



NORA

NATIONAL OCCUPATIONAL RESEARCH AGENDA (NORA)

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NATIONAL TRANSPORTATION, WAREHOUSING, AND UTILITIES AGENDA

FOR OCCUPATIONAL SAFETY AND HEALTH RESEARCH
AND PRACTICE IN THE U.S. TRANSPORTATION,
WAREHOUSING, AND UTILITIES (TWU) SECTOR

**Developed by the NORA Transportation, Warehousing, and Utilities Sector
Council**

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ACRONYMS

BLS	Bureau of Labor Statistics
CFOI	Census of Fatal Occupational Injuries
CVD	Cardiovascular disease
DAFW	Days away from work
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety and Health
NORA	National Occupational Research Agenda
TWU-SC	Transportation, Warehousing, and Utilities Sector Council
TWU	Transportation, Warehousing, and Utilities
WMSD	Work-related musculoskeletal disorders

INTRODUCTION

What is NORA?

The National Occupational Research Agenda (NORA) is a partnership program to stimulate innovative research and workplace interventions that will lead to improvements in worker safety and health. Unveiled in 1996, NORA has become a research framework for the National Institute for Occupational Safety and Health (NIOSH) and the nation. Diverse parties collaborate to identify the most critical issues in workplace safety and health and to develop goals and objectives for addressing these needs.

NORA entered its second decade in 2006 with a new structure based on the premise that the conceptualization of research and movement of research results to the workplace is best accomplished by those who are knowledgeable about the problems and work environment within specific industry groups. NIOSH is the steward of NORA and facilitates the work of the multi-stakeholder NORA Sector Councils, which are developing and implementing research agendas for the occupational safety and health community over the decade (2006-2016).

The new “sector-based” structure for NORA groups industries into eight sectors using North American Industry Classification System (NAICS) codes. The Transportation, Warehousing, and Utilities (TWU) sector encompasses NAICS code groupings 48, 49, and 22. The Transportation sector (NAICS 48) covers all modes of transporting passengers and cargo: air, rail, water, road, and pipeline; as well as support activities related to all modes. The Warehousing sector (NAICS 49) consists of establishments engaged primarily in warehousing and storage of goods. The Utilities sector (NAICS 22) covers electric power, natural gas, water, sewage, and other systems.

What is the NORA Transportation, Warehousing, and Utilities Sector Council (TWU-SC)?

The NORA Transportation, Warehousing, and Utilities Sector Council (TWU-SC) is made up of approximately 25 individuals who represent diverse interests across this wide-ranging sector. The TWU-SC is co-led by one NIOSH representative and another member from outside NIOSH.

The mission of the TWU-SC is: *To implement a focused program of surveillance, research, and prevention that leads to a sustained reduction in occupational injuries, illnesses, and fatalities in this industry sector.*

The TWU-SC draws on an active group of Corresponding Members who participate in ad hoc working groups and serve as reviewers of Council products. Because the TWU sector is so diverse, the Corresponding Members are valuable sources of specialized knowledge that may not reside within the Council itself.

What does the National Agenda for TWU represent?

This is the first effort to create a national occupational safety and health agenda for the transportation, warehousing, and utilities industry sector. It is intended to identify the research,

information, and actions most urgently needed to further prevention of occupational injuries and illnesses in the TWU sector. This National Agenda for TWU provides a vehicle for industry stakeholders to describe the most relevant issues, gaps, and safety and health needs for the sector.

The following draft National Agenda for TWU reflects the breadth and diversity of the sector. It is the product of a challenging process that set out to identify the highest-priority issues to be addressed through research and stakeholder actions. Because the Agenda is intended to delineate national *priorities* for the TWU sector, it cannot at the same time be an *inventory* of all issues worthy of attention. The omission of a topic does not mean that topic was viewed as unimportant. Those who developed this draft did, however, believe that the number of topics should be small enough so that resources could be focused on a manageable set of goals, thereby increasing the likelihood of real impact in the workplace. However, once a topic was selected, the group tried to develop sufficient intermediate goals to address key gaps and needs. Finally, it should be noted that the proposed goals are not tied to any specific budget level or anticipated activity level.

Who are the target audiences?

The National Agenda for TWU will help stakeholders (e.g., industry, labor, safety professionals, and academics) to prioritize their work among the many safety and health issues of interest. It is intended to inspire decision makers and program planners to include these topics in their top priorities, and to guide researchers to relevant topic areas for research proposals. Finally, it is intended to encourage dialogue and partnering among stakeholders on a subset of key issues, thereby increasing our collective ability to make an impact in reducing injuries and illnesses among workers in the TWU industries. Potential users of the Agenda are:

Research funding sources:

- Federal and state agencies
- Research foundations
- Industry-supported research organizations

Public and private researchers:

- Government researchers
- Academic researchers
- Industry and foundation-based researchers

Industry organizations:

- Trade associations
- Vehicle and equipment manufacturers and distributors

Labor organizations

Regulatory agencies at federal, state, and local levels

Public health agencies at federal, state, and local levels

Non-profit organizations

Safety and health practitioners in public and private sectors:

- Individual safety, industrial hygiene, and engineering practitioners
- Health educators and health promotion coordinators
- Consensus standards groups
- Professional associations

- Other professionals with safety and health interests (e.g., economists, occupational physicians, ergonomists)

How was the draft research agenda developed?

NORA was launched with a series of town hall meetings around the country. The meeting that focused on the TWU sector was held on December 5, 2005 in College Park, Maryland. Additional comments related to occupational safety and health priorities for the sector were submitted at other town hall meetings held over the next several months. Written comments were collected through a NORA sector docket. The resulting comments, organized by sector, may be accessed at <http://www2a.cdc.gov/niosh-comments/nora-comments/commentsrch.asp>. Finally, input was solicited at a breakout session dedicated to TWU concerns at the NORA Symposium in April, 2006.

As public input was being collected, potential members for the TWU-SC were being identified and invited to participate. The Council consists of approximately 25 stakeholders representing government, industry, academia, labor, and research organizations. (See <http://www.cdc.gov/niosh/nora/councils/twu/planpart.html> for a list of TWU-SC members.) Prior to the Council's first meeting on November 29, 2006, members prepared worksheets on top occupational safety and health problems, and were asked to consider which actions would most appropriately address those problems. At the meeting, members were briefed on the structure and goals for NORA, the comments received through the town hall meetings and other venues, and current injury and illness data for the TWU sector (see Appendix A for examples of injury and illness data used to identify priority areas).

Subsequent meetings and conference calls led to the identification of strategic areas that would form the basis for **strategic goals**, which capture the key improvements in occupational safety and health to be achieved. Eventually, each strategic goal will be linked with a **performance measure**, a metric that allows tracking of progress toward that goal.

Work groups formed around each strategic goal, co-chaired by TWU-SC members, were charged with drafting intermediate goals to accompany that strategic goal. **Intermediate goals** delineate the expected behaviors of TWU stakeholders that, taken together, contribute to achieving a strategic goal. In turn, **activity/output goals** are specific research or public health prevention activities and outputs relevant to the TWU program. Other interested individuals who are "corresponding members" of the TWU-SC were brought into the work groups, and participated fully in developing intermediate goals and supporting information.

What conditions must be in place if these goals are to be achieved?

In drafting this National Agenda for TWU, the TWU-SC, corresponding members, and partners noted that goals for prevention of occupational injury and illness require strong organizational commitments, and cannot be met without supportive organizational and collaborative linkages.

- First and foremost, the setting of targets for reduction of occupational injuries, illnesses, and fatalities is not intended to imply that any level of injury or illness is acceptable.

Ideally, the efforts of industry, labor, government, the research community, and other interested parties should lead to the elimination of *all* work-related injuries and illnesses.

- The TWU-SC notes the importance of strengthening capacity to apply rigorous research methodology to prevention of work-related injuries and illnesses. The majority of the goals that appear in the following section encompass the full range of the research process: identification of problems and risk factors, development of interventions, evaluation of interventions in the workplace, and finally, broad dissemination and implementation. Formal evaluation of interventions in a work setting is a particularly important part of the process; too often, an intervention may be adopted before its effectiveness in preventing injury or illness is demonstrated.
- Multi-disciplinary research teams can provide a breadth of perspective that will enhance credibility and encourage broader applicability of interventions.
- A culture that supports injury and illness prevention programs at the highest level of the organization is crucial to success. Improved techniques to survey and measure attributes of organizational culture will help safety and health professionals identify changes in policies and practices that will improve safety performance.
- Coordination of injury prevention activities within a single industry or group of industries with common concerns will result in more effective use of scarce resources. One area that would benefit from collaborative activity is the development of integrated safety and health performance measures. Shared knowledge and experience about the predictive value of different outcome measures (e.g., leading, process, and lagging) would further the implementation of industry-appropriate systems for tracking performance.

What are the next steps in this process?

The first step in finalizing the draft goals presented below is to seek feedback from the public to ensure that the broadest possible stakeholder input goes into the final product. The TWU-SC and involved Corresponding Members will evaluate comments from the public and later in 2008, will revise the draft accordingly. Following revision of the draft, the Council will develop an **implementation plan**, which will detail the concrete actions to be undertaken by stakeholders, including NIOSH, to put the National Agenda for TWU into practice. The success of the implementation is dependent upon: the level of interest on the part of key players in participating in Agenda activities that will lead to achieving the goals; the extent to which new research partnerships between industry and the research community can be developed; the availability of research funding; and the availability of researchers with the necessary expertise.

TWU SECTOR GOALS

Strategic Goal 1: By 2016, reduce lost-workday occupational traumatic injury and fatality rates in the TWU sector.¹

Performance measure:

Rate reduction of 20% from 2008 baseline levels in the following sub-sectors: air transportation; rail transportation; truck transportation; transit and ground passenger transportation; couriers and messengers; warehousing and storage; and utilities.

Air Transportation (NAICS 481)

Intermediate Goal 1.1: Industry will incorporate effective interventions into their policies and procedures to prevent aircraft crashes.

Activity Goal 1.1.1: Promote industry collaboration in disseminating information on methods to prevent aircraft crashes.

