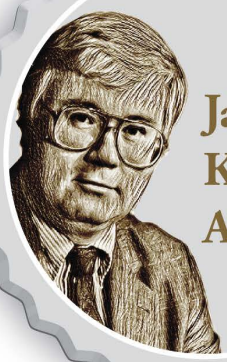
2019 NIOSH SCIENCE AWARDS



James P. Keogh Award

Alice Hamilton Award

r2p®

Bullard-Sherwood r2p Award

PLAIN LANGUAGE AWARD

DIA

The Director's Intramural Award

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

With NIOSH Nominations for CDC's Charles C. Shepard Science Award

Disclaimer

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All Web addresses referenced in this document were accessible as of the publication date.

Get more information

Find NIOSH products and get answers to workplace safety and health questions:

1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348
CDC/NIOSH INFO: cdc.gov/info | cdc.gov/niosh
Monthly NIOSH eNews: cdc.gov/niosh/eNews

April 2019

NIOSH Science Awards 2019

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

This page intentionally left blank.

Contents

James P. Keogh Award for Outstanding Service in Occupational Safety and Health 1
- James P. Keogh Award Winner 2
- Previous James P. Keogh Award Winners 4

Alice Hamilton Award for Occupational Safety and Health 5
- Alice Hamilton, MD 5
- Alice Hamilton Laboratory for Occupational Safety and Health 6
- Alice Hamilton Award Finalists 7
- Education and Guidance Honorable Mention 11
- Education and Guidance Winner 12
- Engineering and Control Honorable Mention 13
- Engineering and Control Winner 14
- Epidemiology and Surveillance Honorable Mention 15
- Epidemiology and Surveillance Winner 16
- Exposure and Risk Assessment Honorable Mention 18
- Exposure and Risk Assessment Winner 19
- Methods and Laboratory Science Honorable Mention 20
- Methods and Laboratory Science Winner 21
- Research Service Honorable Mention 22
- Research Service Winner 23

Alice Hamilton Award 2018 Winner Updates 24
- Education and Guidance 24
- Engineering and Control 25
- Epidemiology and Surveillance 27
- Exposure and Risk Assessment 29
- Methods and Laboratory Science 31

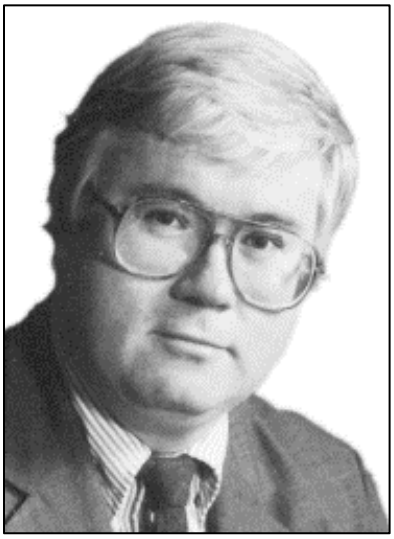
Bullard-Sherwood Research to Practice Award 33
- Edward W. Bullard 33
- R. Jeremy (Jerry) Sherwood 34
- Bullard-Sherwood Research to Practice Finalists 35
- Knowledge Honorable Mention 36
- Knowledge Winner 37
- Intervention Honorable Mention 39
- Intervention Winner 40
- Technology Winner 41

Plain Language Award 42
- Background 42
- Plain Language Award Finalists 43
- Original Product Honorable Mention 44
- Original Product Winner 45
- Before and After Honorable Mention 46
- Before and After Winner 47

Director's Intramural Award for Extraordinary Science 48
Director's Intramural Award for Extraordinary Science Finalists 49
Director's Intramural Award Winner for Distinguished Career Scientist 50
Director's Intramural Award Winner for Early Career Scientist 52
Director's Intramural Award Winner for Scientific Support 54
Director's Intramural Award for Extraordinary Science 2017 Winner Updates 56
Distinguished Career Scientist 56
Early Career Scientist 57
Scientific Support 58
NIOSH Nominations for the 2019 Charles C. Shepard Science Award 60
NIOSH Nominations for the Charles C. Shepard Science Award 61
Lifetime Scientific Achievement Award 63

James P. Keogh Award for Outstanding Service in Occupational Safety and Health

A tireless advocate for worker safety and health



The National Institute for Occupational Safety and Health is pleased to recognize one current or former NIOSH employee each year for exceptional service to the field of occupational safety and health. This award honors the contributions made by public health workers who fight long odds to achieve safer and healthier workplaces.

James P. Keogh, MD, was a tireless advocate for worker safety and health who died in June 1999 at the age of 49. His earliest work in academic medicine identified dimethylaminopropionitrile as the causal agent in an outbreak of bladder neuropathy in the 1970s. Dr. Keogh could determine this because—unlike many of the clinicians initially contacted by the workers—he took their complaints seriously and applied clear public health principles to his investigation. Throughout his life, he listened carefully to workers, characterized hazards and diseases, and then fearlessly worked to identify compensation for the individual and prevention strategies for others. Dr. Keogh was instrumental in including construction workers in the Maryland Occupational Safety and Health lead standard, a full decade before the federal standard included them. He was a leading medical educator who always focused on the need to incorporate clinical compassion with public health prevention. His most outstanding legacy, however, was his fierce determination to put knowledge into practice to benefit the worker.

James P. Keogh Award Winner

Dr. Leslie Nickels

Over her nearly 40-year career, Dr. Leslie Nickels was a dedicated advocate to improving the safety and health of underserved workers. Her legacy continues to touch workers, researchers, students, and health and safety professionals around the world.

Dr. Nickels began her career at the Illinois Department of Labor, where she conducted workplace inspection and enforcement, while building worker and professional capacity through education and training. Dr. Nickels was also co-founder and executive director of the Illinois Network for Agricultural Safety and Health, where she overcame significant organizational boundaries to bring together industry representatives and the farming community with occupational safety and health (OSH) professionals to develop strategies to reduce injuries and illnesses in one of Illinois' most hazardous industries.

Integrating her dedication for community engagement and capacity building with education and training, Dr. Nickels conducted research including investigations of pesticide exposure among farmworkers in Mexico, eye injuries in U.S. farmworkers, and street-corner surveillance of hazards faced by day laborers. Dr. Nickels established worker centers as key partners for the Great Lakes Centers for Occupational and Environmental Safety and Health. The impact of this work has served as a model for other U.S. academic centers, which now regularly engage with worker centers as essential community partners in OSH research and practice.

Dr. Nickels was also heavily involved in international efforts to promote basic occupational health services in low- and middle-income countries through her work with ICOH, WHO, and the NIOSH Global Collaborations program. For example, she managed the WHO Network of Collaborating Centres in Occupational Health's activity area for education, training, and technical materials. Under her leadership, hundreds of OSH professionals created projects in support of shared goals, developing more than 150 practical tools and 140 training courses. Dr. Nickels also created and managed the Global Environmental and Occupational Health e-Library, an online library of free resources in six languages covering OSH, environmental health, and a specialty library focused on road safety at work. Dr. Nickels was an active leader in APHA's Occupational Health and

Safety Section. In recognition of her global reach and impact, the section established and presented the first Leslie Nickels International Award in 2018 to honor an individual with outstanding contributions to international OSH.

From 2010 to 2017 Dr. Nickels worked at NIOSH, where she served many roles including deputy associate director of the Communications and Research Translation Office, associate director of the Research to Practice (r2p) Office and co-manager of the NIOSH Global Collaboration program. In these roles she helped establish the NIOSH Communication Leadership Team and worked towards expanding r2p activities to engage partners and stakeholders more effectively. She also championed the development of national guidance on occupational hazards, to increase the capacity of primary care organizations to treat patients' OSH issues, and to identify barriers to incorporate OSH into electronic medical records.

Perhaps Dr. Nickels' greatest legacy is her commitment to training and mentoring the next generations of OSH professionals. It is difficult to quantify the number of students and professionals who benefitted from Dr. Nickels' guidance, and even more difficult to estimate the number of workers' and families' lives she touched through them. She taught numerous courses and mentored students, faculty, and staff in community-based participatory and action research methods. Dr. Nickels was always enthusiastic and eager to share experiences, thoughts, and advice, and thus, often sought out by early and midcareer colleagues. One of Dr. Nickels' most unique contributions was in her role as OSH historian and storyteller.

Dr. Nickels passed away in November 2017, but her legacy will live on through the many individuals and organizations she inspired, trained, educated, mentored, and collaborated with, as well as the many achievements driven by her uplifting and optimistic spirit, deep commitment, unwavering determination, and passionate advocacy.

