

National Institute for Occupational Safety and Health (NIOSH) Traumatic Injury Research and Prevention Program and Strategic Goals

May 23, 2013

NIOSH Traumatic Injury Research and Prevention Program

Mission Statement

The mission of the NIOSH Traumatic Injury (TI) Research and Prevention Program (referred to as the TI Program) is to reduce the incidence of traumatic occupational injuries and deaths through a focused program of surveillance, research and prevention. The program strives to fulfill its mission through the following:

- **High Quality Research:** NIOSH applies the public health approach to identifying and addressing the most compelling traumatic injury risks facing workers across all industry sectors. Injury and fatality surveillance identifies, characterizes, prioritizes, and tracks injuries and fatalities; case investigations and analytic epidemiologic, social science, and engineering research discover and address risk and causal factors; protective technology research identifies, develops, and assesses prevention options; and evaluation research determines program and intervention efficacy.
- **Practical Solutions:** The NIOSH TI Program is committed to the development of practical solutions to the complex problems that cause traumatic injuries and deaths among workers.
- **Partnerships:** Collaborative partnership efforts with labor, industry, government, and other stakeholders are essential for the TI Program to be relevant and achieve impact for reducing risks, injuries, and deaths among workers. Fostering these partnerships is a cornerstone of the NIOSH TI Program.
- **Research to Practice (r2p):** The NIOSH TI Program strives to conduct research that is oriented to produce effective, practical prevention measures that can be implemented in workplaces. Every intramural research project within the NIOSH TI Program includes a strategy to promote the transfer and translation of research findings into effective, feasible prevention practices, products, and technologies that can be adopted in the workplace.

Program Background

Traumatic occupational injury is defined as any damage inflicted to the body by energy transfer during work with a short duration between exposure and the health event. The TI program focuses on traumatic injuries, while injuries associated with repetitive or cumulative trauma are addressed by the NIOSH Musculoskeletal Disorders Program.

Traumatic injuries at work remain a leading cause of death and disability among U.S. workers. A recent economic analysis suggested that traumatic occupational deaths and injuries cost the nation \$192 billion annually, including direct medical costs and indirect costs such as lost wages and productivity.¹ These societal costs do not include pain, suffering and stress of injured workers and their families.

Fatalities

The Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) identified 4,693 fatal occupational injuries in 2011, the third lowest number of fatalities identified by CFOI since its inception in 1992 (there were fewer fatalities in 2009 and 2010).² The fatality rate across all industries was 3.5 deaths per 100,000 full-time equivalent workers (FTE). Ninety-two percent (4,308) of the fatalities were incurred by men. Consistent with previous years, the leading fatal injury event continued to be transportation-related incidents (41% or 1,937), of which 57% (1,103) were roadway-related events. Seventeen percent (791) of the fatalities were caused by assaults and violent acts, 15% (710) by contact with objects and equipment (includes many fatalities associated with machinery), and 15% (681) by falls. By industry sector, transportation and warehousing accounted for large numbers of fatal injuries (16% or 749), followed by construction (16% or 738), and agriculture, forestry, fishing and hunting (12% or 566). CFOI is a comprehensive surveillance system that uses multiple documentation sources to verify and characterize traumatic occupational injury deaths.

Nonfatal Injuries

For 2011, the BLS estimated 3.8 million injuries and illnesses (predominantly and hereafter referred to as injuries) among workers in all industries including private industry and State and local government agencies, with a rate of 3.8 cases per 100 FTE.³ Of these, nearly 3 million injuries occurred in private industry at a rate of 3.5 per 100 FTE and 820,900 injuries occurred among State and local government workers at a rate of 5.7 per 100 FTE. Private sector industries that had large numbers of nonfatal injuries included health care and social assistance (631,100), wholesale and retail trade (596,300), and manufacturing (502,700). Of the injuries that occurred among State and local government workers, 99% occurred in service providing industries (education/health services and public administration). Information on events leading to injury is available for the estimated 1.2 million injuries that required at least one day away from work.⁴ Overexertion and bodily reaction was most common (35% of cases), followed by falls, slips and trips (25%), and contact with objects and equipment (23%). The BLS data are based on a survey of employers that excludes an estimated 14% of US workers, including the self-employed, private household workers, farms with fewer than 11 employees, and Federal government employees.

The National Electronic Injury Surveillance System-Work Supplement (NEISS-Work), developed and maintained by NIOSH in collaboration with the Consumer Product Safety Commission, estimated 2.9 million occupational injuries and illnesses (predominantly and hereafter referred to as injuries) treated in

¹ Leigh JP [2011]. Economic Burden of Occupational Injury and Illness in the United States. *Millbank Quarterly* 89(4):728-772.

² Census of Fatal Occupational Injuries—Current and Revised Data. Available at: <http://www.bls.gov/iif/oshcfoi1.htm>. Accessed April 17, 2013.

³ Workplace Injuries and Illnesses-- 2011. Available at: http://www.bls.gov/news.release/archives/osh_10252012.pdf. Accessed April 17, 2013.

⁴ Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work, 2011. Available at: http://www.bls.gov/news.release/archives/osh2_11082012.pdf. Accessed April 22, 2013.

emergency departments in 2011, with an estimated 150,000 of these injuries resulting in hospitalization.⁵ NEISS-Work data from 2009 found that contact with objects and equipment was most common (35% of cases), followed by overexertion and bodily reaction (25%), falls, slips and trips (16%).⁶ NEISS-Work does not have the exclusions of the BLS survey, and includes injuries that may not result in time away from work.

Many nonfatal occupational injuries are not captured in BLS employer-based and NIOSH emergency-department based surveillance systems. Employers are not required to report all occupational injuries (e.g. injuries that do not require first-aid treatment), and not all occupational injuries are treated in emergency departments. Additionally, for a variety of reasons, workers may not report some injuries to their employers or health care providers, and employers may not record or report all applicable injuries in their logs.

High Risk and Vulnerable Worker Populations

Occupational hazards are distributed differentially. Industry sectors with elevated rates of fatal occupational injuries include: agriculture, forestry, fishing and hunting (24.9 deaths per 100,000 FTE in 2011), mining, quarrying, and oil and gas extraction (15.9), transportation and warehousing (15.3), and construction (9.1).⁷ Many detailed industry subsectors have even higher fatal occupational injury rates. For example, the 2011 rate for fishing, hunting and trapping was 101.2 deaths per 100,000 FTE. Industries with elevated rates of nonfatal occupational injuries include agriculture, forestry, fishing and hunting (5.5 injuries per 100 FTE in 2011), transportation and warehousing (5.0), healthcare and social assistance (5.0), arts, entertainment and recreation (4.5), and manufacturing (4.4).⁸

Additionally, workers of specific age, gender, social, and/or economic characteristics may have unique vulnerabilities for injury and increased risks. The relative proportions of high risk and vulnerable populations (such as younger workers, older workers, foreign-born workers, minorities, temporary and contract laborers) within the U.S. workforce are increasing, and it is important to focus on these populations, particularly as they have been largely underserved in the past.

Emerging Issues

NIOSH uses multiple on-going surveillance systems to identify significant emerging needs or trends associated with occupational traumatic injuries. These surveillance systems monitor fatal and nonfatal injury trends so that a proactive research response can be formulated to appropriately utilize scarce resources. NIOSH conducts fatality investigations of selected work-related deaths through the Fatality Assessment and Control Evaluations (FACE) program and also funds a State-based FACE program, www.cdc.gov/niosh/face. The targets for investigation are shifted to address previously unaddressed problems and new problems as they emerge. These surveillance and investigation programs play a critical role in identifying significant emerging research areas that are especially relevant to the NIOSH traumatic injury research mission.

⁵ Centers for Disease Control [2012]. Workers' Memorial Day—April 28, 2013. *Morbidity and Mortality Weekly Report (MMWR)* 61(16): 281. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6216a1.htm?s_cid=mm6216a1_w. Accessed April 25, 2013.

⁶ NIOSH Division of Safety Research [2013]. Unpublished 2009 data from the National Electronic Injury Surveillance System—Work Supplement. Morgantown, WV.

⁷ Census of Fatal Occupational Injuries—Current and Revised Data. Available at: <http://www.bls.gov/iif/oshcfoi1.htm>. Accessed April 17, 2013.

⁸ Workplace Injuries and Illnesses-- 2011. Available at: http://www.bls.gov/news.release/archives/osh_10252012.pdf. Accessed April 17, 2013.

TI Program Strategic Goals Background

Impetus

Strategic Goals for the NIOSH TI Program were developed to:

- Focus program activities in areas that are likely to advance the program's mission
- Provide guidance to NIOSH intramural and extramural scientists when conceptualizing and planning research projects and activities
- Assist management with making informed decisions about the direction of the program given finite resources
- Plan program activities by taking into account external factors that impact the program and the stakeholders affected by the program, and
- Facilitate coordination of research within the overall NIOSH National Occupational Research Agenda (NORA) portfolio

The goals were first developed in 2007 and were included in the evidence package for a National Academies' (NA) review of the TI Program.⁹

Format

The TI Program goals follow a format used by all NIOSH programs. This format aligns with the logic model used in the NA review of the TI Program detailing how NIOSH research leads to improvements in worker safety.