Intermediate Goal 1.2: Industry will incorporate effective interventions into their policies and procedures to prevent work-related injuries associated with fatigue among air transportation employees.

Activity Goal 1.2.1: Identify risk factors for work-related injuries associated with fatigue among air transportation employees.

Activity Goal 1.2.2: Collaborate with industry to develop and evaluate interventions to reduce risk factors for work-related injuries associated with fatigue among air transportation employees.

Activity Goal 1.2.3: Collaborate with industry to implement and promote effective interventions to reduce risk factors for work-related injuries associated with fatigue among air transportation employees.

Intermediate Goal 1.3: Industry will incorporate effective interventions into their policies and procedures to prevent slips, trips, and falls on working surfaces among air transportation employees.

Activity Goal 1.3.1: Identify risk factors for slips, trips, and falls on working surfaces among air transportation employees.

Activity Goal 1.3.2: Collaborate with industry to develop and evaluate interventions to prevent slips, trips, and falls among air transportation employees.

Activity Goal 1.3.3: Collaborate with industry to implement and promote effective interventions to prevent slips, trips, and falls among air transportation employees.

¹ For supporting data, discussions, and references, see Appendix B.

Intermediate Goal 1.4: Industry will incorporate effective interventions into their policies and procedures to prevent injuries resulting from contact with objects and equipment in air transportation employee groups.

Activity Goal 1.4.1: Identify risk factors for injuries resulting from contact with objects and equipment among air transportation employees.

Activity Goal 1.4.2: Collaborate with industry to develop and evaluate interventions to prevent injuries resulting from contact with objects and equipment among air transportation employees.

Activity Goal 1.4.3: Collaborate with industry to implement and promote effective interventions to prevent injuries resulting from contact with objects and equipment among air transportation employees.

Intermediate Goal 1.5: Industry will incorporate effective interventions into their policies and procedures to prevent physical assaults to air transportation employees.

Activity Goal 1.5.1: Develop new systems or adapt existing systems for surveillance of physical assaults to air transportation employees.

Activity Goal 1.5.2: Identify risk factors for injuries resulting from physical assaults to air transportation employees.

Activity Goal 1.5.3: Collaborate with industry to develop and evaluate interventions to prevent physical assaults to air transportation employees.

Activity Goal 1.5.4: Collaborate with industry to implement and promote effective interventions to prevent physical assaults to air transportation employees.

Rail Transportation (NAICS 482)

Intermediate Goal 1.6: Industry will incorporate effective interventions into their policies and procedures to prevent injuries related to switching activities among railroad operating employees.

Activity Goal 1.6.1: Identify risk factors for injuries related to switching activities among railroad operating employees.

Activity Goal 1.6.2: Collaborate with industry to develop and evaluate interventions to prevent injuries related to switching activities among railroad operating employees.

Activity Goal 1.6.3: Collaborate with industry to implement and promote effective interventions to prevent injuries related to switching activities among railroad operating employees.

Intermediate Goal 1.7: Industry will incorporate effective interventions into their policies and procedures to prevent work-related injuries associated with fatigue among rail transportation employees.

Activity Goal 1.7.1: Identify risk factors for work-related injuries associated with fatigue in employee groups in rail transportation.

Activity Goal 1.7.2: Collaborate with industry to develop and evaluate interventions to reduce risk factors for work-related injuries associated with fatigue in railroad operations.

Activity Goal 1.7.3: Collaborate with industry to implement and promote effective interventions to reduce risk factors for work-related injuries associated with fatigue in railroad operations.

Water Transportation (NAICS 483)

Intermediate Goal 1.8: Industry will incorporate effective interventions into their policies and procedures to prevent work-related injuries among water transportation employees.

Activity Goal 1.8.1: Develop partnerships with industry to implement a surveillance system within the water transportation industry to capture data on work-related injuries other than those associated with vessel incidents.

Activity Goal 1.8.2: Collaborate with industry to develop and evaluate interventions to reduce leading injury risk factors among water transportation employees, as identified by surveillance.

Activity Goal 1.8.3: Collaborate with industry to implement and promote interventions to reduce leading injury risk factors among water transportation employees, as identified by surveillance.

Intermediate Goal 1.9: Industry will incorporate effective interventions into their policies and procedures to prevent work-related injuries associated with fatigue among water transportation employees.

Activity Goal 1.9.1: Identify risk factors for work-related injuries associated with fatigue among water transportation employees.

Activity Goal 1.9.2: Collaborate with industry to develop and evaluate interventions to reduce risk factors for work-related injuries associated with fatigue among water transportation employees.

Activity Goal 1.9.3: Collaborate with industry to implement and promote effective interventions to reduce risk factors for work-related injuries associated with fatigue among water transportation employees.

Truck Transportation (NAICS 484)

Intermediate Goal 1.10: Implement a surveillance system to better ascertain the nature and extent of work-related injuries to truck drivers.

Activity Goal 1.10.1: Develop and coordinate partnerships to identify data gaps on injuries to truck drivers.

Activity Goal 1.10.2: Define methods for collecting, recording, storing, summarizing and disseminating data that describe work-related injuries to truck drivers.

Activity Goal 1.10.3: Implement newly designed or improved surveillance systems for identifying worker injuries among truck drivers.

Activity Goal 1.10.4: Evaluate the effectiveness of surveillance system improvements for capturing injury cause and risk factors among truck drivers.

Intermediate Goal 1.11: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to truck drivers due to vehicle crashes.

Activity Goal 1.11.1: Identify risk factors for vehicle crashes among truck drivers.

Activity Goal 1.11.2: Partner with truck manufacturers, standard-setting bodies, and other stakeholders to increase seat belt usage among truck drivers.

Activity – Partners will develop, implement, and evaluate a training program to increase safety belt use among truck drivers.

Activity – Truck manufacturers will complete design specifications for occupant restraint systems that will more closely conform to body dimensions of the truck driver population.

Intermediate Goal 1.12: Industry will incorporate effective interventions into their policies and procedures to prevent work-related injuries associated with fatigue among truck drivers.

Activity Goal 1.12.1: Identify risk factors for work-related injuries associated with fatigue in truck drivers.

Activity Goal 1.12.2: Collaborate with industry to develop and evaluate interventions to reduce risk factors for work-related injuries associated with fatigue in truck drivers.

Activity Goal 1.12.3: Collaborate with industry to implement and promote effective interventions to reduce risk factors for work-related injuries associated with fatigue in truck drivers.

Intermediate Goal 1.13: Based on updated anthropometric data, results of ergonomic workspace evaluations, and updated design standards, truck manufacturers will modify cab designs.

Activity Goal 1.13.1: Partner with standard-setting bodies and other stakeholders to update standards to specify more ergonomically efficient truck cab design.

Activity Goal 1.13.2: Update anthropometric data for a nationally representative sample of the truck driver population.

Activity Goal 1.13.3: Complete an ergonomic workspace evaluation of the truck cab environment.

Intermediate Goal 1.14: Partner with industry stakeholders to develop, implement, evaluate, and promote interventions into their policies and procedures to prevent falls from trucks and trailers.

Activity Goal 1.14.1: Develop recommendations for truck cab design and work practices guidelines for safe ingress and egress from large trucks.

Activity Goal 1.14.2: Partner with trade associations, industry, and labor unions to evaluate and disseminate large-truck ingress and egress design and work practices guidelines to independent truckers and trucking companies.

Intermediate Goal 1.15: Industry will incorporate effective interventions into their policies and procedures to prevent slips, trips, and falls on working surfaces (e.g., loading docks, trailer surfaces, cab steps, etc.) in truck transportation.

Activity Goal 1.15.1: Identify risk factors for slips, trips, and falls on working surfaces in truck transportation.

Activity Goal 1.15.2: Collaborate with industry to develop and evaluate interventions to prevent slips, trips, and falls on working surfaces in truck transportation.

Activity Goal 1.15.3: Collaborate with industry to implement and promote effective interventions to prevent slips, trips, and falls on working surfaces in truck transportation.

Intermediate Goal 1.16: Industry will incorporate effective interventions into their policies and procedures to prevent injuries resulting from falling objects during loading and unloading operations in truck transportation.

Activity Goal 1.16.1: Identify risk factors for injuries resulting from falling objects during loading and unloading operations in truck transportation.

Activity Goal 1.16.2: Collaborate with industry to develop and evaluate interventions to prevent injuries resulting from falling objects during loading and unloading operations in truck transportation.

Activity Goal 1.16.3: Collaborate with industry to implement and promote effective interventions to prevent injuries resulting from falling objects during loading and unloading operations in truck transportation.

Transit and Ground Passenger Transportation (NAICS 485)

Intermediate Goal 1.17: Implement a surveillance system to better ascertain the nature and extent of work-related injuries among transit drivers.

Activity Goal 1.17.1: Develop and coordinate partnerships to identify data gaps on injuries to transit drivers.

Activity Goal 1.17.2: Define methods for collecting, recording, storing, summarizing and disseminating data that describe work-related injuries among transit drivers.

Activity Goal 1.17.3: Implement newly designed or improved surveillance systems for identifying worker injuries among transit drivers.

Activity Goal 1.17.4: Evaluate the effectiveness of surveillance system improvements for capturing injury cause and risk factors among transit drivers.

Intermediate Goal 1.18: Industry will incorporate effective interventions into their policies and procedures to prevent slips, trips, and falls on working surfaces among transit drivers.

Activity Goal 1.18.1: Identify risk factors for slips, trips, and falls on working surfaces among transit drivers.

Activity Goal 1.18.2: Collaborate with industry to develop and evaluate interventions to prevent slips, trips, and falls on working surfaces among transit drivers.

Activity Goal 1.18.3: Collaborate with industry to implement and promote effective interventions to prevent slips, trips, and falls on working surfaces among transit drivers.

Intermediate Goal 1.19: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to taxi drivers resulting from physical violence.

Activity Goal 1.19.1: Identify risk factors for injuries to taxi drivers resulting from physical violence.

Activity Goal 1.19.2: Collaborate with industry to develop and evaluate interventions to prevent injuries to taxi drivers resulting from physical violence.

Activity Goal 1.19.3: Collaborate with industry to implement and promote effective interventions to prevent injuries to taxi drivers resulting from physical violence.