Previous James P. Keogh Award Winners

2018: Pete Kovalchik

2017: Diane Porter

2016: Thomas R. Waters

2015: Kathleen Kreiss

2014: Albert E Munson

2013: Michael Attfield

2012: Alice Suter

2011: Linda Rosenstock

2010: James W Collins

2009: John Howard

2008: Mitch Singal

2007: Steven Sauter

2006: Marilyn Fingerhut

2005: Rosemary Sokas

2004: Dawn Castillo

2003: James A. Merchant

2002: Philip J. Landrigan

2001: William Edward Halperin

2000: Richard A Lemen

Alice Hamilton Award for Occupational Safety and Health

The Alice Hamilton Award for Occupational Safety and Health recognizes the scientific excellence of technical and instructional materials by NIOSH scientists and engineers in the areas of Education and Guidance, Engineering and Control, Epidemiology and Surveillance, Exposure and Risk Assessment, Methods and Laboratory Science, and Research Service.

The award honors Dr. Alice Hamilton (1869–1970), a pioneering researcher and occupational physician, and it is presented each year by NIOSH following reviews by panels of scientific experts from inside and outside the institute.

February 27, 1869–September 22, 1970

Alice Hamilton, MD

Many of the first laws and regulations passed to improve the health of workers were the direct result of the work of one dedicated and talented woman, Alice Hamilton, MD. Born into a prominent family in Indiana (her sister was the well-known classicist, Edith Hamilton), Dr. Hamilton graduated from medical school at the University of Michigan in 1893. After accepting a teaching position at the Women's Medical School of Northwestern University in 1897, she moved into Jane Addams' Hull House in Chicago. There she opened a well-baby clinic for poor families in the local settlement house neighborhood. As she acquainted herself with the families, she learned of their pains, strange deaths, lead palsy, "wrist drop," and of the high number of widowed women. Encouraged by the reformers of Hull House, she began to apply her medical knowledge to these social problems and thus began her scientific inquiry into occupational health, for which she became known.

Dr. Hamilton quickly realized that while some progress in understanding occupational illness and disease was being made in Europe, little was written or understood about occupational disease conditions in the United States. In 1908, she published one of the first articles on occupational disease in this country and was soon a recognized expert on the topic. Starting in 1910, under the sponsorship initially of a commission of the State of Illinois, and later the Federal Bureau of Labor Statistics, she conducted a series of brilliant

explorations of occupational toxic disorders. Relying primarily on "shoe leather epidemiology," and the emerging laboratory science of toxicology, she pioneered occupational epidemiology and industrial hygiene in the United States. Her findings were so scientifically persuasive that they caused sweeping reforms, both voluntary and regulatory, to improve the health of workers.

In 1919, Dr. Hamilton was appointed assistant professor of industrial medicine at Harvard Medical School and became the first female faculty member at Harvard University. She served two terms on the Health Committee of the League of Nations. After she retired from Harvard at the age of 66, she was a consultant to the U.S. Division of Labor Standards, and she served as president of the National Consumers League.

Alice Hamilton Laboratory for Occupational Safety and Health

On Friday, February 27, 1987, the National Institute for Occupational Safety and Health dedicated its facility at 5555 Ridge Avenue in Cincinnati, Ohio, to the memory of Alice Hamilton, MD. The facility is known as the "Alice Hamilton Laboratory for Occupational Safety and Health" in honor of the first American physician to devote her professional life to the practice of occupational health.

Construction of this facility began in fall 1952 and was completed in November 1954. For several years, it was used as the world headquarters and manufacturing plant of the Disabled American Veterans (DAV). In this facility, "Ident-o-Tags," miniature license plates for key chains, were manufactured by disabled veterans for distribution throughout the United States.

In the early 1960s, a portion of the facility was leased to the federal government to provide space for a small number of federal employees. From the early 1960s to the early 1970s more and more of the facility was used by the federal government. By 1973 the entire building was leased for federal offices and laboratories. In September 1974, the first employees of NIOSH were assigned to space in the facility. In December 1982, the U.S. Public Health Service purchased the facility for $3.5 million dollars. More than 200 people work there in such fields as engineering, epidemiology, general administration, industrial hygiene, and laboratory research. The facility contains some of the most-advanced laboratories and sophisticated scientific equipment in the institute.

Alice Hamilton Award Finalists

Finalists are alphabetized by first author.

Education and Guidance

NIOSH [2018]. Interim guidance for protecting workers from livestock and poultry wastewater and sludge during and after floods. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, https://www.cdc.gov/niosh/topics/emres/wastewater.html.

Workplace Design Solutions: Protecting Workers During Production and Handling of Nanomaterials:

> NIOSH [2018]. Protecting workers during nanomaterial reactor operations. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-120.
>
> NIOSH [2018]. Protecting workers during the handling of nanomaterials. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-121.
>
> NIOSH [2018]. Protecting workers during intermediate and downstream processing of nanomaterials. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-122.

NIOSH [2018]. Simple solutions for surface mine workers. By Pollard JP, Dempsey PG, Nasarwanji MF, Porter WL. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018–117.

Engineering and Control

Alexander BM, Esswein EJ, Gressel MG, Kratzer JL, Feng HA, Miller AL, Cauda E, Heil G [2018]. Evaluation of an improved prototype mini-baghouse to control the release of respirable crystalline silica from sand movers. J Occup Environ Hyg *15*(1):24–37.

Bennett J, Marlow D, Nourian F, Breay J, Feng A, Methner M [2018]. Effect of ventilation velocity on hexavalent chromium and isocyanate exposures in aircraft paint spraying. J Occup Environ Hyg *15*(3):167–181.

Lu M-L, Dufour JS, Weston EB, Marras WS [2018]. Effectiveness of a vacuum lifting system in reducing the spinal loading during airline baggage handling. Appl Ergon *70*:247–252.

Epidemiology and Surveillance

Cross-sectional Epidemiologic and Exposure Assessment Studies of Workers Exposed to Carbon Nanotubes and Nanofibers in the United States:

Beard JD, Erdely A, Dahm MM, de Perio MA, Birch ME, Evans DE, Fernback JE, Eye T, Kodali V, Mercer RR, Bertke SJ, Schubauer-Berigan MK [2018]. Carbon nanotube and nanofiber exposure and sputum and blood biomarkers of early effect among U.S. workers. Environ Int *116*:214–228.

Dahm MM, Schubauer-Berigan MK, Evans DE, Birch ME, Bertke S, Beard JD, Erdely A, Fernback JE, Mercer RR, Grinshpun SA [2018]. Exposure assessments for a cross-sectional epidemiologic study of U.S. carbon nanotube and nanofiber workers. Int J Hyg Environ Health *221*(3):429–440.

Schubauer-Berigan MK, Dahm MM, Erdely A, Beard JD, Birch ME, Evans DE, Fernback JE, Mercer RR, Bertke SJ, Eye T, de Perio MA [2018]. Association of pulmonary, cardiovascular, and hematologic metrics with carbon nanotube and nanofiber exposure among U.S. workers: a cross-sectional study. Part Fibre Toxicol *15*(1):22.

Meyers AR, Al-Tarawneh IS, Wurzelbacher SJ, Bushnell PT, Lampl MP, Bell JL, Bertke SJ, Robins DC, Tseng C-Y, Wei C, Raudabaugh JA, Schnorr TM [2018]. Applying machine learning to workers' compensation data to identify industry-specific ergonomic and safety prevention priorities: Ohio, 2001 to 2011. J Occup Environ Med *60*(1):55–73.

Yorio PL, Laney AS, Halldin CN, Blackley DJ, Moore SM, Wizner K, Radonovich LJ, Greenawald LA [2018]. Interstitial lung diseases in the U.S. mining industry: using MSHA data to examine trends and the prevention effects of compliance with health regulations, 1996–2015. Risk Anal *38*(9)1962–1971.

Exposure and Risk Assessment

Esswein EJ, Alexander-Scott M, Snawder J, Breitenstein M [2018]. Measurement of area and personal breathing zone concentrations of diesel particulate matter (DPM) during oil and gas extraction operations, including hydraulic fracturing, J Occup Environ Hyg *15*(1):63–70.

Lee T, Thorpe A, Cauda E, Tipton L, Sanderson WT, Echt A [2018]. Laboratory comparison of new high flow rate respirable size-selective sampler. J Occup Environ Hyg *15*(10)755–765.

Lucas DL, Case SL, Lincoln JM, Watson JR [2018]. Factors associated with crewmember survival of cold water immersion due to commercial fishing vessel sinkings in Alaska. Saf Sci 101:190–196.

Methods and Laboratory Science

Blachere FM, Lindsley WG, Weber AM, Beezhold DH, Thewlis RE, Mead KR, Noti JD [2018]. Detection of an avian lineage influenza A(H7N2) virus in air and surface samples at a New York City feline quarantine facility. Influenza Other Respir Viruses *12*(5):613-622.

Green BJ, Couch JR, Lemons AR, Burton NC, Victory KR, Nayak AP, Beezhold DH [2018]. Microbial hazards during harvesting and processing at an outdoor United States cannabis farm. J Occup Environ Hyg *15*(5):430–440.

Stueckle TA, Davidson DC, Derk R, Kornberg TG, Battelli L, Friend S, Orandle M, Wagner A, Dinu CZ, Sierros KA, Agarwal S, Gupta RK, Rojanasakul Y, Porter DW, Rojanasakul L [2018]. Short-term pulmonary toxicity assessment of pre- and post-incinerated organomodified nanoclay in mice. ACS Nano *12*(3):2292–2310.

