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Occupational Fatalities in Alaska: Two Decades of Progress, 1990-1999 and 2000-2009

J.M. Lincoln [a,*], M.B. O'Connor [a], K.D. Retzer [a], R.D. Hill [b], T.D. Teske [a], C.C. Woodward [a], D.L. Lucas [a], P.D. Somervell [a], J.T. Burton [a], N.A. Mode [c], B.J. Husberg [a], G.A. Conway [a]

[a] Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health/Alaska Pacific Office 4230 University Drive, Suite 310 Anchorage, Alaska 99508, USA
[b] Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health/Western States Office Denver Federal Center, 6th Ave & Kipling Street, Building 25, Room 2644 Lakewood, Colorado 80225, USA
[c] Nicolle Mode and Associates, 2610 Gapwall Court Pleasanton California 94566-4520, USA

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ABSTRACT

Introduction: Alaska had the highest work-related fatality rate of any state during 1980–1989. The National Institute for Occupational Safety and Health established the Alaska Field Station (AFS) to address this problem. *Methods:* AFS established surveillance systems to provide scientific assessments of occupational hazards. Interventions were developed in collaboration with partners and evaluated. *Results:* During 2000–2009, Alaska experienced a 42.5% decline in work-related fatalities over the previous decade of 1990–1999. In 2009, the workplace fatality rate for Alaska was 5.6/100,000 workers. Commercial pilot deaths were reduced by 50% and Bering Sea crab fishing death rates were reduced by 60%. Building on this success, AFS established national programs to improve safety in the commercial fishing and oil and gas extraction industries. *Impact on Industry:* A focused, epidemiological approach to reducing fatalities in high-risk occupations is effective. Ongoing commitment to this type of approach will assist in continued success in Alaska and elsewhere.

1. Introduction

During 1980-1989, Alaska had the highest work-related fatality rate of any state in the nation, with a rate of 34.8 deaths/100,000 workers/year compared to the average United States (U.S.) rate of 5/100,000/year (Bell et al., 1990; National Institute for Occupational Safety and Health [NIOSH], 1993). The high rate of work-related fatalities in Alaska may be explained in part by extreme physical and environmental conditions. Cold temperatures, vast mountain ranges, remote tundra, extensive coastline along with harsh and sometimes unpredictable weather and great distances to medical care contributed to the severity of traumatic injuries at worksites across the state. However, the rate of work-related fatalities in Alaska was much higher during the 1980s than in Nordic countries that shared similar industries and environmental risks (Conway et al., 1999), suggesting that the high fatality rate was not merely due to the remote northern locale.

To address the high rate of work-related fatalities in Alaska, the National Institute for Occupational Safety and Health (NIOSH) Division of Safety Research, established the Alaska Field Station (AFS) in Anchorage, Alaska in 1991, at the invitation of the Alaska Department of Health and Social Services and the Alaska Area Native Health Service of the Indian Health Service. The mission of AFS was to combat the urgent problem of work-related fatalities in Alaska. AFS served as a "catalyst for change" by providing a scientific assessment of occupational safety hazards, such as identifying the state's highest risk industries, the workers most at risk of fatality and the highest priority problems. Working with partners, interventions were developed, implemented and then evaluated to measure progress in reducing hazards.

The purpose of this article is to describe how continued prevention activities have resulted in a decline in the number and rate of fatalities among Alaska's workers since 1990, and to explain how the AFS model for reducing workplace fatalities has expanded to address high-risk industries in other states. The timeline illustrates significant events that have occurred since the establishment of the AFS (Fig. 1).

2. 1990-1999

From 1990 to1999, AFS staff used surveillance data and collaborative efforts with various partners to identify high-risk industries and assist in prevention efforts. AFS scientists developed the Alaska Occupational Injury Surveillance System (AOISS) to collect detailed information on all work-related traumatic fatalities in the state. Furthermore, the Interagency Working Group for the Prevention of Work-Related Fatalities was created as a non-regulatory response to

* Corresponding author at: 4230 University Drive, Suite 310, Anchorage, Alaska 99508 USA. Tel.: +1 907 271 2383; fax: +1 907 271 2390.
E-mail addresses: JLincoln@cdc.gov (J.M. Lincoln), MBOConnor@cdc.gov (M.B. O'Connor), KRetzer@cdc.gov (K.D. Retzer), RDHill1@cdc.gov (R.D. Hill), TTeske@cdc.gov (T.D. Teske), CWoodward@cdc.gov (C.C. Woodward), DLucas@cdc.gov (D.L. Lucas), PSomervell@cdc.gov (P.D. Somervell), JBurton1@cdc.gov (J.T. Burton), NMode@cdc.gov (N.A. Mode), BHusberg@cdc.gov (B.J. Husberg), GConway@cdc.gov (G.A. Conway).

