NIOSH Extramural Research and Training Program

Annual Report of Fiscal Year 2012

Prepared by the Office of Extramural Programs | National Institute for Occupational Safety and Health

DEPARTMENT OF HEALTH AND HUMAN SERVICES
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SUGGESTED CITATION

NIOSH [2013]. NIOSH extramural research and training program: annual report of fiscal year 2012. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2014–114.

DHHS (NIOSH) Publication No. 2014–114

February 2014

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Foreword

I am pleased to deliver the FY2012 annual report of activity of the extramural research and training program of NIOSH. These data reflect the exceptional work of the extramural community of researchers supported by NIOSH. This annual report represents considerable effort of the scientific program officials and extramural performance staff in the Office of Extramural Programs (OEP). In this report you will find a description of the NIOSH extramural research and training programs that were active during FY2012 and information on the structure and function of the OEP. A review and summary of funding by program area and grant mechanism is presented with comparison data over the preceding 5 fiscal years. Activities of the extramural portfolio are described for each of the NIOSH multidisciplinary research centers, investigator-initiated research projects, and cooperative research agreements. And funding and activities are also provided for our training project grants, state surveillance programs, small business innovation research, and global health initiatives. This report does not include data on the grants program associated with the World Trade Center Health Program.

This year's annual report includes a review of extramural research and training program activity by NORA sector program goals and a description of the new research integration initiative. Hyperlinks to the NIOSH website have been embedded throughout the report, providing instant access to additional, relevant data and information. The appendices provide data on the activities of the OEP during FY2012, including the listing or program announcements published during the fiscal year, peer review meetings, and success rates by grant mechanism. Appendix 5 provides a detailed summary of the research outputs and impact stories and is organized by type of research activity.

We hope that this report will help inform the ongoing discussion of how extramural research at NIOSH can help the Institute meet its research priorities and further the development of research integration activities across the Institute. This report will provide a template for future reports, and your feedback and suggestions are encouraged.

John Howard, M.D.
Director, National Institute for
Occupational Safety and Health
Centers for Disease Control and Prevention

Executive Summary

In FY2012, NIOSH awarded $96,350,778 in extramural funding. A total of 203 awards were made during the fiscal year, and the success rate for investigator-initiated research grants (R01, R03, and R21) increased from 15% in FY2011 to 18% in FY2012.

A total of $50,154,733 (52%) went to multidisciplinary research and training centers, followed by $32,015,665 (33%) for investigator-initiated and career development research grants (R01, R03, R21, R13, and K01). Cooperative research agreements made up $8,775,584 (9%) of the FY2012 portfolio, followed by $4,306,900 (5%) for individual training project grants and $1,097,896 (1%) for small business innovation research projects.

Of the 203 awards made, 51 (25%) were for new projects and 152 (75%) were continuing awards. Awards were made in the following categories: 35 (17%) to our multidisciplinary research and training centers that include Agriculture Safety and Health, Construction, WorkLife, Education Research Centers (ERC), and Mining; 111 (55%) for investigator-initiated and career development; 25 (12%) for cooperative research agreements; 28 (14%) for individual training project grants; and 4 (2%) for small business innovation research.

Eighteen ERCs received approximately $24 million in funding, followed by just over $14 million for Agriculture Safety and Health Centers. Six million dollars was awarded to the National Center for Construction Research and Training and just over $4 million was awarded to the Centers of Excellence to Promote a Healthier Workforce. Mining training centers received $1 million in funds in FY2012. These centers received funding for both continuing and competing renewals.

A new research integration initiative was launched in FY2012 to leverage resources and opportunities across the intramural and extramural research programs at NIOSH. Activity in FY2012 included a review of NORA sector and cross-sector program goals that were addressed by intramural and extramural research projects. Future efforts will look to enhance the integration of research initiatives at the time projects are requested and as programmatic priorities are reviewed prior to funding.

In spite of a period of economic constriction, NIOSH was able to increase the funds awarded to the extramural research and training programs and increase the success rate for investigator-initiated research. These are notable achievements in a period of economic uncertainty and constriction.

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LIST OF ABBREVIATIONS

Sector Programs

ALL	All Sectors or Multiple Sectors
AFF	Agriculture, Forestry, and Fishing
CON	Construction
HSA	Healthcare and Social Assistance
MNF	Manufacturing
MIN	Mining
MIO	Oil and Gas Extraction
SPS	Public Safety
SRV	Services
WRT	Wholesale and Retail Trade
TWU	Transportation, Warehousing, and Utilities

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I NIOSH Extramural Research and Training Programs

The NIOSH Extramural Research and Training Programs include diverse portfolios of investigator-initiated research, mentored research scientist development awards, training programs, and small business innovation research projects in occupational safety and health. Multidisciplinary education and research centers, state surveillance programs, and global occupational health initiatives complement the breadth and depth of extramural research and training at NIOSH.

MISSION STATEMENT

The mission of the NIOSH extramural research and training programs is to direct, support, and evaluate national occupational safety and health research to reduce work-related injuries and illnesses through a diversified research portfolio with broad public health impact in collaboration with global partners. This mission is led by the Office of Extramural Programs (OEP), which advocates for and supports projects in occupational safety and health research, training, and surveillance. Through partnerships we make the best science possible.

PURPOSE AND STRUCTURE

The purpose of the NIOSH extramural program is to support research and training projects that are focused on the reduction of workplace risk for injury, illness, and death. NIOSH extramural research covers a wide range of program areas. Collectively, these research projects address a myriad of complex issues and further the state of art and knowledge related to the causes and conditions of occupational injury, illness, and mortality. To better manage funded research and respond to the NIOSH mission to generate new knowledge in the field of occupational safety and health and to transfer that knowledge into practice for the betterment of workers, the extramural research portfolio has been organized into six major categories of funded activities: (1) Investigator-initiated Research, (2) Training Programs, (3) Multidisciplinary Centers, (4) State Surveillance Programs, (5) Small Business Innovation Research, and (6) Global Occupational Health Initiatives. Descriptions of these program areas are available in the Appendices and additional information can be found at Research and Training Portfolios on the OEP webpages.

ORGANIZATION AND STAFFING OF OEP

To facilitate the management of the extramural grant and cooperative agreement portfolios, NIOSH established the Office of Extramural Programs (OEP). OEP is under the leadership of the Associate Director for Research Integration and Extramural Performance, which reflects the Institute's commitment to integrating research activities across NIOSH and to assessing extramural research performance. OEP is organized around the four core functions of Review, Program, Performance Measurement, and Management. A listing of OEP staff is available on the NIOSH website.

GRANTS POLICY AND MANAGEMENT

NIOSH utilizes the National Institutes of Health (NIH) model for the administration of its extramural program. This allows NIOSH to partner with other components of the U.S. Public Health Service to support occupational safety and health research. This system also ensures that high-quality research is funded through the two-step peer review process, which evaluates scientific merit and

programmatic relevance of proposed research projects. The peer review and program management of the extramural portfolios is managed by OEP. Please see Appendix 1 for a list of the peer review meetings conducted by NIOSH in FY2012.

FUNDING OPPORTUNITIES

NIOSH announces its extramural research, training, and conference support programs in the *NIH Guide for Grants and Contracts*. To maximize the grants program's usefulness in protecting workers, NIOSH funds projects that are both scientifically sound and related to program priorities. Prevention is the thrust of the research program, and studies are supported to identify occupational populations at risk, develop methods for measuring exposures to hazards and detecting adverse health effects, determine the prevalence and incidence of occupational hazards, understand the etiology of occupational diseases and injuries, and reduce or eliminate exposures to hazards. Support is provided for both laboratory and field studies involving humans, as well as laboratory studies with various animal models and cell lines. Acute, subchronic, and chronic investigations are supported. Methods development involves measurement instrumentation, analytical techniques, medical monitoring procedures, and statistical designs to improve accuracy and precision of results. Fundamental or basic research may be supported if the applicant describes in the proposal the current or potential utility of the research effort in dealing with an occupational safety or health concern. For more information on how to apply for these grants, please see "Funding Opportunities" on the NIOSH Extramural Research and Training Programs webpage. Please see Appendix 2 for a list of all the grant activity mechanisms NIOSH uses and Appendix 3 for a list of the NIOSH Funding Opportunity Announcements published in FY2012.

FUNDING PRIORITIES

To better coordinate the research activities in OEP, the extramural research portfolio is organized into priority areas in occupational safety and health. These research priorities are derived from the National Occupational Research Agenda (NORA), a stakeholder-driven research agenda designed to address the most pressing needs in workplace safety and health in the United States. The NIOSH program portfolio is organized around the 10 NORA sector programs and 24 cross-sector programs that include adverse-health and nonhealth outcomes, statutory programs, and global efforts. Each program area sets priorities for NIOSH work in the sector, monitors NIOSH-funded projects related to its sector, and encourages new NIOSH projects to address sector priorities. Extramural researchers are asked to identify the priority areas their projects address. More information about these program areas and research priorities may be found on the NIOSH Program Portfolio webpage or by clicking on the program names below.

NIOSH Program Areas

NIOSH Sector Program Areas	
Agriculture, Forestry, and Fishing	Oil and Gas Extraction
Construction	Public Safety
Healthcare and Social Assistance	Services
Manufacturing	Transportation, Warehousing, and Utilities
Mining	Wholesale and Retail Trade

NIOSH Cross-sector Program Areas

- Authoritative Recommendations
- Cancer, Reproductive and Cardiovascular Diseases
- Communications and Information Dissemination
- Economics
- Emergency Preparedness and Response
- Engineering Controls
- Exposure Assessment
- Global Collaborations
- Health Hazard Evaluation
- Hearing Loss Prevention
- Immune and Dermal Diseases
- Musculoskeletal Disorders
- Nanotechnology
- Occupational Health Disparities
- Personal Protective Technology
- Prevention Through Design
- Radiation Dose Reconstruction
- Respiratory Diseases
- Small Business Assistance and Outreach
- Surveillance
- Total Worker Health
- Training Grants
- Traumatic Injury
- Work Organization & Stress-Related Disorders

Research to Practice (r2p)

Priority is also given to projects that include "Research to Practice" (r2p) goals. R2p is the transfer and translation of research findings, technologies, and information into highly effective prevention practices and products that may be adopted in the workplace. The goal of r2p is to reduce illness and injury by increasing workplace use of effective NIOSH and NIOSH-funded research findings. In order to achieve this, NIOSH is continuing to work with our partners to focus research on ways to develop effective products, translate research findings into practice, target dissemination efforts, and evaluate the effectiveness of these efforts in improving worker safety and health. More information on the NIOSH r2p Program can be obtained at http://www.cdc.gov/niosh/r2p/.

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II NIOSH Extramural Research Activity

FUNDING DISTRIBUTION FY2012

In FY2012, NIOSH awarded $96,350,778 million in extramural funding. The distribution of awards by type of activity is shown in Figure 1. Fifty two percent (52%) of the extramural funding went to multidisciplinary research and training centers, followed by 33% for investigator-initiated and career development research grants. Cooperative research agreements made up 9% of the FY2012 portfolio, followed by individual training project grants (5%) and small business innovation research projects (1%).

In FY2012 NIOSH made a total of 203 awards. A summary of all the NIOSH extramural awards for FY2012 is shown in Table 1. Of the 203 awards made, 51 (25%) were for new projects and 152 (75%) were continuing awards. Awards were made in the following categories: 35 (17%) to our multidisciplinary research and training centers that include Agriculture Safety and Health, Construction, WorkLife, ERCs and Mining; 111 (55%) for investigator-initiated research and career development; 25 (12%) for cooperative research agreements; 28 (14%) for individual training project grants; and 4 (2%) for small business innovation research. A searchable listing of all active awards funded by NIOSH is available on the OEP webpages.

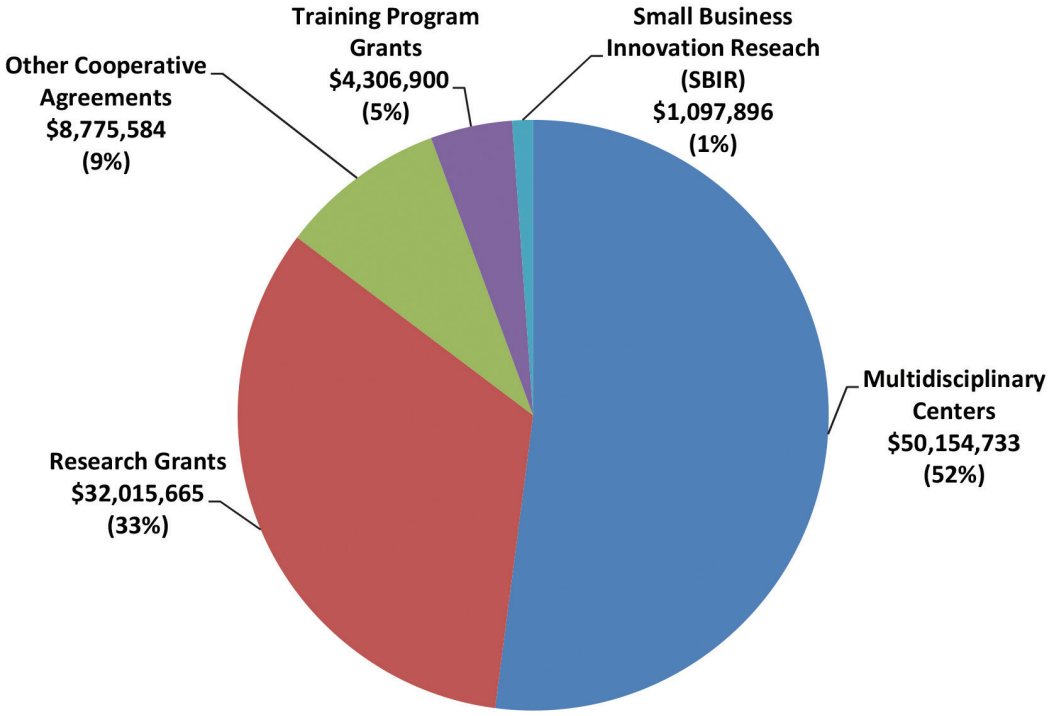


Figure 1. NIOSH Extramural Grant Distribution, FY2012

Table 1. Summary of all awards by type of funding in FY2012

Research and training centers	Award mechanism	Awards	Funding
Agriculture Safety and Health Centers	Cooperative Research Agreement (U54)	9	$13,547,726
National Children's Agriculture Center	Cooperative Research Agreement (U54)	1	$849,045
Construction Center	Cooperative Research Agreement (U60)	1	$5,750,000
WorkLife Centers	Cooperative Research Agreement (U19)	4	$4,662,335
Education and Research Centers	Training Grant (T42)	18	$24,268,033
Western Mining Training Center	Cooperative Research Agreement (U60)	2	$1,077,594
Investigator-initiated research	**Award mechanism**	**Awards**	**Funding**
Research Grants	Investigator-initiated (R01,R03,R21,R13)	102	$31,046,499
Career Development	Mentored Career Scientist (K01)	9	$969,166
Cooperative research agreements	**Award mechanism**	**Awards**	**Funding**
State-based Surveillance	Cooperative Research Agreement (U60)	23	$6,461,017
Construction	Cooperative Research Agreement (U60)	1	$1,294,499
Mesothelioma	Cooperative Research Agreement (U60)	1	$1,020,068
Training program grants	**Award mechanism**	**Awards**	**Funding**
Training Program Grants (TPGs)	Individual Training Program Grants	28	$4,306,900
Small business innovation research	**Award mechanism**	**Awards**	**Funding**
Small Business Innovation Research	Phase I (R43) and Phase II (R44)	4	$1,097,896
Total extramural funding		**203**	**$96,350,778**

APPLICATIONS REVIEWED AND FUNDED BY MECHANISM

NIOSH received a total of 292 applications in FY2012. These applications included fourteen different types of funding award mechanisms (See Appendix 2 for a full listing). Of these 292 new applications, 22 were withdrawn for various reasons and 270 applications went through peer review. This represents a slight decline in the total number of research applications reviewed over the last 2 fiscal years (FY2011 and FY2010) and an increase over FY2009 (Figure 2). On average, 262 applications have been reviewed per year since 2007.

Of the 270 total applications reviewed in FY2012, 175 were research grant applications including R01, R03, and R21 applications. Between 2007 and 2012, the number of R03 and R21 applications increased while the R01 applications decreased (Figure 2).