Zheng L, Kulkarni P, Birch ME, Ashley K, Wei S [2018]. Analysis of crystalline silica aerosol using portable Raman spectrometry: feasibility of near real-time measurement. Anal Chem *90*(10) 6229–6239.

Research Service

NIOSH [2018]. Development of the inventory of 9/11 agents. By Middendorf P, Carreón T, Calvert GM. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. https://wwwn.cdc.gov/ResearchGateway/Content/pdfs/Development_of_the_Inventory_of_9-11_Agents_20180717.pdf.

NIOSH [2018]. Laborer, pipefitter, and utility foreman crushed by falling block wall—Tennessee. By Lincoln JE. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Fatality Assessment and Control Evaluation (FACE) Report No. FACE-2014-02.

NIOSH [2018]. Preventing deaths and injuries of fire fighters working at basement and other below-grade fires. Workplace Solutions. By Merinar T, Wertman S, Loflin M, Morris G. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-154.

Reynolds LE, Blackley DJ, Colinet JF, Potts JD, Storey E, Short C, Carson R, Clark KA, Laney AS, Halldin CN [2018]. Work practices and respiratory health status of Appalachian coal miners with progressive massive fibrosis. J Occup Environ Med *60*(11):e575–581.

Education and Guidance Honorable Mention

Simple Solutions for Surface Mineworkers

Pollard JP, Dempsey PG, Nasarwanji MF, Porter WL

NIOSH [2018]. Simple solutions for surface mine workers. By Pollard JP, Dempsey PG, Nasarwanji MF, Porter WL. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. Publication No. 2018-117.

Abstract

"Simple Solutions for Surface Mine Workers" is designed to provide examples of solutions and task design ideas that you can use to reduce exposure to risk factors for musculoskeletal disorders (MSDs) and slips, trips, and falls (STFs). The ideas in this booklet are not exhaustive; use them as a foundation for developing similar types of solutions. One of the largest categories of injuries in mining is MSDs, and a significant contributor to these MSDs and other mining injuries are STFs. MSDs and STFs can be prevented by identifying risk factors and reducing exposure to these risk factors through ergonomics. Ergonomics is the science of designing tools, tasks, equipment, and the work environment so that job demands do not exceed the capabilities or limitations of the majority of the workforce (preferably, at least 95%). Properly designed work tasks can lead to safer and more efficient performance of your workers. This is especially true in mining, which is characterized by physically demanding work carried out in a range of dynamic environments. Most mines, and maybe your own mine, may not have dedicated personnel for addressing ergonomic issues. This should not prevent you from making ergonomics improvements. The National Institute for Occupational Safety and Health (NIOSH) has developed a range of tools to assist you in addressing ergonomics needs at your mining operations, including training to teach workers how to recognize and report risk factors for MSDs, guidelines for implementing an ergonomics process, and ergonomics audits for several types of operations. Many of these tools can be implemented by observing work habits and taking fairly simple measurements. Once deficiencies are noted, you can help workers redesign tasks to eliminate or reduce the hazards.

Education and Guidance Winner

Workplace Design Solutions: Protecting Workers During Production and Handling of Nanomaterials

Dunn KH, Topmiller JL, McCleery T, Whalen J

NIOSH [2018]. Protecting workers during nanomaterial reactor operations. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-120.

NIOSH [2018]. Protecting workers during the handling of nanomaterials. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-121.

NIOSH [2018]. Protecting workers during intermediate and downstream processing of nanomaterials. Workplace Design Solutions. By Dunn KH, Topmiller JL, McCleery T, Whalen J. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-122.

Abstract

Engineered nanomaterials (ENMs) are intentionally produced to have at least one primary dimension less than 100 nanometers (nm). These materials have new or unique properties different from those of larger forms of the same material, making them desirable for specific product applications. The health effects associated with nanomaterials are not yet clearly understood, making it important for producers and users of ENMs to reduce employee exposure and manage risks appropriately. In 2013, the National Institute for Occupational Safety and Health (NIOSH) published a compendium of control approaches for nanomaterial production and use processes titled *Current Strategies for Engineering Controls in Nanomaterial Production and Downstream Handling Processes*. These *Workplace Design Solutions* documents provide guidance on exposure control approaches for protecting workers during nanomaterial reactor operations, during the handling of nanomaterials, and during the intermediate and downstream processing of nanomaterials.

Engineering and Control Honorable Mention

Effectiveness of a Vacuum Lifting System in Reducing Spinal Load During Airline Baggage Handling

Lu M-L, Dufour JS, Weston EB, Marras WS

Lu M-L, Dufour JS, Weston EB, Marras WS [2018]. Effectiveness of a vacuum lifting system in reducing spinal load during airline baggage handling. Appl Ergon *70*:247–252.

Abstract

Information on spinal loading for using lift assist systems for airport baggage handling is lacking. We conducted a laboratory study to evaluate a vacuum lift system for reducing lumbar spinal loads during baggage loading/unloading tasks. Ten subjects performed the tasks using the industry average baggage weight of 14.5 kg on a typical two-shelved baggage cart with or without using the lift system (i.e. lifting technique). Repeated measures analysis of variance (2 tasks × 2 shelf heights x 2 techniques) was used. Spinal loads were estimated by an electromyography-driven biomechanical model. On average, the vacuum lift system reduced spinal compressive forces on the lumbar spine by 39% and below the 3400 N damage threshold. The system also resulted in a 25% reduction in the anterior-posterior shear force at the L5/S1 inferior endplate level. This study provides evidence for the potential to reduce spinal loads when using a vacuum lift system.

Engineering and Control Winner

Effect of Ventilation Velocity on Hexavalent Chromium and Isocyanate Exposures in Aircraft Paint Spraying

Bennett J, Marlow D, Nourian F, Breay J, Feng A, Methner M

Bennett J, Marlow D, Nourian F, Breay J, Feng A, Methner M [2018]. Effect of ventilation velocity on hexavalent chromium and isocyanate exposures in aircraft paint spraying. J Occup Environ Hyg *15*(3):167–181

Abstract

Exposure control system performance was evaluated during aircraft paint spraying at a military facility. Computational fluid dynamics (CFD) modeling, tracer gas testing, and exposure monitoring examined contaminant exposure vs. crossflow ventilation velocity. CFD modeling using the RNG k-ϵ turbulence model showed exposures to simulated methyl isobutyl ketone of 294 and 83.6 ppm, as a spatial average of five worker locations, for velocities of 0.508 and 0.381 m/s (100 and 75 fpm), respectively. In tracer gas experiments, observed supply/exhaust velocities of 0.706/0.503 m/s (136/99 fpm) were termed full-flow, and reduced velocities were termed 3/4-flow and half-flow. Half-flow showed higher tracer gas concentrations than 3/4-flow, which had the lowest time-averaged concentration, with difference in log means significant at the 95% confidence level. Half-flow compared to full-flow and 3/4-flow compared to full-flow showed no statistically significant difference. CFD modeling using these ventilation conditions agreed closely with the tracer results for the full-flow and 3/4-flow comparison, yet not for the 3/4-flow and half-flow comparison. Full-flow conditions at the painting facility produced a velocity of 0.528 m/s (104 fpm) midway between supply and exhaust locations, with the supply rate of 94.4 m^3/s (200,000 cfm) exceeding the exhaust rate of 68.7 m^3/s (146,000 cfm). Ventilation modifications to correct this imbalance created a midhangar velocity of 0.406 m/s (80.0 fpm). Personal exposure monitoring for two worker groups—sprayers and sprayer helpers ("hosemen")—compared process duration means for the two velocities. Hexavalent chromium (Cr[VI]) exposures were 500 vs. 360 μg/m^3 for sprayers and 120 vs. 170 μg/m^3 for hosemen, for 0.528 m/s (104 fpm) and 0.406 m/s (80.0 fpm), respectively. Hexamethylene diisocyanate (HDI) monomer means were 32.2 vs. 13.3 μg/m^3 for sprayers and 3.99 vs. 8.42 μg/m^3 for hosemen. Crossflow velocities affected exposures inconsistently, and local work zone velocities were much lower. Aircraft painting contaminant control is accomplished better with the unidirectional crossflow ventilation presented here than with other observed configurations. Exposure limit exceedances for this ideal condition reinforce continued use of personal protective equipment.

Epidemiology and Surveillance Honorable Mention

Interstitial Lung Diseases in the U.S. Mining Industry: Using MSHA Data to Examine Trends and the Prevention Effects of Compliance with Health Regulations, 1996–2015

Yorio PL, Laney AS, Halldin CN, Blackley DJ, Moore SM, Wizner K, Radonovich LJ, Greenawald LA

Yorio PL, Laney AS, Halldin CN, Blackley DJ, Moore SM, Wizner K, Radonovich LJ, Greenawald LA [2018]. Interstitial lung diseases in the U.S. mining industry: using MSHA data to examine trends and the prevention effects of compliance with health regulations, 1996–2015. Risk Anal *38*(9):1962–1971.