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developing occupational safety interventions in several industries including helicopter logging and commercial fishing. These efforts led to a 49% decline in work-related deaths including a significant decline in all workplace fatalities and a 67% decline in commercial fishing deaths specifically during 1990-1999 (NIOSH, 2002). However, occupational mortality due to crashes of fixed-wing aircraft and crab fishing vessels sinking in the Bering Sea continued to be persistent problems.

3. Aviation Safety Initiative

During the 1990s, aircraft crashes were the second leading cause of occupational death in Alaska, taking the lives of 192 workers (NIOSH, 2002). During that time, commercial pilots in Alaska had a fatality rate which was five times greater than the rate for all U.S. pilots and nearly 100 times greater than the rate for all U.S. workers (Bensyl, Moran, & Conway, 2001). Research found that the most deadly aviation crashes were due to controlled flight into terrain (CFIT), in which a pilot flew an airworthy aircraft into mountains, water or other terrain, usually in conditions of poor visibility (National Transportation Safety Board [NTSB], 1989). During 1991-1998, CFIT accounted for only 17% of all crashes of air taxi and commuter fixed-wing aircraft in Alaska, but accounted for 59% of all deaths and 55% of all pilot deaths (Thomas, Bensyl, Manwaring, & Conway, 2000).

AFS and partners began a multifaceted public health approach to aviation safety during the late 1990s. Much of this work was encompassed in the Alaska Interagency Aviation Safety Initiative (AIASI) which focused on improving safety for air taxi and commuter airlines operations in Alaska. These partners included the National Transportation Safety Board Alaska Regional Office, the Federal Aviation Administration (FAA), the National Oceanic and Atmospheric Administration's National Weather Service, and the Alaska Air Carriers Association. The interventions that were developed included improved technology, education and voluntary changes in aviation safety culture (Table 1).

Marked improvements to aviation safety were observed after implementation of the interventions. During 1990-1999 there had been an average of 10 commercial pilot deaths in aviation crashes in Alaska per year. This declined by 50% to an average of 5 deaths per year during 2000-2009 (Mode, O'Connor, Conway, & Hill, 2012). An average of 35 air taxi and commuter crashes occurred each year during 1990-1999, declining to 21 per year during 2000-2009. The average number of CFIT crashes decreased from 7 per year during the 1990s to an average of 3 per year during 2000-2009 (Fig. 2) (Mode et al., 2012).

In addition to improving safety among air taxi and commuter operations in Alaska, the interventions may have contributed to a reduction of crashes in other areas of aviation, such as non-commercial aviation, as many of the interventions could be used by all pilots in Alaska. For example, the Capstone project increased situational awareness for pilots by providing avionics with information on terrain, weather and location of other aircraft. This technology paved the way for the new air traffic control system which will be deployed nationwide to transform air traffic control in the U.S. from the current ground-based system of radars to a satellite-based system (FAA, 2007).

The formal Aviation Safety Initiative ended in 2009. With CFIT crashes subsiding since 2000, other types of crashes contribute the most to pilot fatalities. In recent years (2000-2010), 39% of work-related fatal aircraft crashes were associated with intended takeoffs or landings at sites that were not FAA registered landing sites (CDC, 2011). These include gravel bars, snowfields, remote lakes, and temporary airstrips which are in place during hunting or fishing seasons.

