

## II. Executive Summary

Traumatic injuries incurred during work represent an age-old affliction of humankind. In the United States, employers and government administrators were rarely concerned about workplace safety prior to the latter half of the 19<sup>th</sup> century, when the increasing frequency and scale of industrial disasters and the availability of injury and fatality data, brought into focus the plight of workers in high-risk jobs such as mining, railroad work, manufacturing, and construction. The first Federal law addressing work injury (particularly in mining and railroad work) was the Safety Appliance Act of 1893. The first agency with a safety mission was the U.S. Bureau of Mines (USBM), established in 1910 partly in response to one of the worst workplace disasters in U.S. history—the 1906 explosion and fire at a Monongah, West Virginia coal mine that claimed the lives of 362 miners.

The earliest agency with a responsibility for occupational safety and health research, including traumatic injury (TI) research, was the Office of Industrial Hygiene and Sanitation created in the Public Health Service in 1914. Although often relocated, renamed, and transformed, this research organization survived to eventually become the Bureau of Occupational Safety and Health (BOSH) in 1968. When the Occupational Safety and Health Act (OSH Act) of 1970 created the NIOSH, the new Institute absorbed the principal functions of BOSH.

Largely patterned upon the organizational and functional model of its immediate predecessor BOSH, the Institute initially focused most of its resources upon occupational health issues. In particular, NIOSH developed an extensive list of research priorities in support of criteria development efforts that fed the standards development program of the Occupational Safety and Health Administration (OSHA). Although NIOSH acknowledged its “safety” research mandate in the initial OD staffing plan (an Associate Director for Safety in the Office of the Director and shortly thereafter a Coordinator for Safety Standards Development in the Office of Research and Standards Development), early TI research was piecemeal and scattered across the Institute in a handful of sections and labs.

Examples of early TI-related research and prevention efforts in NIOSH included a personal protective equipment (PPE) testing and certification program inherited from the USBM, a small research section that studied behavioral and motivational factors associated with TI, and a small branch that provided workplace safety consultation to other government agencies and corporations. Both of the latter were located in the large Division of Laboratories and Criteria Development in Cincinnati. A small task force in the Division of Technical Services produced dozens of industry-specific safety and health manuals called Health and Safety Guides (HSGs), which partially addressed TI hazards and provided TI prevention recommendations.

TI research priorities for NIOSH were initially developed based upon the opinions of a sample of safety professionals obtained by survey and a review of literature. Early NIOSH TI research strategies consciously omitted consideration of high-risk occupational activities such as motor-vehicle operation and mining, mainly due to the large research efforts of other agencies in these areas. It was not until 1977 that NIOSH formed the Division of Safety Research, the first Division-level focus for the TI Research Program. The new Division carried on the testing and certification program for respirators and other PPE, but in its attempt to address the broader array

of TI issues, recognized the need for a systematic approach to identifying and prioritizing problems. TI sought to apply the public health approach to TI research and prevention, and to base TI Program priorities and direction upon injury and fatality data. Responding to the lack of national data systems that precluded even a basic count of worker deaths in the U.S., TI created the National Traumatic Occupational Fatalities (NTOF) surveillance system in 1984. NTOF verified the huge death toll caused by motor-vehicles, industrial machines, and falls from elevation, and revealed the importance of violence as a cause of traumatic occupational fatalities.

Responding to the lack of more detailed, circumstantial information on traumatic work injuries, TI initiated a workplace fatality investigation program known initially as the Fatal Accident Circumstances and Epidemiology (FACE) Program, and later as Fatality Assessment and Control Evaluation program. FACE enabled clearer understanding of fatality causation and opportunities for prevention.

Other gaps in the TI Program's public health approach were gradually perceived and addressed by TI Program managers. Gaps in analytic epidemiology research, which enables more precise characterization of risk, and intervention evaluation research, which provides data on prevention effectiveness, were addressed by the formation of a new research branch—Analysis and Field Evaluations Branch—in the early 1990s.

A large gap in the ability of the TI Program to identify and develop prevention options through engineering and other safety sciences analyses was addressed by the development of a research strategy and the formation of the Protective Technology Branch.