Top-level Strategic and Sub-strategic Goals state desired macro changes, often articulated as reductions in specific outcomes or exposures (e.g. falls). Strategic and Sub-strategic Goals have Intermediate Goals that center on stakeholders using research results to improve worker safety. The inclusion of Intermediate Goals focused on stakeholder actions helps ensure that TI Program activities explicitly include plans to translate research into practice. Intermediate Goals have Activity/Output goals that identify research activities that will produce research findings that can be acted upon by others to achieve Intermediate and Strategic Goals, and activities to help ensure that the research is translated into practice. Finally, Performance Measures are included to help assess when goals have been reached or points at which strategic decisions are needed on future directions.

Revisions

The TI Program Strategic Goals are periodically revised and input is sought from extramural researchers and stakeholders to ensure that the plan stays current and relevant. The 2007 goals included strategic goals to reduce: falls in the workplace, occupational motor vehicle incidents, workplace violence, injuries associated with machines and industrial vehicles, and injuries among high risk and vulnerable populations. The goals were revised in 2009 based on the NA review and further review by the NIOSH Board of Scientific Counselors. Revisions included the addition of Activity/Output goals to identify research activities that

⁹ IOM (Institute of Medicine) and National Research Council [2009]. *Traumatic Injury Research at NIOSH*. Committee to Review the NIOSH Traumatic Injury Research Program, Rpt. No. 6, Reviews of Research Programs of the National Institute for Occupational Safety and Health. Washington, DC: The National Academies Press.

would produce the science to achieve Intermediate and Strategic Goals, and the addition of a sixth goal on surveillance to recognize the foundational role of surveillance in guiding the TI Program.

In 2012, the NIOSH TI Program began an internal process to propose revisions to Strategic Goals utilizing internal workgroups composed of subject-matter experts across NIOSH. Workgroups considered several inputs and factors, including:

- Occupational injury surveillance data
- Data and evidence of the changing nature of work
- Integration with other NIOSH research programs¹⁰
- An emphasis on goals with the greatest potential for impact, such as those that include Prevention through Design (PtD) principles and intervention evaluations
- Progression of research along the public health framework into practice (i.e., from surveillance, to risk factor identification, to intervention development and evaluation, to translation into practice), and
- Progress on goals and activities by NIOSH, extramural researchers, other government agencies and stakeholders

The NIOSH TI Strategic Goals have historically concentrated on what could be accomplished by NIOSH's intramural researchers, but the current draft TI Strategic Goals are intended to set a comprehensive agenda that integrates the NIOSH extramural research community.

Draft 2014 TI Strategic Goals

The TI Program is now seeking review and input by extramural researchers and stakeholders on draft TI Strategic Goals. The 2014 TI Strategic Goals are intended to guide NIOSH intramural and extramural research for the next five years, from 2014 to 2019.

The draft includes some new Intermediate and Activity/Output goals, and proposes that some previous goals be retired. Goals are proposed for retirement based on assessments that the goal has been accomplished, or that the goal is no longer a priority based on the current state of knowledge. Goals that have been proposed for retirement are identified with parenthetical text. Additionally, some revisions are proposed to streamline the goals, removing redundancy and overlap. Finally, the draft includes Performance Measures, not included in previous versions, for each Activity/Output Goal. The inclusion of Performance Measures is responsive to a NA recommendation that the TI Program develop an explicit plan for each subgoal, including the circumstances in which work in a subgoal should cease. Some Performance Measures identify target years for completion while others do not. Decisions to include specific timeframes were made on a case-by-case

¹⁰ There are ten NIOSH Industry Sector Research Programs and twenty-four NIOSH Cross-sector Programs organized around adverse health outcomes, statutory programs, and global efforts. NIOSH workgroups proposing revisions to the TI Strategic Goals reviewed current goals for all NIOSH programs to foster integration and leveraging of resources with other NIOSH programs. Many of the proposed TI goals are aligned with goals in NIOSH Industry Sector and Cross-Sector programs and a cross-referencing has been completed. To improve readability, cross-references to goals in other programs are not shown in this document.

basis, and included considerations of: ongoing work that was anticipated to be complete by a specific time-frame; points in time at which decisions on future directions should be made; and, as one means to prioritize and encourage more timely attention.

Draft 2014 NIOSH Traumatic Injury Strategic Goals

Strategic Goal 1: Reduce Fall Injuries in the Workplace

Strategic Subgoal 1a: Reduce Fall Injuries in the Construction Industry

Intermediate Goal 1a.1: Construction organizations, engineers, architects, and employers in the construction industry will implement effective, evidence-based fall prevention and protection designs, technologies, programs, and communications materials for their structure design and at their worksites.

Activity/Output Goal 1a.1.1: Collaborate with occupational safety professionals, trade associations, and safety equipment manufacturers to develop effective strategies, protective technologies, and personal protective equipment for preventing fall incidents and protecting workers.

Performance Measure: *By 2018, develop and evaluate at least two innovative fall preventive/protective solutions (strategy, technology, or PPE) addressing each of the top three construction fall-related problem areas (i.e., roofing safety, ladder safety, and heavy equipment safety).*

Activity/Output Goal 1a.1.2: Collaborate with technology development organizations to test the feasibility of incorporating advanced technologies into existing elevation-access equipment to improve fall incident controls.

Performance Measure: *Test the feasibility of at least one advanced technology into three existing elevation-access devices*

Activity/Output Goal 1a.1.3: Collaborate with occupational safety professionals, trade associations, insurance companies, and other government agencies to transfer fall prevention knowledge and innovations to employers.

Performance Measure: *Transfer at least two fall-prevention innovations (or existing effective fall prevention solutions) and the related fall prevention knowledge in each of the top three construction fall-related problem areas (i.e., roofing safety, ladder safety, and heavy equipment safety).*

Activity/Output Goal 1a.1.4: Collaborate with architect and engineering professional organizations to transfer safe-by-design innovations and knowledge to architects, engineers, and construction corporations to incorporate them in structure design and construction plans.

Performance Measure: *Transfer (to architects, engineers, and construction corporations) at least one safe-by-design fall-prevention innovation/solution and the related knowledge*

addressing each of the three leading construction fall-related problem areas (i.e., roofing safety, ladder safety, and heavy equipment safety).

Intermediate Goal 1a.2: Safety research organizations, trade associations, insurance companies, and employers will identify, characterize, and reduce fatal and serious injuries associated with construction falls to a lower level among Hispanic construction workers

Activity/Output Goal 1a.2.1: Explore and evaluate the effectiveness of new types of construction-tailored interventions to address Hispanic worker fall risks. These might include creative mechanisms involving community-based organizations, peer-to-peer networks, family-based measures, or similar efforts as well as policy initiatives.

Performance Measure: *By 2018, evaluate the effectiveness of at least two new construction-tailored interventions to address Hispanic worker fall risks.*

Activity/Output Goal 1a.2.2: Transfer new knowledge and best practices on fall prevention to construction special trade contractors, general building contractors, small employers and companies who employ Hispanic construction workers.

Performance Measure: *By 2018, develop and disseminate materials (transferring new knowledge and best practices) on at least two effective interventions on fall prevention to organizational groups who employ Hispanic construction workers.*

(Retired) **Activity/Output Goal 1a.2.3:** Document effectiveness of implementation of fall prevention measures reflecting critical risk factors and obstacles to Hispanic construction workers.

(Retired) **Strategic Subgoal 1b: Reduce Fall Injuries in the Health Services Industry**

(Retired) **Intermediate Goal 1b.1:** The health services industry, insurance companies, occupational safety and health professionals, trade associations, manufacturers of safety equipment, OSHA, and fall prevention research organizations will develop and implement a national campaign to promote widespread implementation of comprehensive slip, trip, and fall (STF) prevention programs.

(Retired) **Activity/Output Goal 1b.1.1:** Conduct intervention trials in health care settings to evaluate the effectiveness of STF prevention measures.

(Retired) **Activity/Output Goal 1b.1.2:** Develop hazard assessment checklists for use by the health care industry to identify STF hazards in health care settings addressing the most common STF hazards.

(Retired) **Activity/Output Goal 1b.1.3:** Develop evidence-based findings on how to implement a comprehensive slip, trip, and fall prevention program in health care settings that can serve as the basis of a national STF prevention campaign

Strategic Subgoal 1c: Reduce Fall Injuries in the Wholesale and Retail Trade (WRT) Industry.

Intermediate Goal 1c.1: Engineers, WRT trade associations, and employers in the WRT industry will implement effective, evidence-based fall prevention and protection designs, technologies, programs, and communication materials for the handling, storage and retrieval of merchandise.

Activity/Output Goal 1c.1.1 Collaborate with researchers, WRT trade associations, worker groups, occupational safety and health professionals, and manufacturers of safety and health equipment to evaluate and develop effective strategies and technical engineering solutions for storage and retrieval of merchandise, goods, and materials to reduce fall-from-elevation incidents as well as falls on the same level.

***Performance Measure:** Develop and evaluate at least two innovative fall preventive/protective solutions (strategy, technology, or PPE) addressing merchandise-storage-and-retrieval associated fall incidents.*

Activity/Output Goal 1c.1.2: Collaborate with technology development organizations to test the feasibility of incorporating advanced technologies into existing elevation-access and merchandise retrieval equipment to improve fall incident controls

***Performance Measure:** Test the feasibility of at least one advanced technology into three types of existing elevation-access devices.*

Activity/Output Goal 1c.1.3: Collaborate with occupational safety professionals, WRT trade associations, and insurance companies to transfer fall prevention knowledge, innovations, and guidelines to the WRT industry and small business employers.