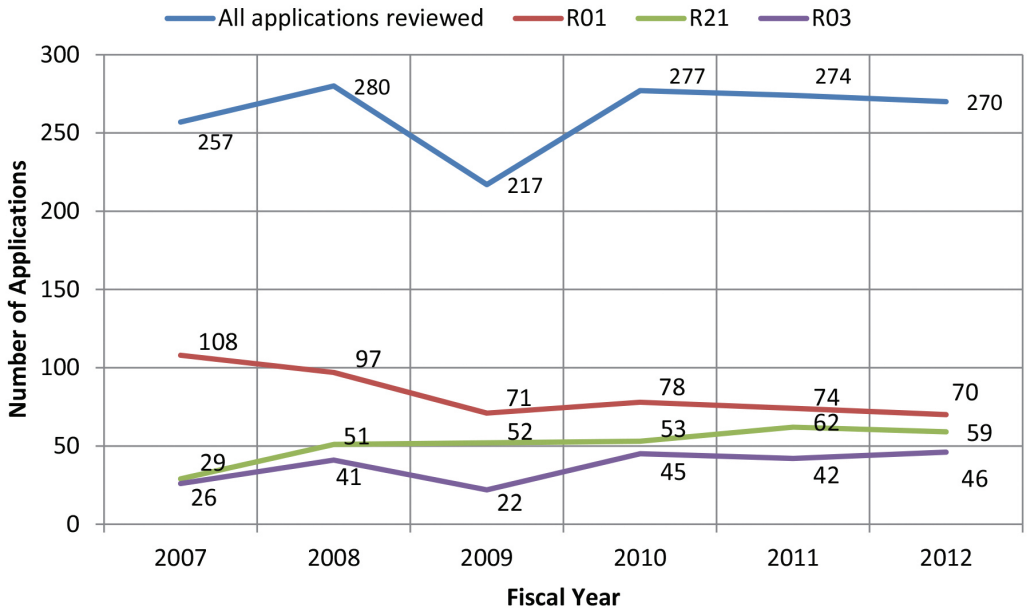


Figure 2. Number of Research Grant Applications Reviewed, FY2007–FY2012*

*Withdrawn applications are not included. All applications reviewed includes research grants (RO1, R21, RO3) and all other applications.

SUCCESS RATES FOR RESEARCH PROJECT GRANTS IN FY2007–FY2012

The success rate is the percentage of reviewed applications that receive funding on a fiscal year basis. The success rate is one of the measures of the viability of the research grants program. The success rate is significant to investigators because it is an indicator of the likelihood of funding. A low success rate may discourage investigators from applying to NIOSH-sponsored funding opportunity announcements (FOA). While a lower success rate tends to discourage potential applicants, it also suggests that a large number of occupational safety and health research projects are in need of funding.

The success rates for new awards are calculated only for the R01, R03, and R21 grant mechanism activity codes and do not include training grants or cooperative research agreements. In FY2012, a total of 31 awards were given out of 170 new applications (Figure 3). Since FY2007, the annual number of new applications has gone down from 192 to 170, while the overall success rate has gone from 17% to 18% over the same period. For FY2007–FY2012, the mean annual number of applications was 182 and awards was 34, while the mean annual success rate is 18.5%. Since FY2010, the numbers of applications reviewed have stabilized (180–170).

In FY2012, the overall success rate for all three research grant applications (R01, R03 & R21) was 18%. The overall success rate had gone up from 13% in FY2011 to 18% in FY2012. However, these rates were lower than the rates for each of the previous 3 fiscal years (FY2008–FY2010) (Figure 3). Success rates for individual research grant mechanisms (R01, R03, R21, and K01) are provided in Appendix 4.

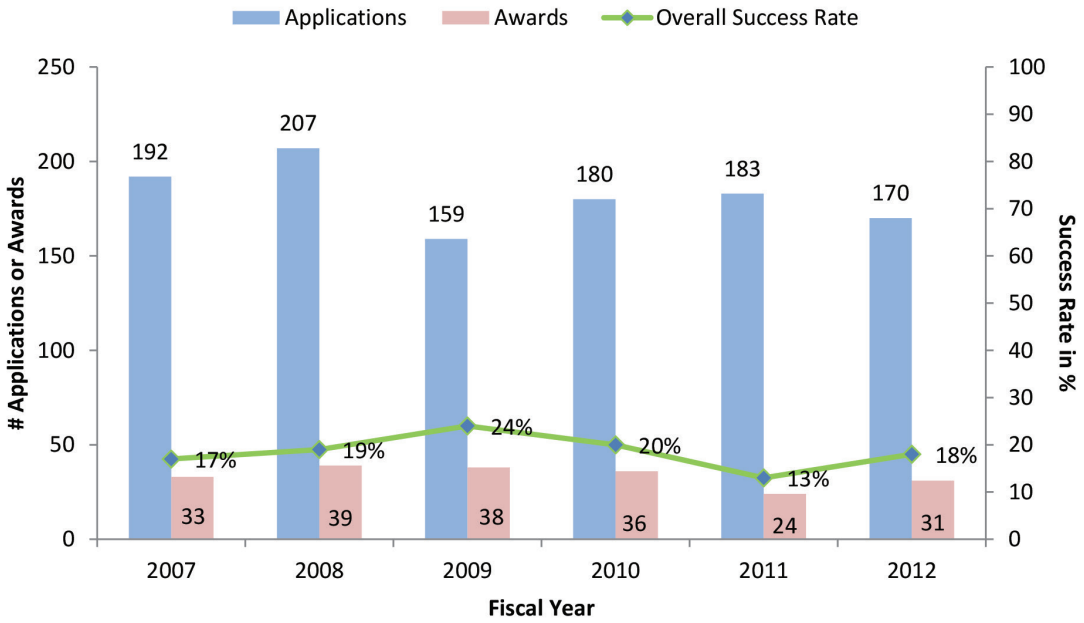


Figure 3. Overall Success Rates for Research Project Grants (R01, R03, & R21), FY2007–FY2012

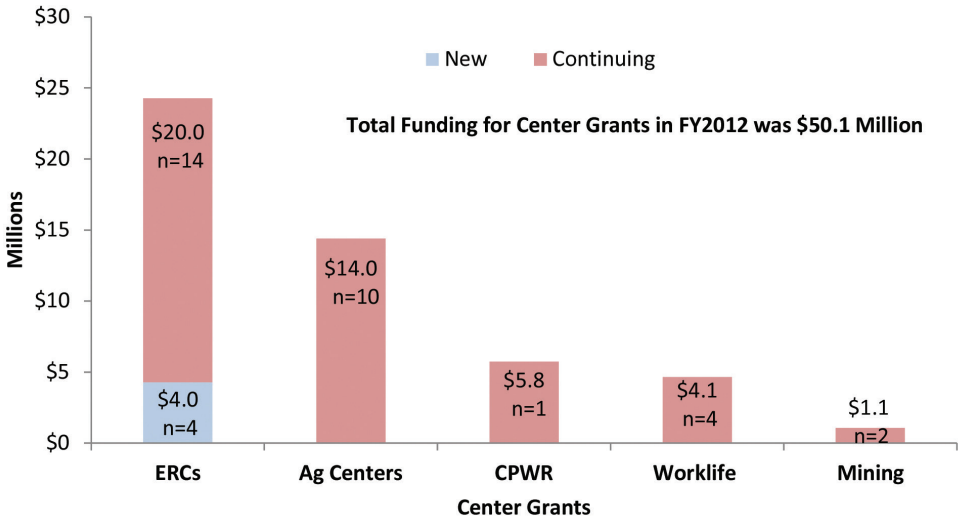
EXTRAMURAL PORTFOLIO FY2012

Multidisciplinary Centers

NIOSH funds targeted research and outreach activities through multidisciplinary centers with a focus on high-risk industries that contribute disproportionately to occupational injury and illness in the United States. These centers are funded through a variety of grant mechanisms including cooperative research agreements and center training grants. The Agriculture Safety and Health Centers (Ag Centers) and the National Center for Construction Research and Training provide critical research and training into the multiple safety and health hazards in agriculture and construction.

Centers of Excellence to Promote a Healthier Workforce (formerly WorkLife Centers) provide a multidisciplinary and multifactorial approach to worker health and wellbeing. The activities of these centers reflect a broader understanding of the critical relationship between work, health, and productivity.

Multidisciplinary education and research activities are carried out through a national network of Education and Research Centers (ERCs). ERCs are university-based centers that provide graduate training in the core and allied fields of occupational safety and health. In addition to degree training, ERCs provide continuing education and outreach to the occupational safety and health community throughout the federal health region they serve. The Western U.S. Miner Safety and Health Training Program connects the mining community with mining-relevant information, resources, and methods that increase the capacity and efficacy of safety training for western states' miners. These services and activities are provided by the Western Mining Safety and Health Training Resource Center at the University of Arizona with the Mine Safety and Health Program at the Colorado School of Mines.



ERCs = Education and Research Centers; Ag Centers = Agriculture, Forestry, and Fishing; CPWR = National Center for Construction Research and Training; Worklife = Total Worker Health Centers; Mining = Mining Training Centers.

Figure 4. Multidisciplinary Center Awards, FY2012

A total of $50.2 million was awarded to 35 multidisciplinary centers in FY2012. A total of 18 ERCs received $24.2 million, with $14.4 million awarded to 10 Ag Centers, $5.8 million was awarded to the National Construction Center, 4 Total Worker Health Centers received $4.7 million, and 2 Western mining centers received $1.1 million. The centers provided support for education and research, agriculture, worklife, mining, and construction. Figure 4 shows the FY2012 distribution of extramural center grant funding. A full description of each of these center portfolios, including a listing of individual center grants, is provided in Appendix 5.

Investigator-initiated Research

The goal of the NIOSH extramural research program is to support relevant and high-quality scientific investigation that will have an impact in reducing occupational disease and injury. NIOSH responds to that goal by funding investigator-initiated research. These diverse awards include funding for large occupational safety and health (OSH) research projects (R01), small OSH research grants (R03), and exploratory OSH research grants (R21). The extramural research portfolio includes research scientist career development awards (K01), which provide mentored training for the next generation of occupational safety and health scientists. These highly competitive awards provide up to 3 years of funding and a scientific focus designed to develop the skills and productivity of new career scientists. A total of approximately $33 million was awarded to new and continuing research projects and mentored scientist grants in FY2012 (Table 2). A description of investigator-initiated research outputs is provided in Appendix 5.

Conference Grants

NIOSH recognizes the value of supporting high-quality scientific meetings that are relevant to the mission of preventing injury, illness, and deaths caused by hazards in the workplace. Conference grants are awarded under a research grant mechanism (R13), and in FY2012 NIOSH funded 6 conference grants (see Table 2).

Table 2. Investigator-initiated research funding, FY2012.

Type of grant	New awards	New funding	Continuing awards	Continuing funding	Total funding
R01	9	$4,343,625	47	$19,562,334	$23,905,959
R21	16	$3,446,225	13	$2788060	$6,234,285
K01	2	$214,260	7	$754,906	$969,166
R03	6	$459,713	5	$332,970	$792,683
R13	4	$73,572	2	$40,000	$113,572
Total	**37**	**$8,537,395**	**74**	**$23,478,270**	**$32,015,665**

Cooperative Agreements

Cooperative agreements provide NIOSH with the ability to arrange collaborative surveillance and research opportunities with state health departments, universities, labor unions, and nonprofit organizations. NIOSH provides funding for a broad array of cooperative agreements to develop knowledge that can be used in preventing occupational diseases and injury.

Unlike grants, which are conducted independently of the sponsoring agency, cooperative agreements bring together the expertise of federal and nonfederal researchers to accomplish public health efforts that would not otherwise occur. In order for a cooperative agreement to be awarded, there must be a clear need for programmatic staff involvement during performance of a proposed project. An evaluation is made to determine that the cooperative agreement is of sufficient priority to warrant the commitment of staff resources required for a collaborative effort during the term of the cooperative agreement award.

NIOSH funded the state-based surveillance program to support the states in developing the capacity to conduct surveillance of occupational injuries, diseases, deaths, and hazards (see Figure 5). NIOSH also continued support of the National Mesothelioma Virtual Tissue Bank and the Construction Cooperative Agreement. No new awards were made in FY2012.

Training Grants

In addition to the Education and Research Centers (ERCs) described under Multidisciplinary Centers above, NIOSH supports professional training in occupational safety and health in single disciplines through Training Project Grants (TPGs). TPGs are individual academic training programs that support undergraduate and graduate training in a single discipline. These programs compliment the national network of graduate training provided by ERCs and are located throughout the United States.

NIOSH funds a unique TPG—the Emergency Responder Training Program—through the International Association of Fire Fighters. This grant supports a comprehensive nationwide hazardous substance training program for fire fighters, paramedics, and other emergency responders across the United States.

The number and funding for all training grant awards (new and continuing) FY2012 are presented in Table 1.

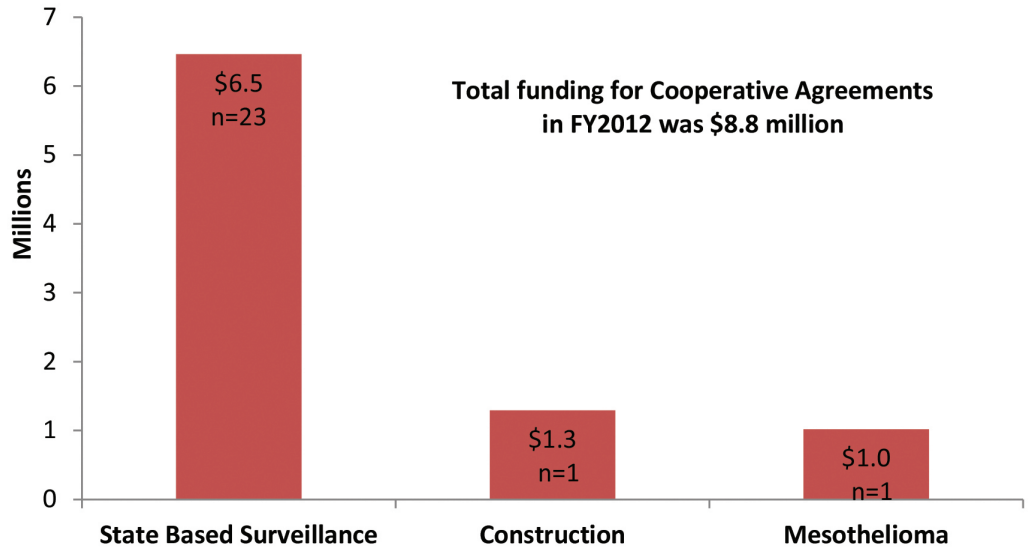


Figure 5. Cooperative Agreements, FY2012

State Surveillance Program

Our state surveillance program (SSP) supports the capacity development among states to conduct surveillance of occupational injuries, diseases, deaths, and hazards and helps expand the role of states in conducting in-depth surveillance and follow-up investigations and interventions. These NIOSH-sponsored programs contribute to a national occupational health surveillance strategy for identifying workplace injury and illness and opportunities for research and intervention. Please see the SSP Annual Reports for more information on these state-based initiatives. See Table 1 for the number and funding for all state surveillance awards (new and continuing) for FY2012.

Small Business Innovation Research

The Small Business Innovation Research (SBIR) program stimulates technological innovation in the private sector and strengthens the role of small business in meeting federal research needs or the private sector's own research and development needs by increasing the commercial application of federally supported research results. This unique portfolio encourages participation by socially and economically disadvantaged small businesses and women-owned businesses to improve the return on investment from federally funded research for economic and social benefits to the Nation. SBIR Annual Reports provide regular updates on activities and outcomes. Included here are a diverse array of efforts to focus research, information, and service for small businesses. Awards and funding for all FY2012 SBIR grants are presented in Table 1.

Global Health Initiatives

NIOSH recognizes the need for global partnership and participation in accomplishing its mission of providing national and world leadership to prevent work-related illnesses and injuries. Global

collaborations can take several forms: (1) leadership among the World Health Organization's (WHO) global network of occupational health centers, (2) partnerships to investigate alternative approaches to reduce workplace illness and injury and to provide technical assistance to put solutions in place, (3) international collaborative research, and (4) building global professional capacity to address workplace hazards through training, information sharing, and research experience.

NIOSH provides funding to support global occupational safety and health (OSH) initiatives through long-standing collaboration with the WHO and partnership with the NIH Fogarty International Center. NIOSH has been the WHO Collaborating Center in Occupational Health for the United States since 1976 and has been involved in program planning, collaborative research, training, management, and direct staff interaction with WHO's Program on Workers' Health.

