environmental Exposure Assessment: February 23-25, 1998

National Occupational Injury Research Symposium: October 15-17, 1997

First National Occupational Research Agenda Symposium: July 1, 1997

Delaware Valley Latex Allergy Conference: March 31-April 1, 1997

Pneumonitis in the Machining Environment Workshop: January 28-29, 1997

Workplace-Related Skin Diseases and Exposure Assessment Workshop: September 25-26, 1996

Tracking the Literature and Recognition of NORA

Bibliometrics

Bibliometrics is among the approaches used to evaluate the impact of NORA. Bibliometrics is a semi-quantitative method to examine publication rates to determine publication trends and research productivity.

To document research productivity in the 21 priority areas, NIOSH and the 20 NORA teams, in collaboration with the Institute for Scientific Information – the world's largest bibliographical source of information covering more than 16,000 international peer-reviewed journals, books and proceedings in the sciences and social sciences– developed a method for generating baseline bibliographical databases for each of the 21 NORA topic areas. The baseline publication rates were computed for the period from 1991 through 1996 (the year NORA was launched) and serves as the reference baseline or metric for evaluating subsequent growth in publication rates in the NORA priority research areas. Publication rates are being tracked from 1996 for each of the 21 priority research areas. Statistical tests will be applied to assess the significance of the rate of change in publications over the baseline period.

NORA Effectiveness Survey

Measuring the amount of money allocated to NORA priority research areas is only one way to gauge the effectiveness of NORA. The NORA Liaison Committee has administered a survey to help determine the recognition and impact of NORA. The Liaison Committee distributed its survey to key associations and professional organizations (see page 24). The survey will be administered periodically by the Liaison Committee to gauge the recognition and influence of NORA over time.

Other Tracking Methods

NIOSH is also tracking “hits” on the NORA web site to assess the diffusion of NORA. The NORA web site has received over 250,000 hits from May 1998 (when the NORA site was initiated) through February 2000 (the last month for which data are available). The NORA web site www.cdc.gov/niosh/norahmpg.html contains all NORA documents, white papers, research summaries, NORA grants information, a calendar of upcoming events, and partnership team information. The team posters, developed for the 1999 NORA Symposium, are also available on the NORA web site.

Many teams are using the NORA web site to enhance their communication efforts. Some teams have also established listservers to communicate among researchers interested in specific priority research areas. The quarterly NORA newsletter, entitled *NORA News*, has also helped improve NORA communication. Feedback from *NORA News* response cards reveals that for readers of the newsletter, *NORA News* is a primary source of information on NORA. Another communications effort, a compendium describing NIOSH-conducted or -funded NORA research, will be available in the summer of 2000.

Partnership

NORA Partnerships

NORA has helped demonstrate that there is a new way of doing business at NIOSH. Although the transformation to the “new NIOSH” was in process prior to NORA, the development and implementation of the Agenda have proven to many in the private sector that collaboration with the government is not only possible, but worthwhile.

Research related to the Traumatic Injury Team has proven particularly fruitful. The Traumatic Injury Team document, *Traumatic Occupational Injury Research Needs and Priorities*, is helping to pave the way for future partnerships. The document provides a foundation for discussion with external partners to explore common research areas. In the first three examples below, industry approached NIOSH to collaborate on topics related to the traumatic injury priority research area. All of the following partnership success stories demonstrate the benefits of partnership for improving worker safety and health. In each, NIOSH provides its scientific expertise and creative problem-solving skills and the partners provide the “laboratories” for evaluating interventions in real work settings.

Wal-Mart

The effectiveness of back belts has been questioned in recent years. In 1994, NIOSH released a report stating that there is inadequate scientific evidence that back belts actually reduce the risk of back injury. The statement reflected concerns that many employers were providing (and often requiring) back belts as the only method to prevent back injury. In partnership with Wal-Mart, NIOSH is completing the most definitive research study to date on the efficacy of back-supporting belts in preventing first and recurrent low back injuries. Approximately 9,000 retail merchandise employees at 160 stores in 30 states were followed for two years to determine if low back injury rates in individuals wearing belts were different from rates in individuals not wearing belts. The results are currently undergoing scientific peer review and will be published in the near future.

BJC Health System

Back injuries are one of the most common injuries among nursing home employees. BJC Health System designed and implemented a “best practices” system, and approached NIOSH for help in scientific evaluation of the program as implemented in Illinois and Missouri. NIOSH and BJC will evaluate the efficacy of a “best practices” program in reducing the incidence and cost of back injury among nursing home workers. The “best practices” program includes: use of specialized, state-of-the-art lifting equipment, training in lifting techniques, accident investigation, and medical management of injured workers. A peer review meeting was held in September 1999 to receive comments from a panel of scientific reviewers and other stakeholders on this intervention effectiveness evaluation. Data collection is ongoing and the project is scheduled for completion in 2001.

Anthony Crane Rental

Crane operators, on-site workers, and the general public are at risk of serious and possibly fatal injury due to incidents involving cranes or hoists. In 1994, incidents involving cranes resulted in 88 fatalities. In addition, damage to property can be extremely costly. Anthony Crane Rental (ACR) is the largest crane rental company in the world, and has over 3,500 cranes and over 4,000 pieces of aerial lift equipment. NIOSH and ACR are currently collaborating on a feasibility study examining the effectiveness of crane operator certification on the prevention of crane-related injuries. The results will help industry, labor, and the public, as well as guide policy-makers about the value of mandatory certification.

Navistar, UAW, Aetna US Healthcare

NIOSH is working with Navistar International Transportation, the United Auto Workers, and Aetna US Healthcare to evaluate the results of expanding workplace-based occupational safety and health programs to include general health care. The study will assess the impact of this intervention on health care status, utilization and costs, and worker productivity.