Couriers and Messengers (NAICS 492)

Intermediate Goal 1.20: Implement a surveillance system to better ascertain the nature and extent of work-related injuries among couriers and messengers.

Activity Goal 1.20.1: Develop and coordinate partnerships to identify data gaps on injuries to couriers and messengers.

Activity Goal 1.20.2: Define methods for collecting, recording, storing, summarizing and disseminating data that describe work-related injuries among couriers and messengers.

Activity Goal 1.20.3: Implement newly designed or improved surveillance systems for identifying worker injuries among couriers and messengers.

Activity Goal 1.20.4: Evaluate the effectiveness of surveillance system improvements for capturing injury cause and risk factors among couriers and messengers.

Intermediate Goal 1.21: Industry will incorporate effective interventions into their policies and procedures to prevent slips, trips, and falls on working surfaces among couriers and messengers.

Activity Goal 1.21.1: Identify risk factors for slips, trips, and falls on working surfaces among couriers and messengers.

Activity Goal 1.21.2: Collaborate with industry to develop and evaluate interventions to prevent slips, trips, and falls on working surfaces among couriers and messengers.

Activity Goal 1.21.3: Collaborate with industry to implement and promote effective interventions to prevent slips, trips, and falls on working surfaces among couriers and messengers.

Intermediate Goal 1.22: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to couriers and messengers resulting from falling objects during loading and unloading operations.

Activity Goal 1.22.1: Identify risk factors for injuries to couriers and messengers resulting from falling objects during loading and unloading operations.

Activity Goal 1.22.2: Collaborate with industry to develop and evaluate interventions for couriers and messengers to prevent injuries resulting from falling objects during loading and unloading operations.

Activity Goal 1.22.3: Collaborate with industry to implement and promote effective interventions for couriers and messengers to prevent injuries resulting from falling objects during loading and unloading operations.

Warehousing and Storage (NAICS 493)

Intermediate Goal 1.23: Industry will incorporate effective interventions into their policies and procedures to prevent slips, trips, and falls on working surfaces in warehousing and storage operations.

Activity Goal 1.23.1: Identify risk factors for slips, trips, and falls on working surfaces in warehousing and storage operations.

Activity Goal 1.23.2: Collaborate with industry to develop and evaluate interventions to prevent slips, trips, and falls on working surfaces in warehousing and storage operations.

Activity Goal 1.23.3: Collaborate with industry to implement and promote effective interventions to prevent slips, trips, and falls on working surfaces in warehousing and storage operations.

Intermediate Goal 1.24: Industry will incorporate effective interventions into their policies and procedures to prevent injuries resulting from contact with objects and equipment in warehousing and storage operations.

Activity Goal 1.24.1: Identify risk factors for injuries resulting from contact with objects and equipment in warehousing and storage operations.

Activity Goal 1.24.2: Collaborate with industry to develop and evaluate interventions to prevent injuries resulting from contact with objects and equipment in warehousing and storage operations.

Activity Goal 1.24.3: Collaborate with industry to implement and promote effective interventions to prevent injuries resulting from contact with objects and equipment in warehousing and storage operations.

Intermediate Goal 1.25: Industry will incorporate effective interventions into their policies and procedures to prevent forklift-related injuries in warehousing and storage operations.

Activity Goal 1.25.1: Identify risk factors for forklift-related injuries in warehousing and storage operations.

Activity Goal 1.25.2: Collaborate with industry to develop and evaluate interventions to prevent forklift-related injuries in warehousing and storage operations.

Activity Goal 1.25.3: Collaborate with industry to implement and promote effective interventions to prevent forklift-related injuries in warehousing and storage operations.

Utilities (NAICS 22)

Intermediate Goal 1.26: Implement a surveillance system to better ascertain the nature and extent of work-related injuries among utilities workers.

Activity Goal 1.26.1: Develop and coordinate partnerships to identify data gaps on injuries to utilities workers.

Activity Goal 1.26.2: Define methods for collecting, recording, storing, summarizing and disseminating data on work-related injuries to utilities workers.

Activity Goal 1.26.3: Implement newly designed or improved surveillance systems for identifying worker injuries among utilities workers.

Activity Goal 1.26.4: Evaluate the effectiveness of surveillance system improvements for capturing injury cause and risk factors among utilities workers.

Intermediate Goal 1.27: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to utilities workers resulting from electrical and chemical burns and from working with energized equipment and tools.

Activity Goal 1.27.1: Identify risk factors for injuries to utilities workers resulting in electrical/chemical burns from working with high/low-voltage panel apparatus and conductors.

Activity Goal 1.27.2: Identify risk factors for cut, crush, and amputation injuries to utilities workers from energized equipment and tools.

Activity Goal 1.27.3: Collaborate with industry to develop and evaluate interventions to prevent injuries to utilities workers resulting in electrical/chemical burns from working with high/low-voltage panel apparatus and conductors.

Activity Goal 1.27.4: Collaborate with industry to implement and promote effective interventions to prevent injuries to utilities workers resulting in electrical/chemical burns from working with high/low-voltage panel apparatus and conductors.

Intermediate Goal 1.28: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to utilities workers resulting from slips, trips and falls from walking and working surfaces, and falls from elevations.

Activity Goal 1.28.1: Identify risk factors for injuries to utilities workers resulting from slips, trips and falls on walking and working surfaces.

Activity Goal 1.28.2: Identify risk factors for injuries to utilities workers resulting from falls from elevations while working on poles, towers, elevated platforms, ladders and scaffolding.

Activity Goal 1.28.3: Collaborate with industry to develop and evaluate interventions to prevent injuries to utilities workers resulting from slips, trips and falls on walking and working surfaces and elevations.

Activity Goal 1.28.4: Collaborate with industry to implement and promote effective interventions to prevent injuries to utilities workers resulting from slips, trips and falls on walking and working surfaces and elevations.

Intermediate Goal 1.29: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to utilities workers in crashes involving motor vehicles and service trucks.

Activity Goal 1.29.1: Identify risk factors for crashes among utilities workers involving motor vehicles and service trucks.

Activity Goal 1.29.2: Collaborate with industry to develop and evaluate effective interventions to prevent injuries to utilities workers from crashes involving motor vehicles and service trucks.

Activity Goal 1.29.3: Collaborate with industry to implement and promote effective interventions to prevent injuries to utilities workers from crashes involving motor vehicles and service trucks.

Intermediate Goal 1.30: Industry will incorporate effective interventions into their policies and procedures to prevent injuries to utilities workers resulting from contact with objects and equipment.

Activity Goal 1.30.1: Identify risk factors for injuries to utilities workers resulting from contact with objects and equipment (e.g., binding, moving, storing, and opening).

Activity Goal 1.30.2: Collaborate with industry to develop and evaluate interventions to prevent injuries to utilities workers resulting contact with objects and equipment (e.g., binding, moving, storing, and opening).

Activity Goal 1.30.3: Collaborate with industry to implement and promote effective interventions to prevent injuries to utilities workers resulting from contact with objects and equipment (e.g., binding, moving, storing and opening).

Strategic Goal 2: By 2016, reduce the incidence and severity of work-related musculoskeletal disorders (WMSD) among workers in the TWU sector.²

Intermediate Goal 2.1: Disseminate and promote a WMSD surveillance system for the TWU sector through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.1.1: Develop and coordinate partnerships for WMSD surveillance data collection within the TWU sector.

² For supporting data, discussions, and references, see Appendix C.

Activity Goal 2.1.2: Define methods for collecting, recording, storing, summarizing and disseminating WMSD surveillance data for the TWU sector.

Activity Goal 2.1.3: Identify critical data fields for tracking changes in WMSD morbidity within the TWU sector.

Activity Goal 2.1.4: Implement improved surveillance systems for identifying WMSDs among the TWU sector.

Activity Goal 2.1.5: Evaluate the effectiveness of surveillance system improvements for capturing WMSDs in the TWU sector.

Intermediate Goal 2.2: Quantify the associations between risk factors and upper extremity, lower back and lower extremity WMSDs in the TWU sector through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.2.1: Evaluate results of previous NORA and other research on evidence for putative risk factors contributing to upper extremity, lower back, and lower extremity WMSDs in the TWU sector.

Activity Goal 2.2.2: Identify research gaps and evidence for inclusion of non-physical risk factors such as fatigue, work organization, individual co-morbidities, and psychosocial metrics as they contribute to upper extremity, lower back, and lower extremity WMSDs in the TWU sector.

Activity Goal 2.2.3: Identify research gaps and evidence for inclusion of physical risk factors such as biomechanical stressors, vibration, and others as they contribute to upper extremity, lower back, and lower extremity WMSDs in the TWU sector.

Activity Goal 2.2.4: Develop accurate and precise tools for exposure measurement of risk factors contributing to upper extremity, lower back, and lower extremity WMSDs in the TWU sector.

Intermediate Goal 2.3: Establish successful WMSD interventions and best practices in **air transportation** through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.3.1: Identify and implement interventions and pilot promising solutions to reduce injury risk factors in air transportation occupations that require baggage and material handling.

Activity Goal 2.3.2: Identify and coordinate common strategies for measuring injury risk and morbidity outcomes of WMSD intervention programs for air transportation occupations that require baggage and material handling.

Activity Goal 2.3.3: Evaluate WMSD interventions and identify successful interventions and best practices for air transportation occupations that require baggage and material handling.

Activity Goal 2.3.4: Disseminate and promote successful WMSD interventions and best practices for air transportation occupations that require baggage and material handling.

Intermediate Goal 2.4: Establish successful WMSD interventions and best practices in the **trucking and courier and messenger** sub-sectors through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.4.1: Identify and implement interventions and pilot promising solutions for reducing injury risk factors in the trucking and courier and messenger sub-sectors.

Activity Goal 2.4.2: Identify and coordinate common strategies for measuring injury risk and morbidity outcomes of WMSD intervention programs in the trucking and courier and messenger sub-sectors.

Activity Goal 2.4.3: Evaluate WMSD interventions and identify successful interventions and best practices in the trucking and courier and messenger sub-sectors.

Activity Goal 2.4.4: Disseminate and promote successful WMSD interventions and best practices in the trucking and courier and messenger sub-sectors.