Since 1995, NIOSH has co-sponsored international research training in occupational and environmental health through a very successful collaboration with the NIH's Fogarty International Center and the National Institute of Environmental Health Sciences (NIEHS). This co-sponsorship has supported dozens of research training grants across the globe designed to prepare the next generation of scientists, researchers, and practitioners to deal effectively with the increasing burden of occupational injury and illness around the world. More information about the global health collaboration with NIH and NIEHS can be found at http://www.fic.nih.gov/Programs/Pages/environmental-occupational.aspx.

EXTRAMURAL RESEARCH ACTIVITY BY PROGRAM AREA

Extramural research activity in FY2012 was distributed across the NIOSH sector program areas. In FY2012, a majority of awards funded pertained to the Manufacturing Sector (n=31), followed by All Sectors (n=25) and Agriculture Sector (n=15) (Figure 6).

Figure 6. Research Funding by Sector Program, FY2012

Funding by NORA Sector

Figure 6 shows the funding for NORA sectors in FY2012. The funding information does not include center grants or other cooperative agreements. $10 million was awarded to Manufacturing Sector research, followed by research that addressed all sectors ($5.1 million). A total of $4.7 million was awarded to research projects that addressed the Healthcare and Social Assistance Sector.

Extramural Research Funding by NORA Strategic Goals, FY2012

In order to better characterize NIOSH-funded research in FY2012, a review was conducted of the strategic goals related to extramural projects by NORA industry sectors. This data was obtained from the NIOSH Project Planning and Management system. Research projects may address multiple goals, and, as a result, the number of projects shown in Tables 3-11 do not sum to the total number of funded projects. These data include all extramural awards active in FY2012. A description of sector strategic goals can be found on the NORA webpage.

Agriculture, Forestry, and Fishing Sector

Table 3 displays the strategic goals addressed by extramural research projects in the Agriculture, Forestry, and Fishing Sector in FY2012. Seven of the nine strategic goals for this sector were addressed by extramural research projects in FY2012. Most of the projects (n = 10) addressed SG5: Agricultural Health.

Construction Sector

Table 4 displays the strategic goals addressed by extramural research projects in the Construction Sector in FY2012. Nine of the 15 strategic goals for this sector were addressed by extramural research projects in FY2012. Most of the projects (n = 9) addressed SG7: Musculoskeletal Disorders.

Healthcare and Social Assistance Sector

Table 5 displays the strategic goals addressed by extramural research projects in the Healthcare and Social Assistance Sector in FY2012. All five of the strategic goals for this sector were addressed by extramural research projects in FY2012. The strategic goal most frequently (n = 6) addressed was SG1: Safety Culture.

Table 3. Agriculture, forestry, and fishing sector awards by strategic goals (SG), FY2012

Strategic goal (SG)	Number of projects	Percent of all agriculture, forestry, and fishing projects
SG1: Surveillance	4	17%
SG2: Vulnerable Workers	2	9%
SG3: Outreach and Partnerships	2	9%
SG4: Agricultural Safety	3	13%
SG5: Agricultural Health	10	43%
SG6: Forestry Injuries	1	4%
SG7: Forestry Illness/Disease	1	4%

Table 4. Construction sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all construction projects
SG1: Falls Prevention	1	4%
SG5: Silica	1	4%
SG6: Welding Fumes	3	13%
SG7: Musculoskeletal Disorders	9	39%
SG9: Safety and Health Management Programs	2	9%
SG11: Training & Education	1	4%
SG12: Health Disparities	2	9%
SG13: Prevention Through Design	1	4%
SG14: Surveillance	3	13%

Table 5. Healthcare and social assistance sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all healthcare and social assistance projects
SG1: Safety Culture	6	46%
SG2: Musculoskeletal Disorders	4	31%
SG3: Hazardous Drugs and Chemicals	1	8%
SG4: Sharp Injuries	1	8%
SG5: Infectious Disease	1	8%

Manufacturing Sector

Table 6 displays the strategic goals addressed by extramural research projects in the Manufacturing Sector in FY2012. Eight of the 10 strategic goals for this sector were addressed by extramural research projects in FY2012. The strategic goal most frequently (n = 11) addressed was SG9: Emerging Risks.

Mining Sector

Table 7 displays the strategic goals addressed by extramural research projects in the Mining Sector in FY2012. All seven of the strategic goals for this sector were addressed by extramural research projects in FY2012. The strategic goal most frequently (n = 6) addressed was SG1: Disaster Prevention.

Public Safety Sector

Table 8 displays the strategic goals addressed by extramural research projects in the Public Safety Sector in FY2012. Eight of the 16 strategic goals for this sector were addressed by extramural research projects in FY2012. The most frequently (n = 2) addressed strategic goals were SG3: Vehicle Related Injuries in Fire Fighters; SG5: Surveillance in Law Enforcement; and SG16: Surveillance in EMS.

Table 6. Manufacturing sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all manufacturing projects
SG2: Falls	1	2%
SG3: Musculoskeletal Disorders	8	19%
SG4: Hearing Loss	2	5%
SG5: Respiratory Disease	9	21%
SG6: Cancer	9	21%
SG7: Vulnerable Populations	2	5%
SG8: Small Business	1	2%
SG9: Emerging Risks	11	26%

Table 7. Mining sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all mining projects
SG1: Disaster Prevention	6	27%
SG2: Disaster Response	1	5%
SG3: Illnesses	4	18%
SG4: Atmospheric Control	3	14%
SG5: Behavior	3	14%
SG6: Design, Operations, and Management	3	14%
SG7: Emerging Technologies	2	9%

Table 8. Public safety sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all public safety projects
SG1: Chronic Diseases in Fire Fighters	1	9%
SG2: Structural Firefighting Operations	1	9%
SG3: Vehicle Related Injuries in Fire Fighters	2	18%
SG5: Surveillance within Law Enforcement	2	18%
SG8: Cardiovascular Disease in Law Enforcement	1	9%
SG11: Occupational Stressors in Correction Personnel	1	9%
SG12: Vehicle Related Injuries in EMS Personnel	1	9%
SG16: Surveillance in EMS	2	18%

Services Sector

Table 9 displays the strategic goals addressed by extramural research projects in the Services Sector in FY2012. Five of the 17 strategic goals for this sector were addressed by extramural research projects in FY2012. The strategic goal most frequently (n = 5) addressed was SG16: Musculoskeletal Disorders

Transportation, Warehousing, and Utilities (TWU) Sector

Table 10 displays the strategic goals addressed by extramural research projects in the TWU Sector in FY2012. All four of the strategic goals were addressed by extramural research projects in FY2012. The strategic goal most frequently (n = 6) addressed was SG4: Chemical/Biological/Physical Hazards.

Wholesale and Retail Trade (WRT) Sector

Table 11 displays the strategic goals addressed by extramural research projects in the Wholesale and Retail Trade Sector in FY2012. Three of the six strategic goals for this sector were addressed by extramural research projects. The strategic goal most frequently (n = 5) addressed was SG1: Musculoskeletal Disorders.

Table 9. Services sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all services projects
SG3: Health Disparities	1	9%
SG4: Education and Schools	1	9%
SG11: Violence in Food Services	1	9%
SG16: Musculoskeletal Disorders	5	45%
SG17: Surveillance	3	27%

Table 10. Transportation, warehousing, and utilities sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all transportation, warehousing, and utilities projects
SG1: Traumatic Injury	3	21%
SG2: Musculoskeletal	4	29%
SG3: Health and Wellness Programs	1	7%
SG4: Chemical/Biological/Physical Hazards	6	43%

Table 11. Wholesale and retail trade sector awards by strategic goals (SG), FY2012

Strategic goal	Number of projects	Percent of all wholesale and retail trade projects
SG1: Musculoskeletal Disorders	5	45%
SG2: Traumatic Injuries	2	18%
SG3: Violence	4	36%

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III FY2012 Research Outputs

Outputs are the products of research activities. Examples include publications, reports, conference proceedings, presentations/posters, databases, tools, methods, guidelines, recommendations, education and training materials, inventions, and patents. This section describes the outputs of NIOSH-funded extramural research during FY2012.

SUMMARY OF PEER-REVIEWED PUBLICATIONS FOR FY2012

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were 292 publications across 127 different journals. NIOSH-funded researchers published their NIOSH-funded research in an array of journals related to occupational safety and health. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Table 12. Number of Publications by Funding Type, FY2012*

Funding type	# of publications
Research Project Grant (R01)	134
Education and Research Center Grant (T42)	48
Agricultural Safety and Health Centers (U50 & U54)	41
World Trade Center (U10)	28
Exploratory/Developmental Grant (R21)	15
National Center for Construction Research and Training (U60)	11
Research Cooperative Agreement (U01)	10
State Surveillance Program (U60)	9
Small Research Grant (R03)	8
Total Worker Health Center (U19)	6
Mentored Research Scientist Development Award (KO1)	8
Construction Cooperative Agreement (U60)	3
Research Demonstration and Dissemination Grant (R18)	3
Training Project Grant (T01)	2
Total	326

*Total number in Table 12 is greater than 292 because a publication could acknowledge more than one source of funding support.

Table 13. Impact factor for NIOSH-sponsored publications, FY2012

	Impact Factor
Average (Mean)	2.895
Median	1.994
Mode	1.625
Min	0.509
Max	53.298

The journal most frequently published in was the *American Journal of Industrial Medicine* (n = 22), followed by the *Journal of Occupational and Environmental Hygiene* (n = 21), the *Journal of Occupation and Environmental Medicine* (n = 19), and the *Journal of Agromedicine* (n = 12).

Impact Factor

The impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period. The annual *Journal Citation Reports* impact factor is a ratio between citations and recent citable items published. Thus, the impact factor of a journal is calculated by dividing the number of current year citations to the source items published in that journal during the previous 2 years.*

The impact factor is frequently used as a proxy for the relative importance of a journal within its field, with journals with higher impact factors deemed to be more important than those with lower ones.

While the impact factor is useful to compare different journals *within* a certain field, comparison *across* different fields using the impact factor is considerably less useful.

> *The journals in which the NIOSH-funded extramural researchers publish their research findings span multiple fields, disciplines, and subject areas, thus making it difficult to compare the impact factors across these different fields. For example, of the 158 journals classified under Public, Environmental, and Occupational Health, the impact factor scores ranged from 7.583 to 0.153. However, of the 66 journals classified under the very specific field of Nanoscience and Nanotechnology, the impact factor scores ranged from 27.270 to 0.343.*

In the field of medicine, NIOSH-funded researchers published articles in the number one ranked journal *The New England Journal of Medicine* (impact factor = 53.298) and the second ranked journal *The Journal of the American Medical Association—JAMA* (impact factor = 30.026). In the field of Public, Environmental, and Occupational Health, one article was published in the number one ranked journal *Epidemiologic Reviews* (impact factor = 7.583) and six articles were published in the second ranked journal *Environmental Health Perspectives* (impact factor = 7.036).

*SCI® Journal Citation Reports®: a bibliometric analysis of science journals in the ISI® database. Philadelphia: Institute for Scientific Information, Inc.®, 1993.

OTHER EXTRAMURAL RESEARCH OUTPUTS

Other research outputs, including presentations, posters, published reports, proceedings and books, were attributed to NIOSH-funded research in FY2012. These data are presented in Appendix 5. Due to the inconsistencies in attribution, the number of outputs may be an underestimate of true productivity. Future efforts will provide clear guidance to researchers so that a more comprehensive listing of outputs can be provided.

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IV Research Integration Initiatives in FY2012

Research integration activities at NIOSH are coordinated under the direction of the Associate Director for Research Integration and Extramural Performance. This position was created by the director of NIOSH to help the Institute integrate and advance the intramural and extramural research portfolios. Resource constraints both now and in the future make this effort even more prudent as NIOSH looks for economies of scale that will help the Institute meet its research missions and continue to provide world leadership in occupational safety and health research.

Recent activity has been focused on identifying strategic goals that are addressed by intramural and extramural projects. To that end, we have completed an assessment of the number of intramural and extramural projects in FY2012 that address common strategic goals. Table 14 shows the strategic goals by number (SG1, SG2, SG3, etc.) for each sector. A full listing and description of each sector's strategic plan and agenda can be found on the NORA homepage on the NIOSH website.

Table 14 indicates that in FY2012, both intramural and extramural research projects addressed all of the strategic goals in the following sectors: Agriculture, Forestry, and Fishing (AFF); Healthcare and Social Assistance (HSA); Mining (MIN); Wholesale and Retail Trade (WRT); and Transportation, Warehousing, and Utilities (TWU). Most of the strategic goals in Construction (CON) and Manufacturing (MFG) were addressed by both intramural and extramural projects. In the Oil and Gas Extraction (MIO), Public Safety (SPS), and Services (SRV) sectors, most of the strategic goals were addressed only by intramural research projects. Data not shown in this table provides further detail of the number of intramural and extramural projects that address each goal to give us an idea of the degree of activity and/or duplication of research in each area. The accuracy of coding is being validated. This data will help us better understand where research is being conducted. Beginning in FY2014, we will publish sector and cross-sector research goals that will be specifically solicited from the extramural research community. We hope that this effort will further the research integration initiative at NIOSH by reducing overlap of research project goals.

Table 14. Integration of research goals by sector, FY2012

Sector	No. of SGs	NORA strategic goals																
		SG 1	SG 2	SG 3	SG 4	SG 5	SG 6	SG 7	SG 8	SG 9	SG 10	SG 11	SG 12	SG 13	SG 14	SG 15	SG 16	SG 17
Agriculture, Forestry, Fishing	9																	
Construction	15		Inactive								Inactive							
Healthcare and Social Assistance	5																	
Manufacturing	10																	
Mining	7																	
Oil and Gas	10					Inactive												
Public Safety	16																	
Services	17																	
Wholesale and Retail Trade	6																	
Transportation, Ware-housing, Utilities	4																	

Legend

- Extramural Research
- Intramural Research
- Both Extramural and Intramural
- Strategic Goal not addressed
- No Strategic Goal

V Appendices

APPENDIX 1: PEER REVIEW MEETINGS, FY2012

Peer review meetings, FY2012‡

Meeting	Location	Review date	# Applications reviewed
Extramural research and training program reviews			
SOH*	Alexandria, VA	October 18–19, 2011	52
SOH Member Conflict	Phone Review	November 15, 2011	4
SEP (TPGs)	Atlanta, GA	January 11, 2012	
SOH	Alexandria, VA	February 22–23, 2012	54
SEP (ERCs)	Atlanta, GA	February 27–March 1, 2012	
SOH Member Conflict	Phone Review	March 7, 2012	6
SOH	San Francisco, CA	June 21–22, 2012	49
SOH Member Conflict	Phone Review	June 28, 2012	5
NIOSH secondary review committee†			
SRC	Cincinnati, OH	October 26, 2011	
SRC	Phone Review	January 11, 2012	
SRC	Morgantown, WV	April 25, 2012	

*SOH = Study Section in Occupational Health; SEP = Special Emphasis Panel; SRC = Secondary Review Committee

†NIOSH SRC reviews scored projects for programmatic relevance.

‡World Trade Center Health Program reviews administered by the Office of Extramural Programs are not included in this report.