Asphalt Partnership

In order to reduce worker exposure to asphalt fumes during paving operations, NIOSH formed a collaborative partnership with government, industry, and labor. The partnership developed a comprehensive engineering control strategy to reduce exposures to asphalt fumes during paving operations. The engineering control is a ventilation system attached to the paver that reduces fume and heat before they can reach the worker. As a result, as of July 1, 1997, all highway paving machines now have this effective control technology. This very successful program was a finalist in the prestigious Innovations in American Government Award Program in 1998. The broad-based network of partnerships created by NORA has helped foster these continuing and evolving efforts. As such, it is only fitting that this project received the first NORA Partnership Award in 1999.

Diesel Research Partnership

Based on the success of the Asphalt Partnership, the United Mine Workers of America, the Bituminous Coal Operators Association, the National Mining Association, and NIOSH have formed multiple partnerships to reduce miners' diesel exposure despite the continuing debate about miners' exposure to and health effects of diesel particulate matter. In spite of continuing scientific and regulatory controversy, both labor representatives and mine operators agree that some action should be taken now to reduce or eliminate the exposures. The partners are launching multiple research and intervention activities to quickly arrive at their shared goal.

Department of Veteran Affairs

The Veterans Health Administration (VHA) within the Department of Veterans Affairs (DVA) employs one of the largest groups of healthcare workers in the U.S. There were 223,602 employees in the VHA as of November 1997. In October 1998, a Memorandum of Understanding (MOU) was signed by NIOSH and the DVA formally establishing a research partnership combining NIOSH's research capabilities and the DVA's large health care organization. This unique partnership will make the DVA facilities available to NIOSH for many types of health care research, and will ultimately lead to better understanding of prevention interventions for health care workers. Initially, the partnership is supporting a joint study on latex allergy which will provide NIOSH with new insights into developing more effective recommendations to protect workers, and will provide the DVA with an accurate estimate of the extent of latex sensitization among its employees. The partnership has also sponsored joint participation in an Expert Meeting on Working Conditions and Quality of Care – looking at the relation between healthcare workers' health and safety and quality of patient care – and will co-sponsor Enhancing Working Conditions and Patient Safety: Best Practices in October 2000, which will explore interventions that improve both worker and patient safety. Effectiveness of preventive intervention activities will also be studied. The partnership directly relates to a number of NORA priority areas, including Health Services Research, Asthma and COPD, Allergic and Irritant Dermatitis, and Special Populations at Risk.

NORA - A Model for Partnership

One of the most encouraging testaments to the success of NORA is the number of other organizations using NORA as a model for creating research agendas or other types of partnership and planning. NORA has generated tremendous interest – especially at the federal level – because of its innovative approach to strategic planning. NIOSH has shared its experience with many who have sought to undertake a similar effort. Examples of such planning efforts follow.

International and Foreign National Organizations

- European Agency for Safety and Health at Work
- Istituto Superiore Per La Prevenzione E La S Curezza Del Lavoro (the Italian Institute for Occupational Safety and Health)
- Japanese National Institute of Industrial Health
- Norwegian National Institute of Occupational Health

Federal Agencies and Programs

- Department of Defense, Deployment Toxicology Research and Development Master Plan
- Environmental Protection Agency, Human Health Indoors Project
- Chemical Safety and Hazard Investigation Board
- National Committee on Vital and Health Statistics
- Centers for Disease Control and Prevention
- Agency for Toxic Substances and Disease Registry

State Agencies Conducting Occupational Health Research

- Maine
- California
- Washington

Non-Profit Research Organizations

- The Pacific Northwest Agricultural Safety and Health Center, Occupational Research Agenda for Northwest Farming
- The Chemical Industry Institute of Toxicology

NORA Partnership Award

NIOSH presented the first NORA Partnership Award for Worker Health and Safety to the Asphalt Partnership at the 1999 NORA Symposium. The award recognizes outstanding NORA partnership activities that lead to improved worker health and safety. Through a unique collaboration, the Asphalt Partnership brought together diverse partners to achieve the goal of reducing workers' exposure to asphalt fumes during highway paving. The partners included NIOSH, the National Asphalt Pavement Association, the Federal Highway Administration, the Occupational Safety and Health Administration, the International Union of Operating Engineers, the Laborers' Health and Safety Fund of North America, the Laborers' International Union of North America, and the Asphalt Institute.

Through use of innovative engineering controls, the partners achieved an unprecedented accomplishment – 100 percent of an industry voluntarily agreeing to implement control technology equipment (which reduces worker fume exposure by about 80 percent) on all new highway pavers produced after July 1997. The partnership formed amid ongoing controversies surrounding the health effects of asphalt fume exposures and possible regulatory activity aimed at reducing these exposures. Working together, the partners avoided the protracted regulatory process and ensured that effective control technologies, designed and evaluated by NIOSH and its partners, were implemented to protect the approximately 300,000 highway paving workers across the nation.

This unique partnership was also selected as one of 25 finalists (out of 1,420 applicants) in the 1998 Innovations in American Government Awards Competition sponsored by the Ford Foundation, the John F. Kennedy School of Government at Harvard University, and the Council for Excellence in Government. The prestigious Innovations Award recognizes excellence in government and celebrates outstanding examples of creative problem-solving in the public sector.

To be eligible for the NORA Partnership Award for Worker Health and Safety, partnership activities must include collaborative research in at least one NORA priority area that results in the development of interventions that reduce hazardous exposures or adverse outcomes. Partners should represent a broad and diverse spectrum of organizations and individuals, such as manufacturers, end-users, labor, the public health community, academia, and government. The next award will be given at the 2001 NORA Symposium.

Guiding NORA Implementation

Liaison Committee

The NORA Liaison Committee, chaired by Dr. Bonnie Rogers (American Association of Occupational Health Nurses), consists of 24 members representing industry, labor, academia, professional organizations, and government (see listing on page 2). The Liaison Committee's role is to provide outreach and commentary on the development, progress, and direction of NORA implementation.