Intermediate Goal 2.5: Establish successful WMSD interventions and best practices in the **transit and ground passenger transportation** sub-sector through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.5.1: Identify and implement interventions and pilot promising solutions for reducing injury risk factors in the transit and ground passenger transportation sub-sector.

Activity Goal 2.5.2: Identify and coordinate common strategies for measuring injury risk and morbidity outcomes of WMSD intervention programs in the transit and ground passenger transportation sub-sector.

Activity Goal 2.5.3: Evaluate WMSD interventions and identify successful interventions and best practices in the transit and ground passenger transportation sub-sector.

Activity Goal 2.5.4: Disseminate and promote successful WMSD interventions and best practices in the transit and ground passenger transportation sub-sector.

Intermediate Goal 2.6: Establish successful WMSD interventions and best practices in the **warehousing** sub-sector through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.6.1: Identify and implement interventions and pilot promising solutions for reducing injury risk factors in the warehousing sub-sector.

Activity Goal 2.6.2: Identify and coordinate common strategies for measuring injury risk and morbidity outcomes of WMSD intervention programs in the warehousing sub-sector.

Activity Goal 2.6.3: Evaluate WMSD interventions and identify successful interventions and best practices in the warehousing sub-sector.

Activity Goal 2.6.4: Disseminate and promote successful WMSD interventions and best practices in the warehousing sub-sector.

Intermediate Goal 2.7: Establish successful WMSD interventions and best practices in the **utilities** sub-sector through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.7.1: Identify and implement interventions and pilot promising solutions for reducing injury risk factors in the utilities sub-sector.

Activity Goal 2.7.2: Identify and coordinate common strategies for measuring injury risk and morbidity outcomes of WMSD intervention programs in the utilities sub-sector.

Activity Goal 2.7.3: Evaluate WMSD interventions and identify successful interventions and best practices in the utilities sub-sector.

Activity Goal 2.7.4: Disseminate and promote successful WMSD interventions and best practices in the utilities sub-sector.

Intermediate Goal 2.8: Disseminate findings on successful practices and partnerships within the TWU sector that reduce WMSD costs and yield economic benefit through the collaboration of employers, employees, workers' compensation insurance carriers, labor, academic institutions, and government agencies.

Activity Goal 2.8.1: Review and synthesize previous work on cost-benefit research for reducing WMSDs within the TWU sector.

Activity Goal 2.8.2: Assess the impact of health and safety investments on the incidence, severity and costs associated with WMSDs in the TWU sector.

Activity Goal 2.8.3: Identify and evaluate critical and practically-obtained cost-benefit model inputs to determine applicability to the TWU sector.

Activity Goal 2.8.4: Develop and test models for measuring cost-benefit in the TWU sector.

Strategic Goal 3: By 2016, improve health and reduce premature mortality among TWU workers through workplace programs and practices that (1) enable workers to engage in healthy behaviors, (2) reduce work-related physiological and psychological stressors, and (3) improve healthcare utilization.³

Performance measures:

1. Increased utilization of health and wellness programs (including mental health) within the TWU sector.
2. Reduction of obesity rates in the TWU sector relative to national averages.
3. Reduction in CVD risk factors in the TWU sector relative to national averages.

Intermediate Goal 3.1: Conduct structured knowledge syntheses that will describe major work-related health concerns, identify knowledge gaps, and delineate existing industry practices that may affect worker health in the TWU sector.

³ For supporting data, discussions, and references, see Appendix D.

Activity Goals for Intermediate Goal 3.1	Background
<u>Activity Goal 3.1.1</u> : Produce a knowledge synthesis document for the warehousing sub-sector.	This activity will synthesize the literature, identify gaps in health knowledge, and delineate existing industry practices that may affect worker health in warehousing occupations. This synthesis will help guide future research and aid the development of health and wellness plans for the warehousing sub-sector.
<u>Activity Goal 3.1.2</u> : Produce a knowledge synthesis document for the utilities sub sector.	This activity will synthesize the literature, identify gaps in health knowledge, and delineate existing industry practices that may affect worker health in utilities occupations. This synthesis will help guide future research and aid the development of health and wellness plans for the utilities sub-sector.
<u>Activity Goal 3.1.3</u> : Produce a knowledge synthesis document for the transportation sub-sector.	This activity will synthesize the literature, identify gaps in health knowledge, and delineate existing industry practices that may affect worker health in various transportation modes (i.e., aviation, rail, trucking and marine shipping, bus, motor coach, and metro-transit operators, drivers, and other workers). This synthesis will help guide future research and aid development of health and wellness plans for the transportation sub sector.

Intermediate Goal 3.2: Establish prevalence of health risk factors and work-related illnesses among commercial drivers.

Activity Goals for Intermediate Goal 3.2	Background
Activity Goal 3.2.1: Use survey research methods to establish prevalence of health risk factors and work-related illnesses among commercial drivers.	National estimates of the prevalence of health status and health risk factors for commercial drivers are currently not available. Prevalence data are needed to determine which medical conditions should receive highest priority for research, medical surveillance and monitoring, and educational campaigns.
Activity Goal 3.2.2: Use medical surveillance, laboratory studies, and biometrics to collect objective measures of commercial driver health status that will validate and complement data collected via self-report.	Objective measures of health status obtained through these methodologies will validate and complement data collected through self-report.

Intermediate Goal 3.3: Promote workplace programs and practices to reduce obesity among commercial drivers.

Activity Goals for Intermediate Goal 3.3	Background
<u>Activity Goal 3.3.1</u> : Establish the national prevalence of obesity among over-the-road truck drivers.	Currently, a national prevalence of obesity among truck drivers is not available. It is important that the forthcoming NIOSH truck driver survey establish the prevalence of obesity in this population, so that the impact of future interventions and regulations can be evaluated.
<u>Activity Goal 3.3.2</u> : Increase understanding of how factors associated with the commercial driver's work environment, such as stress, social isolation, opportunities for physical activity, nutritional support, and fatigue may contribute to obesity.	We need to better understand how work practices affect the driver's ability to maintain a healthy body weight. Work practices currently associated with trucking may be associated with obesity, diabetes, and cardiovascular disease [Saltzman and Belzer 2007; Belzer 2000]; circadian disruption, irregular work schedules, stress, sleep deprivation, long daily and weekly work hours, and lack of work recovery time may all play important roles. Using an ecological (multi-level) perspective [NCI 2005], factors that contribute to lifestyle habits and obesity at multiple levels must be considered; examples include transportation infrastructure and facilities, organizational health climate, dispatcher behaviors, and organization of driving work.

<p><u>Activity Goal 3.3.3:</u> Develop knowledge and methods needed to calculate the true benefit/cost ratio of reducing obesity among commercial drivers.</p>	<p>Currently, benefit/cost ratio calculations cannot accurately incorporate the deleterious effects of many work practices, since the health and safety "cost" of these practices is not known. This is especially true for work practices where the negative health and safety impacts may not be apparent for several years, or where the employee has been exposed to deleterious work practices across multiple employers. For example work practices that result in circadian disruption, sleep deprivation, chronic stress from excessive work, or physical inactivity have an undetermined cumulative impact on the worker. Therefore, we must (1) gain an understanding of the long-term consequences of specific work practices (long and irregular hours, shift work, unpaid labor time, etc.) on both health and safety in general, and obesity in particular, and (2) develop methods that will allow regulators, business owners, and researchers to calculate the health and safety costs associated with specific work practices.</p>
<p><u>Activity Goal 3.3.4:</u> Weight reduction and maintenance programs specific to the needs and demands of the commercial driving population will be developed, implemented, and evaluated for success.</p>	<p>An inventory of weight reduction and maintenance programs will be performed. Because commercial drivers rarely participate in traditional health promotion programs offered by employers [Krueger et al. 2007], it is important to document barriers to driver participation and develop alternatives to these traditional programs.</p> <p>Programs should be aimed at long-term behavioral change and overall health, rather than just weight loss. Identifying ways to help drivers increase their activity levels and improve their diet (for example, limiting consumption of saturated and trans-fats by increasing consumption of fruit and vegetables) may be particularly important. Monitoring improvements in body mass index (BMI), cholesterol, and blood pressure can help motivate individuals to make lasting behavior changes.</p>

<p><u>Activity Goal 3.3.5</u>: Disseminate and promote adoption of effective weight reduction and maintenance strategies for commercial drivers.</p>	<p>Information about successful programs will be disseminated in a format that allows business owners and individuals to easily choose and execute effective and cost efficient programs. Incentives and educational programs should target not only individual drivers, but also companies and independent owner-operators. Strategies that encourage voluntary participation in health programs will be explored. Given economic pressures related to turnover and fuel prices in the trucking industry, measuring return on investment for health promotion programs will be particularly important.</p>
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Intermediate Goal 3.4: Promote workplace programs and practices to reduce incidence of cardiovascular disease (CVD) among TWU workers.