***Performance Measure:** Transfer at least one fall-prevention innovation (or existing effective fall prevention solution) and the related fall prevention knowledge for each of the top two WRT fall-related problem areas (i.e., trucking/transporting and goods retrieval).*

Strategic Subgoal 1d: Reduce Fall Injuries in the Public Safety, Services, Manufacturing and other High Risk Industries

Intermediate Goal 1d.1: Government agencies, vehicle and equipment manufacturers, standards committees, and occupational safety professionals will work together to improve the designs of ambulances, fire trucks, and heavy trucks to reduce the risk of injuries and fatalities associated with falls from these vehicles.

Activity/Output Goal 1d.1.1: Evaluate vehicle configuration and access system designs of ambulances, fire trucks, and heavy trucks; work with equipment manufacturers to review and consider design enhancement.

***Performance Measure:** Evaluate at least one vehicle configuration and access system for at least two types of vehicles.*

Activity/Output Goal 1d.1.2: Work with national standards groups to update or develop vehicle configuration and access system standards for specific motor vehicles.

***Performance Measure:** Update at least one standard for vehicle configuration and access systems for at least two types of vehicles.*

Activity/Output Goal 1d.1.3: Develop and disseminate guidelines for vehicle configuration and access system use and modifications to reduce slips, trips, and falls among emergency medical services (EMS) personnel, firefighters, and truck drivers.

Performance Measure: Develop at least one guideline for vehicle configuration and access systems for at least two types of special vehicles.

Intermediate Goal 1d.2: The food services industry and other high risk industries will implement comprehensive slip, trip, and fall (STF) prevention programs.

(Retired) **Activity/Output Goal 1d.2.1:** Identify STF prevention strategies and research gaps that need to be addressed in the food services and other industries.

Activity/Output Goal 1d.2.2: Develop and evaluate promising solutions for STF prevention in the food services industry.

Performance Measure: By 2018, evaluate at least two solutions for STF prevention in the food services industry.

Activity/Output Goal 1d.2.3: Conduct intervention trials in the food services industry and develop hazard assessment checklists to evaluate the effectiveness of STF prevention measures.

Performance Measure: By 2018, complete an intervention trial on effectiveness of STF prevention measures in the food services industry.

(Retired) **Activity/Output Goal 1d.2.4:** Develop hazard assessment checklists for use by the food services industry to identify the most common STF hazards.

Activity/Output Goal 1d.2.5: Develop evidence-based guidelines for preventing STF incidents in the food services industry that can serve as the basis of a national STF prevention campaign.

Performance Measure: Develop guidelines for preventing STF incidents in the food services industry.

Strategic Subgoal 1e: Reduce Fall Injuries through Research on Human Characteristics, Social-organizational Characteristics, and on Biotechnology-based Fall Control Measures.

Intermediate Goal 1e.1: Scientific research organizations, professional societies, and government agencies will identify biomedical information of humans, social–organizational characteristics, and human-system interface traits that are common precursors to fall incidents and use this information to design out fall risk or craft engineering solutions and organizational interventions to prevent falls or reduce their incidence.

Activity/Output Goal 1e.1.1: Collaborate with safety research organizations and other federal agencies to improve understanding of how individual worker characteristics and human-system interfaces contribute to fall incidents and to the design of effective fall prevention and protection measures. This should include exploration of physical variations,

neurological traits, cognition process, social-organizational, and cultural factors, and safety attitudes.

Performance Measure: *Publish at least five articles on how individual worker characteristics contribute to fall incidents and to the design of effective fall protection devices.*

Activity/Output Goal 1e.1.2: Study older workers' physical and psychosocial characteristics associated with falls and the mechanisms through which older workers are at increased risk for fall injury, and develop guidance to address risks for occupational falls among older workers.

Performance Measure *Publish at least five articles on the risk factors associated and control measures to reduce the risk of occupational falls among older workers.*

Intermediate Goal 1e.2: Manufacturers will produce and market new, improved fall protection devices and systems that effectively reduce the forces to the human body during fall arrest and fall termination.

Activity/Output Goal 1e.2.1: Collaborate with manufacturers of safety equipment to test the effectiveness of new strategies, technologies, and sensor enhancement approaches in reducing postural instability at elevation to reduce fall-initiation risk.

Performance Measure: *By 2020, publish at least five articles on the effectiveness of new strategies, technologies, and sensor enhancement approaches to reduce fall-initiation risk.*

Activity/Output Goal 1e.2.2: Collaborate with manufacturers of safety equipment to develop improved sizing systems and configurations of fall protection devices to accommodate current worker populations, including female workers, for improved fall protection.

Performance Measure: *Publish at least four articles and/or transfer at least four recommendations on improved sizing systems and configurations of fall protection devices to accommodate current worker populations.*

Activity/Output Goal 1e.2.3: Collaborate with manufacturers of safety equipment to develop improved devices or accessories for impact energy or stress relief (such as suspension trauma relief during and after a fall incident) and to establish rescue guidelines to further protect workers.

Performance Measure: *Publish/transfer at least two articles/guidelines on impact energy or stress relief to protect workers.*

Intermediate Goal 1e.3: Researchers, safety professionals, and safety investigators will use comprehensive digital models of human fall dynamics to evaluate new fall prevention and protection technologies, products, and methods and conduct fall injury investigations to recommend solutions.

Activity/Output Goal 1e.3.1: Develop knowledge databases for improving digital human models on fall dynamics, including the phases of fall initiation and fall termination, for use in

efficient evaluation of new fall prevention and protection methods and strategies, in fall incident investigations (reconstruction), and in workers' hazard recognition training.

Performance Measure: *By 2020, publish at least five articles/knowledge databases for improving digital human models on fall dynamics, including the phases of fall initiation and fall termination.*

Activity/Output Goal 1e.3.2: Transfer knowledge databases to digital model developers to develop scientifically comprehensive yet easy-to-use digital modeling modules for use in workplace planning for fall prevention, workers' hazard recognition training, and fall incident investigations.

Performance Measure: *By 2022, transfer at least four digital modeling knowledge databases to digital model developers to develop scientifically comprehensive yet easy-to-use digital modeling modules.*

Strategic Goal 2: Reduce Occupational Injuries and Deaths due to Motor Vehicle Incidents and Crashes

Intermediate Goal 2.1: Industry, government, standards organizations, and regulatory agencies will incorporate effective, evidence-based interventions into policies, procedures, standards, and regulations to reduce work-related motor vehicle crashes among those who drive as a primary job duty and other worker groups at high risk for crashes.

Activity/Output Goal 2.1.1: Conduct intramural and extramural research to identify and interpret risk factors for vehicle crashes for workers who drive as a primary job duty and for other worker groups at high risk for crashes.

Performance Measure: *By 2018, at least three risk-factor projects or analyses will be completed. Results will be published in peer-reviewed journals and where appropriate, will inform standards development or the work of other relevant external committees.*

(Retired) **Sub-activity/Output Goal 2.1.1.1:** Promote partnerships with other federal agencies, such as the Federal Motor Carrier Safety Administration, during all phases of research related to professional truck drivers to ensure effective translation of research results.

Activity/Output Goal 2.1.2: Based on risk-factor research, prioritize subpopulations of drivers at high risk for crashes for targeted research efforts.

Performance Measure: *Annually, with input from NIOSH scientists, the NIOSH Center for Motor Vehicle Safety will provide guidance for development of new research proposals.*

(Retired) **Sub-activity/Output Goal 2.1.2.1:** Promote efforts and research proposals addressing vehicle crashes among subpopulations of professional drivers (other than long-haul truckers) that were identified as highest priority.

(Retired) **Sub-activity/Output Goal 2.1.2.2:** Promote efforts and research proposals addressing vehicle crashes among subpopulations of professional drivers (other than long-haul truckers) that were identified as highest priority.

Activity/Output Goal 2.1.3: Develop, implement, and evaluate strategies for reducing work-related motor vehicle crashes, including engineering controls, technology, training, and changes in work organization.

Performance Measure: By 2018, at least three intramural and/or extramural intervention-evaluation projects or analyses related to motor vehicle safety will provide evidence-based recommendations to prevent work-related motor vehicle crashes.

Activity/Output Goal 2.1.4: Assess the value of road safety management programs within public and private sector organizations, taking into consideration the contribution of individual program elements in reducing frequency and severity of crashes as well as the cost-effectiveness of these elements.

Performance Measure: At least three intramural and/or extramural projects or analyses will provide evidence-based recommendations related to road safety management programs. Results will be published in peer-reviewed journals and where appropriate, will inform standards development or the work of other relevant external committees.

Activity/Output Goal 2.1.5: Translate research results into communications products that give stakeholders evidence-based guidance for prevention of work-related motor vehicle crashes.

Performance Measure: Quarterly, the NIOSH Motor Vehicle Safety topic page will be reviewed and updated. Annually, research results will be reviewed to identify those that can be re-packaged and distributed to stakeholders so that they will be clearly understood and actionable. New information products will be communicated through the topic page, the NIOSH Science Blog, NIOSH e-News, NIOSH Twitter, trade journal articles, presentations, and partner outlets.

(Retired) **Intermediate Goal 2.2:** The road construction industry will incorporate effective interventions into their policies and procedures to reduce injuries and deaths due to vehicle and equipment related struck-by incidents.