In 1999, the Liaison Committee undertook a survey of key occupational safety and health professional organizations. Of the 948 respondents, 42 percent reported that they were aware of NORA. Among this group, 30 percent reported that NORA had changed the research priorities of their organizations. Twenty percent reported that NORA had increased funding for their organization's research and 35 percent responded that NORA had increased partnerships between both researchers and organizations. Additionally, 47 percent responded that NORA had increased the quality of occupational safety and health research.

The Liaison Committee is also responsible for administering the NORA Partnership Award for Worker Safety and Health. The Committee will oversee the nomination and selection process of this biennial award honoring outstanding partnership activities.

Federal Liaison Committee

The Federal Liaison Committee (see listing on next page) is an interagency working group guiding the implementation of NORA. In 1999, the Committee undertook the second biennial survey of federal investment in NORA and in occupational safety and health research overall. The first survey, covering FY 1996, provided a baseline identifying a total of only \$199 million spent for all occupational safety and health research from the survey respondents (including NIOSH), compared to \$218 million in FY 1998. Although the overall increase in spending was not large, there was a substantial increase in spending in NORA priority areas, from \$30 million in FY 1996 to \$70 million in FY 1998 (see page 9).

Members of the Federal Liaison Committee have also been active in leveraging additional resources for NORA. In FY 2000, NIOSH and 10 federal partners announced the third consecutive year of grant funding in the NORA priority research areas (see description on page 12).