APPENDIX 2: NIOSH GRANT MECHANISM ACTIVITY CODES

NIOSH Grant Mechanism Activity Codes

NIOSH activity codes	Grants and agreements
K01	Research Scientist Career Development Grant
R01	Research Project Grant
R03	Small Research Grant
R13	Conference Grant
R21	Exploratory/Developmental Grant
R43/R44	Small Business Innovation Research
T03	Training Project Grant
T42	Education and Research Center Grant
U01	Research Cooperative Agreement
U54/U60	Other Cooperative Agreement

APPENDIX 3: NIOSH PROGRAM ANNOUNCEMENTS BY MECHANISM

NIOSH Program Announcements by Mechanism

Announcement number	Release date	Mechanism	Title
PAR-10-132	3/11/2010	K01	Mentored Research Scientist Development Award (K01)
RFA-TW-12-001*	12/16/2011	P20	Limited Competition: Planning Grants for Hubs of Interdisciplinary Research and Training in Global Environmental and Occupational Health (GEOHealth) (P20) (Fogarty)
PAR-10-188	5/5/2010	R01	Occupational Safety and Health Research (R01)
PAR-12-200	7/25/2012	R03	NIOSH Small Research Program (R03)
PAR-10-272	8/25/2010	R13	NIOSH Support for Conferences and Scientific Meetings (R13)
PAR-12-252	7/27/2012	R21	NIOSH Exploratory/Developmental Grant Program (R21)
PA-12-088†	1/31/2012	R43, R44	PHS 2012-02 Omnibus Solicitation of the NIH, CDC, FDA and ACF for Small Business Innovation Research Grant Applications (Parent SBIR [R43/R44])
PAR-10-288	9/24/2010	T03	Occupational Safety and Health Training Project Grants (T03)
PAR-10-217	6/16/2010	T42	Occupational Safety and Health Education and Research Centers (T42)
PAR-11-022	11/5/2010	U54	Centers for Agricultural Disease and Injury Research, Education, and Prevention (U54)

*Issued by Fogarty International Center
†Issued by NIH

APPENDIX 4: APPLICATIONS AND AWARDS BY MECHANISMS, FY2007–FY2012

Investigator-initiated Research

Figure 7 shows the number of R01 applications and awards made annually from FY2007–FY2012. Success rates for R01 applications have declined over time from FY2007–FY2012. This may be because the budget and project period were reduced in 2010.

Figure 8 shows the number of R03 applications and awards made annually from FY2007 to FY2012. Success rates appear to have increased in 2009 to 30%. However, this is because the number of applications declined to 23 in 2009. An important trend is that since 2009, the annual number of R03 applications has gone from 23 to 44 and the success rate stabilized to around 12%.

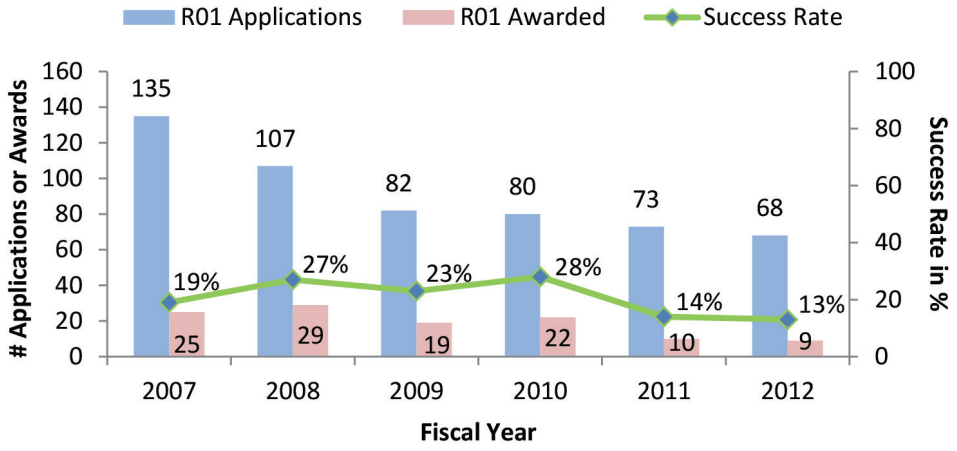


Figure 7. Success Rate for R01 Applications, FY2007–FY2012

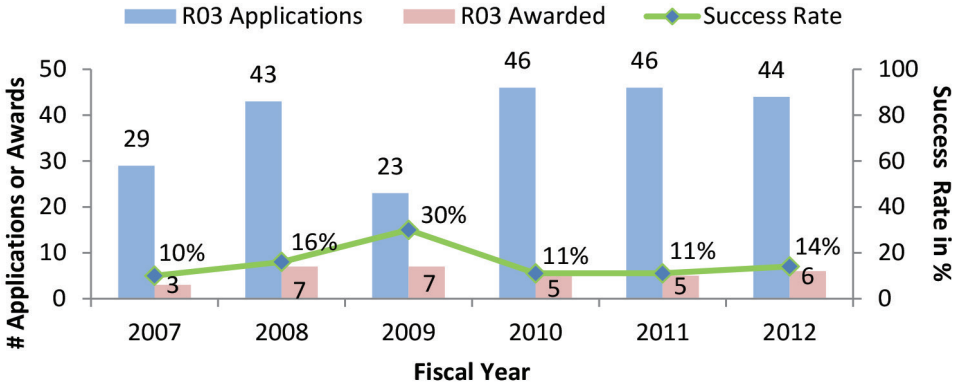


Figure 8. Success Rate for R03 Applications, FY2007–FY2012

Figure 9 shows the number of R21 applications and awards made annually from FY2007 to FY2012. Success rates for R21 increased during FY2007–FY2012. The number of applications has increased almost two-fold from 28 in FY2007 to 58 in FY2012. The success rate has increased from a low of 5% in FY2008 to a high of 28% in FY2012.

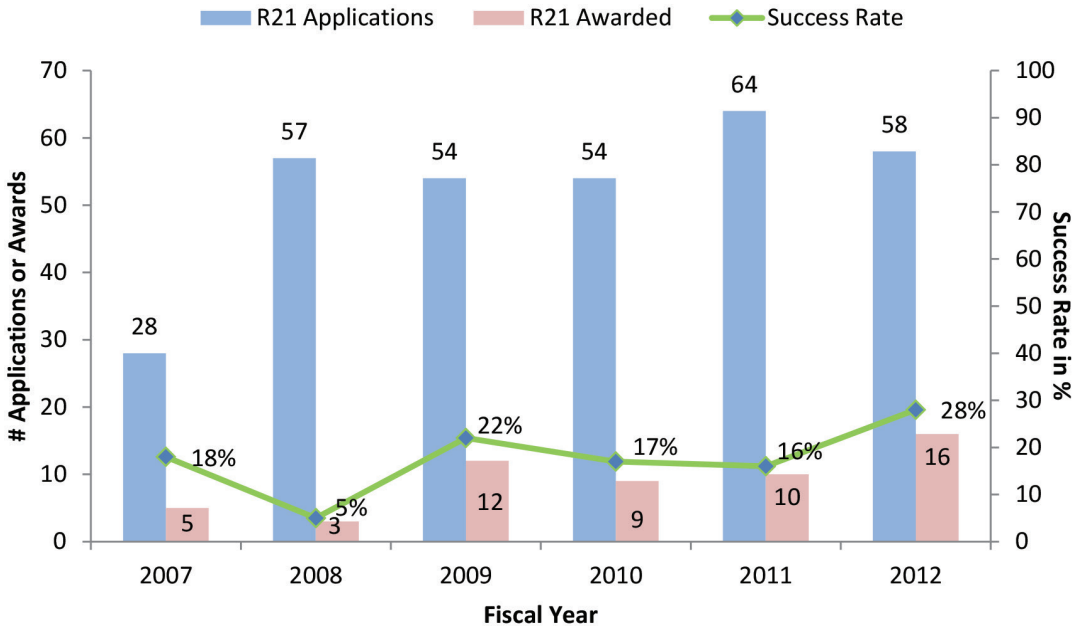


Figure 9. Success Rate for R21 Applications, FY2007–FY2012

Mentored Scientist Career Development

Between FY2007 and FY2012, the number of career development grant applications declined from 12 awards to 2 awards. (Figure 10).

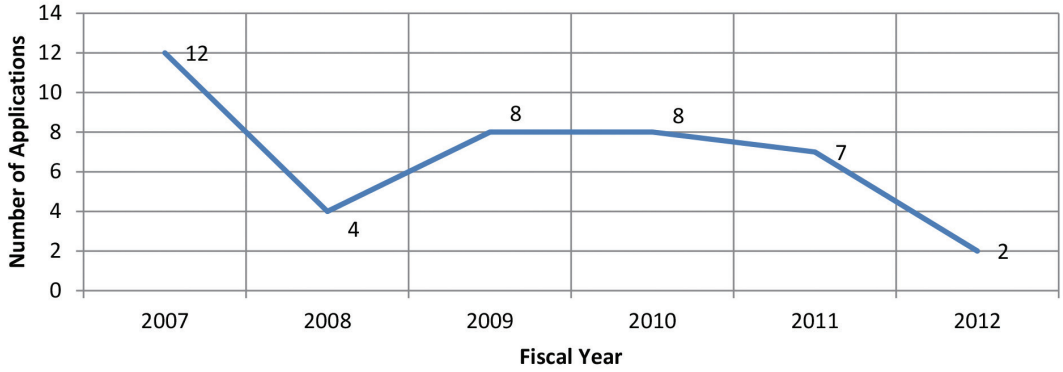


Figure 10. Number of Career Development Applications Reviewed* FY2007–FY2012

Small Business Innovation Research Applications

The Small Business Innovation Research (SBIR) Program supports Phase I feasibility applications (R43) and Phase II applications, which expand meritorious Phase I designs to "proof of concept." Figure 11 shows the total number of SBIR Phase I and Phase II applications reviewed by NIOSH from FY2007 to FY2012. The number of Phase I applications steadily declined from FY2007 to FY2010, then increased sharply in FY2011 with a slight decline in FY2012.

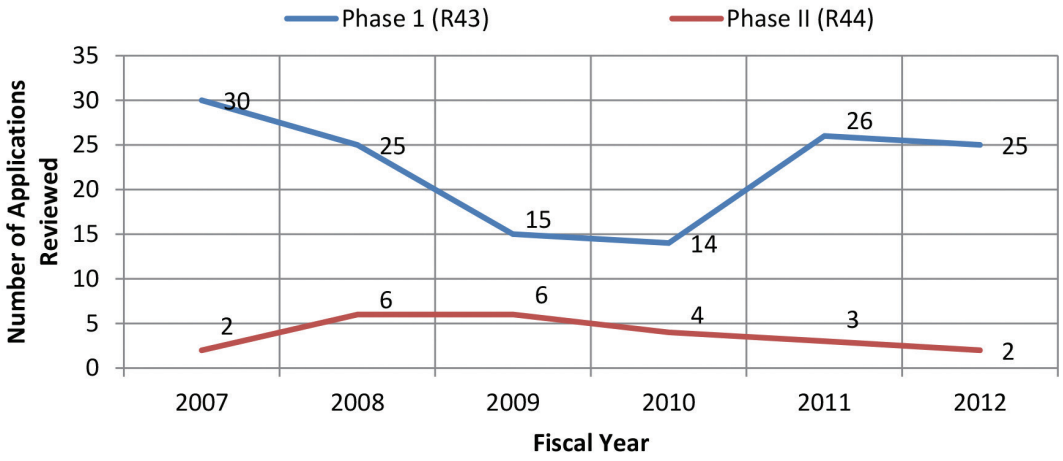


Figure 11. Number of Small Business Innovation Research Applications Reviewed* FY2007–FY2012

*Withdrawn applications are not included.

APPENDIX 5: FY2012 EXTRAMURAL RESEARCH OUTPUTS

A. Multidisciplinary Centers

NIOSH funds targeted research and outreach activities through multidisciplinary centers with a focus on high-risk industries that contribute disproportionately to occupational injury and illness in the United States. These centers are funded through a variety of grant mechanisms including cooperative research agreements and center training grants.

1. Agricultural Safety and Health Centers (Ag Centers)

a. Overview

The Centers for Agricultural Disease and Injury Research, Education, and Prevention represent a major NIOSH effort to protect the safety and health of agricultural workers and their families. In 1990, the NIOSH Ag Centers were established as a part of NIOSH Agricultural Safety and Health Initiative. The centers were established by cooperative agreement to conduct research, education, and prevention projects to address the nation's pressing agricultural safety and health problems. Geographically, the centers are distributed throughout the nation to be responsive to the agricultural safety and health issues unique to the different regions.

Ag Center Program Objectives

- Develop and conduct research related to the prevention of occupational disease and injury of agricultural workers and their families.
- Develop and implement model educational outreach and intervention programs promoting agricultural safety and health for agricultural workers and their families.
- Develop and evaluate control technologies to prevent illness and injuries among agricultural workers and their families.
- Develop and implement model programs for the prevention of illness and injury among agricultural workers and their families.
- Evaluate agricultural disease and injury prevention and educational materials and programs implemented by the Center.
- Provide consultation and/or training to researchers, safety and health professionals, graduate/professional students, and agricultural extension agents and others in a position to improve the safety and health of agricultural workers.
- Develop linkages and communication with other governmental and nongovernmental bodies involved in agricultural safety and health with special emphasis on communications with other NIOSH sponsored agricultural safety and health programs.

b. Extramural Funding for Ag Center Grants in FY2012

Nine Ag centers and one National Children's Ag Center were funded in FY2012. These centers were funded using ongoing funds and no new awards were made (see table below.)

Ag center institution	PI last name	Start date	End date
Colorado State University	Reynolds	9/15/2011	9/14/2016
Marshfield Clinic	Lee	9/30/2008	9/29/2013
Mary Imogene Bassett Hospital	May	9/30/2011	8/31/2016
University of California at Davis	Schenker	9/30/2011	9/29/2016
University of Iowa	Gerr	9/30/2011	9/29/2016
University of Kentucky Research Foundation	McKnight	9/30/2011	9/29/2016
University of Minnesota	Alexander	9/30/2011	9/29/2016
University of Nebraska Medical Center	Rautianen	9/01/2011	8/31/2016
University of Texas Health Center at Tyler	Levin	9/30/2011	9/29/2016
University of Washington	Fenske	9/30/2011	9/29/2016

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were 41 publications from Ag Centers (Activity Codes = U50 & U54). The journal most frequently published in was *The Journal of Agromedicine* with 10 publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the 41 publications, the average impact factor rating was 1.910 with the range extending from 5.856 for the journal *Analytical Chemistry* to 0.559 for *The Journal of Agromedicine*.

d. Impact Stories

ROLLOVER PROTECTIVE STRUCTURES (ROPS) REBATE PROGRAM EXPANDS

PI: May
Northeast Center for Agricultural Health (NEC)
U54OH007542

Overview

According to the National Safety Council, the Agricultural, Forestry, and Fishing Sector has the highest rate of work-related deaths when compared to all other U.S. industries. Tractor overturns are the most frequent cause of fatality in the agricultural community and, with their elimination, estimates indicate that the rate of occupational death could be reduced by 25%. In the past several years, the

Northeast Center for Agricultural Health (NEC) has worked to develop an intervention model that has significantly increased retrofitting activity in New York.

This intervention model works to make retrofitting both easy and cost-effective. Specifically, the ROPS (rollover protective structure) Rebate Program provides toll-free hotline assistance to farmers in locating and pricing certified rollbars and provides a rebate of 70% of the entire cost of the retrofit with a maximum rebate of $765. While professional installation is recommended, program participants have the option of self-installation.

Impact

Efforts to expand this intervention model into neighboring states of Vermont, New Hampshire, and Pennsylvania have been completed. The New York program, now in its fifth year, has retrofitted nearly 900 tractors. The newly launched programs in Vermont, New Hampshire, and Pennsylvania have retrofitted nearly 50 tractors thus far. Surveys conducted with roughly half of these retrofitters have identified 63 potentially fatal events without a serious injury on these newly retrofitted tractors.

Future Efforts

A key element to the success of the New York model and one that will be vital to the development of successful interventions in other states will be support from policy makers and members of the agricultural service community. Researchers at the NEC have already established fruitful partnerships with many of these individuals. Such coalitions are essential for state-based initiatives aiming to launch their own successful initiatives.

DEVELOPMENT OF BLUEBERRY HARVESTING RAKE TO REDUCE MUSCULOSKELETAL INJURIES IN FARMWORKERS

PI: May
Northeast Center for Agricultural Health (NEC)
U54OH007542

The Challenge

Each year, approximately 8,000 migrant and seasonal farmworkers participate in the manual harvesting of blueberries in Maine. Manual raking of blueberries can lead to musculoskeletal pain and injury. Musculoskeletal strains are among the most common injuries for migrant and seasonal farmworkers. Farmworkers have traditionally used a rake with a single, short handle. Raking requires consistent bending at the waist and rapid, repeated, forceful motions.

Approach

Employing a community-based approach to public health intervention targets a community, which can help provide resources and serve as an agent of change. The community-based approach used in this project created the ability to access the experience of knowledgeable individuals in the selection of potentially effective alternatives to the traditional blueberry rake. This project included both migrant farmworkers and employers, which enhanced access to workers, access to work sites, and the process of planning the trials.

Results

After a pilot study employing 12 rake designs, the project focused on a comparison between the extended-handle modification and the traditional short-handle blueberry rakes. With the extended-handle design there was increased productivity, greater acceptability, less force used, and less pain reported. The extended-handle rake may prove effective in reducing musculoskeletal injury associated with blueberry harvesting. A community-based approach to migrant farmworker injuries can be effective, particularly if employers participate.