(Retired) **Activity/Output Goal 2.2.1:** Evaluate strategies to reduce ground worker exposures to road construction vehicles and equipment.

(Retired) **Sub-activity/Output Goal 2.2.1.1:** Evaluate existing engineering control strategies (internal traffic control plans and off-the-shelf proximity warning systems).

(Retired) **Activity/Output Goal 2.2.2:** Promote the availability and use of operator visibility information for construction vehicles and equipment.

(Retired) **Sub-activity/Output Goal 2.2.2.1:** Make available blind area diagrams for selected construction vehicles and equipment used in the road construction industry.

(Retired) **Sub-activity/Output Goal 2.2.2.2:** Disseminate and promote the use of blind area diagrams for training equipment operators and ground workers who work around operating construction vehicles and equipment.

(Retired) **Activity/Output Goal 2.2.3:** Evaluate worker injury risks associated with the expanded use of night work in the road construction industry.

(Retired) **Sub-activity/Output Goal 2.2.3.1:** Survey the industry on night work-related injuries.

(Retired) **Sub-activity/Output Goal 2.2.3.2:** Convene a workshop addressing night work in road construction to improve the understanding of injury patterns and risk factors.

(Retired) **Activity/Output Goal 2.2.4:** Gain widespread usage of effective prevention measures in the road construction industry.

(Retired) **Sub-activity/Output Goal 2.2.4.1:** Partner with road construction industry stakeholders and other federal agencies such as the Occupational Safety and Health Administration (OSHA) to widely disseminate effective practices for reducing injuries associated with vehicle and equipment related struck-by incidents.

(Retired) **Sub-activity/Output Goal 2.2.4.2:** Develop a strategy to use industry surveys to identify a baseline and a mechanism to track usage of prevention measures over the decade.

(Retired) **Activity/Output Goal 2.2.5:** Investigate, through the Fatality Assessment and Control Evaluation (FACE) Program, vehicle and equipment related deaths associated with road construction work zones.

(Retired) **Sub-activity/Output Goal 2.2.5.1:** Identify factors that contribute to vehicle and equipment related fatalities that occur in road construction work zones.

(Retired) **Sub-activity/Output Goal 2.2.5.2:** Develop and disseminate comprehensive recommendations for preventing similar deaths in road construction work zones.

Intermediate Goal 2.3: The fire service, industry, government, standards organizations, and regulatory agencies will incorporate effective, evidence-based interventions into policies, procedures, standards, and regulations to reduce motor vehicle related incidents and crashes among public safety and emergency response workers.

Activity/Output Goal 2.3.1: Evaluate strategies to reduce incidents of vehicle related injuries and deaths among firefighters.

Performance Measure: *By 2018, at least three intramural and/or extramural projects or analyses will evaluate prevention strategies, leading to evidence-based recommendations to prevent vehicle-related injuries and deaths of firefighters. Results of these efforts will be published in peer-reviewed journals.*

(Retired) **Sub-activity/Output Goal 2.3.1.1:** Evaluate seatbelt use in fire service vehicles.

(Retired) **Sub-activity/Output Goal 2.3.1.2:** Evaluate the effectiveness of policies and practices to reduce fatalities related to high-speed response and unsafe driving among fire service personnel.

Activity/Output Goal 2.3.2: Evaluate strategies to reduce incidents of vehicle related injuries and deaths among law enforcement personnel.

Performance Measure: By 2018, intramural and/or extramural projects or analyses will evaluate at least two different prevention strategies, leading to evidence-based recommendations to prevent vehicle-related injuries and deaths of law enforcement officers. Results of these efforts will be published in peer-reviewed journals.

(Retired) **Sub-activity/Output Goal 2.3.2.1:** Evaluate seatbelt use in law enforcement vehicles.

Activity/Output Goal 2.3.3: Evaluate strategies to reduce incidents of vehicle related injuries and deaths among emergency medical services (EMS) personnel.

Performance Measure: By 2018, intramural and/or extramural projects or analyses will evaluate at least two different prevention strategies, leading to evidence-based recommendations to prevent vehicle-related injuries and deaths of EMS personnel. Results of these efforts will be published in peer-reviewed journals.

(Retired) **Sub-activity/Output Goal 2.3.3.1:** Create and promulgate training programs to ensure safe operation of all ground vehicles through management and labor organization partnerships.

(Retired) **Sub-activity/Output Goal 2.3.3.2:** Develop partnerships with vehicle and equipment manufacturers, EMS agencies, and other stakeholders and partners to improve the designs of all vehicle types used by EMS to decrease the risks of injuries and fatalities that result from vehicle crashes.

(Retired) **Activity/Output Goal 2.3.4:** Investigate, through the Fire Fighter Fatality Investigation and Prevention Program (FFFIPP), vehicle related deaths among fire service and EMS personnel.

(Retired) **Sub-activity/Output Goal 2.3.4.1:** Identify factors that contribute to vehicle related fatalities that occur among fire service and EMS personnel.

(Retired) **Sub-activity/Output Goal 2.3.4.2:** Develop and disseminate comprehensive recommendations for preventing similar deaths among fire service and EMS personnel.

Activity/Output Goal 2.3.5: Develop partnerships with vehicle and equipment manufacturers, EMS agencies, and other stakeholders and partners to improve the designs of all vehicle types used by EMS to decrease the risks of injuries and fatalities that result from vehicle crashes.

Performance Measure: By the end of 2016, the NIOSH project team and its 12 collaborative partners will have published five to eight component-specific national consensus standards covering items such as the ambulance patient compartment structure, seating and restraints, cots and patient restraints, and equipment mounting. These individual component standards will then be referenced in the 2nd Edition of the new bumper-to-bumper NFPA 1917 national consensus standard for the construction of an automotive ambulance.

Activity/Output Goal 2.3.6: Identify factors that contribute to work-related motor vehicle incidents and crashes that occur among fire service, EMS, and law enforcement personnel.

Performance Measure: Through NIOSH fatality investigation programs, conduct field investigations of vehicle-related deaths among fire service, EMS, and law enforcement personnel. Investigations will continue until they no longer identify emerging hazards or novel prevention strategies.

Activity/Output Goal 2.3.7: Translate research results into communications products that give stakeholders evidence-based guidance for prevention of work-related motor vehicle incidents and crashes among fire fighters, EMS, and law enforcement personnel.

Performance Measure: Twice annually, Web pages for NIOSH fatality investigation programs will be reviewed and updated. Annually, research results will be reviewed to identify those that can be re-packaged and distributed to stakeholders so that they will be clearly understood and actionable. New information products will be communicated through the topic page, the NIOSH Science Blog, NIOSH e-News, NIOSH Twitter, trade journal articles, presentations, and partner outlets.

Intermediate Goal 2.4: Global partners will collaborate to develop strategies for reducing occupational road traffic injuries worldwide.

(Retired) **Activity/Output Goal 2.4.1:** Partner with the World Health Organization (WHO) to include and promote occupational aspects of road safety in the WHO Global Road Safety Initiative.

(Retired) **Sub-activity/Output Goal 2.4.1.1:** Develop an online library of international good practices for workers driving or walking on roads.

(Retired) **Sub-activity/Output Goal 2.4.1.2:** Hold an international conference to solidify national and international partnerships and initiate actions to implement and evaluate practices in at least three countries.

(Retired) **Sub-activity/Output Goal 2.4.1.3:** Publish a NIOSH/WHO document that describes international good practices for workers driving or walking on roads.

Activity/Output Goal 2.4.2: NIOSH will provide technical assistance and consultation for international initiatives and documents on work-related road safety.

Performance Measure: NIOSH research results and expertise will add information on work-related road safety to products such as the ISO 39001 standard and related guidance, public/private sector policy documents and databases, WHO publications, and the Global OSH-Wiki initiative. Work-related road safety will be integrated into future United Nations (UN) road safety resolutions. Information products coming from the UN Road Safety Collaboration and other organizations central to the Decade of Action will address worker safety and the importance of organizations as a road user category.

(Retired) **Sub-activity/Output Goal 2.4.2.1:** Assist the UN Road Safety Collaboration and the Indian Council of Medical Research.

Activity/Output Goal 2.4.3: NIOSH and partners will initiate and promote international research and demonstration projects to prevent road traffic injury in worker populations, in support of high-priority activities around the UN Decade of Action for Road Safety.

Performance Measure: By 2018, NIOSH will have become a more active participant and promoter of research, playing a lead or consultative role in at least two collaborative international projects on occupational road safety.

Strategic Goal 3: Reduce Occupational Injuries and Deaths due to Workplace Violence

Strategic Subgoal 3a: Reduce Occupational Injuries and Deaths due to Workplace Violence among Taxicab Drivers

Intermediate Goal 3a.1: Industry will implement effective safety equipment in their taxicabs, coupled with effective safety training, and transportation regulators will incorporate effective safety equipment and safety training into their ordinances to prevent injuries to taxi drivers resulting from physical violence.

(Retired) **Activity/Output Goal 3a.1.1:** Develop partnerships with trade associations, police departments, taxicab companies, and community regulators for the development of and support to NIOSH research protocols for evaluation of safety equipment in taxicabs to prevent robberies, assaults and homicides.

(Retired) **Activity/Output Goal 3a.1.2:** Conduct research to identify risk factors for injuries to taxi drivers resulting from physical violence.