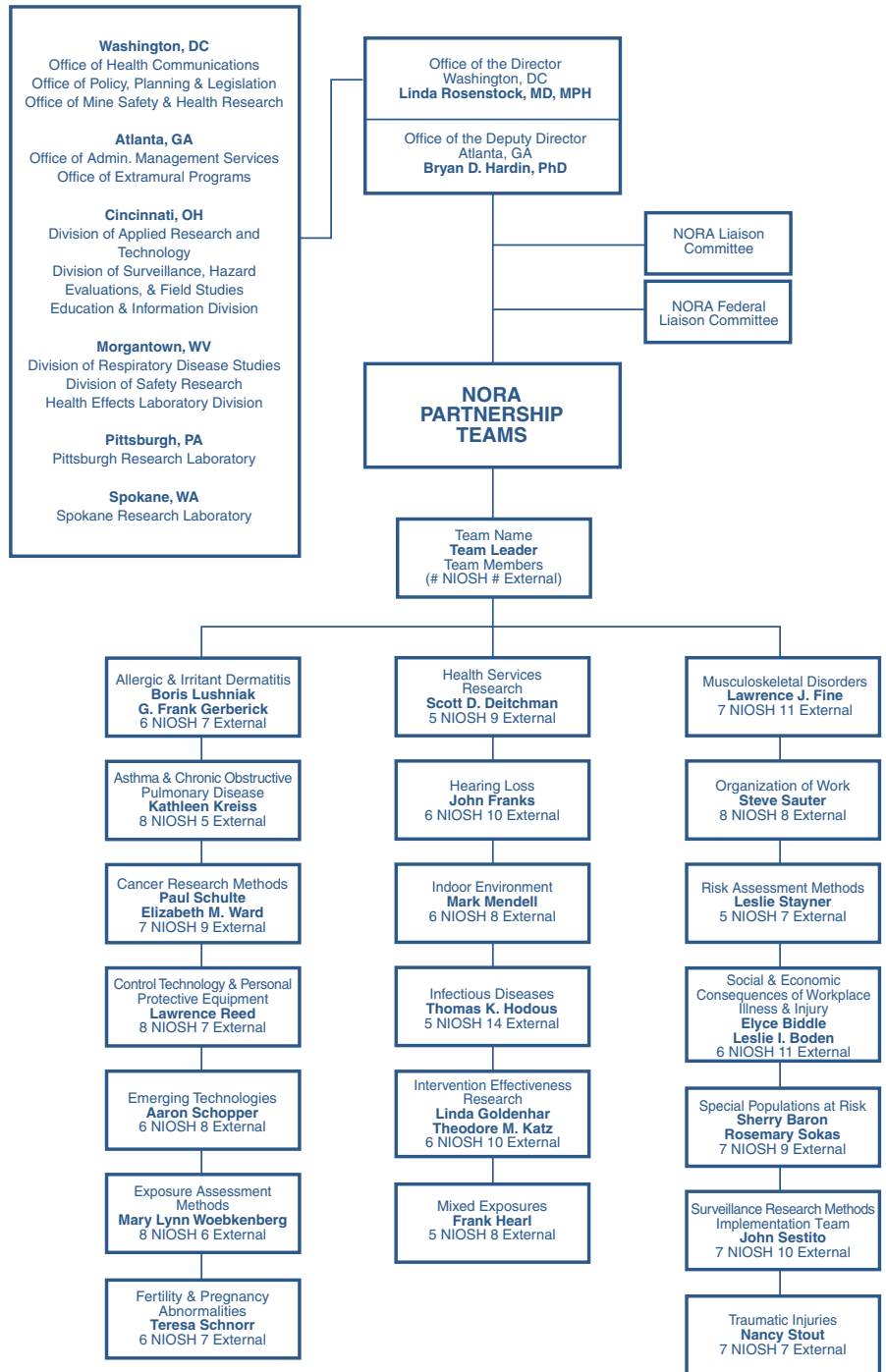
Federal Liaison Committee

FEDERAL AGENCY	OFFICE/INSTITUTE/DIVISION
Consumer Product Safety Commission	
Department of Agriculture	Cooperative State Research, Education and Extension Service
Department of Defense	Office of Naval Research
Department of Energy	Office of the Environment, Safety and Health
Department of Health and Human Services	Agency for Health Care Research and Quality Agency for Toxic Substances and Disease Registry Centers for Disease Control and Prevention Epidemiology Program Office National Center for Chronic Disease Prevention and Health Promotion National Center for Environmental Health National Center for Health Statistics National Center for HIV, STD, and TB Prevention National Center for Infectious Diseases National Center for Injury Prevention and Control National Immunization Program Office of Minority Health Office of Women's Health Food and Drug Administration Office of Intergovernmental Affairs National Institutes of Health Fogarty International Center National Cancer Institute National Heart, Lung, and Blood Institute National Institute on Aging National Institute of Allergy and Infectious Diseases National Institute of Arthritis and Musculoskeletal and Skin Diseases National Institute on Deafness and Other Communication Disorders National Institute of Environmental Health Sciences National Institute of Mental Health National Institute of Neurological Disorders and Stroke National Institute of Nursing Research Office of Women's Health Substance Abuse and Mental Health Services Administration
Department of Justice	National Institute of Justice
Department of Labor	Bureau of Labor Statistics Mine Safety and Health Administration Occupational Safety and Health Administration Wage and Hour Division
Department of Transportation	Federal Aviation Administration Federal Highway Administration National Highway Traffic Safety Administration
Department of Veterans Affairs	
Environmental Protection Agency	National Exposure Research Laboratory Office of Prevention, Pesticides, and Toxic Substances

IMPLEMENTATION

NIOSH/NORA Partnership Structure

IMPLEMENTATION



Partnership Teams

Fundamental to the success of NORA are the contributions of the Partnership Teams. The Teams' ability to involve key stakeholders in the priority areas, define research needs, and leverage resources for research are critical to the implementation of the Agenda.

Each team consists of a team leader, NIOSH researchers, and external partners. The 20 partnership teams have brought together approximately 130 NIOSH researchers and 170 external members (see inside front and back covers for team membership). External membership includes faculty from public and private colleges and universities, representatives of professional organizations and major industries, leaders in the insurance industry, health and safety professionals from organized labor, and representatives from other government agencies. The following summaries highlight the work of each of the 20 NORA Partnership Teams.

Team Summaries

Allergic and Irritant Dermatitis Team

The Allergic and Irritant Dermatitis (AID) Team mission is to develop a broad-based, active, and lasting group to catalyze research in AID. To date, AID Team accomplishments include: organizing and co-sponsoring meetings within the occupational safety and health and dermatology community; enhancing dermatology-related activities through both intramural and extramural research; and developing research priorities. In September 1998, the team cosponsored the Workshop on Health Effects and Benefits of UV Radiation and Tanning with the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), NIOSH, and others. The Experimental Contact Dermatitis Research Group, sponsored by NORA AID Team/NIOSH, the Skin Disease Research Centers at the University of Texas Southwestern Medical Center, Case Western Reserve University/ University Hospitals of Cleveland, and the Procter & Gamble Company, was convened in Cincinnati May 20-21, 1999. The purpose of this meeting was to discuss the basic and applied science of experimental contact dermatitis. On March 9, 2000, the NORA AID Team/NIOSH sponsored the Donald J. Birmingham Occupational Skin Diseases Session at the 11th Annual Meeting of the American Contact Dermatitis Society in San Francisco. In FY 1998, NIOSH and NIAMS co-funded an RFA for irritant dermatitis and funded five dermatitis projects. In FY 2000, NIOSH funded an inter-divisional intramural research program, Developing Dermal Policy Based on Lab and Field Studies. Finally, the team has been working on the development of research priorities in AID (now available in draft form).

Asthma & Chronic Obstructive Pulmonary Disease Team

The Asthma & Chronic Obstructive Pulmonary Disease Team has continued its successful partnerships with federal agencies to increase resources available for the extramural community for research on occupational asthma and chronic obstructive pulmonary disease (COPD). Requests for applications for such research have been jointly supported with the National Heart, Lung, and Blood Institute in each of the last three years. In addition, NIOSH has partnered with the CDC's National Center for Environmental Health and Agency for Toxic Substances and Disease Registry to fund two cooperative agreements to ascertain the population-based proportion of incident asthma cases attributable to occupational exposures. Intramurally, NIOSH sponsors a major initiative on research for occupational asthma reduction, including projects on building-related asthma in offices and schools, workplace exacerbation of pre-existing asthma, medical monitoring for isocyanate asthma, and latex asthma in Veterans Administration hospitals. The team

hosted an international symposium on asthma in 1998, a workshop on questionnaire revisions pertinent to building-related asthma in 1999, and an ad hoc committee of the American Thoracic Society to prepare a published statement on occupational asthma and COPD.

Cancer Research Methods Team

The NORA Cancer Research Methods Team has been reviewing methodologies that can have an impact on occupational cancer research. These methodologies range from the microlevel (such as structure-activity relationships to predict carcinogens) to the macrolevel (such as improvements in exposure assessments in epidemiological studies). The team is planning to publish a white paper on research needs and gaps for cancer research methods in four areas: carcinogen identification, epidemiologic studies, risk assessment, and prevention. An important theme will be better integration of laboratory and epidemiologic research.

Control Technology and Personal Protective Equipment Team

The Control Technology & Personal Protective Equipment Team, in conjunction with the American Industrial Hygiene Association and the American Society of Safety Engineers, held a unique conference and workshop in 1998, The Control of Workplace Hazards for the 21st Century: Setting the Research Agenda. It brought together over 250 researchers, manufacturers, and users of engineering controls and personal protective equipment. The participants created a future control technology research agenda for six areas: chemical protective clothing, engineering controls, noise, non-ionizing radiation, respirators, and traumatic injuries. Draft proceedings from this conference and workshop will soon be available for public use.

Emerging Technologies Team

The NORA Emerging Technologies Team is working on establishing mechanisms to ensure that worker health and safety is considered when new technologies are developed and implemented. The team is also seeking partners who are interested in co-sponsoring research that attempts to bring advanced and emerging technologies to bear on occupational safety and health concerns. The team is currently co-sponsoring, along with the National Science Foundation, the National Institute of Standards and Technology, and industry, a workshop to be held in conjunction with a meeting of the American Society of Mechanical Engineers relating to the application of emerging technologies to the field of ergonomics. The workshop will explore how the development of affordable, objective means of estimating and measuring ergonomic factors related to musculoskeletal disorders and hand-arm vibration can enhance research and monitoring capabilities in this area.