Activity Goals for Intermediate Goal 3.4	Background
<p><u>Activity Goal 3.4.1</u>: Establish the prevalence of CVD risk factors in the TWU sector.</p>	<p>Major risk factors for CVD include hypertension, hyperlipidemia, obesity, smoking, unhealthy diet, sedentary lifestyle, and diabetes [Saltzman and Belzer 2007]. Prevalence of these conditions/behaviors must be established prior to setting specific reduction goals for the population.</p>
<p><u>Activity Goal 3.4.2</u>: Increase understanding of how factors associated with the TWU work environment such as shift work, stress, lack of work recovery time, and use of stimulant medications may contribute to CVD.</p>	<p>Using an ecological (multi-level) perspective [NCI 2005], factors that contribute to lifestyle habits and CVD risk at multiple levels must be considered; examples include transportation infrastructure and facilities, organizational health climate and dispatcher behaviors, and organization of driving work.</p>

<p><u>Activity Goal 3.4.3</u>: Develop knowledge and methods needed to calculate the true benefit/cost ratio of reducing CVD risk among TWU workers.</p>	<p>Currently, benefit/cost ratio calculations cannot accurately incorporate the deleterious effects of many work practices, since the health and safety "cost" of these practices is not known. This is especially true for work practices where the negative health and safety impacts may not be apparent for several years, or where the employee has been exposed to deleterious work practices across multiple employers. For example, work practices that result in circadian disruption, sleep deprivation, chronic stress from excessive work, or physical inactivity have an undetermined cumulative impact on the worker. Therefore, we must (1) gain an understanding of the long-term consequences of specific work practices (long and irregular hours, shift work, unpaid labor time, etc.) on CVD risk, and (2) develop methods that will allow regulators, business owners, and researchers to calculate the health and safety costs associated with specific work practices.</p>
<p><u>Activity Goal 3.4.4</u>: Reduce TWU workers' exposure to tobacco smoke.</p> <p>Activity – promote smoking cessation programs</p> <p>Activity – promote smoke-free workplaces</p>	<p>Cigarette smoke is linked with cardiovascular disease and myocardial infarction, as well as a host of other negative health outcomes. Reducing exposure to tobacco smoke for all workers – smokers and nonsmokers – is an important step in reducing CVD in the TWU sector.</p> <p>Nicotine is a powerfully addictive substance, and research shows that nicotine administration via cigarette smoking is a particularly difficult behavioral habit for individuals to break. However, research also shows that tobacco cessation counseling, support, and pharmacological interventions do help individuals quit smoking. Employers can help smokers quit by offering smoking cessation programs at work and providing a smoke-free workplace.</p>

Intermediate Goal 3.5: Reduce workplace psychological stressors for workers in the TWU sector.

Activity Goals for Intermediate Goal 3.5	Background
<p><u>Activity Goal 3.5.1:</u> Increase understanding of how stressors such as social isolation, sleep disorders, work organization (long hours, shift work, irregular hours of work), and fatigue may affect TWU worker health and performance.</p> <p>Activity – Fully identify work-related psychological stressors that exist within the TWU sector.</p>	
<p><u>Activity Goal 3.5.2:</u> Develop knowledge and methods needed to calculate the true benefit/cost ratio of reducing work-related stress among TWU workers.</p>	<p>Currently, benefit/cost ratio calculations cannot accurately incorporate the deleterious effects of many work practices, since the health and safety "cost" of these practices is not known. This is especially true for work practices where the negative health and safety impacts may not be apparent for several years, or where the employee has been exposed to deleterious work practices across multiple employers. For example work practices that result in circadian disruption, sleep deprivation, chronic stress from excessive work, or physical inactivity have an undetermined cumulative impact on the worker. Therefore, we must (1) gain an understanding of the long-term consequences of specific work practices (long and irregular hours, shift work, unpaid labor time, etc.) on stress, and (2) develop methods that will allow regulators, business owners, and researchers to calculate the health costs associated with specific work practices.</p>
<p><u>Activity Goal 3.5.3:</u> Identify and evaluate workplace programs and practices to reduce stress among TWU workers.</p>	
<p><u>Activity Goal 3.5.4:</u> Increase awareness of risk factors and demonstrate the benefits of reducing stress in the workplace within the TWU sector.</p> <p>Activity – measure the availability and utilization of psychological support, e.g., employee assistance programs, occupational health professionals, and mental health care providers.</p>	

<p>Activity – measure absenteeism, presenteeism (being present at work, but not fully ready for work, as for example, when the worker actually should be home on sick leave), productivity, physical activity, workplace violence.</p> <p>Activity – determine the incidence of sleep disorders in the TWU sector workforce.</p>	
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Intermediate Goal 3.6: Promote workplace programs and practices that increase appropriate utilization of healthcare services among TWU workers.

Activity Goals for Intermediate Goal 3.6	Background
<p><u>Activity Goal 3.6.1</u>: Improve access to healthcare among commercial drivers.</p> <p>Activity – develop a national guide that lists healthcare facilities that are accessible to large trucks.</p> <p>Activity – identify ways to increase the number of clinics housed at truck stops.</p> <p>Activity – establish utilization rates for health care services and preventive screening services among commercial drivers.</p> <p>Activity – promote preventive health care screening among commercial drivers as outlined by the U.S. Preventive Services Task Force (e.g. screening for cholesterol, diabetes, prostate cancer, colon cancer, immunizations).</p> <p>Activity – explore development of a medical record system so that health care providers in various geographical locations can access health information about commercial drivers in transit.</p>	<p>Commercial drivers who work long hours or spend multiple days “on the road” have very limited access to healthcare. Strategies for improving their access to healthcare need to be developed and executed. One barrier to obtaining care is simply the driver’s inability to identify health facilities that can be accessed by a tractor-trailer [Renner 1998]. Another barrier is affordability of healthcare; this population not only has inadequate health insurance coverage [Belman and Monaco, 2001; Belman et al. 2005], but likely suffers from broader barriers due to socioeconomic class [Saltzman and Belzer, 2007]. With the growing use of subcontracting to owner-drivers, as well as the increase in the number of owner-operators, an increasing number of commercial drivers are neither covered by workers’ compensation nor by their own personal insurance policies [Saltzman and Belzer 2007; Belzer 2000] .</p>

<p><u>Activity Goal 3.6.2:</u> Improve utilization of the workers' compensation system by commercial drivers.</p> <p>Activity – conduct independent review of workers' compensation system and its impact on workers</p> <p>Activity - educate workers of their rights under workers' compensation systems.</p> <p>Activity – identify and evaluate methods for removing barriers to filing for workers' compensation.</p> <p>Activity – Identify conditions that have a high frequency of denial by workers' compensation rules as not work-related. Perform analysis of these conditions to establish causal relationships, including attribution of work-relatedness.</p>	<p>Workers who are injured or develop illness on the job must pass through a complex and potentially adversarial system to receive benefits from their workers' compensation system. Some workers do not report injury or illnesses because they do not understand their rights, while others fear job loss, disciplinary action, and denial of overtime or promotional opportunities. If they have good benefits, it is often easier for workers to use their own sick time and health insurance, rather than go through the workers' compensation system [Azaroff et al. 2002].</p> <p>Difficulties in utilizing workers' compensation negatively affect health in a number of ways:</p> <ol style="list-style-type: none"> 1. Reduces access to health care, especially among uninsured or under-insured workers 2. Inflicts psychological stress, both through financial hardship and through conflict with the employer 3. Corrupts statistical reports, since the difficulties associated with filing and winning a claim leads to under-reporting
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Strategic Goal 4: By 2016, prevent and reduce chemical, biological, physical, and psychosocial occupational hazards and exposures resulting in a reduction of occupational injuries, illnesses, and fatalities in the TWU sector.

Intermediate Goal 4.1: By 2013, identify baseline statistics for occupational exposures within the TWU sector.

- Activity Goal 4.1.1: By 2009, refine exposures of concern for TWU sector in Table 1.
- Activity Goal 4.1.2: By 2011, collect occupational exposure data within the TWU sector for the contaminants listed in Table 1.
- Activity Goal 4.1.3: Create Job Exposure Matrices for TWU to identify exposures, develop engineering control strategies, and prioritize long term research needs.

Intermediate Goal 4.2: Implement substitution programs, engineering controls, and administrative programs in the TWU sector to reduce and eliminate **chemical hazards and exposures** listed in Table 1 through collaboration with employers, employees, as well as appropriate union, government, academic, and industry representatives.

- Activity Goal 4.2.1: Identify prevalence of diseases and injuries resulting from hazards and exposures identified in Table 1 among TWU employees.
- Activity Goal 4.2.2: Develop and pilot substitutions or mechanical alternatives in the TWU sector for the chemical agents listed in Table 1.

Activity Goal 4.2.3: Develop and pilot engineering control solutions, and mitigation strategies in the TWU sector to prevent and/or reduce exposures listed in Table 1.

Activity Goal 4.2.4: Incorporate administrative programs into safety management programs in the TWU sector as a stopgap measure to reduce chemical occupational exposures as listed in Table 1.

Activity Goal 4.2.5: Develop and pilot real-time technologies (biosensors etc.) and biomonitoring techniques in the TWU sector to detect and measure potential exposures listed in Table 1.

Activity Goal 4.2.6: Develop and pilot training programs in the TWU sector which result in improved work practices and a reduction in exposures.

Activity Goal 4.2.7: Develop prospective and retrospective evaluation plans so as to monitor and continuously improve upon developed and implemented countermeasures in the TWU sector.

Activity Goal 4.2.8: Develop a business case methodology for the TWU sector that can be applied to illustrate economic benefits of reducing and eliminating chemical occupational hazards and exposures and of improving training programs with appropriate union, government and industry representatives.

Activity – Identify and evaluate benchmarking⁴ models for application in the TWU industries.

Activity – Validate benchmarking for application in the TWU industries.

Activity – Disseminate economic models to stakeholders and partners within TWU.

Activity – Initiate and improve training programs (e.g., training for management to reduce and eliminate hazards and exposures and to implement fatigue countermeasures for employees, lock-out/tag-out).

Intermediate Goal 4.3: Implement substitution programs, engineering controls, and administrative programs in the TWU sector to reduce and eliminate **biological hazards and exposures** listed in Table 1 through collaboration with employers, employees, as well as appropriate union, government, academic, and industry representatives.

Activity Goal 4.3.1: Identify prevalence of diseases and injuries resulting from hazards and exposures among TWU employees, as identified in Table 1.

Activity Goal 4.3.2: Develop and pilot substitutions or mechanical alternatives in the TWU sector for the agents identified in Table 1.

Activity Goal 4.3.3: Develop and pilot engineering control solutions and mitigation strategies in the TWU sector to prevent and/or reduce exposures identified in Table 1.

Activity Goal 4.3.4: Incorporate administrative programs into safety management programs in the TWU sector as a stopgap measure to reduce biological occupational exposures, as identified in Table 1.

Activity Goal 4.3.5: Develop and pilot biomonitoring or surveillance techniques in the TWU sector to detect and measure potential exposures identified in Table 1.

⁴ Technique in which company measures its performance against that of best in class companies, determines how those companies achieved their performance levels and uses this information to improve its own performance. Can serve as mechanism to create a market for safety by using a “continuous improvement” benchmarking model and method that allows development of an appropriate safety rating.

Activity Goal 4.3.6: Develop and pilot training programs in the TWU sector which result in improved work practices and a reduction in exposures.