Abstract

Given the recent increase in dust-induced lung disease among U.S. coal miners and the respiratory hazards encountered across the U.S. mining industry, it is important to enhance an understanding of lung disease trends and the organizational contexts that precede these events. In addition to exploring overall trends reported to the Mine Safety and Health Administration (MSHA), the current study uses MSHA's enforcement database to examine whether or not compliance with health regulations resulted in fewer mine-level counts of these diseases over time. The findings suggest that interstitial lung diseases were more prevalent in coal mines compared with other mining commodities, in Appalachian coal mines compared with the rest of the United States, and in underground compared with surface coal mines. Mines that followed a relevant subset of MSHA's health regulations were less likely to report a lung disease over time. The findings are discussed from a lung disease prevention strategy perspective.

Epidemiology and Surveillance Winner

Cross-sectional Epidemiologic and Exposure Assessment Studies of Workers Exposed to Carbon Nanotubes and Nanofibers in the United States

Beard JD, Bertke SJ, Birch ME, Dahm MM, de Perio MA, Erdely A, Evans DE, Eye T, Fernback JE, Grinshpun SA, Kodali V, Mercer RR, Schubauer-Berigan MK

Beard JD, Erdely A, Dahm MM, de Perio MA, Birch ME, Evans DE, Fernback JE, Eye T, Kodali V, Mercer RR, Bertke SJ, Schubauer-Berigan MK [2018]. Carbon nanotube and nanofiber exposure and sputum and blood biomarkers of early effect among U.S. workers. Environ Int *116*:214–228.

Dahm MM, Schubauer-Berigan MK, Evans DE, Birch ME, Bertke S, Beard JD, Erdely A, Fernback JE, Mercer RR, Grinshpun SA [2018]. Exposure assessments for a cross-sectional epidemiologic study of U.S. carbon nanotube and nanofiber workers. Int J Hyg Environ Health 22*1*(3):429–440.

Schubauer-Berigan MK, Dahm MM, Erdely A, Beard JD, Birch ME, Evans DE, Fernback JE, Mercer RR, Bertke SJ, Eye T, de Perio MA [2018]. Association of pulmonary, cardiovascular, and hematologic metrics with carbon nanotube and nanofiber exposure among U.S. workers: a cross-sectional study. Part Fibre Toxicol *15*(1):22.

Abstract

Carbon nanotubes and nanofibers (CNT/F) are increasingly used for diverse applications. Although animal studies suggest CNT/F exposure may cause deleterious health effects, human epidemiological studies have typically been small, confined to single workplaces, and limited in exposure assessment. The researchers involved in this project conducted industrywide cross-sectional epidemiological and exposure assessment studies of 108 workers from 12 U.S. sites to evaluate associations between occupational CNT/F exposure, including the range from non-exposed to highly exposed, and early biologic effects.

The first publication, by Beard et al., assessed CNT/F exposure via personal breathing zone, filter-based air sampling to measure background-corrected elemental carbon (EC) (a CNT/F marker) mass and microscopy-based CNT/F structure count concentrations. The outcomes of interest were 36 sputum and 37 blood biomarkers. The results indicated that inhalable rather than respirable CNT/F was more consistently associated with fibrosis, inflammatory, oxidative stress, and cardiovascular biomarkers.

The second publication, by Dahm et al., focused on exposure assessments. Personal full-shift exposures were assessed based on EC mass at the respirable and inhalable aerosol particle size fractions and microscopy-based CNT/F characterization and particle size. Sputum samples to determine internal exposures and dermal samples of the hands and wrists were taken. Internal exposures to CNT/F were confirmed in 18% of study participants and approximately 70% had positive dermal exposures.

The third publication, by Schubauer-Berigan et al., examined the association between CNT/F and pulmonary, cardiovascular and hematologic markers. Multi-day, full-shift sampling to measure background-corrected ED and CNT/F structure count concentrations were conducted, and induced sputum samples were collected to measure CNT/F in the respiratory tract. Fine and ultrafine particulate matter mass and count concentrations were measured. Outcomes of interest were measured from physical exams, blood pressure, spirometry, and whole blood samples. CNT/F was found in the sputum of 18% of participants. Positive associations between CNT/F exposure and respiratory allergies, resting heart rate and hematocrit counts were found. These associations may not be causal and require further examination.

Exposure and Risk Assessment Honorable Mention

Laboratory Comparison of New High Flow Rate Respirable Size-Selective Sampler

Lee T, Thorpe A, Cauda E, Tipton L, Sanderson WT, Echt A

Lee T, Thorpe A, Cauda E, Tipton L, Sanderson WT, Echt A [2018]. Laboratory comparison of new high flow rate respirable size-selective sampler. J Occup Environ Hyg *15*(10):755–765.

Abstract

A newly developed high flow rate respirable size-selective cyclone sampler (GK4.162—also known as the Respirable Air Sampling Cyclone Aluminum Large [RASCAL]) was calibrated to determine its optimum operating flow rate. The Health and Safety Laboratory in the United Kingdom and two laboratories from the National Institute for Occupational Safety and Health in the United States conducted experiments using two different methods: (1) polydisperse aerosol and time-of-flight direct reading instrument (aerodynamic particle sizer [APS]) and (2) monodisperse aerosol and APS. The measured performance data for the cyclone were assessed against the international respirable convention using the bias map approach. Although the GK4.162 cyclone was tested using different aerosols and detection methods, the results from the three laboratories were generally similar. The recommended flow rate based on the agreement of results from the laboratories was 9.0 L/min.

Exposure and Risk Assessment Winner

Factors Associated With Crewmember Survival of Cold Water Immersion due to Commercial Fishing Vessel Sinkings in Alaska

Lucas DL, Case SL, Lincoln JM, Watson JR

Lucas DL, Case SL, Lincoln JM, Watson JR [2018]. Factors associated with crewmember survival of cold water immersion due to commercial fishing vessel sinkings in Alaska. Saf Sci *101*:190–196.

Abstract

Occupational fatality surveillance has identified that fishing vessel disasters, such as sinkings and capsizings, continue to contribute to the most deaths among crewmembers in the U.S. fishing industry. When a fishing vessel sinks at sea, crewmembers are at risk of immersion in water and subsequent drowning. This study examined survival factors for crewmembers following cold water immersion after the sinking of decked commercial fishing vessels in Alaskan waters during 2000–2014. Two immersion scenarios were considered separately: immersion for any length of time, and long-term immersion defined as immersion lasting over 30 minutes. Logistic regression was used to predict the odds of crewmember survival. Of the 617 crewmembers onboard 187 fishing vessels that sank in Alaska during 2000–2014, 557 (90.3%) survived and 60 died. For crewmembers immersed for any length of time, the significant adjusted predictors of survival were: entering a life-raft, sinking within three miles of shore, the sinking not being weather-related, and working as a deckhand. For crewmembers immersed for over 30 minutes, the significant adjusted predictors of survival were: wearing an immersion suit, entering a life-raft, working as a deckhand, and the sinking not being weather-related. The results of this analysis demonstrate that in situations where cold water immersion becomes inevitable, having access to well-maintained, serviceable lifesaving equipment and the knowledge and skills to use it properly are critical.

Methods and Laboratory Science Honorable Mention

Detection of an Avian Lineage Influenza A(H7N2) Virus in Air and Surface Samples at a New York City Feline Quarantine Facility

Blachere FM, Lindsley WG, Weber AM, Beezhold DH, Thewlis RE, Mead KR, Noti JD

Blachere FM, Lindsley WG, Weber AM, Beezhold DH, Thewlis RE, Mead KR, Noti JD [2018]. Detection of an avian lineage influenza A(H7N2) virus in air and surface samples at a New York City feline quarantine facility. Influenza Other Respir Viruses *12*(5):613–622.

Abstract

In December 2016, an outbreak of low pathogenicity avian influenza (LPAI) A(H7N2) occurred in cats at a New York City animal shelter and quickly spread to other shelters in New York and Pennsylvania. The A(H7N2) virus also spread to an attending veterinarian. In response, 500 cats were transferred from these shelters to a temporary quarantine facility for continued monitoring and treatment. The objective of this study was to assess the occupational risk of A(H7N2) exposure among emergency response workers at the feline quarantine facility. Aerosol and surface samples were collected from inside and outside the isolation zones of the quarantine facility. Samples were screened for A(H7N2) by quantitative RT-PCR and analyzed in embryonated chicken eggs for infectious virus. H7N2 virus was detected by RT-PCR in 28 of 29 aerosol samples collected in the high-risk isolation (hot) zone with 70.9% on particles with aerodynamic diameters >4 μm, 27.7% in 1-4 μm, and 1.4% in <1 μm. Seventeen of 22 surface samples from the high-risk isolation zone were also H7N2 positive with an average M1 copy number of 1.3×10^3. Passage of aerosol and surface samples in eggs confirmed that infectious virus was present throughout the high-risk zones in the quarantine facility. By measuring particle size, distribution, and infectivity, our study suggests that the A(H7N2) virus had the potential to spread by airborne transmission and/or direct contact with viral-laden fomites. These results warranted continued A(H7N2) surveillance and transmission-based precautions during the treatment and care of infected cats.