Exposure Assessment Methods Team

The Exposure Assessment Methods Team is composed of 14 members representing various disciplines (e.g., chemistry, biology, industrial hygiene, occupational health nursing, toxicology, and epidemiology) from government, academia, labor, and industry. The team has co-sponsored a symposium on Exposure Assessment with the American Conference of Government Industrial Hygienists; served on the planning committee of a workshop on the role of human exposure assessment in the prevention of environmental disease with the National Institute of Environmental Health Sciences/National Toxicology Program; and served on the planning committee of the International Symposium on Occupational Exposure Data Bases and Their Application in the Next Millennium. The team has completed a draft of a white paper that addresses key exposure assessment issues such as field study design, monitoring methods development, and toxicology research, along with education and communication needs relative to exposure assessment.

Fertility and Pregnancy Abnormalities Team

The mission of the Fertility and Pregnancy Abnormalities Team is to assist in the development and pursuit of reproductive health research. One of the team's goals is to increase public awareness and understanding of known reproductive hazards. To do this, the team is using the NORA web page, the NTP/NIEHS Center web page, and pamphlets published by NIOSH. The team helped organize the conference, Hazardous Substances and Male Reproductive Health, held in May 1998 in New York. The conference was sponsored by the Mount Sinai School of Medicine, NIEHS, NIOSH, and the New York Academy of Medicine. The team is also developing a paper on current research needs in the field of occupational reproductive health to help encourage research in areas that are most in need. NIOSH and NIEHS cosponsored the FY 1999 RFA which included fertility and pregnancy abnormalities as a targeted research area, a FY 2000 R21 RFA for developmental grants, and an RFA on endocrine disruptors and reproductive/developmental effects. The team will also cosponsor an NIEHS workshop in November 2000, Comparing and Contrasting Reproductive Toxicity Testing for Males and Females.

Health Services Research Team

The Health Services Research Team seeks to define and promote research into the delivery of health care to workers. In June 1999, the team co-hosted the conference, Functional, Economic, and Social Outcomes of Occupational Injuries and Illnesses: Integrating Social, Economic, and Health Services Research, in Denver, Colorado. This conference brought together NORA team members and other researchers in the fields of occupational health services research and social and economic consequences of occupational injury and illness. Ten commissioned papers, which have been submitted for peer-reviewed publication, served as the starting point for discussions of current needs, challenges, and priorities for research in these areas. Using this information, the Health Services Research Team is developing a white paper to identify key research priorities. Team members are also participating in a research project funded by the Robert Wood Johnson Foundation to create performance measures for occupational health services provided in managed care. Several research papers from this project have been drafted for submission to peer-reviewed journals. New research partnerships are being explored with major industrial employers. Team members also contributed to an announcement of grant funds for students training in occupational health services research.

Hearing Loss Team

The Hearing Loss Team is finalizing a white paper on the prevention of occupational hearing loss and plans to publish the document in 2000. The Team is conducting a series of best practices conferences, the first of which focused on the manufacturing sector and was held in Detroit, Michigan, in October 1999. The conference was cosponsored by NIOSH, Wayne State University, and the National Hearing Conservation Association. The second best practices conference, focusing on construction, was held in March 2000 in Washington D.C., and was cosponsored by NIOSH, OSHA, and the Laborers International Health and Safety Fund of North America. Future best practices conferences may address small business, mining, and agriculture. Proceedings will be available for each best practices conference as NIOSH publications.

The team is also working on the development of training curricula for the prevention of occupational hearing loss for Industrial Hygiene and Audiology graduate programs at the masters level. As a first step in this process, the team conducted an Internet survey of industrial hygienists and audologists on hearing loss prevention training. Team members will also be contacting universities and colleges with graduate training in Industrial Hygiene and Audiology to determine the availability of formal course work. At this time, neither certifying body requires formal course work or provides curriculum guidance.

Indoor Environment Team

The goal of the NORA Indoor Environment (IE) Team is to focus and facilitate research among broadly based multi-sector partnerships that improves the health of workers in indoor environments. The IE team has produced a draft research agenda giving priority to specific building-related health effects with the largest estimated adverse health and economic impacts. It will be published as a scientific article. The draft research agenda, in combination with the availability of increased NIOSH extramural funding, has already stimulated a large increase, both in number and in rigor, of IE-related research proposals in the U.S. NIOSH funded four extramural projects, two in FY 1998 and two in FY 1999. Three are blinded, controlled intervention studies on ventilation, viral respiratory infections, and illness absence; the joint effects of volatile organic compounds, ozone, and stress on health; and the health benefits of in-duct ultraviolet radiation. The fourth study will develop a hand-held instrument to identify and quantify low concentrations of mixed volatile organic compounds. The IE team has also developed a request for proposals for inclusion in a FY 2000 CDC RFA to evaluate the health benefits of existing regulations related to ventilation and other IE parameters. Internally, NIOSH has recently begun a large research initiative in the Division of Respiratory Disease Studies on respiratory disease in indoor work environments.

Infectious Diseases Team

The mission of the Infectious Diseases (ID) Team is to review and recommend needed changes in occupational infectious diseases research efforts, facilitate the development of new research and collaboration in this area, call attention to national needs in occupational infectious diseases research, and help in the greater dissemination of research data in the field. To this end, the team has developed a draft white paper addressing major research needs, particularly those involving human-to-human transmission, which will be presented at a session of the American Occupational Health Conference on May 18, 2000, in Philadelphia to receive external comments. Team members helped in the development and review of the NIOSH Alert Preventing Needlestick Injuries in Health Care Settings. The team will also be involved with a session on needlestick injuries to be presented at the National Occupational Injury Research Symposium in October 2000 in Pittsburgh. As experts in the infectious disease community, several team members have independently contributed to other conferences discussing occupational infectious disease issues, including Tuberculosis Control in the 21st Century (December 1999) and the Fourth Decennial International Conference on Nosocomial and Healthcare-Associated Infections (March 2000).