Activity Goal 4.3.7: Develop prospective and retrospective evaluation plans so as to monitor and continuously improve upon developed and implemented countermeasures in the TWU sector.

Activity Goal 4.3.8: Develop a business case methodology for the TWU sector that can be applied to illustrate economic benefits of reducing and eliminating biological occupational hazards and exposures and of improving training programs with appropriate union, government and industry representatives.

Activity – Identify and evaluate benchmarking models for application in the TWU industries.

Activity – Validate benchmarking for application in the TWU industries.

Activity – Disseminate economic models to stakeholders and partners within TWU.

Activity – Initiate and improve training programs (e.g., training for management to reduce and eliminate hazards and exposures and to implement fatigue countermeasures for employees, lock-out/tag-out).

Intermediate Goal 4.4: Implement substitution programs, engineering controls, and administrative programs in the TWU sector to reduce and eliminate **physical hazards and exposures** listed in Table 1 through collaboration with employers, employees, as well as appropriate union, government, academic, and industry representatives.

Activity Goal 4.4.1: Identify prevalence of diseases and injuries resulting from hazards and exposures identified in Table 1 among workers in the TWU sector.

Activity Goal 4.4.2: Develop and pilot substitutions or mechanical alternatives in the TWU sector for the agents listed in Table 1.

Activity Goal 4.4.3: Develop and pilot engineering control solutions, and mitigation strategies in the TWU sector to prevent and/or reduce exposures listed in Table 1

Activity Goal 4.4.4: Incorporate administrative programs into safety management programs in the TWU sector as a stopgap measure to reduce physical occupational exposures as listed in Table 1.

Activity Goal 4.4.5: Develop and pilot real-time technologies (biosensors etc.) and biomonitoring techniques in the TWU sector to detect and measure potential exposures listed in Table 1.

Activity Goal 4.4.6: Develop and pilot training programs in the TWU sector which result in improved work practices and a reduction in exposures.

Activity Goal 4.4.7: Develop prospective and retrospective evaluation plans so as to monitor and continuously improve upon developed and implemented countermeasures in the TWU sector.

Activity Goal 4.4.8: Develop a business case methodology for the TWU sector that can be applied to illustrate economic benefits of reducing and eliminating physical occupational hazards and exposures and of improving training programs with appropriate union, government and industry representatives.

Activity – Identify and evaluate benchmarking models for application in the TWU industries.

Activity – Validate benchmarking for application in the TWU industries.

Activity – Disseminate economic models to stakeholders and partners within TWU.

Activity – Initiate and improve training programs (e.g., training for management to reduce and eliminate hazards and exposures and to implement fatigue countermeasures for employees, lock-out/tag-out).

Intermediate Goal 4.5: Implement substitution programs, engineering controls, and administrative programs in the TWU sector to reduce and eliminate **psychosocial hazards and exposures** listed in Table 1 through collaboration with employers, employees, as well as appropriate union, government, academic, and industry representatives.

Activity Goal 4.5.1: Identify prevalence of diseases and injuries resulting from hazards and exposures identified in Table 1 among workers in the TWU sector.

Activity Goal 4.5.2: Develop and pilot substitutions or mechanical alternatives in the TWU sector for the agents listed in Table 1.

Activity Goal 4.5.3: Develop and pilot engineering control solutions, and mitigation strategies in the TWU sector to prevent and/or reduce exposures listed in Table 1.

Activity Goal 4.5.4: Incorporate administrative programs into safety management programs in the TWU sector as a stopgap measure to reduce psychosocial occupational exposures as listed in Table 1.

Activity Goal 4.5.5: Develop and pilot real-time technologies (biosensors etc.) and biomonitoring techniques in the TWU sector to detect and measure potential exposures listed in Table 1.

Activity Goal 4.5.6: Develop and pilot training programs in the TWU sector which result in improved work practices and a reduction in exposures.

Activity Goal 4.5.7: Develop prospective and retrospective evaluation plans so as to monitor and continuously improve upon developed and implemented countermeasures in the TWU sector.

Activity Goal 4.5.8: Develop a business case methodology for the TWU sector that can be applied to illustrate economic benefits of reducing and eliminating psychosocial occupational hazards and exposures and of improving training programs with appropriate union, government and industry representatives.

Activity – Identify and evaluate benchmarking models for application in the TWU industries.

Activity – Validate benchmarking for application in the TWU industries.

Activity – Disseminate economic models to stakeholders and partners within TWU.

Activity – Initiate and improve training programs (e.g., training for management to reduce and eliminate hazards and exposures and to implement fatigue countermeasures for employees, lock-out/tag-out).

Table 1. Exposures of Concern (subject to prioritization)

	Aviation	Rail	Trucking	Utilities	Warehousing	Water transport
Chemical	<ul style="list-style-type: none"> • Pyrolyzed oil and hydraulic fluid contaminants in engine and APU bleed air supply • Pesticides • Deicing fluid contaminants 	<ul style="list-style-type: none"> • Diesel exposure • PCBs • Machine shop chemicals • Container leaks 	<ul style="list-style-type: none"> • Diesel exposure (liquid) • Exhaust exposure (particulates, CO, NOx) in truck and in parking, sleeping, and dock areas • Maintenance worker exposure to solvents, asbestos, paint, etc. 	<ul style="list-style-type: none"> • Solvents and degreasers • Wood preservatives • Heavy metals • Pesticides and herbicides • Chlorine (water treatment plants) 	<ul style="list-style-type: none"> • Engine bleed air • CO2 • Particulate 	<ul style="list-style-type: none"> • Diesel
Biological	<ul style="list-style-type: none"> • Bioaerosol • Infectious agents • Dermal contacts • Fumigants • Vector borne 		<ul style="list-style-type: none"> • Cargo exposure (livestock, waste, other agricultural products) • Off-duty (truck stop showers, STDs) 	<ul style="list-style-type: none"> • Animal bites • Hepatitis A 	<ul style="list-style-type: none"> • Fumigants 	<ul style="list-style-type: none"> • Fumigants
Psychosocial	<ul style="list-style-type: none"> • Aggressive passengers • Workload • Work schedules • Disincentives to report illness and injury 	<ul style="list-style-type: none"> • PTSD (rail collisions) • Stress from potential workplace violence (transit) • Shift work • Work schedules 	<ul style="list-style-type: none"> • Shift work • Work schedules 	<ul style="list-style-type: none"> • Overtime • Shift work 	<ul style="list-style-type: none"> • Shift work 	<ul style="list-style-type: none"> • Shift work • Work schedules
Physical	<ul style="list-style-type: none"> • Noise • Vibration • Heat/cold • Cosmic and solar radiation 	<ul style="list-style-type: none"> • Heat/cold • Noise • Vibration 	<ul style="list-style-type: none"> • Noise (in-truck; parking, sleeping, fueling, loading areas) • Temperature (parking, sleeping, fueling, loading areas) 	<ul style="list-style-type: none"> • Noise • Heat • Confined space • Electric current • Dust 	<ul style="list-style-type: none"> • Heat/cold • Noise 	<ul style="list-style-type: none"> • Heat/cold

Appendix A

Table 2. Fatal and nonfatal occupational injuries and illnesses in the TWU sector, 2006

Industry	Number of employees ¹	Fatalities ²	Fatalities per 100,000 workers	Nonfatal injuries and illnesses with DAFW ^{3,4}	Nonfatal injuries and illnesses with DAFW per 10,000 workers ³
All TWU	7,455,000	967	13.0	116,010	---
Utilities (NAICS 22)	1,186,000	73	6.2	6,210	115.0
Air transportation (NAICS 481)	536,000	51	9.5	20,800	541.4
Rail transportation (NAICS 482)	266,000	19	7.1	3,530	146.2
Water transportation (NAICS 483)	68,000	21	30.9	1,210	191.8
Truck transportation (NAICS 484)	2,034,000	555	27.3	40,090	271.4
Transit and ground passenger transportation (NAICS 485)	781,000	70	9.0	6,320	216.7
Bus service and urban transit (NAICS 4851-4859, exc. 4853)	578,000	21	3.6	5,360	---
Taxi/limousine service (NAICS 4853)	223,000	49	22.0	960	177.6
Pipeline transportation (NAICS 486)	36,000	---		230	60.0
Scenic and sightseeing transportation (NAICS 487)	27,000	8	29.6	410	212.6
Support activities for transportation (NAICS 488)	673,000	84	12.5	9,310	175.5
Postal Service (NAICS 491)	799,000	21	2.6		
Couriers and messengers (NAICS 492)	680,000	41	6.0	15,210	345.9
Warehousing (NAICS 493)	349,000	17	4.9	12,700	220.6
All industries	144,427,000	5,840	4.0	1,183,500	127.8

¹ These employment estimates were taken from BLS, Current Population Survey electronic files. Available at: http://www.bls.census.gov/cps_ftp.html#cpsbasic. These numbers are different from those published in the BLS, Annual Survey of Occupational Injuries and Illnesses as they include both public and private sector employees.

² Source: BLS, Census of Fatal Occupational Injuries, 2006. Available at: <http://data.bls.gov/GQT/servlet/InitialPage>.

³ Source: BLS, Annual Survey of Occupational Injuries and Illnesses, 2006. Available at: <http://www.bls.gov/iif/oshsum.htm>. These estimates are for private industry only.

⁴ DAFW = Days away from work

Table 3. Nonfatal occupational injuries and illnesses involving days away from work by private industry and selected events or exposures; transportation, warehousing, and utilities sector, United States, 2006.

Private Industry	Total	Event					
		Transportation incidents	Assaults & violent acts	Contact with objects & equipment	Fall to lower level; fall on same level; slips or trips without fall	Overexertion	Harmful substance or environment
Air transportation	20,800	1,190	70	3,990	3,790	8,730	730
Rail transportation†	3,530	500	40	570	700	520	150
Water transportation	1,210	110	--	340	210	280	90
Truck transportation	40,090	5,440	290	8,280	10,670	9,270	940
Transit and ground passenger transportation (including Taxi/limo)	6,320	2,020	230	860	1,270	1,080	150
Taxi/limousine service	960	450	70	90	100	160	20
Pipeline transportation	230	30	--	60	40	20	--
Scenic and sightseeing transportation	410	60	--	60	160	40	30
Support activities for transportation	9,310	1,070	60	2,670	1,960	2,090	290
Marine cargo handling	1,900	330	---	430	480	300	---
Couriers and messengers	15,210	940	150	3,080	2,740	5,200	150
Warehousing and storage	12,700	1,100	70	3,360	1,990	4,230	150
Utilities	6,210	350	140	1,140	1,350	1,250	450

Source: BLS, Annual Survey of Occupational Injuries and Illnesses, 2006. Available at: <http://www.bls.gov/iif/oshwc/osh/case/ostb1796.pdf>.