Methods and Laboratory Science Winner

Short-term Pulmonary Toxicity Assessment of Pre- and Post-incinerated Organomodified Nanoclay in Mice

Stueckle TA, Davidson DC, Derk R, Kornberg TG, Battelli L, Friend S, Orandle M, Wagner A, Dinu CZ, Sierros KA, Agarwal S, Gupta RK, Rojanasakul Y, Porter DW, Rojanasakul L

Stueckle TA, Davidson DC, Derk R, Kornberg TG, Battelli L, Friend S, Orandle M, Wagner A, Dinu CZ, Sierros KA, Agarwal S, Gupta RK, Rojanasakul Y, Porter DW, Rojanasakul L [2018]. Short-term pulmonary toxicity assessment of pre- and post-incinerated organomodified nanoclay in mice. ACS Nano *12*(3):2292–2310.

Abstract

Organomodified nanoclays (ONCs) are increasingly used as filler materials to improve nanocomposite strength, wettability, flammability, and durability. However, pulmonary risks associated with exposure along their chemical lifecycle are unknown. This study's objective was to compare pre- and post-incinerated forms of uncoated and ONCs for potential pulmonary inflammation, toxicity, and systemic blood response. Mice were exposed via aspiration to low (30 μg) and high (300 μg) doses of preincinerated uncoated montmorillonite nanoclay (CloisNa), ONC (Clois30B), their respective incinerated forms (I-CloisNa and I-Clois30B), and crystalline silica (CS). Lung and blood tissues were collected at days 1, 7, and 28 to compare toxicity and inflammation indices. Well-dispersed CloisNa caused a robust inflammatory response characterized by neutrophils, macrophages, and particle-laden granulomas. Alternatively, Clois30B, I-Clois30B, and CS high-dose exposures elicited a low grade, persistent inflammatory response. High-dose Clois30B exposure exhibited moderate increases in lung damage markers and a delayed macrophage recruitment cytokine signature peaking at day 7 followed by a fibrotic tissue signature at day 28, similar to CloisNa. I-CloisNa exhibited acute, transient inflammation with quick recovery. Conversely, high-dose I-Clois30B caused a weak initial inflammatory signal but showed comparable pro-inflammatory signaling to CS at day 28. The data demonstrate that ONC pulmonary toxicity and inflammatory potential relies on coating presence and incineration status in that coated and incinerated nanoclay exhibited less inflammation and granuloma formation than pristine montmorillonite. High doses of both pre- and post-incinerated ONC, with different surface morphologies, may harbor potential pulmonary health hazards over long-term occupational exposures.

Research Service Honorable Mention

Work Practices and Respiratory Health Status of Appalachian Coal Miners with Progressive Massive Fibrosis

Reynolds LE, Blackley DJ, Colinet JF, Potts JD, Storey E, Short C, Carson R, Clark KA, Laney AS, Halldin CN

Reynolds LE, Blackley DJ, Colinet JF, Potts JD, Storey E, Short C, Carson R, Clark KA, Laney AS, Halldin CN [2018]. Work practices and respiratory health status of Appalachian coal miners with progressive massive fibrosis. J Occup Environ Med *60*(11):e575–e581.

Abstract

The objective of this study was to characterize workplace practices and respiratory health among coal miners with large opacities consistent with progressive massive fibrosis (PMF) who received care at a federally funded black lung clinic network in Virginia. Participants were interviewed about their workplace practices and respiratory health. Medical records were reviewed. Nineteen former coal miners were included. Miners reported cutting rock, working downwind of dust-generating equipment, non-adherence to mine ventilation plans (including dust controls), improper sampling of respirable coal mine dust exposures, working after developing respiratory illness, and suffering from debilitating respiratory symptoms. Consistent themes of suboptimal workplace practices contributing to development of PMF emerged during the interviews. Some of the practices reported were unsafe and unacceptable. Further research is needed to determine the prevalence of these factors and how best to address them.

Research Service Winner

Preventing Deaths and Injuries of Fire Fighters Working at Basement and Other Below-Grade Fires

Merinar T, Wertman S, Loflin M, Morris G

NIOSH [2018]. Preventing deaths and injuries of fire fighters working at basement and other below-grade fires. Workplace Solutions. By Merinar T, Wertman S, Loflin M, Morris G. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2018-154.

Abstract

Fire fighters are at significant risk of injury or death when fighting fires in basements or floors below-grade level. The increased risk is due to limited entry and egress; working above the fire; weakened floor structures; being caught in the fire's flow path; unknown fire load; ventilation issues; utility panels, hanging wires, meters, and connections; and appliances. These risks can lead to fire fighter entrapment from floor collapse, burns, and asphyxiation. Fire departments should conduct a complete 360-degree size-up to locate the fire, attack the fire externally, and reassess fire conditions prior to conducting interior operations.

Alice Hamilton Award 2018 Winner Updates

Education and Guidance

Improving EMS Worker Safety Through Ambulance Design and Testing

Green J, Webb S, Marshall J, Spata S

> NIOSH [2017]. Improving EMS worker safety through ambulance design and testing. Video. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2017-143.

We produced a 7-part video series, jointly funded by the National Institute for Occupational Safety and Health and the Department of Homeland Security's Science and Technology Directorate. The video series covers 10 new crash test methods designed to reduce crash-related injuries and deaths to emergency medical services (EMS) workers in the patient compartment. A NIOSH-led team that included numerous industry and government partners developed the 10 new crash test methods from over a decade's worth of research and collaborative testing. Each was published by the Society of Automotive Engineers.

The video series provides an overview of the many changes impacting ambulance design, testing, and manufacture resulting from the new test methods. These changes impact the (1) layout of the ambulance patient compartment, (2) contents housed in the ambulance patient compartment (seating, patient cot, equipment mounts, and storage devices), and (3) the outside or body of the ambulance. Ambulance builders, major ambulance component suppliers, and those responsible for designing and purchasing ambulances will benefit from viewing this video series, which aims to keep EMS workers and patients safe during ambulance transport.

Following the dissemination of the video series, NIOSH worked closely with the National Association of State EMS Officials (NASEMSO) to build awareness of new opportunities to improve ambulance safety. NASEMSO represents those at the state level responsible for the regulation, inspection, and licensure of ambulances. To date, 11 states have adopted a national consensus standard which incorporates all 10 NIOSH-led, and SAE published test methods, while several other states have proposals pending for adoption in their state's regulatory language in 2019.

Engineering and Control

Ambulance Disinfection Using Ultraviolet Germicidal Irradiation (UVGI): Effects of Fixture Location and Surface Reflectivity

Lindsley WG, McClelland TL, Neu DT, Martin SB Jr., Mead KR, Thewlis RE, Noti JD

> Lindsley WG, McClelland TL, Neu DT, Martin SB Jr., Mead KR, Thewlis RE, Noti JD [2018]. Ambulance disinfection using ultraviolet germicidal irradiation (UVGI): effects of fixture location and surface reflectivity. J Occup Environ Hyg *15*(1):1–12.

Patients in ambulances frequently shed infectious bacteria and viruses, which then pose an exposure risk to emergency medical service (EMS) workers and subsequent patients. Ambulance patient compartments are typically disinfected by manually wiping down surfaces, which is time-consuming and often does not remove all pathogens. Several studies have shown that contamination by infectious microorganisms such as methicillin-resistant *Staphylococcus aureus* (MRSA) can be found in ambulances even after cleaning. The ability to effectively decontaminate ambulances would be especially important during an infectious disease pandemic, when large numbers of highly contagious patients would be transported and when the ability to return ambulances to service as quickly as possible would be needed.

One promising option is to follow manual cleaning with ultraviolet germicidal irradiation (UVGI), which uses UV light to kill bacteria and viruses. Although studies of UVGI have been conducted in hospital rooms and similar settings, no studies have evaluated how well UVGI works in ambulance patient compartments, even though companies are currently marketing UVGI systems expressly for ambulances. Ambulances present a number of decontamination challenges: ambulances have higher patient turnover rates, use different materials, and have a more complex topography than hospital rooms.

Our paper was the first published study that examined the effectiveness and limitations of UVGI in ambulances. We identified several important factors to consider when implementing an ambulance UVGI system:

- The amount of UV irradiation delivered to different surface locations varies tremendously. Thus, when evaluating a UVGI system, multiple locations must be tested.
- The time required to disinfect an ambulance compartment is governed by the exposure time needed for the least-irradiated surfaces, not the average irradiation.

- Covered and concealed locations, such as underneath seat cushions or behind cabinet doors, will not be disinfected by a UVGI system.
- The position of the UVGI fixture can have a substantial effect on the overall disinfection time.
- Moving the UVGI fixture to multiple locations during a disinfection cycle or using multiple fixtures can reduce the disinfection time.
- Increasing the UV reflectivity of interior surfaces can also reduce the disinfection time.
- Finally, before putting an ambulance UVGI system into service, it should be thoroughly tested with the actual ambulance configuration for which it is to be used and be periodically retested to verify that the UVGI system's performance has not changed over time.