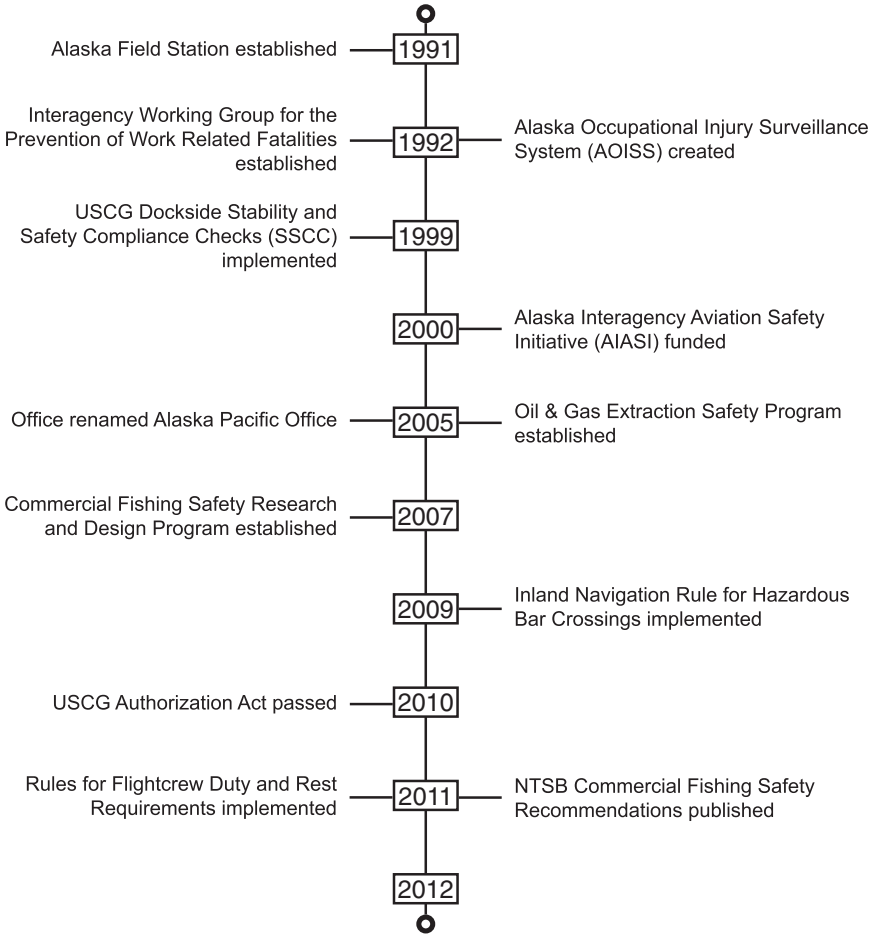

Fig. 1. Caption: Timeline illustrating significant events that have occurred since the establishment of the AFS.

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Table 1
Caption: These six interventions have helped improve aviation safety in Alaska through partnerships between federal agencies and industry associations.

Interventions Implemented During the Alaska Interagency Aviation Safety Initiative			
Intervention	Goal	Organization	Implementation
Weather Cameras	Real-time mountain pass and remote location information	Federal Aviation Administration, National Weather Service	1997-Current Federally funded in 2004
Capstone Safety Program	Install advanced navigational equipment	Federal Aviation Administration	Phase I: 1999-2003 Phase II: 2003-2007
Risk Factor Identification/ Survey	Scientific Assessments	National Institute for Occupational Safety and Health	Survey 2001-2002 Risk factor summaries presented annually
Mike-in-Hand	Real-time weather information	National Weather Service, Federal Aviation Administration	2001-Current
Medallion Foundation	Promote higher industry standard of safety	Alaska Air Carriers Association	2001-Current
Circle of Safety	Passenger safety information	Federal Aviation Administration	2002-Current

This research also found that encounters with adverse weather conditions, pilots' loss of aircraft control, pilots' failure to maintain clearance from terrain, water or objects and engine, structure or component failure were leading causes of work-related crashes. Future research will be conducted to further analyze types of flight operations in work-related crashes and provide recommendations and interventions for prevention.

4. Preventing the "Deadliest Catch"

At the end of the 1990s, AFS also focused prevention efforts on the most hazardous fishing fleet, the Bering Sea and Aleutian Island (BSAI) crab fleet. From August 1990 through March 1999, 73 workers died in the BSAI crab fisheries as a result of vessels capsizing and/or sinking, man overboard (MOB), and industrial accidents, such as being struck or crushed by crab pots. During this period, 50 workers on 12 vessels died after their vessels capsized or sank. Additionally, there were 18 MOB fatalities caused by gear entanglement, and falling/being washed overboard (Woodley, Lincoln, & Medlicott, 2009). When taking into account changes in workforce size, variations in season length and number of vessels participating in the fishery, workers participating in BSAI crab fisheries were experiencing a fatality rate of 770 fatalities per 100,000 full-time equivalent fishermen (CDC, 2008a).