Intervention Effectiveness Research Team

The Intervention Effectiveness Research (IER) Team has been active in carrying out the team's mission to: 1) increase the awareness and appreciation of the value of OSH intervention research, 2) increase the understanding and use of optimal research methods for conducting IER, 3) promote investment in IER across OSH, and 4) broaden dissemination of results and lessons learned from occupational safety and health intervention research. The team has prepared a journal article describing a conceptual framework which outlines the major phases and activities involved in conducting intervention research. The team has also developed a case-based workshop exercise to train health and safety professionals to think critically about important issues when developing, implementing, and evaluating interventions. The workshop has been presented at a number of health and safety conferences. The team is also developing a practical manual for evaluating safety and health interventions in the workplace and collaborating with the Institute of Labor and Health in Toronto, Canada, in preparing a "How To" intervention evaluation manual for safety and health professionals.

Mixed Exposures Team

The Mixed Exposures Team has reviewed the recent and past literature and has examined on-going work both nationally and internationally. Through meetings held in 1999, the Mixed Exposure Team is building on its analysis of ongoing mixed exposure research to develop a research agenda. Past analysis lead the team to group the subject into the following categories: complex mixtures (such as combustion exhausts), mixtures with identifiable composition, mixed stressor exposures (such as noise and chemicals), and mixtures associated with particular workplaces or processes (such as coal mine dust). Although research can be directed at various specific mixtures in each of these categories, the team is recommending that priority be given toward those studies that yield a broader understanding of how mixed exposures potentiate the health response, and to the extent possible, simultaneously carry out the research with real-world mixtures that affect large numbers of workers. Through application of the priority selection logic, the team hopes to stimulate research on physiologically based pharmacokinetic modeling, case studies to develop tools for broad applications in mixed exposure research, and further work on biomarkers. The team continues to facilitate communications and collaboration among researchers and those interested in mixed exposures through a list server and a site on the Internet. Instructions for joining the list server are provided on the Mixed Exposures Team Internet site at: <http://www.cdc.gov/niosh/mixed.html>.

Musculoskeletal Disorders Team

The Musculoskeletal Disorders Team is continuing to work on the development of a NIOSH document that includes a comprehensive National Occupational Research Agenda directed at prevention of work-related musculoskeletal disorders. Four workshops (Washington, DC, Chicago, Illinois, Seattle, Washington, and Houston, Texas) were conducted to identify gaps in existing knowledge and shape the agenda. The document includes comments from practitioners, academics, and members of the NORA MSD team. Additionally, in March 2000 at the Applied Ergonomics Conference, the NORA MSD Team joined in a partnership with the Institute for Industrial Engineers to conduct a workshop on research needs for interventions in the health care industry. The team will summarize the findings from the workshop and place them on the NIOSH web page.

Organization of Work Team

Since 1998, the Organization of Work Team has met on a regular basis to consider the changing nature of work, potential health and safety risks, and prevention strategies. To better understand knowledge gaps and research needs in these areas, an outreach workshop with key interest groups was held in March 1999 in Baltimore, MD. Team members met with representatives from national and international stakeholder organizations to elicit their viewpoints on three broad topics: 1) how the organization of work is changing, 2) safety and health implications of these changes, and 3) interventions for reducing health and safety risks. Information from this meeting is being integrated into a strategic report by the team on research needs in work organization and health. Also in 1999, the team cosponsored (with the American Psychological Association) a major scientific conference on work organization and health and delivered technical presentations on safety and health concerns in the changing organizational environment at meetings of the European Agency for Safety and Health at Work, the American Industrial Hygiene Association, the Academy of Management, and the American Public Health Association. The team has formulated Year 2000 plans for sponsorship of research symposia on work organization and health at stakeholder conferences, and for a federal interagency meeting to leverage support for an expanded program of research on this topic.

Risk Assessment Methods Team

The Risk Assessment Methods Team has defined ten research areas that will promote improvements in the methodologies used for risk assessment. One of these research areas was funded by NIOSH in a Cooperative Agreement with researchers at the University of North Carolina and will support research to evaluate the degree of concordance between toxicologic and epidemiologic estimates of risk for carcinogenic hazards. NIOSH, EPA, and NCI have funded a 1999 RFA for research focusing on the development of cancer risk assessment methods and practices. The team is currently organizing a workshop, Future Research to Improve Risk Assessment Methods, that will be held in August 2000.

Social and Economic Consequences of Workplace Illness and Injury Team

The Social and Economic Consequences of Workplace Illness and Injury Team seeks to help guide the Nation's research of the social and economic consequences of workplace illness and injury over the next decade through increasing the quality and quantity of research, improving the availability of data to measure social and economic consequences, and extending the scope of traditional economic and sociologic inquiry into public health. This team, in conjunction with the Health Services Research NORA implementation team, sponsored a conference in June 1999 that addressed performance measures for health services delivered to prevent or treat occupational injury or illness, measures of the economic and social impact of occupational injury or illness, and research that integrates these two areas. Following the conference, summaries of each session discussion were completed and posted to the NORA website. Professional opinion, judgment, and recommendations from the conference provided direction for developing a draft national occupational research agenda. Background papers, which were used to fuel the discussions at the conference, were submitted for publication in a peer-reviewed journal. In addition to this work, several team members are focusing their efforts on improving the availability of data. To help identify gaps in existing data sources, a comprehensive inventory of national data on injury and illness mortality, morbidity, and the social and economic consequences of those injuries and illness is being compiled. The Robert Wood Johnson Foundation funded team members to develop and test a standardized method for creating an interstate database for the study of worker's compensation medical care, and the International Association of Industrial Accident Boards and Commissions is working in collaboration with the team to create an international data repository of worker's compensation administrative records.