Impact

Northeast Center (NEC) researchers used a community-based approach to develop a new blueberry rake. A long, two-handled blueberry rake design was tested and proven to increase productivity, required less force, and reduced pain among farmworkers. A 2-year follow-up showed over 70% of those interviewed now use a long-handled rake.

2. National Center for Construction Research and Training

a. Overview

The National Center for Construction Research and Training (CCRT) was awarded NIOSH's National Construction Center cooperative agreement for 2009–2014 through an extramural competition. NIOSH intends for the partner with the diverse construction community to serve as a leader in applied construction research and to diffuse and disseminate effective interventions to the construction industry. The CCRT along with its consortium of ten academic partners conducts research to identify causes of and solutions for safety and health risks that construction workers face on the job. Most of the research projects support NORA construction research goals as well as emerging issues (http://www.cpwr.com/research-new projects.html).

b. Funding

Institution	PI last name	Start date	End date
Center for Construction Research and Training	Stafford	09/01/2009	08/31/2014

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were 11 publications from the National Center for Construction Research and Training (Activity Codes = U54 & U60). The journal most frequently published in was the journal *Work* with two publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the 11 publications, the average impact factor rating was 2.212 with the range extending from 7.583 for the journal *Epidemiologic Reviews* to 0.521 for the journal *Work*.

d. Impact Stories

NATIONAL CONSTRUCTION FALL PREVENTION CAMPAIGN

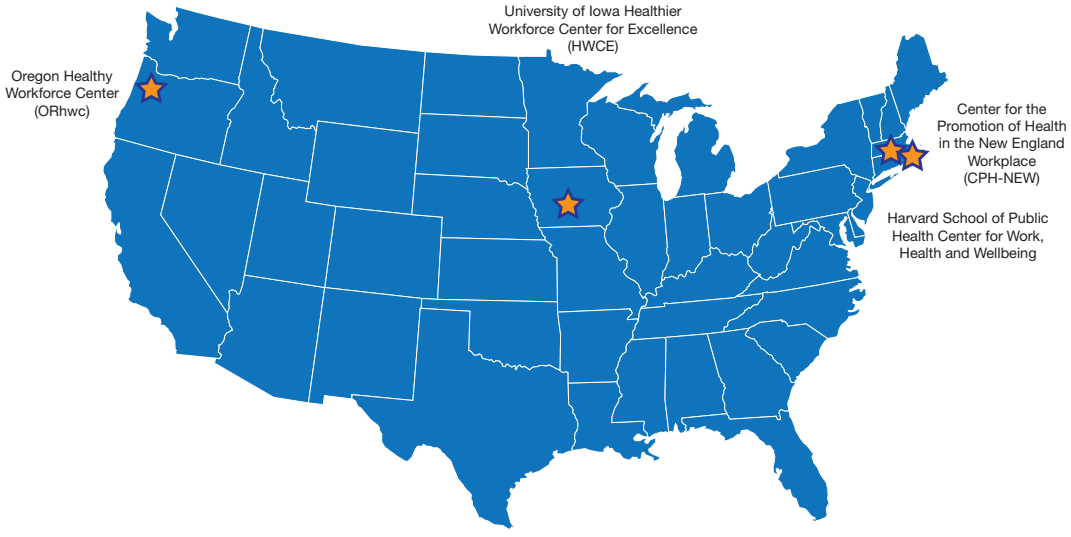
PI: Stafford
Center for Construction Research and Training
U60OH009762

On April 28, NIOSH, the Occupational Safety and Health Administration (OSHA), and CPWR—The Center for Construction Research and Training announced the relaunch of the construction fall prevention campaign, the national initiative to prevent falls at construction sites. Falls continue to be the leading cause of work-related injury and deaths in construction, accounting for 35% of deaths among private industry construction workers.

Over the first year of the campaign, NIOSH and OSHA collaborated on the development of a number of resources to promote the campaign. These and other materials are available on the NIOSH website (www.cdc.gov/niosh/construction/stopfalls.html) and the OSHA website (www.osha.gov/stopfalls). In addition, there is a central campaign website managed by CPWR—The Center for Construction Research and Training (www.stopconstructionfalls.com), which provides those interested in joining the campaign additional resources and information on ways they can participate.

The construction falls prevention campaign is a collaborative effort out of the NORA program, which brings together partners from government, labor, management, and academia. The primary goal of the campaign is to raise awareness and equip contractors and workers with the information to help them prevent falls. For more information on CPWR research products, events, and accomplishments in 2012, visit their website at http://www.cpwr.com/research-new projects.html.

Centers of Excellence to Promote a Healthier Workforce



3. Centers of Excellence to Promote a Healthier Workforce

a. Overview

NIOSH has funded Centers of Excellence to explore and research the concepts of Total Worker Health™. The Centers' research examines the integration and cross-promotion of worker protection, worksite enhancement, and worker health promotion interventions. The effort strives to recognize the synergy in combining efforts to reduce personal health risk factors with traditional safety and psychosocial stress hazard reduction approaches in the workplace.

Efforts include pilot testing of promising workplace policies and programs; developing and disseminating best practices and tool kits; developing strategies for overcoming barriers to organizational acceptance and adoption of comprehensive, coordinated work-based health protection and promotion interventions; investigating costs and benefits associated with integrated programs; and promoting increased development and application of physiological and biological markers of stress, sleep, and depression and their use for worker protection or improved health outcomes.

In 2011, NIOSH funded four Centers of Excellence to Promote a Healthier Workforce. Centers are located at the University of Connecticut/University of Massachusetts in Lowell, MA; Harvard University in Boston, MA; Oregon Health and Science University in Portland, OR; and, at the University of Iowa in Iowa City, IA.

b. NIOSH Funded Centers of Excellence in FY2012

Institution	PI last name	Start date	End date
Harvard University	Sorensen	9/01/2007	8/31/2016
Oregon Health and Science University	Anger	9/01/2011	8/31/2014
University of Iowa	Merchant	9/01/2006	8/31/2016
University of Massachusetts Lowell	Punnett	7/01/2006	7/31/2016

For more information on the Total Worker Health™ projects in each Center of Excellence, visit their websites listed below:

1. Harvard School of Public Health Center for Work, Health and Wellbeing
2. University of Iowa Healthier Workforce Center for Excellence (HWCE)
3. Oregon Healthy WorkForce Center (ORhwc)
4. Center for the Promotion of Health in the New England Workplace (CPH-NEW) at the University of Massachusetts and at the University of Connecticut

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were six publications from the Centers of Excellence to Promote a Healthier Workforce (Activity Code = U19). The journals most frequently published in were the *American Journal of Industrial Medicine* and the *Journal of Occupational and Environmental Medicine*, both with two publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the six publications, the average impact factor rating was 1.968 with the range extending from 3.926 for the *American Journal of Public Health* to 0.509 for the journal *Workplace Health and Safety*.

d. Impact Stories

EDUCATION AND DISSEMINATION TO PROMOTE WORKER HEALTH

PI: Sorensen
Harvard University
U19OH008861

The Harvard School of Public Health Center for Work, Health, and Well-being is collaborating with a health promotion vendor, SafeWell, who is exploring the adoption of integrated health promotion and protection strategies by small- to medium-sized businesses using *The SafeWell Practice Guidelines: An Integrated Approach to Worker Health.*

The *Guidelines* have been updated as of September 2012 to include an executive summary. Readers will

- learn about the evidence for integrated worksite health protection and health promotion programs,
- discover approaches worksites may use to implement their own programs, and
- examine existing tools and resources.

The *Guidelines* are being used globally to inform organizations about ways they may conduct integrated approaches to worker health and well-being. They are free and available for download from the Harvard School of Public Health Center for Work, Health, and Well-being's website at http://centerforworkhealth.sph.harvard.edu/.

4. Education and Research Centers

a. Overview

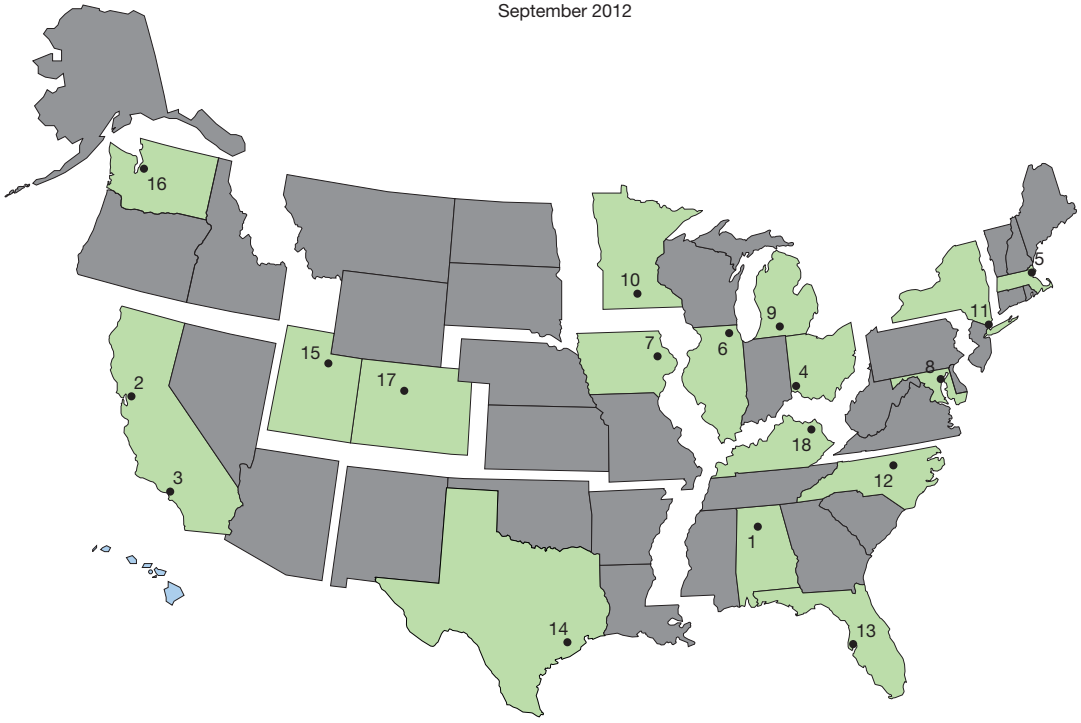
In 1970, the U.S. Congress passed Public Law 91-596, the Occupational Safety and Health Act, in part, establishing NIOSH. Under Section 21(a), the Act mandated that "… the Secretary shall conduct, directly or by grants and contracts, education programs to provide an adequate supply of qualified personnel to carry out the purposes of this Act...." Consistent with this mandate, NIOSH established 11 Educational Resource Centers, renamed as the Education and Research Centers (ERCs) in 1998, in universities throughout the country. The ERC network has expanded nationally and represents every federal health region in the United States. A total of 18 ERCs were funded in FY2012 and are represented in the map on the following page.

The ERCs are multidisciplinary/interdisciplinary programs that address OSH training and research training in a cross-cutting and integrated manner. ERCs result in cross-fertilization among the various disciplines and impact occupational safety and health practice and research. The ERCs are the major part of a network of training grants that help ensure an adequate supply of qualified professional occupational safety and health practitioners and researchers. These training programs are intended to provide multilevel practitioner and research training.

ERCs also conduct continuing education programs for OSH, providing training courses for physicians, nurses, industrial hygienists, safety professionals, and other occupational safety and health

NIOSH Education and Research Centers

September 2012



1. Univ. of Alabama, Birmingham
2. Univ. of California, Berkeley
3. Southern CA (UCLA and UCI)
4. Univ. of Cincinnati
5. Harvard Univ.
6. Univ. of Illinois, Chicago
7. Univ. of Iowa
8. Johns Hopkins Univ.
9. Univ. of Michigan
10. Univ. of Minnesota
11. Mt. Sinai School of Medicine
12. Univ. of North Carolina
13. Univ. of South Florida
14. Univ. of Texas
15. Univ. of Utah
16. Univ. of Washington
17. Univ. of Colorado
18. Univ. of Kentucky

professionals, paraprofessionals, and technicians, including personnel from labor-management safety and health committees.

An essential component of ERCs is outreach and research-to-practice activities with other institutions, businesses, community groups, or agencies located within the region. Programs are encouraged to address area needs and implement innovative strategies for meeting those needs with a focus on impacting the practitioner environment.

b. Funding

In FY2012, a total of 18 ERCs received NIOSH funding with appropriated funds of $24,268,033. Of the 18 ERCs, 14 awards were continuing, 3 were competing renewals and 1 was a new award.

ERC institution	PI last name	Start date	End date
Harvard School of Public Health	Christiani	7/01/2008	6/30/2013
John Hopkins University	Agnew	7/01/2007	6/30/2013
Mount Sinai School of Medicine	Lucchini	7/01/2011	6/30/2016
University of Alabama-Birmingham	Oestenstad	7/01/2012	6/30/2017
University of California Berkeley School of Public Health	Balmes	7/01/2010	6/30/2015
University of California-Los Angeles	Krause	7/01/2012	6/30/2017
University of Cincinnati	Reponen	7/01/2011	6/30/2016
University of Colorado Health Sciences Center	Newman	7/01/2010	6/30/2015
University of Illinois	Conroy	7/01/2008	6/30/2013
University of Iowa	O'Shaughnessy	7/01/2008	6/30/2013
University of Kentucky	Sanderson	7/01/2012	6/30/2014
University of Michigan	Batterman	7/01/2008	6/30/2013
University of Minnesota	Gerberich	7/01/2010	6/30/2015
University of North Carolina-Chapel Hill	Rogers	7/01/2012	6/30/2017
University of South Florida	Bernard	7/01/2011	6/30/2014
University of Texas Health Science Center Houston	Symanski	7/01/2011	6/30/2014
University of Utah	Hegmann	7/01/2007	6/30/2013
University of Washington	Seixas	7/01/2010	6/30/2015

ERCs are academic institutions that provide interdisciplinary graduate training in industrial hygiene, occupational health nursing, occupational medicine (OM), occupational safety (OS), and other fields of occupational safety and health (OSH). Training disciplines in the 18 ERCs supported in FY2012 are shown below.

c. Outputs

Trainees, Graduates, and Employment of Graduates

In academic year 2011–2012, 222 students graduated from ERC programs with specialized training in disciplines that include industrial hygiene, occupational health nursing, occupational medicine, occupational safety, and other closely related occupational safety and health fields of study.

Of the 222 ERC graduates in 2011–2012, 211 (95%) entered careers in occupational safety and health or entered more advanced degree programs in OSH. The following chart illustrates employment of ERC graduates in the field of occupational safety and health, 2011–2012.

Discipline	Enrolled	Graduates	Employed or seeking advanced training*
Industrial Hygiene	233	76	75 (99%)
Occupational Health Nursing	96	35	33 (94%)
Occupational Medicine	71	40	35 (88%)
Occupational Safety	81	26	26 (100%)
Other	217	45	42 (93%)
Total	698	222	211 (95%)

*Employed includes graduates seeking OSH jobs and not yet placed.

ERC graduates work in a variety of OSH-related industries. The placement of FY2012 graduates is shown in the table below by discipline and work setting. Graduates currently seeking placement in the OSH field who have not yet been placed, and ERC graduates who are seeking advanced OSH degree training are included as remaining in the OSH field.

Industry	Industrial hygiene (n = 76)	Occupational health nursing (N = 35)	Occupational medicine (N = 40)	Occupational safety (N = 26)	Other (N = 45)	Total (N = 222)
Private Industry	40	7	4	13	10	74
Federal Government	2	1	0	4	4	11
State/Local Govt.	0	1	0	0	2	3
Academic Institutions	14	1	3	1	9	28
Clinics/Hospitals	5	8	15	0	0	28
Seeking Advanced Degree	5	1	3	2	6	17
Not Yet Placed	9	14	10	6	11	50
Total in OSH	75	33	35	26	42	211
Percentage in OSH	99%	88%	88%	100%	93%	95%

Continuing Education Outputs

A required component of ERCs is continuing education of OSH professionals. Each year, the NIOSH ERCs provide training to thousands of OSH professionals around the United States through course offerings in the OSH core and related disciplines. The table below summarizes the continuing education activity for FY2012 OSH by discipline.