Difficulties in providing relevant risk and prevention information to the individuals, organizations, and companies—particularly those at risk—prompted the development of a targeted dissemination approach in TI, which, along with experimentation with health communication, social marketing, and technology transfer approaches, fed the development of what ultimately became the NIOSH-wide Research-to-Practice(r2p) initiative.

Finally, the lack of a national forum to facilitate information sharing and research collaboration among the nation's occupational injury researchers prompted TI to organize the National Occupational Injury Research Symposium (NOIRS). The first NOIRS was conducted in Morgantown, the home of DSR, in October 1997. Subsequent NOIRS were held in Pittsburgh in 2000 and 2003.

TI has used data from the NTOF Surveillance System and the BLS Census of Fatal Occupational Injuries (CFOI), as well as nonfatal occupational injury data from BLS and the National Electronic Injury Surveillance System (NEISS) managed by the Consumer Product Safety Commission (CPSC), to identify major TI problem areas, set program priorities, and establish research goals. Other inputs to the TI Program include Congressional directives and research needs outlined by the National Occupational Research Agenda (NORA) Traumatic Injury team in a 1998 white paper. Assessment of these inputs led TI to establish eight main research goals that have dictated TI efforts during most of the evaluation period for the NA review—i.e., 1996 through 2005. The eight research goals are:

1. Reduce injuries and fatalities due to motor-vehicles
2. Reduce injuries and fatalities due to falls from elevations

3. Reduce injuries and fatalities due to workplace violence
4. Reduce injuries and fatalities due to machines
5. Reduce acute back injury
6. Reduce injuries and fatalities among workers in Alaska
7. Reduce injuries and fatalities to emergency responders
8. Reduce injuries and fatalities to working youth

*Outputs.* Since 1996, TI has authored 55 NIOSH documents addressing the eight research goals. More than 1.7 million copies of these documents have been distributed to date. TI researchers have authored 120 journal articles addressing the eight research goals; these articles have been cited in other literature at least 583 times. TI publications and other outputs have been reprinted, redistributed, and incorporated into training courses, campaigns, and informational products by other organizations.

TI has also employed engineering approaches to study and design new protective technologies and products. For example, TI researchers have

- Made recommendations for redesigned patient compartments in ambulances incorporating enhanced safety features
- Developed sizing schemes based more closely upon today's workforce to ensure that new fall-arrest harnesses that will be more appropriately sized, and recommended design features to reduce the risk of "suspension trauma"
- Designed and tested new automatically deploying roll-over protective structures (ROPS) for agricultural tractors
- Developed safety interventions to prevent injuries and deaths from using winches on the decks of commercial fishing vessels.

*Outcomes.* These outputs have been used by other researchers, manufacturers, employers and others in their own prevention efforts and products. For example, TI program data, findings, recommendations, and direct staff participation have contributed to or influenced:

- Increased awareness of traumatic occupational injury and fatality risks and prevention options
- Increased research and subsequent research publication by other researchers and research organizations
- Development of new or modified products featuring improved safety-enhanced design
- Acquisition and use of new equipment and products
- Adoption of safe work procedures
- Direct compliance or inspection activities by agencies with specific jurisdictional authority
- Promulgation of new or changed regulations, standards, and guidance issued by various standards-setting agencies
- Reductions in numbers and rates of specific types of traumatic occupational injuries and fatalities.

TI findings, recommendations, and direct participation have contributed to promulgation of Federal and State regulations, national voluntary consensus standards, and compliance guidelines. For example, research and recommendations from the TI Program were cited among

the justifications for new Federal child labor regulations that went into effect in February 2005. These changes have the potential to reduce young worker deaths and injuries associated with working on roofs, compactors and balers, driving, and the manufacture of explosives. The Department of Labor reports that they continue to consider NIOSH recommendations for child labor law changes and will be proposing additional rule changes in the future. TI staff members were instrumental in the development and passage of the first occupational safety standard aimed at protecting workers who drive motor-vehicles as part of their jobs, but who are not covered by the Federal Motor Carrier Safety Regulations that cover professional drivers (ANSI Z15.1—Safe Practices for Motor-Vehicle Operation). TI data, investigations, and recommendations (and collaborative efforts with OSHA and the National Association of Tower Erectors (NATE)) informed both the OSHA guidance issued on safe telecommunications tower construction and maintenance and the first State telecommunication tower standard (North Carolina).