Special Populations at Risk Team

The Special Populations at Risk Team has identified home health workers as a work sector disproportionately comprised of special populations at risk and will also explore the "super healthy worker effect" as a targeted area. The team is also addressing research directions for the aging workforce and presented a panel discussion at the Fall 1999 State of the Art Occupational Medicine Conference on the topic of the aging workforce. Team members participated in town meetings sponsored by NIEHS to identify appropriate mechanisms to address health disparities related to the environment, and facilitated NIOSH co-sponsorship of a joint RFA soliciting research to eliminate health disparities due to occupational and environmental exposures. The team will sponsor sessions at the October 2000 National Occupational Injury Research Symposium in Pittsburgh and the annual American Public Health Association meeting in Boston in November 2000. The team assisted in the development of the July-September 1999 issue of the journal, *Occupational Medicine: State of the Art Reviews*, which focused entirely on the issues facing special populations at risk. Several team members also participated in the development of the Institute of Medicine report, *Youth at Work*, which was released in

November 1998. The research track at the annual Migrant Stream Forum meeting, established by NORA team members in 1998, is in its third year. The research listserve, a direct outgrowth of this effort, has proven to be extremely successful.

Surveillance Research Methods Team

The Surveillance Research Methods Team has played an integral role in the selection of surveillance research methods topics for the FY 1999 grant solicitation and the three new surveillance RFAs in FY 2000. The Exposure Assessment and Surveillance Research Methods Teams are discussing exposure surveillance issues with the American Industrial Hygiene Association to advance a vigorous program of exposure surveillance research, to partner in the creation of a national occupational exposure database, and to conduct a new National Occupational Exposure Survey (NOES). Members of the team contributed significantly to the NIOSH surveillance strategic planning effort and the development of the NIOSH *Worker Health Chartbook 2000*.

Traumatic Occupational Injury Research Team

The Traumatic Occupational Injury Research Team continues to foster collaborative research partnerships with internal and external partners. The team is currently assisting with planning for the National Occupational Injury Research Symposium (NOIRS) 2000. This second national symposium will be held in Pittsburgh, PA, in October 2000. A number of the NORA Teams are participating in this symposium such as Special Populations at Risk, Organization of Work, Control Technology & PPE, Social and Economic Consequences, Risk Assessment Methods, and Intervention Effectiveness. This conference builds on the success of the first NOIRS conference in October 1997. This first ever national conference on occupational injury research was attended by over 300 occupational safety professionals from a wide variety of disciplines and organizations.

The team has also developed a document describing the needs and priorities for traumatic occupational injury research in the U.S. Published by NIOSH in 1998, the document, *Traumatic Occupational Injury Research Needs and Priorities*, provides a broad framework of the objectives and research needed to begin filling the gaps in knowledge and furthering progress toward safer workplaces and practices. Furthermore, it provides a reference and structure for traumatic occupational injury research which can be used to facilitate new, and rekindle existing, partnerships and collaborative research to prevent worker injuries and deaths.

Kudos for NORA

NORA has received broad support from many quarters. The following examples are from May 1999 through February 2000.

The Committee is encouraged with the progress by NIOSH on implementing the National Occupational Research Agenda [NORA]. The Committee is supportive of NIOSH's efforts to further its partnerships with the occupational safety and health community and the broader public and private public health research community, and believes these partnerships will be important in the implementation phase. The Committee urges NIOSH to work with its partners to augment resources available to the Institute for NORA research.

– Senate Appropriations Report Language, FY 2000

NORA initiatives are so important because they base themselves on the kinds of interactions that will have to become central issues for our society as the next century begins.... NORA is a prototype for these kinds of initiatives.

**– Kenneth Shine, M.D., President, Institute of Medicine,
National Academy of Sciences**

This country is making a transition into a new economy ... an economy that will present all of us with a whole new series of workplace health hazards to overcome. In my judgement, NORA is absolutely essential to how we are going to take on these kinds of issues From its [NORA's] beginnings, NIOSH and its partners have understood that a prerequisite to making workplaces safer in this new economy is making sure that no one is left out of the decision making process. That's really the genius of NORA. . . . I've encouraged all my staff to use NORA as a model for building strong research partnerships.

**– Donna Shalala, Ph.D., Secretary, U.S. Department of
Health and Human Services**

By coming together with others who care about the costs of occupational injuries and illnesses, both in human and economic terms, we all benefit. It is also important that NORA's agenda emphasize not only medical problems but the social and economic concerns also. At the Building and Construction Trades Department, representing more than three million workers, . . . we are very proud to be partners in NORA.

**– Robert Georgine, President, Building and Construction
Trades Department, AFL-CIO**

The highpoint of the year, if not of NAPA's 44-year history, was the day in April when NAPA received the first NORA Award, bestowed by the National Institute for Occupational Safety and Health for the initiative that put engineering controls on asphalt pavers.

– Mike Acott, President, National Asphalt Paving Association

NORA is vitally important. It's important because it provides clear focus and sets priorities on health and safety issues. It's important because it's resulting in significantly more resources directed toward the 21 priority areas. And it's increasing our understanding. Through the research, it's helping us anticipate, identify and provide innovative solutions to health and safety concerns and to prevent injuries and illnesses before they occur.

– Lawrence Burns, Ph.D., Vice President for Research, Development and Planning, General Motors Corporation

I was particularly struck by the National Occupational Research Agenda. This incredible scheme is undoubtedly one of the largest international efforts to develop and implement a plan to establish research priorities in this sector.

– Antonio Moccaldi, Ph.D., Director, Italian National Institute for Occupational Health and Safety

... research in occupational safety and health matters is vital. We believe that the NORA process plays a valuable role in this regard, and we plan to continue to participate fully with NIOSH and other members to promote research.

– James Thornton, President, American Industrial Hygiene Association

The NORA process has proven very successful, and serves as a model of broad stakeholder influence in priority setting. Most recently, the second phase of the process has encouraged the National Institutes of Health and other federal agencies to join NIOSH in sponsoring a number of focused research programs directly relevant to workplace health and safety.