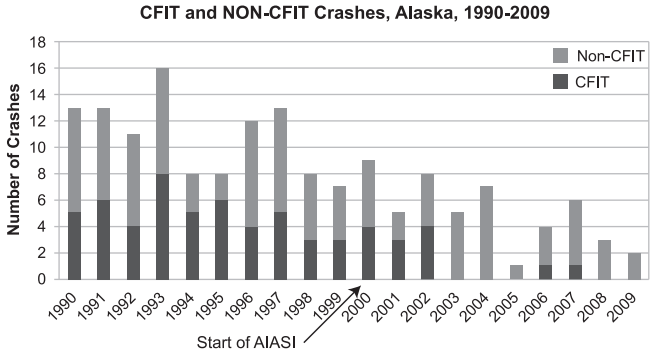

Fig. 2. Caption: These interventions helped reduce pilot fatalities by 50% between 1990 and 2009. The installation of weather cameras and upgraded avionics helped to decrease the occurrence of CFIT crashes.

During this period (1990-1999), the BSAI crab fleet had a high level of compliance with safety regulations that required primary lifesaving equipment to be onboard, however fatality rates remained very high. The existing safety regulations did not address the problem of overloading vessels with crab pots (cages that weigh 800-900 pounds and are used to catch crab). When fully loaded with crab pot gear, these vessels are susceptible to capsizing, especially during icing conditions, as is common in the winter months. At least eight of the 12 vessels lost during 1990-1999 were enroute to or coming from the crab grounds in a loaded condition (Woodley et al., 2009).

To address this fleet specific problem, the United States Coast Guard (USCG) developed the "At the Dock Stability and Safety Compliance Check" (SSCC) for the BSAI crab fleet, using NIOSH data for support. To execute the program, USCG staff reviewed vessel loading and stability instructions with the master of each vessel and checked for overloading. Vessels found to be without stability reports, overloaded, or having missing, outdated, or inoperable primary lifesaving equipment (i.e. immersion suits, liferafts, EPIRBs) were not allowed to leave the dock until the safety discrepancy was corrected (Woodley et al., 2009).

Since the establishment of the SSCC in 1999, a total of nine lives have been lost (Fig. 3). This is a significant improvement over the 1990–1999 time period, where the fleet lost an average of eight fishermen annually. This program has resulted in a 60% reduction in the fatality rate in the BSAI crab fleet (CDC, 2008a).

5. National Commercial Fishing Safety Research and Design Program

Building on the successes in reducing workplace fatalities in the fishing industry in Alaska, NIOSH expanded the commercial fishing safety research work geographically and established the Commercial Fishing Safety Research and Design Program in 2007. This NIOSH program identifies high-risk fisheries and regional hazards for all fishing regions of the U.S. The surveillance summaries and research projects that have been completed have also affected regional and national policy.

NIOSH developed the Commercial Fishing Incident Database (CFID) to identify commercial fishing fatalities and vessel losses across the U.S. NIOSH has now identified high-risk fisheries outside of Alaska that urgently require targeted interventions to improve safety (CDC, 2010; and NIOSH, 2010a,b,c, & d) and has started to initiate various projects with partners to implement interventions in these areas. The fishing fleets with the highest frequency of death during 2000-2009 were the shrimp fleet in the Gulf of Mexico (55 deaths, 11%), the scallop fleet along the east coast of the US (44 deaths, 9%) and the salmon fleet in Alaska (39 deaths, 8%). Of those fisheries for which fatality rates could be calculated, the Northeast Multispecies ground fish fleet had the highest rate (600 deaths per 100,000 per year) followed by the east coast scallop fleet (425 deaths per 100,000/year) and the West Coast Dungeness crab fleet (310 deaths/100,000/year) (CDC, 2010).

The NIOSH Program has also targeted specific fleets for prevention efforts by conducting surveys to identify personal flotation devices (PFDs) that are comfortable to wear while working (Lincoln, Lucas, McKibbin, Woodward, & Bevan, 2008; Lucas, Lincoln, Somervell, & Teske, 2012), developing engineering solutions to prevent deck injuries, developing tools to avoid progressive flooding due to open hatches in watertight compartments, and developing tools to monitor fluid levels in tanks.