† Data for railroad transportation were provided to BLS by the Federal Railroad Administration of the U.S. Department of Transportation, therefore estimates for this industry are not comparable to estimates in other industries.

Table 4. Rates of nonfatal occupational injuries and illnesses involving days away from work by private industry and selected events or exposures; transportation, warehousing, and utilities sector, United States, 2006.

Private Industry	Rate per 10,000 full-time workers	Event				
		Transportation incidents	Assaults & violent acts	Contact with objects & equipment	Overexertion	Fall to lower level
All private industry	127.8	6.1	2.4	36.2	30.8	8.0
Air transportation	541.4	30.9	1.7	104.0	227.2	17.5
Rail transportation†	146.2	20.6	1.7	23.6	21.4	24.1
Water transportation	191.8	17.8	--	54.5	44.2	13.2
Truck transportation	271.4	36.8	2.0	56.1	62.7	35.8
Transit and ground passenger transportation (including Taxi/limo)	216.7	69.2	7.9	29.3	36.9	12.1
Taxi/limousine service	177.6	84.3	27.8	17.4	28.9	---
Pipeline transportation	60.0	8.4	--	15.3	5.5	---
Scenic and sightseeing transportation	212.6	29.0	--	33.4	18.4	18.0
Support activities for transportation	175.5	20.2	1.1	50.3	39.3	10.7
Marine cargo handling	494.5	86.4	---	113.2	77.1	36.1
Couriers and messengers	345.9	21.5	3.5	70.1	118.3	15.4
Warehousing and storage	220.6	19.1	1.2	58.3	73.6	8.8
Utilities	115.0	6.5	2.5	21.1	23.2	9.8

Source: BLS, Annual Survey of Occupational Injuries and Illnesses, 2006. Available at: <http://stats.bls.gov/iif/oshwc/osh/case/ostb1800.pdf>.

† Data for railroad transportation were provided to BLS by the Federal Railroad Administration of the U.S. Department of Transportation, therefore estimates for this industry are not comparable to estimates in other industries.

Appendix B

Background/Support for Strategic Goal 1: By 2016, reduce lost-workday occupational traumatic injury and fatality rates in the TWU sector.

Air Transportation (NAICS 481)

In 2006, the incidence rate of nonfatal occupational injuries and illnesses involving days away from work for the air transportation sub-sector (NAICS 481) was 5.4 per 100 full-time workers [BLS, 2007a]. This rate was 4.2 times the national rate for all private industry (1.3 injuries and illnesses per 100 full-time workers). Since the mid-1990's, the year-by-year trends for these most serious injury and illness cases have been mixed: In 2004 and 2005, the rate was actually slightly lower, at 5.3, which was an improvement from the 2003 rate of 5.8. Prior to 2003, Bureau of Labor Statistics (BLS) data were tabulated using the Standard Industrial Classification (SIC) system, which is slightly different from the NAICS categories in use today. For SIC 45 Transportation by air, incidence rates for days away from work injury/illness cases have drifted up and down since the mid-1990's, with a high of 8.4 in 1995 to a low of 5.2 in 2002.

For 2006, the injuries and illnesses involving days away from work within the air transportation sub-sector were most frequently due to overexertion (227.2 injuries and illnesses per 10,000 full-time workers), contact with objects and equipment (104.0 injuries and illnesses per 10,000 full-time workers), and slips, trips and falls (98.6 per 10,000 full-time workers) [BLS, 2007b]. The hazards that contribute to the occurrence of these incidents should receive particular attention when developing annual goals for injury/illness mitigation strategies. In terms of severity, for all of private industry the median number of days away from work for lost work day injury/illness cases in 2006 was 7 days; for the air transportation sub-sector, the median was 16 days [BLS, 2007c]. This difference indicates the high relative severity of injuries and illnesses that occur to workers in the air transportation sub-sector.

Certain occupations specific to the air transportation industry have occupational injury or fatality rates that are among the highest for all occupations. For example, in 2006, there were 104 work-related fatalities involving aircraft pilots and flight engineers reported by the Census of Fatal Occupational Injuries (CFOI), with a U.S. fatality rate of 90.4 per 100,000 employed workers. This rate is more than three times higher than the work-related fatality rate for driver/sales workers and truck drivers (27.5 per 100,000 employed workers) for 2006, and more than 22 times higher than the fatality rate for all workers (4.0 per 100,000 employed workers) for 2006 [BLS, 2007d]. Further, in 2006, the rate of nonfatal injuries involving days away from work for flight attendants was 7.3 per 100 full-time workers, well above the rate of 5.4 for the air transportation sub-sector as a whole [BLS, 2007e].

Rail Transportation (NAICS 482)

Between 1998 and 2007 human factors related incidents accounted for 38% of railway incidents leading to injuries [FRA 2005]. The Federal Rail Administration (FRA) identified the following factors as most frequent contributors to these incidents between 2001 and 2004:

- Improper line switches (16%) [FRA 2005]. In 2003 the FRA determined that 63% of employees fatally injured in struck-by incidents were involved in switching activities [FRA 2006].
- Shoving movement (15%).
- Cars left out to foul (4%) [FRA 2005].

Like many other transportation sub-sectors, rail operations place workers at risk of fatigue-related incidents. The hours-of-service laws allow employees to work 12 hours and have 10 hours off-duty. A 2006 FRA study examined approximately 1,400 train accidents and found a strong statistical correlation between the crew's estimated level of alertness and the likelihood that they would be involved in an accident caused by human factors [FRA 2005].

The FRA reports that 31.7% of the fatalities that occurred between 2004 and 2006 were struck-by, 63% of which occurred in switching activities. In 2003 the FRA found that 19% were fatally injured maintaining track [FRA 2006]. BLS reports that the rate per 10,000 workers for nonfatal injuries caused by struck-by ranged from 15.6-10.7 from 2003 to 2006 [BLS, 2007f]. The FRA reports that 25.3% of the fatalities that occurred between 2004 and 2006 were collisions [FRA 2008].

Truck Transportation (NAICS 484)

In 2006, 5,840 fatal work-related injuries were reported by the CFOI with a U.S. fatality rate of 4.0/100,000 [BLS 2007d]. The estimated total cost for fatal and nonfatal work-related unintentional injuries in 2006 was \$164.7 billion dollars [National Safety Council 2008]. Included in that amount were wage and productivity losses of \$80.0 billion, medical expenses of \$31.3 billion, and motor-vehicle damage costs of \$1.7 billion. Truck transportation fatalities accounted for 10% (n= 555) of all worker fatalities in 2006 [BLS 2007k].

The nonfatal occupational injury and illness incidence rate for the truck transportation industry was 5.8 injuries and illness/ 100 full-time workers, which was 32% higher than the national rate for all private industries (4.4 injuries and illnesses/ 100 full-time workers) [BLS 2007a].

National workers' compensation premium rates correspond with injury rates and are a burden to employers (\$2.48 per \$100 of payroll in the year 2006 [Oregon Department of Consumer & Business Services 2007]. Employer costs for workers' compensation per hour worked in the trade, transportation and utilities industry were estimated to be \$0.50 per hour in March 2008. Workers' compensation costs were higher in the trade,

transportation, and warehousing industry than in all service-producing industries (\$0.38 per hour) but lower relative to all goods-producing industries (\$0.83 per hour) [BLS 2007l].

Most of the injuries within the truck transportation industry were due to events involving overexertion (62.7 injuries and illness per 100 full-time workers), transportation accidents (36.8 injuries and illnesses per 100 full-time workers), falls to a lower level (35.8/ 100), and being struck by an object (30.2 per 100 full-time workers) due primarily to falling objects [BLS 2007b]. Injury sources accounting for the highest truck transportation injury incidence rates were floors, walkways or ground surfaces (65.1 injuries and illnesses per 10,000 full-time workers) and vehicles (68.4 injuries and illnesses per 10,000 full-time workers) [BLS 2007g].

Warehousing and Storage (NAICS 493)

The Warehousing and Storage industry sub-sector employs approximately 600,000 people in the U.S. [BLS 2007a] and consists of an estimated 28,000 businesses [NAICS 2007]. These businesses are primarily engaged in handling goods in containers (e.g., boxes, barrels, or drums) and using equipment (e.g., forklifts, pallets, and racks) [NAICS 2007]. The sub-sector includes refrigerated storage, farm product warehousing, and other miscellaneous warehousing such as bulk petroleum and lumber storage. It does not include leased self-storage or hazardous materials storage for treatment and disposal.

Among six main components of the Transportation, Warehousing, and Utilities Sector (i.e., ground, air, rail, water, warehousing, utilities), the Warehousing and Storage sub-sector had one of the lowest fatality rates, with 2.8-3.8 fatalities per 100,000 from 2004-2006 [BLS 2007h]. In contrast, the Warehousing and Storage sub-sector had the third highest nonfatal injury rate from 2003-2006, with 220-300 injuries per 10,000 full-time workers [BLS 2007i]. In 2006 specifically, the overall nonfatal injury incidence rate was 220.6 per 10,000 full-time workers [BLS 2007e].

BLS data indicated that contact with objects and equipment and slips, trips, and falls are two of the leading nonfatal injury and illness events resulting in days away from work (DAFW). Of the 12,700 warehousing and storage industry injuries and illnesses resulting in DAFW in 2006, more than a quarter are from contact with objects and equipment (n = 3360) and 16% are from slips, trip, and falls (n = 1990) [BLS 2007j]. Nonfatal injuries and illnesses resultant of contact with objects and equipment and falls on the same level had rates of 58.3 and 20.3 per 10,000 full-time workers, respectively [BLS 2007b].