Discipline	Courses	Trainees	Contact Hours
Industrial Hygiene	228	5,547	85,482
Occupational Health Nursing	203	5,171	45,227
Occupational Medicine	241	7,197	41,213
Occupational Safety	856	12,362	137,788
HST	235	4,770	59,247
Other	241	4,574	56,513
Mutidisciplinary	25	1,850	17,300
TOTAL	2,029	41,471	442,770

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were 48 publications across all 18 of the Education and Research Centers (Activity Code = T42). The journal most frequently published in was the *Journal of Occupational and Environmental Medicine*, with eight publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the 48 publications, the average impact factor rating was 2.573 with the range extending from 7.583 for the journal *Epidemiologic Review* to 0.509 for the *American Association of Occupational Health Nurses (AAOHN) Journal*.

d. Impact Stories

ADDRESSING THE SHORTAGE OF OCCUPATIONAL SAFETY AND HEALTH PROFESSIONALS

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

ERCs address a critical need for well-trained OSH specialists by providing graduate level academic training and continuing education. For the 2011–2012 academic year, the ERCs had a total of 698 fulltime trainees and 172 part-time trainees. There were 222 trainees who received graduate degrees. Of these graduates, 95% entered the occupational safety and health workforce. The ERCs provided continuing education for 36,597 occupational safety and health professionals, with the largest number, 14,378 or 39%, employed in the private sector.

ERCs are academic institutions that provide interdisciplinary graduate training in industrial hygiene, occupational health nursing, occupational medicine (OM), occupational safety (OS), and other fields of occupational safety and health (OSH). Training disciplines in the 18 ERCs supported in FY2012 are shown below.

ERC Institution	CE	Pilot project	IH	OHN	OM	Safety	TRT	Injury prev.	Occ. epi.	Ergo-nomics	Bio-markers	Occ. psych.	Ag OSH	Occ. physics	Occ. health services	Mining
Harvard University	x	x	x		x			x	x							
Johns Hopkins University	x	x	x	x	x			x			x					
Mt. Sinai School of Medicine	x	x	x		x	x				x						
Southern California (UCLA &UCI)	x	x	x	x	x		x									
University of Alabama at Birmingham	x	x	x	x		x		x								
University of California at Berkeley	x		x	x	x		x			x						
University of Cincinnati	x	x	x	x	x	x	x	x			x					
University of Colorado	x	x	x		x					x		x		x		
University of Illinois at Chicago	x	x	x		x	x	x		x				x			
University of Iowa	x	x	x	x	x	x		x	x	x			x			
University of Kentucky	x	x		x		x							x			x
University of Michigan	x	x	x	x		x	x		x							
University of Minnesota	x	x	x	x	x			x	x						x	
University of North Carolina	x	x		x	x	x			x		x					
University of S. Florida	x	x	x	x	x	x						x				
University of Texas	x	x	x		x			x	x							
University of Utah	x	x	x		x	x	x	x								
University of Washington	x		x	x	x		x	x	x						x	
Subtotal	18	16	16	12	15	10	7	9	8	4	3	2	3	1	2	1

CE = Continuing Education; IH = Industrial Hygiene; OHN = Occupational Health Nursing; OM = Occupational Medicine; TRT = Targeted Research Training; Injury Prev. = Injury Prevention; Occ. Epi. = Occupational Epidemiology; Occ. Psych. = Occupational Psychology; Ag OSH = Agriculture Occupational Safety and Health; Occ. Physics = Occupational Physics; Occ. Health Services = Occupational Health Services.

RECEIVING NATIONAL RECOGNITION FOR ERC FACULTY AND TRAINEES

Northwest Center for Occupational Health and Safety Education and Research Center

PI: Seixas
University of Washington
T42OH008433

ERC faculty members served in the following professional capacities: president of the International Society for Environmental Epidemiology, president of the American Conference of Governmental Industrial Hygienists, chair of the NIOSH Occupational Safety and Health Study Section (SOH designation by NIH), and member of the National Advisory Committee for Occupational Safety and Health, which advises the Assistant Secretary of Labor for OSHA. An ERC trainee received an award for Best Student Presentation at the 2012 American Industrial Hygiene Conference.

ENSURING AUTOWORKER HEALTH WHILE SAVING SMALL BUSINESS MONEY

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

Subsequent to the earthquake-induced Fukushima Daiichi nuclear power plant meltdown in Japan, the Automotive Aftermarket Industry Association (AAIA), representing over 23,000 member companies and over 100,000 repair shops, was concerned that Japanese auto components might be radioactive. Consequently, membership companies planned to install radiation detection devices to protect their workers and customers. Through consultations with the AAIA, ERC faculty members concluded that no components were likely to contain measurable radiation and there was no measurable risk to autoworkers or the public. This advice from ERC faculty members saved AIAA membership companies unnecessary expenditures and delays in production.

RAISING WORKER AWARENESS OF HEAT-RELATED ILLNESS

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

The annual heat-related death for crop workers is 20 times the rate for all civilian workers in the United States. In order to increase knowledge concerning occupational heat exposure and control of heat-stress disorders, ERC trainees manned an information booth at three state health fairs. These trainees were able to raise awareness of heat exposure and appropriate controls for over 1,000 fair attendees.

CALLING ATTENTION TO WORKERS WITH THE GREATEST NEEDS

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

Workplace demographic changes have resulted in significant disparities in occupational safety and health among working populations. An ERC sponsored a workshop titled "Workshop on Research and Translation among Vulnerable Workers," which focused on immigrant workers, older workers,

constructions workers, young workers, home healthcare workers, and informal sector workers. A total of 68 researchers and 14 graduate students from 20 states and 4 countries attended the workshop.

DEVELOPING AN INNOVATIVE REVIEW COURSE FOR INDUSTRIAL HYGIENE CERTIFICATION

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

In 2010, only 39.8% of practicing industrial hygienists who sat for the certified industrial hygiene (CIH) examination successfully passed. Most existing CIH examination preparation courses are expensive, 5-day events, which make it difficult for students to understand, retain, and apply information. ERC faculty and staff developed "CIH Online," which is the first-ever, fully web-based, 24/7 accessible, CIH exam review course and maintenance course.

INTRODUCING NEW STUDENTS TO CAREERS IN OCCUPATIONAL SAFETY AND HEALTH

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

In order to enhance knowledge about careers in occupational safety and health, an ERC established a 3-week summer program called the Public Health Academy. This program exposes high school and undergraduate students to the core components of occupational safety and health. During the initial 2 years, over 40 high school and undergraduate students have graduated from the Public Health Academy with greater awareness of occupational safety and health professions.

ENHANCING ALL-TERRAIN VEHICLE SAFETY FOR AGRICULTURAL PRODUCERS

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

All-terrain vehicle (ATV) use has exploded in the United States, and 60% of all ATV-related deaths occurred in agricultural operations. ERC faculty worked with the national ATV Safety Institute to provide ATV safety training to agriculture extension agents. These trained extension agents then serve as a source for local farmers and ranchers to receive ATV safety training.

IMPROVING DAIRY WORKER HEALTH AND SAFETY THROUGH INTERNATIONAL COLLABORATION

Mountain and Plains Education and Research Center

PI: Newman
University of Colorado
T42OH009229

Today's dairy industry is large and industrialized, with industrial equipment that may contribute to occupational musculoskeletal injuries. Supported by an ERC-funded pilot research project, an ERC trainee

determined that 27% of injuries among large-herd dairy operations were to the wrist, hand, and fingers and that their workers may be exposed to high levels of ergonomic risk factors. These findings have led to an international industry-led initiative to address ergonomic and safety hazards in the dairy industry.

DEVELOPING EFFECTIVE OFFICE ERGONOMIC TRAINING

The Southwest Center for Occupational and Environmental Health

PI: Symanski
University of Texas Health Science Center Houston
T42OH008421

An ERC, working in collaboration with major national insurance carrier, developed training that is compliant with ANSI and CSA standards. This training has been shown to be effective in changing worker behavior and reducing musculoskeletal symptoms. The training is being integrated into a learning management shareware program.

FACILITATING WORLDWIDE EDUCATION OF OCCUPATIONAL HEALTH NURSES

North Carolina Occupational Safety and Health Education and Research Center

PI: Rogers
University of North Carolina, Chapel Hill
T42OH008673

An ERC faculty member updated her textbook, *Occupational Health Nursing: Concepts and Practice.* This textbook has been used around the world and has been translated into many different languages.

REDUCING OCCUPATIONAL VIOLENCE AGAINST HEALTHCARE WORKERS

Midwest Center for Occupational Health and Safety Education and Research Center

PI: Gerberich
University of Minnesota
T42OH008434

ERC faculty and staff conducted research that identified risk factors for work-related physical assault of nurses. The ERC collaborated with NIOSH and developed an online violence prevention course that provides education for healthcare workers, which will help reduce these risk factors.

REDUCING RESPIRABLE DUST IN UNDERGROUND COAL MINES

Midwest Center for Occupational Health and Safety Education and Research Center

PI: Gerberich
University of Minnesota
T42OH008434

An ERC faculty member and trainee are researching how sprays with different surfactants vary the amount of coal dust that is captured. The data generated in this study have national implications and will assist mine operators in making informed decisions about the type of surfactant to use in spray to maximize dust capture, depending on the characteristics of the coal being mined.

USING TAI CHI TO IMPROVE TOTAL WORKER HEALTH

Education and Research Center

PI: Reponen
University of Cincinnati
T42OH008432

An ERC trainee used a pilot research training project to study 32 firefighters who received Tai Chi instruction once a week for 10 weeks at their worksite. Preliminary analysis showed that Tai Chi practice had an average of a 13-point decrease in systolic and a 10-point decrease in diastolic blood pressure. Plans are underway to expand the program as several other fire departments have asked to be part of the activity.

5. Western Mining Training Center

a. Overview

The mining community in the eastern United States is served by the MSHA Training Academy in Beckley, West Virginia. The training program in West Virginia is not easily accessible to miners in the western United States, and certain aspects of western mining operations are not pertinent to operations in the east. To increase access to training and to address gaps related to western mining operations, NIOSH has supported mining safety and health training in the western United States since 1999. This training provides an integrated approach to reduce injuries to miners and other workers in mining operations and to translate research into workplace practices that (1) improve mining safety, (2) improve the safety and health of miners, and (3) enhance the safety and health of other workers involved in mining operations.

Major objectives are to provide training that (1) addresses the needs of miners, (2) increases the number of qualified mine safety and health trainers in the western United States, (3) develops and delivers training to mineworkers in the western United States, (4) provides qualified instructors and faculty, (5) evaluates training effectiveness and impact on reducing injuries and illnesses to miners, and (6) coordinates with existing training programs, such as those offered by MSHA and MSHA-funded state programs.

b. Funding

Institution	PI last name	Start date	End date
Colorado school of mines	Dagdelen	9/1/2010	8/31/2013
University of Arizona	Poulton	9/1/2010	8/31/2013

Two grantees are currently funded by NIOSH under a congressionally authorized program using an earmarked appropriation in the NIOSH budget. The Western Mining Safety and Health Resource Center at the University of Arizona (http://miningsh.arizona.edu/) and the Western U.S. Mine Safety and Health Training Program at the Colorado School of Mines (http://mshp.mines.edu/MSH-training-courses) work collaboratively to enhance the quality and availability of safety and health training for mineworkers in the western United States. Together these grantees refer to their combined efforts as the Western Mining Training Center.

c. Outputs

The Colorado School of Mines works collaboratively with the University of Arizona to enhance the quality and availability of safety and health training for mineworkers in the western United States. These grantees refer to their combined efforts as the Western Mining Training Center. Both programs have produced significant results.

The Western Mining Safety and Health Resource Center at the University of Arizona

- Translation of the Part 46 Toolbox Training Modules to Spanish
- Training software for computer simulations of accidents described in fatalgrams (memos detailing fatality events). Trainees may change the outcome by using best practices to avoid the accidents.
- Mine Institute for Supervisory Leadership (MISL), a training program for supervisors/leaders employed in mining that is based on a succession of former trainees becoming mentors for current trainees; now expanded with "Silver" level of advanced training
- Evaluation and assessment tools for training
- Teaching Strategies for Mine Safety Trainer courses
- Trained miners (> 5,800), mining supervisors (> 100), and trainers (> 300) in the past 2.25 years
- Improved safety leadership for mine supervisors and employees through MISL
- Established partnerships/liaisons with industries (multiple mines in AZ/NM/NV/UT/ID/CO), state government, trade associations (AZ/NV), and other academic institutions (e.g., UCLA's ERC) to support professional training and educational opportunities in areas of mine safety and health
- Improved teaching methods for trainers with Teaching Strategies for the Mine Safety Trainer
- Identified deficiencies in training and safety culture through evaluations

The Western U.S. Mine Safety and Health Training Program at the Colorado School of Mines

- 826 miners and students trained via Part 48 courses
- 17 MSHA Part 48 new miner courses offered and 28 MSHA Part 48 annual refresher courses offered over the course of the project period
- Other trainings offered included a MSHA Instructor course (n = 1), Mine Safety Specialist course (n = 2), Leading Culture Change (n = 1), First Aid courses (n = 2) and two newly developed professional courses (Root Cause Analysis and Job Safety Analysis/Hazard Recognition)
- Multiple mine rescue teams were trained using computer simulations (n = 18) or through exercises at the Edgar Mine (n = 4)
- Expanded mine rescue technical training courses to include Completing Heavy Lifts with Air Bags (n = 5), Fire Brigade exercises at the Edgar Mine (n = 2), Confined Space Entry and Rescue, and Technical Rope Rescues
- Developed an Abandoned Mine Hazards and Assessment course for local first responders (n = 2)
- Served as mentor/supervisor for three CSM student mine rescue teams (completed 41 training sessions and participated in two out-of-state mine rescue contests (total training hours = 2,870))
- Designed/constructed an ultralight mine rescue stretcher cart for training at the Edgar Mine
- Fourteen interactive hazard recognition activities were developed, tested, and posted on the CSM MSHP website
- Continued development of a searchable database for MSHA fatality reports and fatalgrams
- Assisted NIOSH with translation of information circulars to Spanish
- Participation in NORA activities and SME Safety and Health Committee

Publications and Presentations

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, two publications were submitted for peer review. There were also 11 additional papers for 3 conference proceedings, 5 newsletters , 4 training guides, and 21 conference presentations across Western Mining Safety and Health Resource Training Center (Activity Code = U60). A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

No publications were in print or in press during FY2012. Therefore, an average impact factor rating for publications could not be computed.

d. Impact Stories

INTERACTIVE COMPUTER GAMES FOR MINE SAFETY

PI: Poulton
5U60OH10014-03
University of Arizona

Researchers of the Western Mining Safety and Health Resource Center at the University of Arizona jointly with two other partners are developing interactive computer games to better train miners to avoid fatal accidents and potential emergencies while working in mines.

Fatalgrams are an important teaching tool for new miner and refresher course training. They give valuable perspective into recent accidents, through diagrams, textual accounts, and suggested best practices. We have developed a simulator platform to turn fatalgrams into living, 3D environments that better convey the story and flow of events. Through our simulator, users can watch the unfolding story as passive observers or dive into the story to become an active participant. The program allows miners to play the role of characters in each situation; they can make decisions leading to alternate outcomes and can replay the games as many times as necessary to understand the potential consequences of each decision they make. The Arizona Mine Safety & Training Simulator offers scalable visualization and interface capabilities that will run on a variety of computer hardware that includes gaming PCs and common interface devices, such as keyboard, mouse, and game pad. In addition, our platform supports a gamer-oriented user interface that is accessible to a large audience and built-in instrumentation to promote evaluation and testing.

One of the objectives of the simulations is to get users more involved in the learning process, to make them think critically in the context of the situation.The second goal of the computer game simulations is to train miners how to respond to a mine emergency.

MINE RESCUE COMPUTER SIMULATION TRAINING

PI: Dagdelen
5U60OH10017-03
Colorado School of Mines

Currently, very few training opportunities are available for the mining professionals responsible for making the crucial decisions needed during a mine emergency. With recent technical advances, it is now feasible to use a computer-based simulator to train mine rescue personnel for mine emergencies

in their mine or any other mine at a convenient location without interrupting normal mining operations. This simulated environment teaches underground search and rescue procedures, communications, and decision making based on real-time information and hazard recognition.