The Commercial Fishing Safety Research and Design Program staff has provided data, technical assistance and testimony to develop regional and national policies to improve fishing safety. In response to a 2008 NIOSH report describing the hazards that exist for the commercial fishing industry in California, Oregon, and Washington (CDC, 2008a), the USCG developed rules for the Washington and Oregon Coasts that improved safety procedures for crossing hazardous river bars. These rules were implemented in December 2009 (Inland Navigation Rules,

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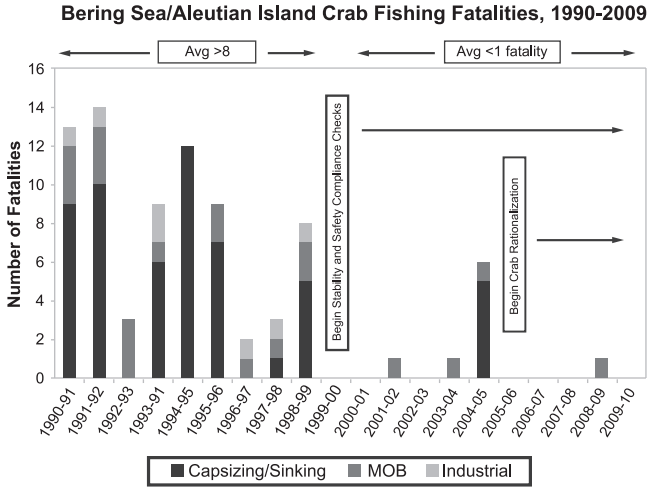

Fig. 3. Caption: Dramatic reduction in fatalities among BSAI crab fishermen occurred as a result of targeted public health interventions recommended by NIOSH and implemented by the US Coast Guard.

2005). Based on NIOSH Congressional Testimony, Congress passed the US Coast Guard Authorization Act of 2010 – Pub.L. 111-281, which contains instructions to the USCG to prevent vessel loss, falls overboard, and severe injuries in the commercial fishing industry and to improve safety training. In April 2011, NIOSH provided technical guidance to the National Marine Fisheries Service (NMFS) of the National Oceanographic and Atmospheric Association on how to evaluate the safety of human life at sea during their fisheries management policy development process. NIOSH has shown that the fishery management process (which controls the amount of fish that can be caught) can more explicitly address safety at sea by analyzing fishing hazards quantitatively. In addition, NIOSH testimony during the National Transportation Safety Board (NTSB) Fishing Vessel Safety Forum was cited extensively for the foundation of recommendations to the USCG in November 2011 by the NTSB (NTSB, 2011).

6. NIOSH Oil and Gas Extraction Safety and Health Program

Applying the same approach that was used to reduce workplace fatalities in Alaska, including collecting and analyzing surveillance data and developing partnerships to better understand the hazards, NIOSH began investigating hazards in the U.S. oil and gas extraction industry and suggesting possible controls (Mode & Conway, 2007) in 2005. Also during this year, the office name was changed from the Alaska Field Station to the Alaska Pacific Office (APO) to better reflect the broad scope of research and prevention activities. APO researchers found that 98 oil and gas extraction workers died on the job in the U.S. in 2004. This resulted in a fatality rate of 31.9 deaths/100,000 workers – a rate that was similar to coal miners, twice the rate of construction workers and almost 8 times higher than the rate for all U.S. workers (U.S. Bureau of Labor Statistics, 2004). As of 2011, APO works closely with the NIOSH Western States Office in Denver on most research projects involving the oil and gas industry; staff is shared between the two offices to work on specific projects.

APO has found that, during 2003-2006, the most common fatal events in this industry were highway crashes, making up 29% of fatalities (190 deaths), followed by workers struck by an object (tools, equipment, drill pipe), which resulted in 20% of fatalities (131 deaths) (CDC, 2008b). APO staff have also found that the risk of being fatally injured varied by company type. For example, during 2003-2008, workers employed by drilling contractors had the second highest number of fatalities (198 deaths), but had the highest fatality rate (45.8/100,000/year) (Retzer, Hill, & Conway, 2011). Likewise, the fatality rate was found to be highest among the smallest companies, with a particularly high fatality rate among small drilling contractors (211.7/100,000/year) (Retzer et al., 2011). Results of these analyses have helped APO staff focus their research activities on the most frequent fatal events and the groups of workers most at risk of being killed on the job. Current research projects are addressing the leading causes of injury and illness in this industry including the prevention of motor vehicle crashes, 'struck by' injuries, falls, fires and explosions. Additional projects focus on the control of silica during well completion activities.