Activity/Output Goal 3a.1.3: Conduct research studies to evaluate the effectiveness of safety equipment in taxicabs and organization policies and practices (such as partitions, cameras, Global Positioning Systems (GPS) and emergency alert systems, cashless systems, and training programs) to reduce robberies, assaults and homicides of taxicab drivers.

Performance Measure: At least three intramural and/or extramural projects or analyses will evaluate the effectiveness of safety equipment and organization policies and practice interventions to assess their impact on preventing robberies, assaults, and homicides to taxicab drivers. Results of these efforts will be published in peer-reviewed journals.

(Retired) **Activity/Output Goal 3.a.1.4:** Conduct research studies to demonstrate the effectiveness of model programs to increase adoption by the industry, transportation regulators, and drivers and their associations of effective safety equipment in cabs to reduce violence risk. Evaluate effectiveness of partnerships with regulators and industry to implement programs.

(Retired) **Activity/Output Goal 3a.1.5:** Develop partnerships with community transportation regulators, police departments and their associations, and taxicab associations to implement a model program in at least 1 community to increase the number of taxicabs compliant with effective interventions.

Activity/Output Goal 3a.1.6: Collaborate with industry, municipal and state transportation regulators, taxicab safety equipment manufacturers, and OSHA to promote and evaluate the

implementation of evidence-based safety equipment and organizational policies and practices, to prevent injuries to taxi drivers resulting from physical violence.

***Performance Measure:** At least two intramural and/or extramural research projects will have evaluated broad-based intervention efforts to reduce workplace violence against taxicab drivers. Results of these efforts will be published in peer-reviewed journals. At that time, a meeting of taxicab industry leaders and stakeholders would be convened to assess if there is sufficient evidence and stakeholder interest and engagement to support a national campaign.*

Strategic Subgoal 3b: Reduce Workplace Violence among High Risk Retail Trade Workers including Grocery Stores, Gasoline Stations, Convenience Stores, Bakeries, Liquor Stores, and Other Shops and Businesses at Risk of Robbery.

Intermediate Goal 3b.1: Retail businesses will implement NIOSH recommendations for effective security equipment, cash handling procedures, environmental designs, and employee training for behavior in a robbery event for prevention of robberies and robbery-related injury in their workplaces.

Activity/Output Goal 3b.1.1: Conduct research to evaluate models for diffusion of NIOSH and OSHA guidelines for prevention of robbery and robbery-related assaults and homicides to retail businesses. Different models will include evaluation of problem-oriented community policing model, health communication models, legislative models, and business self-certification programs. Research will be conducted to evaluate different approaches and partnerships using these diffusion models for increasing participation in training and education programs and compliance to recommendations.

***Performance Measure:** Intramural and/or extramural research projects will evaluate at least three diffusion models to determine the most effective methods for disseminating information to convince retailers to adopt robbery prevention guidelines. Results of these efforts will be published in peer-reviewed journals.*

Activity/Output Goal 3b.1.2: Partner with stakeholders to improve transfer, diffusion, and adoption of effective workplace violence interventions using proven diffusion models in high robbery-risk retail trade sector businesses.

***Performance Measure:** Documented evidence that there has been at least one widely adopted evidence-based workplace violence prevention program in high robbery-risk retail trade sector businesses. Documentation of such adoption includes national or state legislation and/or dissemination by trade associations and labor unions of “best practices.”*

(Retired) **Sub-Activity/Output Goal 3b.1.2.1:** Utilize partnerships with employers, labor unions, trade associations, police departments and their associations, and federal agencies to increase the knowledge of workplace violence risks and potential strategies and interventions that limit risks in high risk wholesale and retail trade businesses.

(Retired) **Sub-Activity/Output Goal 3b.1.2.2:** Develop and implement communication plans for effective workplace violence intervention strategies that are demonstrated to have reached target audiences in the wholesale and retail trade sector.

(Retired) **Sub-Activity/Output Goal 3b.1.2.3:** Utilize and evaluate partnerships with employers, trade associations, government agencies, police departments and their associations, and crime prevention organizations to increase knowledge among police departments and implement a successful community policing program which increases business compliance to interventions and reduces robbery-related assaults in three communities.

Activity/Output Goal 3b.1.3: Use reliable economic models to accurately assess the costs of fatal and non-fatal injuries and illnesses from workplace violence and the potential savings from reducing incidence and severity of workplace violence events.

***Performance Measure:** At least three intramural and/or extramural projects or analyses will complete an assessment of return on investment due to implementation of workplace violence prevention efforts in high risk retail settings. Results of these efforts will be published in peer-reviewed journals.*

(Retired) **Sub-Activity/Output Goal 3b.1.3.1:** Complete an assessment of reduction in costs due to implementation of a successful community policing program in one community.

(Retired) **Sub-Activity/Output Goal 3b.1.3.2:** Disseminate return on investment and cost data to community partners to promote compliance to NIOSH and OSHA guidelines for retail workplace violence prevention.

Strategic Subgoal 3c: Identify Risk Factors and Effective Interventions to Prevent Workplace Violence among High Risk Services, Health Care, Social Service, and Public Safety Sector Workers such as eating and drinking establishment workers including: pizza delivery services; hotel/motel workers; automotive repair mechanics; teachers and other high risk school workers; nurses and nursing assistants in general medical, home health care, nursing homes, and psychiatric hospitals; social service workers in job training, residential care, and day care industries; private security workers; and public safety and correctional workers in emergency response tasks (e.g., medical services and police calls and correctional officer activities).

Intermediate Goal 3c.1: Industry will implement NIOSH recommendations for effective interventions to reduce workplace violence to high risk services, health care, and social service sector workers.

(Retired) **Activity/Output Goal 3c.1.1:** Develop partnerships with industry, unions, and federal agencies in the development of and support to NIOSH protocols for research into workplace violence risk factors and evaluation of interventions in high risk services, health care, social service, and public safety sector workers.

Activity/Output Goal 3c.1.2: Conduct studies to identify risk factors associated with physical trauma and verbal abuse (such as bullying, harassment and intimidation) from workplace violence among high risk services, health care, social service, and public safety sector workers.

***Performance Measure:** At least two intramural and/or extramural projects or analyses will identify risk factors for physical trauma and verbal abuse in high risk services, healthcare,*

social services, and public safety workers. The results of these efforts will be published in peer-reviewed journals.

Activity/Output Goal 3c.1.3: Identify, develop, and evaluate interventions that reduce violence among high risk populations of workers in the high risk services, health care, social service, and public safety sectors. Intervention research will include organizational policies and practices and prevention through design approaches.

Performance Measure: *At least two intramural and/or extramural projects or analyses will evaluate the effectiveness of violence reducing interventions in at least two high risk occupational settings within each of the following sectors: services, healthcare, social services, and public safety. The results of these efforts will be published in peer-reviewed journals.*

Activity/Output Goal 3c.1.4: Partner with stakeholders to improve transfer, diffusion, and adoption of effective workplace violence interventions in high risk services, health care, social service, and public safety sector workers.

Performance Measure: *Documented evidence that there has been at least one widely adopted evidence-based workplace violence intervention in each of the following high risk sectors: services, health care, social service, and public safety. Documentation of such adoption includes national or state legislation and dissemination by trade associations and labor unions of “best practices.”*

(Retired) **Sub-Activity/Output Goal 3c.1.4.1:** Utilize partnerships with employers, labor unions, trade associations and government agencies in the services sector to increase the knowledge of workplace violence risks and potential strategies to limit risks, and evaluate the effectiveness of these partnerships.

(Retired) **Sub-Activity/Output Goal 3c.1.4.2:** Develop and implement communication plans for effective workplace violence intervention strategies that are demonstrated to have reached target audiences in the range of small to large employers.

Activity/Output Goal 3c.1.5: Use reliable economic models to accurately assess the costs of fatal and non-fatal injuries and illnesses from workplace violence and the potential savings from reducing incidence and severity of workplace violence events among service and public safety sector workers.

Performance Measure: *At least one intramural or extramural project or analysis will complete a cost assessment for workplace violence related fatal and non-fatal injuries and illnesses for (1) services and (2) public safety workers. The results of these efforts will be published in peer-reviewed journals or NIOSH publications.*

(Retired) **Sub-Activity/Output Goal 3c.1.5.1:** Disseminate return on investment and cost data to promote compliance to NIOSH and OSHA guidelines for workplace violence prevention in high risk service and public safety sectors.

Activity/Output Goal 3c.1.6: Partner with stakeholders to develop and implement communication plans for effective workplace violence intervention strategies that are demonstrated to have reached target audiences in the range of small to large employers.

***Performance Measure:** Documented evidence that at least one widely adopted evidence-based workplace violence prevention program has been implemented by small and/or large high-risk services and public safety sector entities. Documentation of such adoption includes national or state legislation and/or dissemination by trade associations and labor unions of “best practices.”*

Strategic Subgoal 3d (15PPTRISG3d): Identify Prevention Strategies and Effective Interventions to Prevent Workplace Violence by Socio-demographic Characteristics, such as Sex, Age, Race/ethnicity, and National Origin.

Intermediate Goal 3d.1: Industry will implement NIOSH recommendations for effective prevention strategies and interventions to reduce workplace violence by socio-demographic characteristics.

Activity/Output Goal 3d.1.1: Collaborate with industry, academia, government, and other partners to develop socio-demographic specific workplace violence prevention strategies and interventions. Interventions will include organization policies and practices.