Since 2010, the Colorado School of Mines (CSM) has offered computer-simulated mine rescue training using an incident command center (ICC) directed toward enhancing decision making and communication skills. To support this training, CSM partnered with Rite Solutions, Inc., to modify, enhance, and create simulation software for mine rescue applications. The focus of this partnership is to modify existing simulation technology to address the unique nature of underground rescue operations, make it applicable to any underground operation, create generic scenarios, and develop customized computer simulations, including scenarios, for specific sites.

All mine rescue teams who have participated in the computer simulation training responded positively regarding the value of training. Participants said they benefited from it because of the ease of setup, more opportunities to train, and familiarization with mine rescue procedures. Trainees also reported that the simulator offered excellent communication, decision making, and hazard recognition training. Most participants felt that after completing the training they were better prepared for a mine emergency and everyone said the training will be useful in their jobs. Teams also found they did much better on underground exercises after first running the exercise on the simulator.

ULTRALIGHT MINE RESCUE CART TO FACILITATE MINE RESCUE EXERCISES TRAINING

PI: Dagdelen
5U60OH10017-03
Colorado School of Mines

An ultralight stretcher cart was constructed to support the mine rescue exercises at the Edgar Mine. The cart was designed for transporting a stretcher, first aid bag, and equipment during rescue responses. This cart replaced two other stretcher carts that had significant design flaws that made them very difficult to use in the Edgar Mine. The new cart is constructed of aircraft-grade aluminum, has two large wheels, and is equipped with racks for two fire extinguishers and a BG4.

The rescue scenarios address multiple hazards and victims with varying degrees of complexities and are completed in artificial smoke while using a breathing apparatus. This training has been approved by MSHA and qualifies as meeting the annual training requirements for a Mine Emergency Response Development Exercise. This approval applies only to metal/nonmetal mines. This course is usually a 1-day course.

B. Investigator-initiated Research

The goal of the NIOSH extramural research program is to support relevant and high-quality scientific investigation that will have an impact in reducing occupational disease and injury. NIOSH responds to that goal by funding investigator-initiated research. These diverse awards include funding for large occupational safety and health (OSH) research projects (R01), small OSH research grants (R03), and exploratory OSH research grants (R21). The extramural research portfolio includes mentored research scientist development awards (K01) that provide mentored training for the next generation of occupational safety and health scientists. These highly competitive awards provide up to 3 years of funding and a scientific focus designed to develop the skills and productivity of new career scientists.

1. Research Grants

a. Overview

Large OSH Research Grants (R01). The purpose of this funding opportunity is to develop an understanding of the risks and conditions that are associated with occupational diseases and injuries, to explore methods for reducing risks and for preventing or minimizing exposure to hazardous conditions in the workplace, and to translate significant scientific findings into prevention practices and products that will effectively reduce work-related illnesses and injuries.

Small Research Grants (R03). This grant mechanism supports different types of projects including pilot and feasibility studies; secondary analysis of existing data; small, self-contained research projects; development of research methodology; and development of new research technology. The R03 is intended to support small research projects that can be carried out in a short period of time with limited resources.

Exploratory Grant Program (R21). The R21 mechanism is intended to encourage new exploratory and developmental research projects. For example, such projects could assess the feasibility of a novel area of investigation or a new experimental system that has the potential to enhance health-related research. Another example could include the unique and innovative use of an existing methodology to explore a new scientific area. These studies may involve considerable risk but may lead to a breakthrough in a particular area or to the development of novel techniques, agents, methodologies, models, or applications that could have a major impact on a field of biomedical, behavioral, or clinical research. Applications for R21 awards should describe projects distinct from those supported through the traditional R01 mechanism. Projects of limited cost or scope that use widely accepted approaches and methods within well-established fields are better suited for the R03 small grant mechanism.

b. Funding

Funding data for all research grants in FY2012 is provided in this report in Section II, Extramural Portfolio FY2012 under Investigator-initiated Research. This data is also available on the NIOSH extramural research portfolio website.

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were 160 publications across all types of investigator-initiated research (Activity Codes = R01, R03, R18, & R21). The journal most frequently published in was the *Journal of Occupational and Environmental Medicine*, with 11 publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the 160 publications, the average impact factor rating was 3.141 with the range extending from 30.026 for *The Journal of the American Medical Association—JAMA* to 0.509 for the journal *Workplace Health and Safety*.

d. Impact Stories

TESTING INTERVENTIONS TO HUMAN-GENERATED OCCUPATIONAL AIRBORNE INFECTIONS

PI: Nardell
Harvard University
R01OH009050

This project is aimed to quantitatively test three interventions to reduce the risk of airborne infection among healthcare workers: (1) surgical masks on individuals with airborne infections, (2) portable room air disinfection units, and (3) upper room ultraviolet germicidal irradiation (UVGI) air disinfection using patients with multidrug resistant tuberculosis (MDR-TB) as a prototype. The study site was Airborne Infections Research (AIR) Facility, in Mpumalanga, South Africa. In this unique facility, guinea pigs breathing exhaust air from the clinical ward served as quantitative air samplers for transmission from TB patients. Key findings indicate that (1) upper room UVGI fixtures with ceiling mixing fans were highly effective (80%) in preventing airborne infections as used, (2) surgical masks on patients were intermediately effective (53%) in reducing infection, and (3) portable filtration air cleaners were not effective as used because they reduced the risk of infection by about 20% (not statistically significant). These data are likely to be used soon in cost-effectiveness studies in comparing surgical masks to various other interventions for use against airborne infections such as TB, influenza, and SARS. Finally, and perhaps most important for global TB control efforts, is the impact of effective treatment on transmission. Findings indicate that if patients can be quickly identified and placed on effective treatment (that is, tailored to their drug resistance pattern), transmission will stop almost immediately. All of these results will impact the protection of workers in the United States and around the world.

FORCE-REPETITION INTERACTION IN A RAT INJURY MODEL

PI: Barbe
Temple University
R01OH003970

Musculoskeletal pain occurs with repetitive strain, overuse, and work-related musculoskeletal disorders (WRMSD). The pathophysiology of musculoskeletal pain is not completely clear, but inflammation, fibrosis, tissue degradation, neurotransmitters, and neurosensory disturbances have been implicated. The goal of this study was to use a unique animal model of WRMSD to identify and characterize cellular mechanisms underlying tissue changes associated with long-term performance of repetitive and/or forceful reaching. Findings from this study demonstrate that occupational tasks involving highly repetitive motions and forceful muscle contractions of the upper limb increase MSDs. These findings have been disseminated in numerous publications and presentations and have been widely cited by scientists, clinicians, and epidemiologists, both nationally and internationally. Several studies citing this work have extended these findings to workers performing high-velocity, hand manipulative jobs; substantiated the findings; and even developed electrogoniometers and other electronic instrumentation for monitoring and quantifying repetitive hand and finger movements and forces. These findings led to the recognition of an early inflammatory response in the pathogenesis of upper extremity overuse disorders and pain, specifically highlighting the link between inflammatory cytokines, pain, and WRMSDs. The findings of increased serum cytokines in this rat model prompted several studies in humans with short-term musculoskeletal injuries. These studies in patients with MSDs identified systemic inflammatory cytokines (including C-reactive protein, tumor necrosis factor alpha, interleukin 6, interleukin 1 family members) that serve as biomarkers of early tissue pathophysiology and predictors of patients' symptoms of pain

and motor dysfunction. Use of these biomarkers will allow better prediction of the onset of MSDs and can lead to targeted and scientifically based treatment and prevention strategies.

PORTABLE ANALYZER FOR ON-SITE MONITORING OF WORKER EXPOSURE TO TOXIC METALS

PI: Yantasee and Timchalk
Battelle Memorial Institute
R21OH008900

The goal of this project was to develop portable and field-deployable metal analyzers capable of detecting multiple metal analytes in urine with a high degree of selectivity and sensitivity similar to the in-lab, state-of-the-art ICP-MS. These electrochemical sensors are applicable in "real world" samples, specifically human urine, without sample pretreatment and sample dilution. They investigated two classes of nanomaterials: functional mesoporous silica (SAMMS) and functional superparamagnetic nanoparticles (NPs) for metal preconcentration. They successfully optimized sensor preparation process and measurement conditions to achieve the most sensitive, reliable, and robust measurements. They have built two programmable portable metal analyzers, one for quantitative metal analysis and the other for low-cost, rapid-screening testing of the urinary metals.

Their work showed for the first time that mercury-free electrochemical sensors can be used successfully in protein-rich biological samples like urine without sample pretreatment (e.g., acid digestion, large dilution) or the use of internal standards. Their work involving magnetic nanoparticles has attracted a lot of interest. A manuscript resulting from this work was one of the most accessed articles in *Environmental Science and Technology* during the fall of 2007 while another was one of the most accessed articles in the journal *Analyst* during early 2008. The magnetic nanoparticles have great potential for metal preconcentration at analytical instruments. The results of this study have been widely disseminated with seven peer-reviewed publications, two book chapters, and two U.S. patent applications. The portable metal analyzer was nominated for the 2008 NIOSH Director Award. They have press releases on the portable sensor technology based on functional nanomaterials, which have been posted on over 30 science and technology websites including Chemistry World, ChemEurope.com, and eponline.com. The PI received the 2007 Ronald L. Brodzinski Early Career Exceptional Scientific Achievement Award, recognizing her achievement in the development of the next-generation metal analyzer.

USE OF THE WASHINGTON STATE TRAUMA REGISTRY FOR OCCUPATIONAL INJURY SURVEILLANCE

PI: Sears
University of Washington
R03 OH009883

The goal of this project was to explore and document the Washington State Trauma Registry (WTR) as a potential resource for occupational injury surveillance and research. WTR records were linked to workers' compensation (WC) claims data maintained by the Washington State Department of Labor and Industries. The WTR work-related indicator exhibited 87% sensitivity and 97% specificity. Injured workers without a WC claim were more likely to be older, have no insurance, have been injured at home or in motor vehicle traffic, and less likely to have been injured at industrial locations or by machinery. The WTR captured about 25% of Washington's occupational fatalities. There were significant upward trends from 2003 through 2008 in age-adjusted rates of moderate and severe work-related traumatic

injuries, but flat trends when minor injuries were included. We found not only a disparity in the burden of work-related traumatic injuries sustained by Latinos relative to non-Latinos, but also that the disparity increased over time. The study demonstrated the importance of considering differential access to other insurance coverage and adaptation by healthcare settings to financial pressures when assessing trends in occupational injury incidence and reporting, especially when using payer (WC) as a proxy for work-relatedness. The research yielded five peer-reviewed publications along with a research application to NIOSH resulting in a new R21 Exploratory and Developmental Award.

2. Mentored Research Scientist Development Awards (K01)

a. Overview

This research program is intended to prepare the next generation of occupational safety and health researchers and educators. Emphasis for funding is placed on projects that specifically address the priority goals of the NIOSH program portfolio, which is described at http://www.cdc.gov/niosh/programs/. Research training supported by this announcement may include a wide range of training modalities reflecting the diverse approaches needed to effectively address occupational safety and health problems.

b. Funding

Institution	PI last name	Start date	End date
Colorado State University	Koehler	9/01/2011	8/31/2014
Duke University	Kucera	9/01/2010	8/31/2013
Henry Ford Health System	Gumenyuk	9/01/2011	8/31/2014
Johns Hopkins Health System	Heaney	7/01/2012	6/30/2015
New York University	Vaughan Dickson	9/01/2011	8/31/2014
University of Iowa	Nonnenmann	8/01/2011	7/31/2013
University of Iowa	Smith	8/01/2010	7/31/2013
University of Utah	Sleeth	7/01/2012	8/31/2015
University of Utah	Thiese	9/01/2011	8/31/2014

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were eight publications across all Mentored Research Scientist Development Awards (Activity Code = K01). A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the eight publications, the average impact factor rating was 8.33 with the range extending from 53.298 for *The New England Journal of Medicine* to 0.559 for *The Journal of Agromedicine*.

d. Impact Stories

While all of the grantees listed above are still in the active period of their career development grants, two of the career scientist awardees received tenure track faculty positions during FY2012. One grantee has received funding from NIEHS as a new principal investigator. Both professional career placement and successful competition as an independent investigator are stated goals of the K01 awards.

C. Other Cooperative Agreements

Cooperative agreements provide NIOSH with the ability to arrange collaborative surveillance and research opportunities with state health departments, universities, labor unions, and nonprofit organizations. NIOSH provides funding for a broad array of cooperative agreements to develop knowledge that can be used in preventing occupational diseases and injury. In FY2012, NIOSH funded the state surveillance program to support the capacity development among states to conduct surveillance of occupational injuries, diseases, deaths, and hazards. NIOSH also continued support of the National Mesothelioma Virtual Bank and the construction cooperative agreement. This center performs integrated and multidisciplinary construction research, and r2p.

Unlike grants that are conducted independently of the sponsoring agency, cooperative agreements bring together the expertise of federal and nonfederal researchers to accomplish public health efforts that would not otherwise occur. In order for a cooperative agreement to be awarded, there must be a clear need for programmatic staff involvement during performance of a proposed project. An evaluation is made to determine that the cooperative agreement is of sufficient priority to warrant the commitment of staff resources required for a collaborative effort during the term of the cooperative agreement award.

1. State Surveillance Program

a. Overview

Our state surveillance program (SSP) supports the capacity development among states to conduct surveillance of occupational injuries, diseases, deaths, and hazards and helps expand the role of states in conducting in-depth surveillance and follow-up investigations and interventions. These local state-based skills and abilities help meet the NIOSH mandate to ensure a safe workplace. Please see the SSP Annual Reports for more information on these state-based initiatives. See Table 1 for the number and funding for all state surveillance awards (new and continuing) for FY2012.

b. Funding

Institution	PI last name	Start date	End date
California Public Health Institute	Harrison	7/01/2005	6/30/2015
Colorado State Department	Miller	7/01/2010	6/30/2015
Connecticut State Department of Public Health	St. Louis	7/01/2005	6/30/2015
Florida State Department of Health	Watkins	7/01/2010	6/30/2015
Georgia Division of Public Health	Bayakly	7/01/2010	6/30/2015

Institution	PI last name	Start date	End date
Iowa State Department of Public Health	Gergely	7/01/2006	6/30/2015
Louisiana State Office of Public Health	Dugas	7/01/2005	6/30/2015
Maryland State Department of Health	Mitchell	7/01/2010	6/30/2015
Massachusetts State Department of Public Health	Davis	7/01/2005	6/30/2015
Michigan State University	Rosenman	7/01/2005	6/30/2015
Minnesota State Department of Health	Williams	7/01/2010	6/30/2015
NC State Department of Health & Human Services	Higgins	7/01/2010	6/30/2015
Nebraska State Department of Health & Human Services	Safranek	7/01/2010	6/30/2015
New Jersey State Department of Health	Lumia	7/01/2005	6/30/2015
New Mexico State Department of Health	Landen	7/01/2005	6/30/2015
New York Center of Environmental Health	Gelberg	7/01/2005	6/30/2015
NH State Department of Health	Armenti	7/01/2010	6/30/2015
Oregon Public Health Services	Douglas	7/01/2005	6/30/2015
Texas State Department of Health Services	Villanacci	7/01/2006	6/30/2015
University of Illinois	Forst	7/01/2010	6/30/2015
University of Kentucky	Bunn	7/01/2008	6/30/2015
Washington State Department	Bonauto	7/01/2005	6/30/2015
Wisconsin Department of Health Services	Anderson	7/01/2005	6/30/2015

c. Outputs

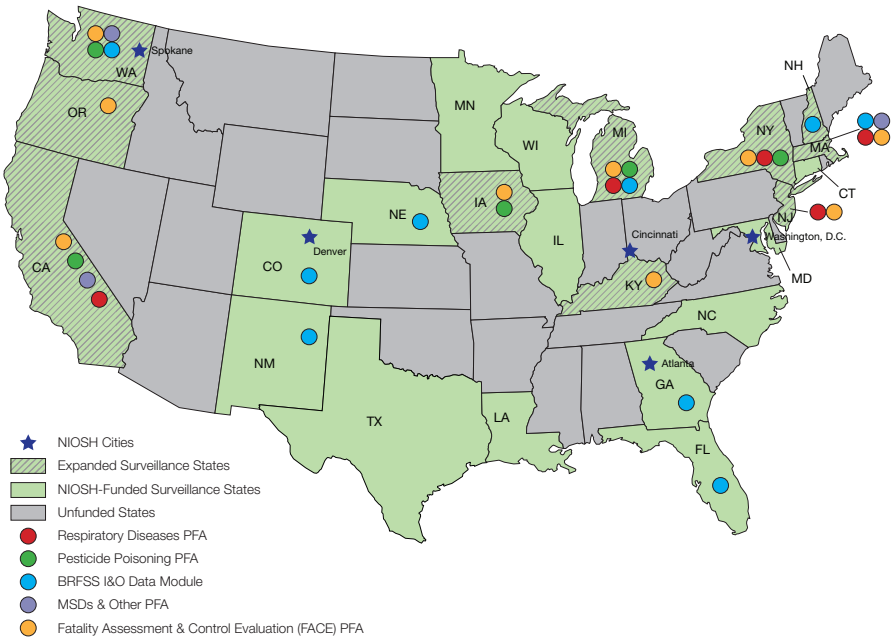
Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were nine publications across State Surveillance Program grants (Activity Codes = U60). The journal most frequently published in was the *American Journal of Industrial Medicine*, with three publications in FY2012. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

Across the nine publications, the average impact factor rating was 1.723 with the range extending from 2.062 for the *Journal of Occupational and Environmental Medicine* to 1.193 for the journal *Waste Management and Research*.