7. Two Decades of Progress

The reduction in fatalities through 2009 in both the aviation and commercial fishing industries influenced the overall decline in workplace fatalities in Alaska. During 2000-2009, Alaska experienced a 42.5% decline in work-related fatalities over the previous decade of 1990-1999.

Since the establishment of AFS, the surveillance, analysis, and focused interventions in the most hazardous occupations, have resulted in a significant decline in workplace fatalities in Alaska (Fig. 4). In 2009, the workplace fatality rate for Alaska was 5.6 deaths per 100,000 workers (Verrelli, 2012).

8. The Next Decade

APO will continue to work to improve workplace safety in all industries in Alaska, and in high-risk industries such as the aviation, commercial fishing and oil and gas industries throughout the U.S. The partnership with the State of Alaska Department of Health and Social Services continues so that the surveillance data collected for AOISS is used to monitor work-related injury data for new trends and patterns among Alaska workers. Relationships with state and federal agencies, industry partners and non-governmental organizations will be maintained to keep abreast of proposed changes in regulations, industry trends and developments and emerging hazards.

To further improve aviation safety, APO recently provided comments on the FAA's Notice of Proposed Rulemaking (NPRM) for Flightcrew Member Duty and Rest Requirements and shared fatigue findings from a previous APO survey of commercial pilots and aviation companies in Alaska (NIOSH, 2006). The final rule established flight, duty and rest times for flight crews on large passenger aircraft. The NPRM also stated that small, air taxi operations, which are common in Alaska, should expect to see an NPRM very similar to the final rule governing large air carrier operations. APO is currently leading a study focusing on fatigue among commercial pilots in Alaska. Results from this study will be used to develop tools for fatigue awareness, assessment, management, prevention and training and will be made available to all pilots and aviation companies in Alaska.

APO will continue to provide data and support to research activities to improve safety in the commercial fishing industry in all parts of the country. This currently includes preventing falls overboard among shrimp fishermen in the Gulf of Mexico, winch entanglements in New England and evaluating sources for non-fatal injury surveillance in the Pacific Northwest. APO will continue to provide technical assistance to partners including the U.S. Coast Guard, in accordance with the newly authorized U.S. Coast Guard Authorization Act of 2010, and the National Marine Fisheries Service. These activities will result in further declines in the fishing fatality rates in the U.S.

9. Conclusion

The overall decline in work-related fatalities in Alaska demonstrates the success of a focused, epidemiological approach to reducing fatalities in high-risk occupations. While progress has been made, several industries in Alaska continue to experience fatality rates well above the

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Fig. 4. Caption: Since the establishment of the NIOSH Alaska Pacific Office in 1991 the fatality rate in Alaska has declined 42.5%.

national average. In addition, the programs that work in Alaska to reduce fatalities in these high-risk industries have expanded geographically. Commercial fishing and aviation require active surveillance to identify risk factors and guide prevention strategies and evaluation. The oil and gas industry continues to grow and occupational safety and health initiatives must keep up with emerging hazards. The characteristics of the work environments, occupations and culture of these high- risk industries make injury prevention challenging. Yet the evidence from two decades of NIOSH work in Alaska suggests that further improvements in worker safety are possible. Ongoing commitment to collaborative efforts by governmental agencies, industry and non-governmental organizations will assist in reducing the still high numbers of work-related fatalities in Alaska and in the high-risk industries found in Alaska and elsewhere.

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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JM Lincoln is the Director of the NIOSH Alaska Pacific Office and leads the Commercial Fishing Safety Research and Design Program. Dr. Lincoln received her PhD from Johns Hopkins University in Health Policy Management, is a CAPT in the US Public Health Service and a Certified Safety Professional (CSP). She is an advocate for providing strong science to improve safety in the work-place. She has authored numerous journal articles and is regularly consulted regarding marine safety issues.