***Performance Measure:** At least two intramural and/or extramural projects will assess current and potential prevention strategies and interventions. The results of these efforts will be published in peer-reviewed journals.*

Activity/Output Goal 3d.1.2: Conduct research studies to demonstrate the effectiveness of socio-demographic specific workplace violence prevention strategies and interventions.

***Performance Measure:** At least two intramural and/or extramural projects will evaluate the effectiveness of prevention strategies and interventions within each of two specific socio-demographic classifications (e.g. women, African-Americans, Hispanic-Americans, immigrants). The results of these efforts will be published in peer-reviewed journals.*

Activity/Output Goal 3d.1.3: Collaborate with industry, academia, government, and other partners to promote and evaluate the implementation of effective socio-demographic specific workplace violence prevention strategies and interventions.

***Performance measure:** Documented evidence that there has been at least one widely adopted evidence-based prevention strategy and intervention that limits risks in specific socio-demographic populations (e.g. women, African-Americans, Hispanic-Americans, immigrants). Documentation of such adoption includes national or state guidelines and dissemination by trade associations and labor unions of “best practices.”*

Activity/Output Goal 3d.1.4: Use reliable economic models to accurately assess the costs of fatal and non-fatal injuries and illnesses from workplace violence and potential savings from reducing incidence and severity of workplace events among socio-demographic specific characteristics.

***Performance Measure:** At least two intramural and/or extramural projects will complete an assessment of return on investment due to implementation of strategies or interventions within two socio-demographic classifications. The results of these efforts will be published in peer-reviewed journals or NIOSH publications.*

Strategic Goal 4: Reduce Occupational Injuries and Deaths due to Machines and Industrial Vehicles

Strategic Subgoal 4a: Reduce Occupational Injuries and Deaths in Industries at High Risk for Mobile Machine and Industrial Vehicle Overturns.

Intermediate Goal 4a.1: Government agencies, equipment manufacturers, and farming groups will work together in a Prevention-through-Design (PtD) effort to increase the use of Rollover Protective Structures (ROPS) on tractors in the agricultural production industry and other high risk industries.

(Retired) **Activity/Output Goal 4a.1.1:** Provide data to manufacturers on the effectiveness of cost-effective rollover protective structures (CROPS) for existing ROPS retrofit programs (e.g. New York and Virginia programs).

(Retired) **Activity/Output Goal 4a.1.2:** Partner with manufacturers to provide cost-effective rollover protective structures (CROPS) for existing ROPS retrofit programs (e.g. New York and Virginia programs).

Activity/Output Goal 4a.1.3: Partner with the NIOSH Agricultural Health Centers, equipment manufacturers, and other stakeholders to increase the percentage of farm tractors in the U.S. equipped with ROPS.

Performance Measure: National prevalence of ROPS on tractors will have reached 72%.

Activity/Output Goal 4a.1.4: Partner with the USDA, National Agricultural Statistics Service (NASS) to continue monitoring the prevalence of ROPS-equipped tractors used on agricultural production establishments in the U.S.

Performance Measure: Partner with NASS to monitor the percentage of ROPS in use on farms until prevalence reaches at least 72%.

Intermediate Goal 4a.2: Government agencies, equipment manufacturers, and industry groups will work together in a Prevention-through-Design (PtD) effort to increase the use of new ROPS technologies on mobile machines at high risk for overturns.

(Retired) **Activity/Output Goal 4a.2.1:** Work with volunteer standards organizations to finalize the adoption of an AutoROPS standard for use on zero-turn mowers and similar mobile machines.

(Retired) **Activity/Output Goal 4a.2.2:** Partner with zero-turn mower manufacturers to transfer AutoROPS technology to the industry.

Activity/Output Goal 4a.2.3: Identify mobile machine with a high risk for overturn and partner with one or more equipment manufacturers to develop a rollover prevention/protection strategy.

Performance Measure: NIOSH or partners will have worked with one or more equipment manufacturer(s) to develop a rollover prevention/protection strategy for three high risk machines. Results of these efforts will be documented in peer-reviewed and trade journal articles.

Strategic Subgoal 4b: Reduce Occupational Injuries and Deaths in Industries at High Risk for Mobile Machine and Industrial Vehicle Non-overturn Events.

Intermediate Goal 4b.1: Government agencies, equipment manufacturers, and industry groups will work together in a Prevention-through-Design (PtD) effort to decrease pedestrians being struck by mobile machinery and industrial vehicles.

Activity/Output Goal 4b.1.1: Work with industry partners and OSHA to develop controls to reduce fatal injuries due to forklifts.

Performance Measure: NIOSH or partners will have worked with one or more equipment manufacturer(s) to develop engineering controls or other prevention strategies. Results of these efforts will be documented in peer-reviewed and trade journal articles.

Activity/Output Goal 4b.1.2: Work with mining industry partners to develop interventions for preventing injuries related to machine safety and powered haulage equipment.

Performance Measure: The next generation Proximity Warning System for underground coal mine face equipment will be commercially available, and the proximity detection manufacturers will adopt the concepts and algorithms developed as part of the intelligent proximity research.

Activity/Output Goal 4b.1.3: Partner with the NIOSH Agricultural Health Centers, equipment manufacturers, and other stakeholders to decrease the deaths and injuries to pedestrians struck by farm tractors and other agricultural machines.

Performance Measure: Form and strengthen partnerships with two NIOSH Agricultural Safety and Health Centers and one stakeholder to decrease the deaths and injuries to pedestrians struck by farm tractor and other agricultural machines.

Activity/Output Goal 4b.1.4: Disseminate to the commercial logging industry proven or promising prevention strategies to address key injury risk factors.

Performance Measure: Form and strengthen partnerships between NIOSH and at least one forestry safety and health organization to disseminate prevention strategies. Results of these efforts will be documented by formal letters and/or memoranda of agreement and at least one trade journal article.

Activity/Output Goal 4b.1.5: Develop new solid-state lighting technologies to increase the safety of workers in underground mines, particularly by improving miners' visual performance so they can better recognize slip, trip, and fall hazards, as well as pinning and striking hazards from moving machinery.

Performance Measure: At least one manufacturer incorporates NIOSH solid-state lighting recommendations into their approved mine illumination system.

Intermediate Goal 4b.2: Government agencies, equipment manufacturers, and industry groups will work together in a Prevention-through-Design (PtD) effort to decrease other injury events caused by mobile machinery and industrial vehicles.

Activity/Output Goal 4b.2.1: Validate a computer simulation model to analyze the impact of dynamic loading of scissor-lifts for evaluating fall, collapse and tip-over incidents for use in improving equipment design and developing effective safety devices for adoption by equipment manufacturers.

Performance Measure: The validated and refined simulation model will be used by major scissor-lift manufacturers and consensus standards committee members to improve equipment design and redesign.

Strategic Subgoal 4c: Reduce Occupational Injuries and Deaths in Industries at High Risk for Stationary Machine Entanglements.

Intermediate Goal 4c.1: Government agencies, equipment manufacturers, and industry groups will work together to use existing or new technologies and training programs to prevent machinery entanglements.

Activity/Output Goal 4c.1.1: Work with the ANSI B11 safety standards for machines committees and OSHA on the adoption of new ANSI and ISO methods for machine risk reduction.

Performance Measure: NIOSH will be an active member of the ANSI B11 Accredited Standards Committee by developing, reviewing, and commenting on standards as applicable.

Activity/Output Goal 4c.1.2: Work with small businesses to limit entanglement events.

Performance Measure: Best practice guidelines for owners/operators will be available for preventing stationary machine entanglements that address most high risk machines. These guidelines will be published by NIOSH or partners.

(Retired) **Activity/Output Goal 4c.1.3:** Work with the mining industry to develop interventions, best practices and strategies for improving miners' training with respect to hazard recognition, risk factor awareness, and emergency response.

Intermediate Goal 4c.2: Government agencies, equipment manufacturers, and industry groups will work together in a Prevention-through-Design (PtD) effort to evaluate and adopt new technologies to prevent machinery entanglements.

Activity/Output Goal 4c.2.1: Partner with the U.S. Coast Guard and the commercial fishing industry to continue adoption of emergency-stop (e-stop) and other machine safety technologies.

Performance Measure: Available mechanical guarding, e-stop technologies and deck machinery safety best practices will be in use in the East Coast Multi-Species Groundfish and in the Gulf of Mexico Shrimp fisheries. Partnerships and the state of intervention adoption will be documented by at least three trade journal articles.

(Retired) **Activity/Output Goal 4c.2.2:** Complete the testing and market development of passively controlling hazardous energy during un-jamming tasks on industrial machines for adoption by manufacturers.

(Retired) **Activity/Output Goal 4c.2.3:** Complete testing and market development of the NIOSH radio frequency (HASARD) device for passively controlling hazardous energy from worker proximity to conveyors and communicate the findings to manufacturers.

Activity/Output Goal 4c.2.4: Work with manufacturers to investigate new technologies for improving situational awareness so miners are able to take steps to decrease his/her exposure to machine or moving equipment related injuries.

Performance Measure: Make applicable design guidelines available to the mining industry.

Strategic Subgoal 4d: Reduce Occupational Injuries and Deaths due to Machines and Industrial Vehicles through the Identification of New Hazards and Risk Factors.

Intermediate Goal 4d.1: Government agencies, equipment manufacturers, and industry groups will work together to analyze and evaluate surveillance data for deaths and injuries caused by machinery and industrial vehicles.