NIOSH-Funded State Programs for Occupational Health Surveillance, 2010–2015



Alaska and Hawaii not shown, but are unfunded states.

Map Created by M. Groenewold CDC/NIOSH/DSHEFS

NIOSH Funded Surveillance States

California, Connecticut, Colorado, Florida, Georgia, Illinois, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Texas, Washington, Washington

Respiratory Diseases PFA

California, Massachusetts, Michigan, New Jersey, New York

FACE PFA

California, Iowa, Kentucky, Massachusetts, Michigan, New Jersey, New York, Oregon, Washington

Pesticide Poisoning PFA

California, Iowa, Michigan, New York, Washington

BRFSS I&O Data Module

Colorado, Florida, Georgia, Massachusetts, Michigan, Nebraska, New Hampshire, New Mexico, Washington

MSDs & Other PFA

California, Massachusetts, Washington

d. Impact Stories

WASHINGTON STATE TRUCKING INJURY REDUCTION EMPHASIS THROUGH SURVEILLANCE (TIRES) PROGRAM

PI: Bonauto
Washington State Department of Labor & Industries
U60OH008487

The Washington State trucking industry has some of the highest costs and rates for work-related injuries, however very little is being done to address injuries other than those caused by motor vehicle collisions. The SHARP Program revealed that the most common and costly injuries in trucking are musculoskeletal disorders, falls, and motor vehicle collisions and injuries from being struck by or against an object. The TIRES program determined that these injuries occurred during four particular work activities: loading and unloading activities including manual handling, securing the load, entering and exiting the cab, and walking around the job site. Determining the root cause of injuries and producing useful safety materials to prevent them is the continuing mission of TIRES. They had several outputs including an online simulation training tool, TIRES E-news electronic newsletter, true story narratives, tip sheets, posters, trade journal article, YouTube video (http://www.youtube.com/watch?v = vEIXlrU-3Jew&feature = plcp), Website (www.KeepTruckingSafe.org), social media, and brand recognition.

2. Construction Research (Virginia Tech)

a. Overview

The purpose of the 5–year cooperative agreement with Virginia Tech is to contribute meaningful applied research results and interventions that address construction safety and health knowledge gaps and research findings addressing several NORA Construction Sector research goals. Partnering institutions that lead or participate in individual research projects include Wake Forest University, Duke University, Pennsylvania State University, University of Wisconsin-Madison, Washington Department of Labor and Industries, Carpenters Trust of Western Washington, and the Royal Melbourne Institute of Technology (RMIT) University in Australia.

b. Funding

Institution	PI last name	Start date	End date
Virginia Polytechnic Institute & State University	Kleiner	9/01/2009	8/31/2014

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were three publications across all Construction Research Cooperative Agreements (Activity Codes = U19 & U60). A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

There were too few publications with impact factors to compute an average impact factor rating for these publications.

d. Impact Stories

A DECISION SUPPORT SYSTEM FOR ERGONOMIC CONSTRUCTION DESIGN

PI: Kliener
Virginia Polytechnic Institute & State University
U60OH009761

(http://www.oshrc.ictas.vt.edu/projects/descriptions/DSS-ErgoConstruction.html)

Work-related musculoskeletal disorders (WMSDs) remain prevalent among residential construction workers. Premanufacturing (or industrialization) is a contemporary trend in this sector, one important aspect of which is the use of panelized walls that are generated by a designer. While this approach provides increased efficiencies, centralization of design provides an opportunity to promote ergonomics in the design process and is critical given the physical demands involved in building with panels. They are developing decision support system (DSS) for panelized design and construction. Currently, decision support software (DSS) is being generated for performing all design and planning activities in panelized residential construction. A prototype of the DSS was completed earlier and is currently under

continuing development and evaluation. This software consists of panelization (breaking walls into panels), stacking (determining how to arrange panels into stacks for delivery), construction sequencing (order in which panels pulled from stacks), and construction planning (what tasks used to erect each panel, how many workers, which particular workers). This software also includes a discrete-event panelized residential construction simulator and animator, so that any planned construction process can be simulated and animated (in 3D). The software is coded in C++ (Visual Studio 2010) and implemented via Web-based user interface (ASP.NET). The software is simulator developed using object-oriented animation classes developed for this research; animation is created via PROOF 3D general-purpose animation software.

3. National Mesothelioma Virtual Tissue Bank

a. Overview

The National Mesothelioma Virtual Bank (NMVB) is a virtual biospecimen registry designed to support and facilitate basic science, clinical, and translational research that will advance understanding of mesothelioma pathophysiology with the goal of expediting the discovery of preventive measures, novel therapeutic interventions, and, ultimately, cures for mesothelioma. NMVB currently has 1,092 annotated cases and 1,361 biospecimens including paraffin-embedded tissue, fresh frozen tissue, and blood and DNA samples. To accelerate scientific advances and ultimately benefit patients, the NMVB communicates with the scientific community, key stakeholders, the patient advocacy community, representatives from the legal community, and the public-at-large about the importance of this endeavor.

b. Funding

Institution	PI last name	Start date	End date
University of Pittsburgh	Becich	9/01/2011	8/31/2016

c. Outputs

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were two publications from the National Mesothelioma Virtual Tissue Bank. A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

There were too few publications with impact factors to compute an average impact factor rating for these publications.

d. Impact Stories

TISSUE MICROARRAYS DEVELOPED AND AVAILABLE

Three tissue microarrays (TMAs) have been developed and are available for investigators at New York University, the University of Pennsylvania, and the University of Pittsburgh. TMAs are used to

examine the distribution of marker molecules in hundreds of different tissues displayed on a single slide. These are now the second most requested type of biospecimen.

D. Training Project Grants

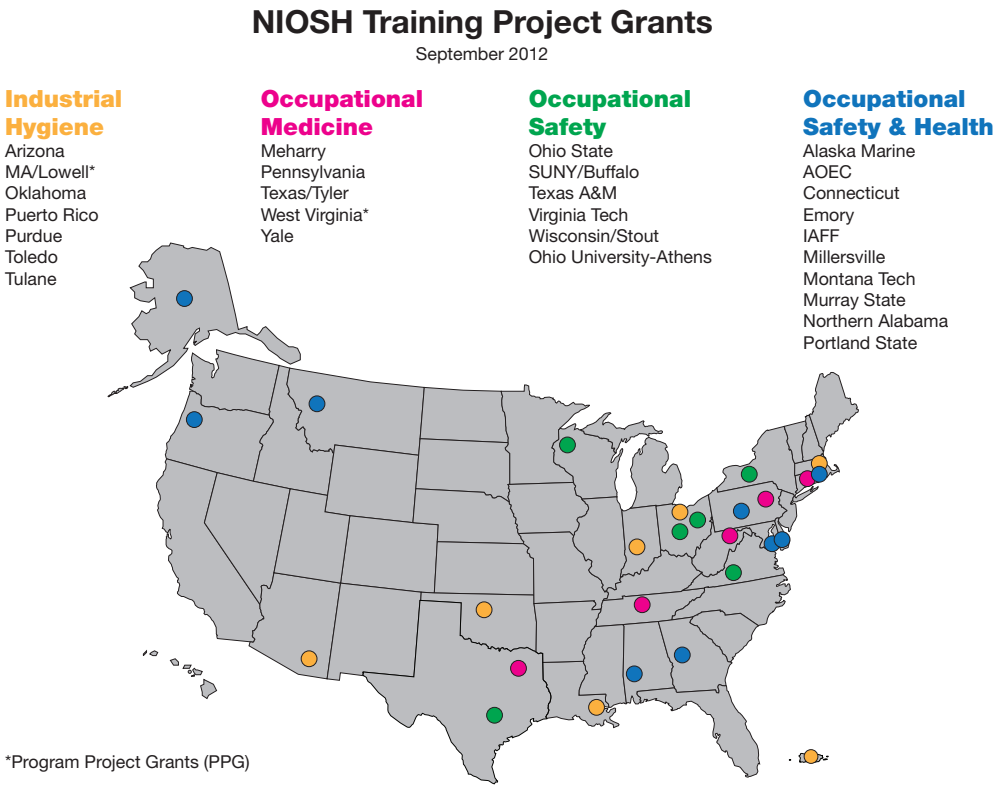
NIOSH supports professional training in occupational safety and health in single disciplines through Training Project Grants (TPGs). TPGs are individual academic training programs that support undergraduate and graduate training in a single discipline. These programs compliment the national network of graduate training provided by ERCs and are located throughout the United States.

NIOSH funds a unique TPG in Emergency Responder Training Program through the International Association of Fire Fighters. This grant supports a comprehensive nationwide hazardous substance training program for fire fighters, paramedics, and other emergency responders across the United States.

1. Training Project Grants (TPG)

a. Overview

NIOSH TPGs support academic programs that enable students to obtain specialized training in disciplines such as occupational medicine, occupational health nursing, industrial hygiene, occupational safety, and other closely related disciplines. Training disciplines supported by FY2012 TPG awards are shown in the map below.



b. Funding

Institution	PI last name	Start date	End date
Alaska Marine Safety Education Association	Dzugan	7/01/2011	6/30/2016
Association of Occupational And Environmental Clinics	Harrison	7/01/2010	6/30/2013
Emory University	Tolbert	7/01/2012	6/30/2017
International Association Fire Fighters	Morrison	9/30/2012	9/29/2017
Meharry Medical College	Chakrabarty	7/01/2011	6/30/2016
Millersville University	Specht	7/01/2009	6/30/2014
Montana Tech	Jensen	7/01/2008	6/30/2013
Murray State University	Kraemer	7/01/2010	6/30/2015
Ohio State University	Sommerich	7/01/2011	6/30/2016
Ohio State University	Schwerha	7/01/2012	6/30/2015
Portland State University	Hammer	7/01/2010	6/30/2015
Purdue University	Rosenthal	7/01/2011	6/30/2016
State University of New York	Paquet	7/01/2010	6/30/2015
Texas A&M University Health Science Center	Congleton	7/01/2012	6/30/2017
Tulane University	Grimsley	7/01/2012	6/30/2015
University of Arizona	Burgess	7/01/2012	6/30/2017
University of Connecticut	Magley	7/01/2010	6/30/2015
University of Massachusetts-Lowell	Kriebel	7/01/2010	6/30/2015
University of North Alabama	Figuerca	7/01/2012	6/30/2017
University of Oklahoma	Phillips	7/01/2009	6/30/2014
University of Pennsylvania	McKenzie	7/01/2009	6/30/2014
University of Puerto Rico	Gonzalez	7/01/2008	6/30/2013
University of Texas Health Science Center Houston	Levin	7/01/2010	6/30/2015
University of Toledo Health Science	Bisesi	7/01/2009	6/30/2014
University of Wisconsin-Stout	Sorrell	7/01/2010	6/30/2015

c. Outputs

Trainees, Graduates, and Employment of Graduates

In academic year 2011–2012, 199 professionals graduated from the TPG training programs with specialized training in disciplines that include industrial hygiene, occupational safety, industrial hygiene, occupational medicine, and occupational safety and health. Of the 199 TPG graduates, 170 (85%) entered the OSH workforce.

Program area	Trainees	Graduates	Employed in osh field or seeking advanced training
Industrial Hygiene	101	38	30 (79%)
Occupational Safety	67	29	28 (97%)
Occupational Medicine	25	11	9 (82%)
Occupational Safety and Health	536	121	103 (85%)
Total	729	199	170 (85%)

Peer-reviewed Publications

Publications by NIOSH-funded extramural researchers were collected from principal investigator reports to NIOSH, the NIH Reporter database, and PubMed database. From October 1, 2011, to September 30, 2012, there were two publications across Training Project Grants (Activity Codes = T01, T02, T03). A searchable database of NIOSH publications can be found at Grantee Award Final Reports and Publications on the OEP webpages.

Impact Factor

There were too few publications with impact factors to compute an average impact factor rating for these publications.

d. Impact Stories

During FY2012, all projects in this portfolio were in process and had no impact stories to report.

2. Emergency Responder Training Program

a. Overview

NIOSH funds a unique TPG in Emergency Responder Training Program through the International Association of Fire Fighters (IAFF). This grant supports a comprehensive nationwide hazardous substance training program for fire fighters, paramedics, and other emergency responders across the United States. The IAFF has had a long-standing relationship with NIOSH since 1991; the IAFF has conducted 2,762 training deliveries, trained over 58,650 students, and has logged 1,266,800 contact hours. Under NIOSH funding, the IAFF currently delivers the following training: First Responder Operations, Confined Space Operations, and Emergency Response to Terrorism: Operations, Illicit Drug Labs, Infectious Diseases and Chemical Process Industries.

b. Funding

Institution	PI last name	Project start	Project end
International Association of Fire Fighters	Morrison	9/30/2012	9/29/2017

c. Outputs

The IAFF exceeded its projected goal of conducting 97 training courses by 65% and provided 150 training classes in FY2012. The following table shows the classes provided to more than 2,800 students.

Class title	# Of classes	# Of students	# Of contact hours
FRO (24 HR)	59	1,274	30,576
CPI (8 HR)	45	659	5,272
Drug Lab (8 HR)	26	466	3,728
ERT-Ops (8, 16, 24 HR)	11	245	5,366
CSO (24 HR)	8	204	4,896
Infectious Disease	1	10	10
Totals	150	2,858	49,848

Peer-reviewed Publications

There were no reported publications from the Emergency Responder Training Program during FY2012.

d. Impact Stories

IAFF training is a proven resource that directly impacts decisions made in real world scenarios that fire fighters experience every day. For example, in a small rural community in New Hampshire, police found the remains of a methamphetamine (meth) lab (propane, a gas burner, hydrochloric acid). A few weeks after that incident, local police and federal agents responded to a reported one-pot meth lab in a neighboring community. Due to these events, Londonderry hosted four 8-hour training sessions at the police station, led by the IAFF. Seventy-six local first responders participated. Similar IAFF courses have been favorably received and comments reflected that course material is relevant and the specific skills learned and tools employed are relevant to all emergency situations, not just those pertaining to chemical process and hazardous materials responses.

E. Small Business Innovation Research Grants

a. Overview

The Small Business Innovation Research (SBIR) program stimulates technological innovation in the private sector and strengthens the role of small business in meeting federal research or research and development needs by increasing the commercial application of federally supported research results. This unique portfolio encourages participation by socially and economically disadvantaged small businesses and women-owned businesses to improve the return on investment from federally funded research for economic and social benefits to the Nation. SBIR annual reports provide regular updates on activities and outcomes. Included here are a diverse array of efforts to focus research, information, and service for small businesses.

b. Funding

Institution	Activity	PI last name	Start date	Project end
Alertek, LLC	Phase II	Meiksin	8/01/2009	8/31/2013
Dan Macleod, LLC	Phase II	Macleod	12/01/2007	8/31/2013
Giner, INC.	Phase II	Manoukian	9/01/2011	8/31/2013
Avec, INC.	Phase I	Schwartz	9/15/2012	9/15/2013

c. Outputs

Three of the four SBIR projects are Phase II follow-on research that is the result of successful completion of Phase I projects.

d. Impact Stories

During FY2012, all projects in this portfolio were in process and had no impact stories to report.

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

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TTY: 1–888–232–6348
E-mail: cdcinfo@cdc.gov

or visit the NIOSH Web site at **http://www.cdc.gov/niosh**.

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DHHS (NIOSH) Publication No. 2014–114

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