The publication of this manuscript led to inquiries and discussions with EMS providers and UVGI suppliers about the use of UVGI in ambulances. After completing this project, our research shifted to studying the efficacy and possible improvements to ambulance ventilation systems for reducing exposure to airborne infectious microorganisms. We have also studied UVGI as a means of disinfecting disposable N95 respirators to allow their safe reuse during a pandemic, and we have begun examining the effectiveness of UVGI against *Candida auris*, a fungal pathogen that is of increasing concern in healthcare settings.

Epidemiology and Surveillance

Examining Factors That Influence the Existence of Heinrich's Safety Triangle Using Site-specific H&S Data From More Than 25,000 Establishments

Yorio PL, Moore SM

Yorio PL, Moore SM [2018]. Examining factors that influence the existence of Heinrich's safety triangle using site-specific H&S data from more than 25,000 establishments. Risk Anal *38*(4):839–852.

Established in the 1930s, Heinrich's safety triangle theory includes two tenets: (1) the ratio of lower-to-higher-severity incidents forms a triangle (300 near misses: 29 minor injuries: 1 major injury), and (2) the incidents included in the triangle have similar root causes. Since the original publication, this theory has become an institutionalized occupational accident prevention theory. Over time, however, research examining the ratio and the common cause theory has been mixed, and questions and criticisms of the theory have been voiced. Criticisms of the theory include the following:

- The data used to develop the initial safety triangle are not available to reproduce or explore the findings.
- The overall statement of research methodology was unclear in the original publication.
- Safety triangles describe a general pattern of incidents, and are often used as predictive supported in the belief that reductions in lower severity accidents will systematically reduce the probability of a major/catastrophic injury.
- Recent studies have found that fatal occupational accident events and lower severity accident events often do not share the same causes.
- Safety triangles are a summary of counts of injuries across many establishments or industries, but they have their strongest theoretical application at the establishment level.
- Different safety triangles have been derived using different methods to categorize severity. In Heinrich's original triangle, the terms "major" and "minor" were loosely defined.

We designed a study to address each of these criticisms by using publically available data, maintaining the data in its longitudinal form, and using predictive statistical models. We ensured that the level of analysis was the establishment, using multiple ways to define injury severity to explore if distinct definitions can produce different ratios in the same

context using the same data, and describing the methodology with enough clarity to ensure reproducibility.

By executing numerous statistical models, evidence suggested that lower severity accident events could be used as a leading indicator and predictor of future fatal accident events at the establishment level. The study applied three approaches to define severity: (1) lost time and recordable injuries, (2) categories based on total number of days lost, and (3) categories based on the average number of days lost. The study found that a single, fixed ratio of accidents delineated by severity could not be derived. A pyramid shape was derived using either the (1) total number of days lost, or (2) average number of days lost per injury delineations—positing these as potentially important leading indicators of future catastrophic accident events.

The practical application of these findings are extensive. Since winning the award, the authors have focused their efforts on research translation. The authors worked extensively with the Society for Mining, Metallurgy, and Exploration (SME) to ensure that their findings were translated to health and safety professionals within this dynamic and complex risk management industry. SME is an international society with a dedicated Health and Safety Division to support professionals within the mining and mining-related industries. The study findings were presented at SME's Annual Conference and Expo in February 2018, and the authors also provided an expanded presentation as part of SME's webinar series in June 2018. SME, NIOSH, and the authors worked in coordination to issue a press release of the study findings in the SME's July 2018 issue of Mining Engineering.

To further reach out to a practitioner audience, the authors also worked with the ORC HSE industry association and presented a live broadcast to members in February 2019. ORC HSE is a membership-based, global health, safety and environmental networking, and service firm. ORC HSE has 110 member companies representing 20 different industry sectors. Additionally, the authors worked with NIOSH's Communications Office to include the study findings in NIOSH's *Research Rounds*, which resulted in numerous follow-up communications with industry associations and front-line occupational accident prevention specialists.

Finally, recognizing the importance of communicating and discussing the study findings and implications with the research community, the authors presented this work at the National Occupational Injury Research Symposium (NOIRS) conference in October 2018.

Exposure and Risk Assessment Winner 2018

Contamination of Firefighter Personal Protective Equipment and Skin and the Effectiveness of Decontamination Procedures

Fent KW, Alexander B, Roberts J, Robertson S, Toennis C, Sammons D, Bertke S, Kerber S, Smith D, Horn G

Fent KW, Alexander B, Roberts J, Robertson S, Toennis C, Sammons D, Bertke S, Kerber S, Smith D, Horn G [2017]. Contamination of firefighter personal protective equipment and skin and the effectiveness of decontamination procedures. J Occup Environ Hyg *14*(10):801–814.

Several epidemiology studies have suggested that firefighters have an increased risk of cancer. Chemical exposures encountered during firefighting are thought to contribute to this risk. Understanding how firefighters are exposed to chemicals is essential to identifying appropriate control interventions. In our study, we investigated dermal exposure to polycyclic aromatic hydrocarbons (PAHs) during controlled residential fires and the effectiveness of using cleansing wipes to remove PAHs from skin. We also evaluated the contamination of turnout gear with PAHs and the effectiveness of gross on-scene decontamination procedures at removing the PAHs. Importantly, our study was also able to differentiate exposures and contamination levels by job assignment. We found that firefighters performing interior operations, such as fire attack and search and rescue, were more exposed than firefighters performing other tasks. This information will help both the decision makers in the fire service and researchers investigating health outcomes among firefighters. Since publication in 2017, our paper has become the second-most-read article in the *Journal of Occupational and Environmental Hygiene*, with more than 8,000 views and has been cited 10 times.

Our study found that wet decontamination methods that used dish soap as a surfactant were able to remove a median of 85% of PAH contamination from the surfaces of the turnout jackets. Prior to 2017, few fire departments engaged in any type of gross decontamination following a fire response. After exposure to our published study, a number of fire departments, including some of the largest in the country, have implemented post-fire decontamination policies and procedures. These procedures, which are economical and feasible, are likely to reduce the amount of contamination on turnout gear that might otherwise transfer to the skin. Fire departments can use these decontamination methods until the turnout gear is professionally laundered. Further, our information regarding contamination levels by job assignment can be used by fire departments to prioritize the laundering of turnout gear.

Before our study, several departments were using cleansing wipes to remove contamination on the skin post-firefighting; however, evidence to support the efficacy of this intervention was lacking in the literature. Our study found that cleansing wipes were able to remove a median of 54% of PAH contamination from skin. This finding has informed fire departments throughout the country and led to more widespread purchasing of cleansing wipes and procedures that ensure firefighters shower upon return to the fire station (to more thoroughly clean the skin). The practice of using cleansing wipes is now commonplace at fire departments, both large and small, and is an important step in reducing dermal exposure to PAHs and other potential carcinogens.

Another important finding from this study was that volatile organic compounds, including benzene, will off-gas from turnout gear for a period of time after firefighting. These results have led fire departments throughout the country to transport their contaminated turnout gear in sealed bags or unoccupied compartments on the fire apparatus to reduce potential inhalation exposures for firefighters. This practice is also becoming widely adopted in the fire service.

Information from this study is being considered in the current revision of the National Fire Protection Association (NFPA) *1851 Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* and the new NFPA *1700 Guide for Structural Fire Fighting*. Fire departments throughout the United States and internationally follow NFPA standards and guidelines. Publishing revised or new standards based on the findings in our study will likely increase the adoption of the control measures throughout the fire service, which in turn, should reduce firefighters' exposures to carcinogens and other hazardous chemicals.

Methods and Laboratory Science Winner 2018

In Vivo Toxicity Assessment of Occupational Components of the Carbon Nanotube Life Cycle to Provide Context to Potential Health Effects

Bishop L, Cena L, Orandle M, Yanamala N, Dahm MM, Birch ME, Evans DE, Kodali VK, Eye T, Battelli L, Zeidler-Erdely PC, Casuccio G, Bunker K, Lupoi JS, Lersch TL, Stefaniak AB, Sager T, Afshari A, Schwegler-Berry D, Friend S, Kang J, Siegrist KJ, Mitchell CA, Lowry DT, Kashon ML, Mercer RR, Geraci CL, Schubauer-Berigan MK, Sargent LM, Erdely A

Bishop L, Cena L, Orandle M, Yanamala N, Dahm MM, Birch ME, Evans DE, Kodali VK, Eye T, Battelli L, Zeidler-Erdely PC, Casuccio G, Bunker K, Lupoi JS, Lersch TL, Stefaniak AB, Sager T, Afshari A, Schwegler-Berry D, Friend S, Kang J, Siegrist KJ, Mitchell CA, Lowry DT, Kashon ML, Mercer RR, Geraci CL, Schubauer-Berigan MK, Sargent LM, Erdely A [2017]. In vivo toxicity assessment of occupational components of the carbon nanotube life cycle to provide context to potential health effects. ACS Nano *11*(9):8849–8863.