– Occupational Research Agenda for Northwest Farming

ACCIDENTS

NORA Milestones

July 1995 - May 1999

NORA Development

- July 1995 NIOSH commits to lead the creation of a research Agenda for occupational safety and health
- September 1995 ... Agenda framework developed and 50 potential topics identified by an initial working group of internal and external scientists
- November 1995 First National public meeting convened to provide input into the Agenda and discuss criteria for priorities
- January 1996 Four additional working groups (NIOSH, external researchers, health professionals, other stakeholders) expand and prioritize research areas
- February 1996 Three town meetings (Boston, Chicago, and Seattle) convened
- March 1996 Second national public meeting held to review the draft Agenda
- April 1996 Final Agenda unveiled – The National Occupational Research Agenda identified 21 priority research areas to guide occupational safety and health research (released on NIOSH 25th Anniversary)

NORA Implementation Year 1

- November 1996 Partnership teams formed for each priority area to implement NORA
- February 1997 First ever survey conducted of federal (non-NIOSH) resources (FY 1996) committed to occupational safety and health research
- July 1997 First NORA Implementation Symposium held at the National Academy of Sciences, Washington, D.C.
NORA Update 1997 document released

NORA Implementation Year 2

- November 1997 Congress appropriated \$5 million for the implementation of NORA
- Jan-Feb 1998 Three NIH Institutes each contributed \$1 million to NORA research priorities
- March 1998 NIOSH and NIH partners announced a Request for Applications (RFA) for the largest ever funding for targeted occupational safety and health research (\$8 million)
American Association of Occupational Health Nurses and the American College of Occupational and Environmental Medicine established a joint research award, giving emphasis to NORA in the selection criteria
- April 1998 NORA logo created
- May 1998 NORA and the asphalt partnership both selected as semifinalists (two of 100 semifinalists – two of 19 federal semifinalists) for the Ford Foundation and Harvard University's 1998 Innovations in American Government Awards Program from an initial pool of 1,420 applicants
First issue of the NORA newsletter, *NORA News*, distributed
NORA Web site mounted
- July 1998 NORA Update 1998 document released
- September 1998 ... Asphalt research partnership selected as one of 25 finalists in the 1998 Innovations in American Government awards program
First private sector funds (Aetna U.S. Health Care) leveraged for NORA research (musculoskeletal disorders project)

NORA Implementation Year 3

- October 1998 First NORA research grants announced—50 grants totaling \$8 million make up the single largest infusion of funding ever by the federal government for extramural investigator-initiated occupational health and safety research
 NIOSH received permission to trademark the NORA logo
 Congress continued to provide support for NORA through an \$11 million appropriation in the FY 1999 NIOSH budget
- February 1999 The President’s FY 2000 budget proposal to Congress included \$12 million for NORA to support both intramural and extramural research and related activities
- March 1999 Second survey of federal (non-NIOSH) resources (FY 1998) committed to occupational safety and health research conducted
 Liaison Committee conducted two surveys to determine the effectiveness and reach of NORA among associations and private industry
 NIOSH/NIH invited NORA grant applications for FY 1999 (\$9 million)
- April 1999 NIOSH/EPA/NCI announced RFA for \$1.5 million for research focusing on the development of cancer risk assessment methods and practices
- May 1999 NORA Update 1999 document released
 First NORA Partnership Award For Worker Health and Safety awarded to the Asphalt Research Partnership
 NORA Symposium 1999: Partnership for Research held at the National Academy of Sciences, Washington, D.C.
 NIOSH announced a cooperative agreement with the Association of Schools of Public Health to solicit applications for intervention effectiveness research.
 NIOSH announced an RFA to fund research on intervention effectiveness
- August 1999 NIOSH/NIH invited applications through a general program announcement (PA) for research in the 21 NORA priority areas
 NIOSH/NCI/NIEHS announced a PA on research methods for occupational cancer
 NIOSH announced the availability of approximately \$500,000 in grants to train occupational health services researchers

NORA Implementation Year 4

- October 1999 NIOSH awarded \$5.4 million in grant funds for 23 projects in seven NORA areas
- November 1999 Congress continued to provide support for NORA through a \$11.3 million appropriation in the FY 2000 NIOSH budget
 NIOSH/NIEHS and five other NIH partners announced a \$5 million RFA to stimulate new research on risk disparities among special populations
- February 2000 The President’s FY 2001 budget proposal to Congress included \$4.9 million to support research under NORA
- March 2000 NIOSH announced RFAs for intervention effectiveness (\$1.2 million); surveillance research (\$2.5 million); exploratory research in allergic and irritant dermatitis, social and economic consequences of workplace injury and illness, health services research, and fertility and pregnancy abnormalities (\$1 million); agriculture-related injuries to children (\$1.6 million) and musculoskeletal disorders (0.9 million).
- April 2000 NIOSH/EPA/NIEHS announce a \$5 million RFA on Mixed Exposures

Summary

The implementation of NORA has been a huge success in its first four years. Those dedicated to NORA and occupational safety and health have produced:

- An enthusiastic and productive, broad-based NORA Liaison Committee.
- Successful efforts of 20 NORA teams, including outreach; conferences and symposia; and production of white papers, documents, and journal articles.
- The participation of a large number of federal agencies in NORA activities.
- A successful grants process which has produced record-breaking funding for targeted occupational safety and health research in Fiscal Years 1998, 1999, and 2000.
- Two surveys (in Fiscal Years 1996 and 1998) of federal occupational safety and health research investment.
- Evidence that a national research agenda was, and continues to be, needed and that NORA research priority areas were well chosen.
- Recognition that NORA continues to be used as a model for public-private partnerships and is being widely used by other organizations in similar planning efforts.
- For the first time, a broad-based network of public and private partnerships in occupational safety and health.

(continued from inside front cover)

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DHHS (NIOSH) Publication No. 2000-143