TI research and outreach efforts also informed State legislators who recently enacted laws in six States addressing safe patient lifting practices in nursing homes. Findings from TI research on baler safety have been used by the ANSI Z245.5 standards committee in a revision of the Baling Equipment Safety standard. Baler manufacturers are already providing purchasers of new balers with safety equipment and safety instructions that meet the revised standard's requirements. The National Fire Protection Association (NFPA) 1982 PASS standard was recently revised and issued (effective December 20, 2006) based upon TI information from its investigations of fire fighter fatalities.

As a result of safety conferences and workshops and interagency collaborations that were organized and led by TI in Alaska, certain agencies with specific inspection and compliance mandates directly intervened to halt hazardous operations. For example, after participating in a Vessel Loss Prevention Working Group at the November 1997 FISH Workshop in Seattle, the U.S. Coast Guard (USCG) designed and implemented a Dockside Pre-season Boarding program to perform safety inspections in order to identify and correct safety hazards known to exist in the Bering Sea crab fisheries. Similarly, after a rash of fatal crashes of helicopters engaged in logging operations, TI convened emergency meetings of an interagency working group which led to direct intervention by the U.S. Forest Service, the Alaska Department of Labor (AKDOL), and the Federal Aviation Administration (FAA). On-site inspections led FAA and AKDOL to close down dangerous helicopter logging operations.

TI research and development activities, and partnerships with other safety researchers and vehicle and equipment manufacturers have resulted in, or are leading toward, the availability of new and modified products with enhanced safety features, including:

- New ambulances with redesigned patient compartments incorporating enhanced safety features that are based upon TI recommendations
- New fall-arrest harnesses that will be more appropriately sized for today's workforce, and will incorporate design features to reduce the risk of "suspension trauma"
- New automatically deploying roll-over protective structures (ROPS) for agricultural tractors designed and tested by TI
- New TI-developed safety interventions to prevent injuries and deaths from using winches on the decks of commercial fishing vessels

TI research outputs are often used to develop training materials and courses and safety guidance in many other forms. For example, an encouraging preliminary finding from a recent evaluation of the TI Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) is that TI recommendations have been used by approximately 11,000 fire departments to update the content of their training programs.

Also, the American Road and Transportation Builders Association (ARTBA) and the National Safety Council (NSC) consulted with TI researchers in developing an OSHA 10-hour training course specifically for the road construction industry. Key measures from a NIOSH document on work zone safety were incorporated in the course training materials.

The contribution of TI surveillance and research likely contributed to an increase in research addressing workplace violence (WPV). The number of WPV-related publications increased dramatically from 1970 to 2004 in the Medline database following media attention to TI surveillance reports on the scope and characteristics of WPV. Similar trends have been noted in the business, occupational safety and health, and legal literature. The dramatic upturn in interest in WPV, expressed in a high volume of published literature, occurred in the period from the late 1980s to the early 90s, coincident with TI surveillance findings and early reports in the literature indicating that homicide was a leading cause of traumatic occupational fatality.

From 1996 to 2005, traumatic occupational fatalities among the U.S. workforce declined 39 percent. It is likely that the TI Program has contributed to this decline. While efforts of many external entities have also influenced the reduction in worker deaths, the TI contribution to this decrease is reinforced by decreases in specific goal areas where TI has concentrated efforts. For example, TI surveillance, research, intervention evaluation, and national leadership efforts addressing workplace violence have contributed to a reduction in the number of workplace homicides. TI efforts in Alaska have likely contributed to an overall reduction in fatal work injuries, with specific reductions in the number and rate of commercial fishing fatalities (especially among crab fishermen), and helicopter logging crashes and related deaths. TI research has also contributed to reductions in back injuries in nursing home employees, and injuries to youth working on farms. These are a few of the ways in which the NIOSH TI Research and Prevention Program has contributed toward reducing the risk and the actual toll of traumatic occupational injuries in the U.S. The narratives describing TI activities, outputs, and outcomes that are presented in this evidence package present these and other positive impacts on worker safety. TI is dedicated toward increasing program impact and welcomes the scrutiny that the National Academies Evaluation Committee will bring to bear on the program.