Engineered nanomaterials, because of their electrical, chemical, and thermal properties, are already being incorporated into existing, everyday products, with broad applications to medicine, electronics, composites, and construction. From smart phones, to water purification, to makeup and sunscreen, to incorporation into thermoplastics (e.g., toys, containers), human exposure to engineered nanomaterials, and their applications, is inevitable. Properly understanding and developing risk profiles to reflect the worker and end-user, which may be very different, is necessary to prevent any unintended health consequences to humans from the production and utilization of engineered nanomaterials.

The first decade of engineered nanomaterial research focused almost exclusively on the as-produced, or pristine, material with very little attention to downstream applications of nanoparticles. Given that applications of nanomaterials into existing and emerging technologies will reach virtually everyone in some way, a more comprehensive evaluation of potential health risks associated with exposure to nanomaterials in a wider cohort was needed. Our study represented the first to quantitatively examine potential health effects of an engineered nanomaterial from production, to post-production modification, and, finally, to product incorporation.

A primary goal of our initial project was to develop methods and standardize the approach to evaluate potential health risks with post-production modifications and

materials incorporated with engineered nanomaterials. Since funding of the initial project, four additional projects utilizing the approach were funded with two more projects that are currently under review. These projects in total will provide extensive knowledge regarding various applications for engineered nanomaterials and how different classes of nanomaterials (e.g., high aspect ratio, 2-dimensional, metal oxide) affect existing or emerging technologies.

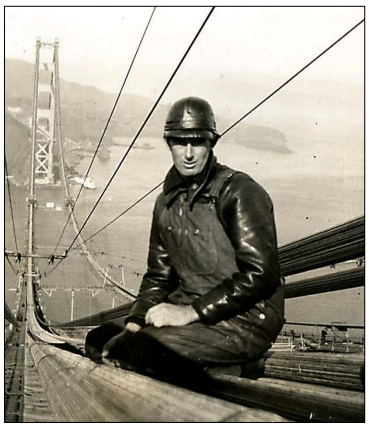
View the previous Alice Hamilton Award Winners and Honorable Mentions.

Bullard-Sherwood Research to Practice Award

NIOSH presents the Bullard-Sherwood Research to Practice (r2p) Award to recognize outstanding efforts by its scientists and their partners in applying occupational safety and health research to prevent work-related injury, illness, and death. The award is named in honor of two distinguished inventers who made significant improvements in workplace injury and illness prevention.

Edward W. Bullard

Edward W. Bullard designed the first "hard hat" as protective headgear for miners. He combined his experience with doughboy Army helmets during World War I and his understanding of customer needs to develop the "Hard Boiled Hat." The name was derived from the steam used to harden the hat as it was manufactured. Joseph Strauss, the engineer in charge of constructing the Golden Gate Bridge, requested that Mr. Bullard adapt his mineworker helmet to help protect bridge workers from falling rivets. The bridge site became the first designated "Hard Hat Construction Area." In related history, the steel used to build the bridge oxidized during transport to San Francisco from Pennsylvania, and it required sandblasting before it could be painted. As a result, Mr. Bullard designed and sold another helmet to the bridge builders to specifically protect the sandblasting workers. This helmet was similar to the Hard Boiled Hat, but it included in its design a hood or "canopy" over the hat, a window to see through, and supplied air for respiratory protection. The helmets helped to prevent death and injury during the project and have prevented countless injuries and deaths since. However, despite the exemplary safety precautions taken during the Golden Gate Bridge construction, a total of 11 workers died at the site—including 10 who were killed in 1937 when a scaffold collapsed. Today, about 6 million hard hats are sold annually



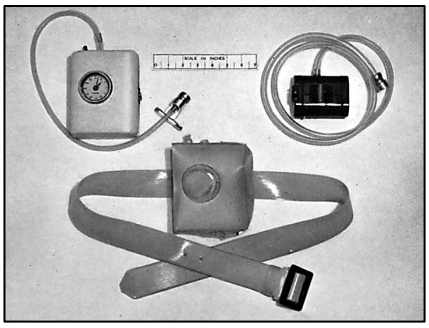
Labor Archives and Research Center,
J. Paul Leonard Library,
San Francisco State University

A Golden Gate construction worker wears a Bullard "hard boiled hat" in this photograph, circa 1936. This worker, Fred Dümmatzen, died on Feb. 17, 1937, when a scaffold at the bridge collapsed and killed 10 workers.

throughout the world to protect workers. Bullard's family-owned company still produces many of those hard hats, as well as more-modern sandblasting helmets.

R. Jeremy (Jerry) Sherwood

R. Jeremy (Jerry) Sherwood successfully merged research and industrial hygiene by inventing the first practical personal sampling pump in the late 1950s. He identified a need for sampling pumps that could be worn by workers and not impede their work processes. Until then, sampling was done on an area basis, or an industrial hygienist followed a worker while carrying heavy, bulky, and short-term sampling equipment. Using the newly developed personal sampling pump, he demonstrated that area sampling often severely underestimated worker exposures. Within a few years of this invention, personal sampling pumps became the staple in industrial hygiene work that they are today. He also developed a miniature sampler for sulfur dioxide that became commercially available and was widely used throughout Europe. His research on respirators led to the first fit testing. While at the International Labour Organization and later at the World Health Organization, Mr. Sherwood put his own knowledge and research experiences into practice by training others in occupational safety and health, particularly in developing countries. This became one of his greatest passions, and many workers around the world have benefitted from his efforts.



Sherwood RJ and Greenhalgh DMS

The personal air sampler system designed by R. Jeremy Sherwood, as it appeared in a 1960 *Annals of Occupational Hygiene* article announcing its invention. From: Sherwood RJ, Greenhalgh DMS [1960]. A personal air sampler. Ann Occup Hyg *2*:127–132, https://doi.org/10.1093/annhyg/2.2.127.

Bullard-Sherwood
Research to Practice Finalists

Projects are listed by category, alphabetically by project name.

Knowledge

Improving Self-escape From Underground Coal Mines Training Initiative
Ryan M, Hoebbel CL, Brnich MJ, Diamond J, Moore T, DeWitt T, DeWitt S, Nichols R

Reaching Our Audience Where They Are: NIOSH Work With Wikipedia
Morata TC, Lum M, Sadowski J, Carreón T, Blumenthal H, Ramjohn I, Ceballos D, Haynes E, Genter MB, Jacob Corteletti L, Lima Mortari Moret A, Tangerino de Souza Jacob R, Barreto F Lopes N, Montilla A, Peschanski JA, Scott D

Special Issue of the Annals of Work Exposures and Health on "Understanding Small Enterprises" (USE) Conference 2017
Cunningham T, Brown C, Schulte PA, Newman L, Jacklitsch B, Burnett G

Intervention

Effectiveness of Extension-ladder Safety Innovations: Evaluation of a Modified Anthropometric Method for Ladder Positioning—an Intervention to Reduce the Risk of Ladder Fall Injury
Simeonov PI, Hsiao H, Knox E, Van Bree M, Schmitt T, Gipson D, Rapp J, Ver Halen J

Fishing Safety Success Stories
Teske T, Welch D, Smith T, Bew A, Case S, Lucas DL

Technology

A Novel Method for Wireless Transport of Critical Safety and Health Monitoring Data From Underground Mines
Jacksha R, Sunderman CB

Field-based Respirable Crystalline Silica Monitoring Approach
Cauda E, Chubb LG, Cole GP, Britton J, Fritz JE, Hummer J, Ashley E, Barone T, Pampena J, Archer WJ

Knowledge Honorable Mention

Improving Self-escape From Underground Coal Mines Training Initiative

Ryan M, Hoebbel CL, Brnich MJ, Diamond J, Moore T, DeWitt T, DeWitt S, Nichols R

Source: Pittsburgh Mining Research Division (PMRD)

Background: During a coal mine emergency, often the best opportunity for survival is to self-escape rather than rely on rescue. Thus, each miner must master the knowledge, skills, and abilities (KSAs) necessary for successful self-escape. In three mine emergencies in 2006, more than 80% of those who died had survived the initial event but perished while attempting to self-escape. To facilitate better self-escape performance in the event of an emergency, the National Research Council recommended that the industry transition to a competency-based training system. A competency-based system requires a standardized definition of what it means to be competent, performance criteria, and tools for performance assessment.

NIOSH self-escape researchers developed the competency framework necessary for industry professionals to develop and implement competency-based self-escape training systems. NIOSH researchers conducted the Self-escape Competency Survey to assess miners' confidence in critical self-escape KSAs, which revealed that many gaps still exist. Safety professionals at Consol Energy, which participated in the competency survey, examined the most prominent KSA gaps identified and decided to use this knowledge to develop strategies to improve their workforce's KSA gaps. They mobilized a multiple mine site-wide intervention and invited NIOSH to participate and observe. In turn, NIOSH researchers were provided with necessary knowledge to translate its research efforts into practical guidance on how to implement competency-based training and assessment procedures at underground coal mines. NIOSH researchers and Consol practitioners continued to collaborate during the development of an information circular specifically designed for practitioners as a blueprint for developing competency-based self-escape systems at their mine sites.