Mary B. O'Connor has been with the National Institute for Occupational Safety and Health for three years, working with the Aviation Safety in Alaska Program. She has a master's degree in environmental and public health and is also a commissioned officer in the U.S. Public Health Service.

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Kyla D. Retzer has a Masters in Public Health with a focus in Epidemiology. She worked at the Alaska Native EpiCenter and in Injury Prevention within the Alaska Tribal Health System for six years prior to joining NIOSH. She is now the Assistant Coordinator of the Oil & Gas Safety and Health Program at NIOSH and an epidemiologist focused on the research project "Best Practices in Motor Vehicle Safety for the Oil & Gas Industry". Her research interests include motor vehicle safety, suicide prevention and injury epidemiology.

Ryan D. Hill is an Epidemiologist at the National Institute for Occupational Safety and Health in Denver, CO. He has a Master's Degree in Public Health from the George Washington University and is also a commissioned officer in the U.S. Public Health Service. Ryan's primary duties with NIOSH include conducting research and prevention activities to reduce injuries among oil and gas extraction workers. Ryan Manages the NIOSH Oil and Gas Extraction Safety and Health Program and serves as a co-Chair of the NORA Oil and Gas Extraction Council.

Theodore D. Teske is the health communication specialist for the NIOSH Alaska Pacific Office. He began his career at NIOSH in 1999, developing safety training videos for the mining industry while earning his BA in Broadcasting from Gonzaga University. He received his MA in Communication and Leadership from Gonzaga in 2008 and began working with APO. His expanded duties include health communication and technology transfer. Ted is focused on improving the research to practice efforts and looks for innovative ways to engage workers to participate in and adopt the results of NIOSH research. His research interests include technology transfer and adoption, qualitative research methods for field research, and organizational and cultural communication.

Chelsea C. Woodward studied at Wenatchee Valley College and at Gonzaga University. He has worked as an electrical engineering contractor for the U.S. Bureau of Mines at the Spokane Research Center, and presently with the National Institute for Occupational Safety and Health, Alaska Pacific Office. His professional emphasis at NIOSH has been in developing mechatronic safety systems, motion control and semi-autonomous system designs and applications, hydrogen-fueled vehicle safety systems and gas monitors, data acquisition controls and sensor networking formally focusing on the mining sector and currently designing safety interventions to serve commercial fishermen.

Devin L. Lucas is a Health Statistician at the National Institute for Occupational Safety and Health and a doctoral student in occupational safety and health at Oregon State University.

Philip D. Somervell received a B.A. degree in Anthropology from Beloit College, a M.S. degree from Boston University and a Ph.D. degree in Epidemiology from the University of North Carolina at Chapel Hill. He has been with the Alaska Pacific Office, NIOSH, in Anchorage, Alaska, since 2007. His research interests include injury prevention in oil and gas extraction and other industries. Before joining NIOSH, he served as an epidemiologist with the New Mexico Department of Health, the New York State Department of Health, and was on the faculty of the University of Colorado Health Sciences Center.

Jason T. Burton is a Technical Information Specialist with the National Institute for Occupational Safety and Health. He works in the Oil and Gas Extraction Program. He joined the Institute in 2008 after graduating from the University of South Florida's School of Information with a master's degree in library and information science.

Nicolle A. Mode has worked extensively in the field of public health research at government research institutes, private research centers and universities since obtaining her master's degree in biostatistics. She worked at the National Institute for Occupational Safety and Health for 5 years before starting her own consulting company. Ms. Mode is an author on over 20 publications and has provided statistical summaries and support for many more.

Brad J. Husberg is a Captain in the U.S. Public Health Service working as a Senior Program Management Officer and Epidemiologist. He is assigned to the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Office of Agriculture Health and Safety. CAPT Husberg is the Coordinator for the NIOSH Office of Agriculture Safety and Health and the NORA Agriculture, Forestry, and Fishing Sector Council.

George A. Conway directed the Alaska Pacific Office from 1992-2011. Dr. Conway received his MD from the University of New Mexico and his MPH at the University of South Carolina. He has participated in a variety of field research and prevention activities in Alaska and has collaborated on disease and injury surveillance and prevention projects in Canada, Greenland, Sweden, Finland, Norway, Russia, Iceland, Bangladesh, India, Sri Lanka, and Taiwan.

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