Activity/Output Goal 4d.1.1: Characterize and track injuries and fatalities from machinery and industrial vehicles.

Performance Measure: Analyses characterizing injuries and fatalities associated with machinery and industrial vehicles will be published at least every five years.

Activity/Output Goal 4d.1.2: Identify and prioritize risk factors associated with machinery and industrial vehicles through stakeholder group collaboration.

Performance Measure: In at least one project, work with stakeholder groups for “high risk” machinery or industrial vehicles to identify risk factors through risk assessment.

Activity/Output Goal 4d.1.3: Identify work situations of high risk for machine-related fatal injury and develop prevention strategies for those who can intervene in the workplace by conducting Fatality Assessment and Control Evaluation (FACE) investigations of targeted occupational fatality incidents in industries at high risk for machinery-related deaths.

Performance Measure: At least every five years, the results and recommendations from FACE investigations will be made available to industries at high risk for machine-related deaths using health marketing techniques and social media.

Intermediate Goal 4d.2: Government agencies, equipment manufacturers, and industry groups will work together to prioritize new research and intervention strategies based on machinery and industrial vehicles surveillance activities.

Activity/Output Goal 4d.2.1: Partner with high risk industries to identify and prioritize research and intervention programs for risk factors found to be associated with machinery and industrial vehicles.

Performance Measure: Partner with at least three high risk industries to implement intervention programs based on published research identifying risk factors for common machine and industrial vehicle injuries. Results of these efforts will be documented in peer-reviewed and trade journal articles.

Activity/Output Goal 4d.2.2: Partner with OSHA to identify and prioritize the development of new standards and employer programs based on machinery and industrial vehicles risk factors, engineering control technology, and intervention evaluations.

Performance Measure: Meet at least annually with OSHA to share research on machinery and industrial vehicles risk factors, engineering control technology, and intervention evaluations.

Strategic Goal 5: Reduce Occupational Injuries and Deaths among High Risk and Vulnerable Worker Groups (e.g., young workers, older workers, racial and ethnic minority workers, foreign-born workers, immigrant workers, workers with physical disabilities, day workers, and groups with injury rates that exceed the average for all workers and/or are increasing over-time).

Intermediate Goal 5.1: Employers, unions, regulatory agencies, safety practitioners and researchers will use occupational injury data and surveillance research findings to raise awareness of occupational safety problems among vulnerable worker groups (e.g., young workers, older workers, racial and ethnic minority workers, foreign-born workers), and to guide prevention and research efforts.

Activity/Output Goal 5.1.1: Develop and follow a schedule whereby existing injury surveillance data are analyzed and reported for vulnerable worker groups. These analyses will address injury burden, patterns, and trends.

Performance Measure: Summarize injury and fatality data specific to vulnerable worker groups and update annually on the NIOSH Occupational Health Disparities website.

Activity/Output Goal 5.1.2: Work with external partners (e.g. Wage and Hour Division, OSHA, National Center for Injury Prevention and Control, Child Labor Coalition, American Association of Retired Persons, Experience Works, Hispanic media) to promote the use of surveillance research findings on vulnerable worker groups in public and private sector intervention efforts.

Performance Measure: NIOSH's vulnerable worker-related traumatic injury research findings will be shared during at least 2 partner meetings per year.

Activity/Output Goal 5.1.3: Target specific vulnerable worker groups (i.e., currently foreign-born workers, but other groups could be included in the future) for on-site fatality investigations through the Fatality Assessment and Control Evaluation Program (FACE) and collect information on potential contributors to disparate risks, including informal and formal workplace policies and norms, work arrangements, and worker characteristics.

Performance Measure: Summarize findings from State-FACE reports conducted on deaths to vulnerable workers on the NIOSH State-FACE website every two to three years.

Activity/Output Goal 5.1.4: Meet and communicate regularly with the NIOSH Occupational Health Disparities Program and NIOSH funded researchers looking at vulnerable workers (e.g. state FACE programs, NIOSH grantee researchers) to share findings and experiences, and identify additional opportunities for research and prevention collaborations.

Performance Measure: Conduct at least one meeting annually between the NIOSH Occupational Health Disparities Program and NIOSH staff in other programs, such as surveillance.

Performance Measure: Conduct at least one meeting annually with a NIOSH grantee group to share vulnerable worker-related traumatic injury research findings, and identify possible collaborative research opportunities. Documenting meetings will be done using existing NIOSH reporting mechanisms.

Activity/Output Goal 5.1.5: Develop and disseminate occupational safety and health materials that are age, language and culturally appropriate.

Performance Measure: Produce at least two traumatic injury-related age, language, or culturally appropriate NIOSH products (e.g., NIOSH document, Fact Sheet, website) that address at least one vulnerable worker group every three years. Documenting products will be done using existing NIOSH reporting mechanisms.

Intermediate Goal 5.2: Employers, unions, regulatory agencies, safety practitioners and researchers will use risk factor, human factors engineering, intervention evaluation, work organization, and safety culture research findings to reduce occupational injuries to vulnerable worker groups (e.g. young workers, older workers, racial and ethnic minority workers, immigrant workers, workers with physical disabilities, day workers).

(Retire) **Activity/Output Goal 5.2.1:** Work with the NIOSH Occupational Health Disparities Program to explore partnerships to support risk factor research and intervention evaluations targeted at vulnerable worker groups (e.g. young worker, older workers, immigrant workers, workers with physical disabilities, day workers), including community participatory approaches.

(Retire) **Activity/Output Goal 5.2.2:** Develop and seek funding for follow-back investigations and focused surveys of vulnerable worker groups (e.g. young workers, older workers, immigrant workers, workers with physical disabilities, day workers), in order to supplement existing surveillance data.

Activity/Output Goal 5.2.3 Develop and seek funding for risk factor, human factors engineering, intervention, intervention evaluation, work organization, and safety culture research for vulnerable worker groups.

Performance Measure: Intramural and/or extramural researchers will conduct at least three human factors engineering research projects focusing on vulnerable workers. Results of these efforts will be published in peer-reviewed journals and shared with intramural and extramural partners to improve intervention research on vulnerable populations.

Performance Measure: Intramural and/or extramural research will identify at least five highly effective interventions to reduce injury among vulnerable worker groups. Results of these efforts will be published in peer-reviewed journals. Activity/output goals will be developed to transfer these effective interventions into practice.

(Retire) **Activity/Output Goal 5.2.4:** Work with the NIOSH Office of Extramural Programs to support extramural research to assess risk factors, evaluate interventions, and evaluate

policies to prevent childhood agricultural injuries as part of the NIOSH childhood agricultural injury prevention initiative and disseminate findings to stakeholders.

(Retire) **Activity/Output Goal 5.2.5:** Evaluate risk factors for workplace violence associated with high risk immigrant workers.

(Retire) **Activity/Output Goal 5.2.6:** Evaluate the factors associated with fatal and non-fatal workplace violence incidents among youth worker populations in high risk services sector industries.

Intermediate Goal 5.3: Employers, unions, regulatory agencies, safety practitioners and researchers will use occupational injury data and surveillance research to raise awareness of occupational safety problems among high-risk worker groups (e.g., groups with injury rates that exceed the average for all workers and/or are increasing over time), modify standards, and guide prevention and research efforts.

Activity/Output Goal 5.3.1: Work with external partners (e.g., OSHA, MSHA, US Fire Administration, National Highway Traffic Safety Administration, US Coast Guard, United Mine Workers of America, International Association of Fire Fighters, International Association of Fire Chiefs, National Fire Protection Association, American Society of Safety Engineers) to promote the use of surveillance research findings on high risk worker groups in public and private sector intervention efforts.

Performance Measure: *NIOSH will share high risk worker-related traumatic injury surveillance findings during at least four partner meetings per year. Documenting meetings will be done using existing NIOSH reporting mechanisms.*

Activity/Output Goal 5.3.2: Conduct fatality investigations of line-of-duty fire fighter injury deaths through the NIOSH Fire Fighter Fatality Investigation and Prevention Program to identify contributory factors (e.g., work organization, safety culture, personal protective equipment (PPE) issues), and to develop recommendations for preventing similar deaths in the future.

Performance Measure: *Conduct at least 18 fire fighter fatality investigations annually on targeted causes of traumatic death.*

Performance Measure: *Every five years modify investigation priorities to address the leading causes of fire fighter injury deaths.*

Activity/Output Goal 5.3.3: Develop, seek funding, and complete follow-back investigations and focused surveys of high risk worker groups (e.g. miners, fire fighters, emergency medical services workers, farm workers, fishers), in order to supplement existing surveillance data.

Performance Measure: *NIOSH will complete a report on the NEISS-Work follow-back survey on occupational injuries to emergency medical services (EMS) workers, assess the value of continued surveillance on this population, and prioritize other groups for similar studies.*

Performance Measure: *Use EMS results to determine if the results support the development of an R2P activity/output goal on preventing EMS worker injuries.*

Intermediate Goal 5.4: Employers, unions, regulatory agencies, safety practitioners and researchers will use risk factor, human factors engineering, intervention evaluation, work organization, and safety culture research findings to reduce occupational injuries to high risk worker groups (e.g., groups with injury rates that exceed the average for all workers and/or are increasing over time).

(Retire) **Activity/Output Goal 5.4.1:** Develop, seek funding, and complete follow-back investigations and focused surveys of high risk worker groups (e.g. miners, fire fighters, emergency medical services workers, farm workers, fishers), in order to supplement existing surveillance data.