Injuries and illnesses involving forklifts are of particular concern in the warehousing and storage industry. In 2006, one-fifth (n = 2,440) of all injuries and illnesses involving forklifts and resulting in DAFW were in the transportation and warehousing industries [BLS 2007k]. In addition, the rate for forklift injuries and illnesses in transportation and warehousing is notably higher at 6.0 per 10,000 full-time workers compared to 1.3 per 10,000 full-time workers in all private industry.

Utilities (NAICS 22)

The Utilities sector is made up of establishments that provide the following services:

- Electric power: generation, transmission, and distribution (629,200 workers)
- Natural gas: Distribution (134,500 workers);
- Combination: Electric and gas, and other combinations (70,900 workers);
- Water, sewage, and other systems: Provision and/or distribution of steam; water treatment and distribution; and collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities (330,300 workers); and
- Unspecified utilities (20,900 workers) [BLS 2007m].

The CFOI reported 73 workplace fatalities within the utilities industries in 2006. The leading causes of fatalities were transportation incidents (25 deaths, 34%), exposure to harmful substances or environments (20 deaths, 28%), contact with objects and equipment, and falls (10 and 11 deaths respectively, 14% and 15%). The majority of fatalities (n=47) occurred within the electric power generation, transmission, and distribution sub-sector [BLS 2007k].

Estimates for 2006 from the BLS Survey of Occupational Injury and Illness show that there were 6,210 nonfatal injuries resulting in DAFW among utilities industry employees. The rate of 115 lost-workday injuries per 10,000 full-time workers in the utilities sector was slightly below the rate of 127.8 for all workers in private industry. Workers in water, sewage, and other systems had a somewhat higher rate, at 162.2 lost workday injuries per 10,000 full-time workers [BLS 2007k].

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Appendix C**Background/Support for Strategic Goal 2: Reduce incidence and severity of work-related musculoskeletal disorders among workers in the TWU industries.**

Work-related musculoskeletal disorders (WMSDs) are defined as “Non-traumatic disorders of the soft tissues of the musculoskeletal system that can be caused or aggravated by work activities such as repetitive forceful motions, awkward postures, use of vibrating tools or equipment, or by manual handling of heavy, awkward loads” [WA DOH 2003]. Risk factors associated with WMSDs that occur in the TWU industries include repetitive motion, heavy lifting, forceful exertion, vibration exposure (including whole-body vibration), prolonged sitting, and poor postures.

In 2006 WMSDs⁵ in the TWU industries accounted for 33% of all occupational injuries and illnesses resulting in days away from work [BLS 2007a]; the same distribution was reported in 2005 [BLS 2006a]. A total of 38,290 WMSDs were reported in the TWU industries during 2006. The combined rate for WMSDs in transportation and warehousing was 89.7 per 10,000 workers. This is markedly higher than the rate for all private industries of 38.6 per 10,000 [BLS 2007a]. Within TWU, industries with the highest rates of WMSDs were air transportation (245.7 per 10,000) and couriers and messengers (137.4 per 10,000). The industry with the highest number of WMSDs was truck transportation (10,870) [BLS 2007b].

Freight, stock and material movers reported the most WMSDs of all occupations in 2006 (28,860) and truck drivers, heavy and tractor trailer reported the third highest number (17,400). The WMSD rates for these occupations were among the highest at 158 per 10,000 and 108 per 10,000 respectively [BLS 2007c].

From 1993 to 2002 the Transportation and Public Utility Sector, inclusive of warehousing, experienced a 36% reduction in the combined fatal and non-fatal occupational injury and illness incidence rate. This reduction is estimated to have decreased the injury cost for this sector by a total of \$2.8 billion over that time frame [Zaloshnja et al. 2006]. Considering the cost-per-employee for occupational injuries and illnesses, transportation and manual moving occupations ranked third highest for non-fatal injuries (\$1,641) and second highest for fatalities (\$849) [Leigh et al. 2006].

⁵ BLS defines WMSDs to include “cases where the nature of injury is: sprains, strains, tears; back pain, hurt back; soreness, pain, hurt, except back; carpal tunnel syndrome; hernia; or musculoskeletal system and connective tissue diseases and disorders and when the event or exposure leading to the injury or illness is: bodily reaction/bending, climbing, crawling, reaching, twisting; overexertion; or repetition. Cases of Raynaud's phenomenon, tarsal tunnel syndrome, and herniated spinal discs are not included. Although these cases may be considered MSD's, the survey classifies these cases in categories that also include non-MSD cases.”

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Appendix D

Background/Support for Strategic Goal 3: By 2016, improve health and reduce premature mortality among TWU workers through workplace programs and practices that (1) enable workers to engage in healthy behaviors, (2) reduce work-related physiological and psychological stressors, and (3) improve healthcare utilization.

Aside from physical hazards such as whole body vibration and chemical vapors (which are addressed in Strategic Goal 4) and safety (which is addressed in Strategic Goal 1) there are specific threats to health that result from work organization; psychological stress; and the physical stress of chronic sleep deprivation, disruption of circadian rhythm, and long periods of immobility. These threats are the health risks that Strategic Goal 3 addresses.

Undoubtedly many of the occupational health-related problems identifiable for workers in the TWU sector are also concerns for the nation's work force in general. For example, health risks associated with individual conditions of obesity, cardiovascular disease, hypertension, diabetes, tobacco use, lack of good nutrition, and poor physical fitness likely affect large swaths of the U.S. population of workers. Therefore, advances made within the TWU sector may benefit workers in every NORA sector.

Building TWU sector knowledge synthesis

Work-related health concerns are not adequately tracked by surveys conducted through the Bureau of Labor Statistics. To fill this void, a series of knowledge syntheses should be conducted to provide in-depth information on health-related topics for the entire TWU sector.

The goal of the program is to provide a rapid assessment of baseline worker health and occupational hazards within the sector. One relatively short synthesis document (50-100 pages) for each of the three major sub-sectors (i.e., Transportation, Warehousing, and Utilities) should summarize the nature and extent of worker health concerns and problems and identify existing industry practices that may affect worker health. Each synthesis should include a critical literature review, an examination of relevant organizations and practices (e.g. employer practices, rules, existing model programs, worker concerns, health insurance related issues, etc.) and analyses of existing data (for example, National Health Interview Survey, National Occupational Mortality Surveillance System). Additionally, each synthesis will provide a list of recommended research topics and actionable programs aimed at improving worker health and reducing premature mortality in the TWU sector.

These syntheses will use multiple sources of information, and will be similar in nature to those produced by the National Research Council's Transportation Research Board (see www.trb.org for more information and synthesis publications).

Reducing obesity

Obesity is a physical condition that contributes to diabetes, cardiovascular disease, osteoarthritis, obstructive sleep apnea, and numerous other preventable conditions. These conditions not only affect quality of life, but may also interfere with the ability to operate a vehicle safely. Many factors influence obesity, including physical activity, stress, eating behavior, sleep quality and quantity, and certain medications.

Although obesity is a national problem – and is likely to be prevalent in a variety of occupational groups in the TWU sector – for two reasons, commercial drivers are targeted initially. First, more than 88% of the truck drivers participating in two recent studies were either overweight or obese, far above the national prevalence of 64%. [Pack et al. 2006; FMCSA 2006] Second, the work demands of commercial drivers create special challenges for this group: the driving task is sedentary in nature, they have limited options for where and when to eat while working or resting away from home, and daily continuous off-duty periods can be as short as 10 hours (team drivers may have even fewer options and shorter continuous off-duty periods). The lessons learned from working to reduce obesity in commercial drivers are expected to ultimately benefit all workers in the TWU and other sectors, particularly those with similar working conditions.

Reducing the incidence of cardiovascular disease (CVD)

Cardiovascular disease (CVD) is the most common cause of death in the United States [Kung et al. 2008]. CVD is also a leading contributor to premature mortality in a variety of TWU sector occupational groups. Much of this body of research has focused on truck drivers, for whom several studies have revealed excess heart disease mortality among truck drivers. An examination of the BLS Supplementary Data System for 1985 and 1986 found that among all occupations, heavy truck drivers contributed 29 deaths due to “heart conditions, including heart attack” – more than any other occupation. Truck drivers accounted for 7.6% of all deaths from heart conditions; this was 4 times the expected number, since they represented only 1.9% of the civilian workforce [Leigh and Miller 1998]. Analysis of the National Occupational Mortality Surveillance system (NOMS) from 1979 through 1990 revealed that long-haul, but not short-haul, drivers had elevated proportionate mortality ratios (PMRs) for heart disease. For acute myocardial infarction specifically, the PMR for white long-haul drivers was 112 (95% CI 108-116) and for black long-haul drivers it was 114 (95% CI 101-128) [Robinson and Burnett 2005].

Another study suggested linkages between lifestyle factors and risk of CVD among truck drivers. Bigert et al. (2003) conducted a study of myocardial infarction (MI) among professional drivers involving 1,067 cases (defined as first MI event) and 1,482 population controls. They reported an MI odds ratio of 1.66 (95% CI 1.22-2.26) for truck drivers who had driven for at least one year compared to people who had never driven a truck, bus, or taxi, after adjusting for age, year of selection, and hospital catchment area. When other individual risk factors were added to the model, such as socioeconomic status, tobacco use, alcohol use, sedentary lifestyle, and being overweight, the odds ratio

fell to 1.10 (95% CI 0.79-1.53). The researchers concluded that lifestyle factors explain most of the truck driver risk for MI, but acknowledged that since "... an occupational factor such as stress may exert its effect through mechanisms such as hypertension or metabolic changes, the adjustment for hypertension, diabetes and BMI may introduce 'overadjustment' if the purpose is to evaluate the influence of occupational factors alone."

Two recent Japanese studies [Sato et al. 1999; Koda et al. 2000] examined hypertension in truck drivers. Koda et al. surveyed 134 local drivers, 199 long distance drivers, and 71 clerical workers, and found that truck drivers had significantly higher prevalence of both hypertension and ulcers than did the clerical workers. Sato et al. reported a mean systolic reading of over 140 mmHg for the eight drivers they monitored, and discovered that their blood pressure was higher when driving or loading than it was during a day off.

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