Activity/Output Goal 5.4.2: Develop and seek funding for risk factor, human factors engineering, intervention, intervention evaluation, work organization, and safety culture research for high risk worker groups (e.g. miners, fire fighters, emergency medical services workers, farm workers, fishers) and geographic areas.

***Performance Measure:** Intramural and/or extramural researchers will conduct at least three human factors engineering research projects focusing on high risk workers. Results of these efforts will be published in peer-reviewed journals and shared with intramural and extramural partners to improve intervention research on vulnerable populations.*

***Performance Measure:** Intramural and/or extramural researchers will identify at least five highly effective interventions to reduce injury among high risk worker groups. Results of these efforts will be published in peer-reviewed journals. Activity/output goals will be developed to transfer these effective interventions into practice.*

Activity/Output Goal 5.4.3: Develop and seek funding for risk factor, intervention, intervention evaluation, work organization, and safety culture research within states with the highest occupational fatality rates in the U.S.

***Performance Measure:** Intramural and/or extramural research will identify at least three highly effective state-based interventions to reduce deaths within states with the highest occupational fatality rates. Results of these efforts will be published in peer-reviewed journals. Activity/output goals will be developed to transfer these effective interventions into practice.*

Strategic Goal 6: Increase the Use of Surveillance Data to Guide Occupational Traumatic Injury Research and Prevention Efforts.

Intermediate Goal 6.1: Employers, unions, regulatory agencies, safety practitioners and researchers will use occupational injury surveillance data to raise awareness of occupational safety problems and guide prevention and research efforts.

Activity/Output Goal 6.1.1: Partner with other federal agencies to analyze, modify or piggyback on their data collection systems and infrastructure to analyze and collect data on occupational injury deaths, nonfatal injuries, hazards, organizational policies and safety climate, Prevention-through-Design (PtD) information, and economic and societal costs data in a cost-effective manner.

Performance Measure: Maintain existing Interagency Agreements, Memorandum of Understandings, or Letter of Agreements with agencies such as the Bureau of Labor Statistics (provider of the Census of Fatal Occupational Injuries surveillance data), the Consumer Products Safety Commission (provider of the NEISS-Work surveillance data), and the US Coast Guard (provider of data on deaths and injuries in the commercial fishing industry).

Performance Measure: Expand existing collaborative relationships with the Bureau of Labor Statistics by conducting at least one detailed analysis of the Survey of Occupational Injuries and Illnesses per year.

Performance Measure: Partner with the Bureau of Labor Statistics (BLS) and the National Highway Traffic Safety Administration (NHTSA) to conduct a match of two data systems, the Census of Fatal Occupational Injuries from the BLS and the Fatal Analysis Reporting System from NHTSA.

Performance Measure: Monitor and document, where possible, changes in existing data collection systems that are made based on NIOSH recommendations. Documenting changes will be tracked through existing NIOSH reporting mechanisms.

Activity/Output Goal 6.1.2: Work with the NIOSH Office of Extramural Programs to support, enhance and expand state-level occupational injury surveillance programs that use existing state-level occupational injury data for state-level prevention, and collect unique state-level data to guide prevention efforts and fill gaps in national occupational injury surveillance systems.

Performance Measure: Work with FACE cooperative agreement program grantees to identify changes to FACE investigation priorities, including identifying emerging occupational fatality issues. FACE targets will be reassessed every three to four years.

Performance Measure: Collaborate with NIOSH state-based surveillance grantees on one high risk nonfatal injury outcome (e.g., amputations, burns) every two to three years.

Activity/Output Goal 6.1.3: Develop and follow a schedule whereby existing occupational injury surveillance data are analyzed and reported by NORA industry sector and event, to the greatest level of detail as supported by the data. These analyses will address injury burden, patterns, and trends.

Performance Measure: NORA Industry Sector Managers will be provided with summary analyses from the most recent year of the Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries and Illnesses (SOII) on an annual basis. Summaries provided in future years will provide prior year(s) data for tracking purposes by Sector Managers. After the initial summaries are provided, obtain feedback from Sector Managers to ensure future summaries meet their needs.

Activity/Output Goal 6.1.4: Provide relevant occupational injury surveillance data to external partners and the public.

Performance Measure: Respond to and track requests for technical assistance for occupational injury surveillance data, providing guidance and results as appropriate.

Documenting technical assistance requests will be done using existing NIOSH reporting mechanisms.

Activity/Output Goal 6.1.5: Disseminate occupational injury surveillance data and associated prevention recommendations in collaboration with state agencies and other partners.

Performance Measure: Develop and disseminate at least one traumatic injury surveillance product annually with a state agency or other external partner. Documenting new products will be tracked through existing NIOSH reporting mechanisms.

Activity/Output Goal 6.1.6: Increase access to occupational injury surveillance data through the internet.

Performance Measure: Release NIOSH adult farm injury survey results on the NIOSH website, followed by the release of the NIOSH farm safety surveys.

Performance Measure: NIOSH will publicly release NEISS-Work surveillance data from 1998 forward via an online query system with new data added annually.

Performance Measure: The NIOSH Fire Fighter Fatality Map website using data from the US Fire Administration will be made available on the NIOSH website. The fatality map website will be updated annually.

(Retire) **Activity/Output Goal 6.1.7:** Provide technical assistance on collecting, analyzing and interpreting occupational injury surveillance data.

Intermediate Goal 6.2: NIOSH will support research into the contributors to under-reporting of nonfatal occupational injuries, improvements to existing surveillance systems tracking injuries at varying levels of severity (e.g., Emergency Department, Trauma Registries, Hospital Discharge), and additional systems that provide supplementary data on occupational fatal injuries, nonfatal injuries, hazards, and use of control strategies.

(Retire) **Activity/Output Goal 6.2.1:** Develop a prioritized list of research questions and promising research approaches to understand under-reporting and improve occupational nonfatal injury surveillance in conjunction with other federal agencies, statistical and research organizations, and academic researchers.

(Retire) **Activity/Output Goal 6.2.2:** Meet annually with the Bureau of Labor Statistics to exchange information, coordinate surveillance activities, identify data gaps (including gaps in denominator data), and develop strategies to address these gaps.

Activity/Output Goal 6.2.3: Work with federal agencies, academicians and other internal and external partners to research innovative approaches to document the experience of worker groups who are not well captured in the conventional occupational injury surveillance systems (e.g. immigrant workers, workers with disabilities, contract workers, day laborers, and volunteers).

Performance Measure: Meet annually with the Bureau of Labor Statistics, Council of State and Territorial Epidemiologists, NIOSH State-based Surveillance grantees, and the National Center for Injury Prevention and Control to exchange information, coordinate surveillance

activities, identify data gaps (including gaps in denominator data), and develop strategies to address these gaps.

Activity/Output Goal 6.2.4: Support the inclusion of standardized codes and narrative information on work-relatedness, occupation, industry, and circumstances of injury, organizational policies and safety climate, Prevention-through-Design (PtD) information, and economic and societal costs data in existing data systems.

Performance Measure: Every two years, at least one existing data system will add occupational injury variables (e.g., injury module in the National Agricultural Workers Survey; industry, occupation, and improved capture of work-relatedness in the Fatal Analysis Reporting System).

Performance Measure: Through collaborations with the Public Health Data Standards Consortium, CDC, and other federal partners, the Office of the National Coordinator will adopt injury external cause, status, activity, and location codes as required fields for Electronic Health Records in the US.

(Retire) **Activity/Output Goal 6.2.5:** Work with federal and state agencies and other internal and external partners to explore the addition of economic burden variables to existing and under-development surveillance systems.

(Retire) **Activity/Output Goal 6.2.6:** Work with federal and state agencies and other internal and external partners to explore the addition of variables on personal protective technology and other control strategies in existing and under-development surveillance systems.

(Retire) **Activity/Output Goal 6.2.7:** Develop and seek funding for surveillance research methods projects and projects that address NORA industry sector goals to improve industry sector-specific surveillance.

Activity/Output Goal 6.2.8: Work with the NIOSH Office of Extramural Programs and NORA Sectors to increase occupational injury surveillance research, including evaluations of existing surveillance systems and methods, and the development of innovative approaches to conducting occupational injury surveillance at the national, state, and/or local level.

Performance Measure: Intramural and/or extramural researchers will conduct at least three research projects focusing on innovative occupational injury surveillance approaches. Results of these efforts will be published in peer-reviewed journals and shared with intramural and extramural partners.

Activity/Output Goal 6.2.9: Contribute new research findings to existing underreporting knowledge in order to improve nonfatal occupational injury surveillance.

Performance Measure: Conduct an expert panel to review and comment on how to interpret, present, and disseminate NIOSH underreporting research results by 2015.

Performance Measure: NIOSH will synthesize results from internal, BLS, OSHA, and other studies on the underreporting of occupational injuries and develop recommendations for reducing the magnitude of underreporting in occupational injury surveillance systems.

Activity/Output Goal 6.2.10: Support the development and assessment of leading indicators of occupational injury (e.g., active hazard assessments, percentage of employees receiving safety training, measures of establishment safety climate) by employers, professional organizations, and external researchers to promote injury prevention activities at the employer level.

Performance Measure: NIOSH will use intramural or extramural research identifying validated leading indicators of occupational injuries to develop activity/output goals to transfer research findings into practice.

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