Relevance: This two-way knowledge exchange was significant both locally at Consol's mine sites, where miners were better able to acquire and maintain their KSAs because of the competency-based performance management system, and globally, enabling NIOSH researchers to create translational outputs that were designed to facilitate KSA improvement at mine sites across the country.

For more information, visit The ABCs of KSAs: Assessing the Self-Escape Knowledge, Skills, and Abilities of Coal Miners.

Knowledge Winner

Reaching Our Audience Where They Are: NIOSH Work with Wikipedia

Morata TC, Lum M, Sadowski J, Carreón T, Blumenthal H, Ramjohn I, Ceballos D, Haynes E, Genter MB, Jacob Corteletti L, Lima Mortari Moret A, Tangerino de Souza Jacob R, Barreto F Lopes N, Montilla A, Peschanski JA, Scott D

Source: Division of Applied Research and Technology (DART)

Background: Wikipedia is one of the most widely read websites in the world. The challenge at NIOSH is to put research into practice, turning the findings of research into recommendations and best practices that will improve the safety and health of all workers. Working with Wikipedia is one way to make sure that widely available occupational safety and health information is complete, up to date, and free of errors. NIOSH is one of the first U.S. federal agencies to collaborate with the Wikimedia organizations. Since 2012, NIOSH has collaborated with several organizations within the Wikimedia umbrella to expand and improve occupational safety and health content in their platforms. NIOSH is working to make the occupational safety and health content comprehensive and one of the better-developed areas of knowledge within Wikipedia. NIOSH efforts not only contribute to Wikipedia's goal to freely share information, but also towards its own mission of translating research into usable information.

This project focused on expanding NIOSH's science communication efforts by examining mechanisms to make the occupational safety and health information that reaches Wikipedia's millions of readers complete, up to date, and accurate. In addition to individual researchers directly creating or improving Wikipedia articles with guidance from the NIOSH Wikipedian-in-residence, two approaches were taken to address the project goals. (1) Creating partnerships with university graduate programs using the Wiki Education Foundation platform to train students to contribute evidence-based content for Wikipedia articles. (2) Organizing edit-a-thon events on specific topics, where subject matter experts and Wikipedia editors work together to improve Wikipedia articles, typically including basic editing training for new editors.

Relevance: Several of the Wikimedia platforms offer detailed metrics with results of the communication initiatives. The feedback received from partners, including both faculty and students, has been consistently positive. For instance, a common response among students was that they "enjoyed writing to be read" and not just "to be graded." All partners involved in this initiative learned something about science communication and

digital literacy while contributing solid, verifiable knowledge about health to the public and reducing misinformation.

For more information, visit Expanding and Improving Occupational Safety and Health Content in Wikipedia. It Matters and Reaching Our Audience Where They Are: Our Work with Wikipedia.

Intervention Honorable Mention

Effectiveness of Extension-Ladder Safety Innovations: Evaluation of a Modified Anthropometric Method for Ladder Positioning—An Intervention to Reduce the Risk of Ladder Fall Injury

Simeonov PI, Hsiao H, Knox E, Van Bree M, Schmitt T, Gipson D, Rapp J, Ver Halen J

Source: Division of Safety Research (DSR)

Background: Every year in the United States, more than 500,000 people are treated for, and about 300 people die from, ladder-related fall injuries. Sliding out at the ladder base is the leading cause of extension ladder fall incidents, and the angle of ladder inclination is a critical factor affecting ladder stability. Providing ladder users with a more accurate and practical method for optimal ladder positioning can be an effective intervention to improve ladder safety and reduce the risk of ladder fall injury.

NIOSH conducted the first study to provide in-depth experimental comparative analysis of the two anthropometric methods for extension ladder positioning, and it thus established the scientific basis for validating these methods. The study revealed some of the deficiencies of the existing "hold-the-rung" body method and found that the fireman's "hold-the-rail" method is more robust in producing consistent ladder angles by eliminating the ladder use height as a source of variability. The study findings were published and broadly disseminated among industry partners and stakeholders. Throughout the project, NIOSH researchers worked closely with the American Ladder Institute and the ANSI A14 committee to ensure research quality, dissemination of research results, and integration into improved standards and practices.

Relevance: The improved method was adopted by the ANSI A14 standard committee on ladder safety and is included in the updated ladder safety standards that were released January 2018. The new ladder safety labels, with a graphic that shows the "hold-the-rail" method, will be attached to every new extension ladder product sold after January 1, 2018. Furthermore, the new method is being integrated into ladder safety training curricula by companies, safety organizations, and safety professionals. It is expected that increased exposure to the new labels and training involving the improved ladder positioning method will result in more accurate ladder positioning angles in everyday practice of ladder users across the United States.

For more information, visit Factors Affecting Extension Ladder Angular Positioning and Falls in the Workplace.

Intervention Winner

Fishing Safety Success Stories

Teske T, Welch D, Smith T, Bew A, Case S, Lucas DL

Source: Western States Division (WSD)

Background: Commercial fishing is regularly one of the most hazardous industries in the United States, with a fatality rate many times that of the national average. Ongoing surveillance has shown that falls overboard are the second-leading cause of death among commercial fishermen nationwide, and of the 227 fatal falls from 2000 to 2016, none of the victims were wearing a personal flotation device when they drowned. For this same time, onboard injuries, including winch entanglements, were the third-leading cause of fatality. Surveillance systems track fatalities and nonfatal injuries, but injuries and fatalities that have been prevented are not regularly recorded.

The "Fishing Safety Success Stories" are a series of short videos that capture instances where adopting safe industry practices in commercial fishing resulted in a prevented injury or fatality. The videos center on interviews with the fishermen involved in these situations, so they could explain the incident and in their own words promote adopting the intervention that saved their lives. The first two videos feature a man-overboard event where the victim was wearing a personal flotation device that prevented his drowning, and a near-miss winch entanglement incident that involved an emergency-stop system that prevented a severe or fatal traumatic injury. The videos were developed, made, and produced in partnership with the U.S. Coast Guard; Integrity Machining, Inc., a deck machinery manufacturer and vendor for the emergency-stop system; and M2 Multimedia Communications, Inc., a video production services contractor.

Relevance: Both videos were disseminated via the CDC YouTube page and were promoted via social media and fishing industry trade media. Based on the release of these videos, NIOSH staff have heard more stories of fishermen surviving falls overboard by using personal flotation devices, and it has enabled the project to extend with a new contract for two more videos in the series.

For more information, visit Commercial Fishing Safety and Fishing Safety Videos.

Technology Winner

Field-Based Respirable Crystalline Silica Monitoring Approach

Cauda E, Chubb LG, Cole GP, Britton J, Fritz JE, Hummer J, Ashley E, Barone T, Pampena J, Archer WJ

Source: Pittsburgh Mining Research Division (PMRD)

Background: Exposure to respirable crystalline silica (RCS) is a health hazard for several occupational environments, including mining, construction, oil and gas, and general industry. Several diseases are associated with prolonged exposure to RCS, including silicosis and lung cancer. A proper monitoring program for RCS is essential to identify, prioritize, evaluate, and assess interventions in an occupational environment. Traditional RCS monitoring practices provide accurate data, but because the practice typically involves using an external analytical laboratory for RCS analysis, it takes considerable time to obtain the results. Because of the high variability of RCS concentrations, the ability to collect data quickly is crucial.

Field-based RCS monitoring is an advanced exposure monitoring approach that allows health and safety professionals to generate RCS exposure data at the workplace at the end of the shift. The novel field-based RCS approach combines portable analyzers, traditional sampling techniques, a new sampling cassette, and a novel NIOSH software package titled "Field Analysis of Silica Tool" (FAST). The new sampling cassette was developed with a cooperative research and development agreement with Zefon International, and the product was commercialized in August 2018. FAST is the key component for transforming data from portable analyzers into meaningful, actionable information in terms of RCS concentration.

Relevance: The advanced field-based RCS monitoring approach has had enthusiastic reception from mining stakeholders, as well as in the oil and gas industry and construction sector. This approach has been adopted by a coal mine company in West Virginia operating three underground and one surface operation for two independent studies. It has also been adopted by a large copper mine company for a limited period of time in seven different operations. The field-based approach can improve RCS monitoring significantly, and its implementation can help health and safety professionals in protecting the workforce from overexposure to RCS.

For more information, visit Silica and NIOSH Releases Beta Version of New Respirable Crystalline Silica Monitoring Software.

Plain Language Award

Background

The Plain Writing Act of 2010 requires that federal agencies provide clear communication that the public can understand and use. NIOSH encourages plain language in all of its communication products. Established in 2017, this award recognizes NIOSH fact sheets, brochures, infographics, and web pages that demonstrate excellence in applying plain language principles.

Awards for winner and honorable mention are given in two categories:

Original recognizes a NIOSH fact sheet, brochure, infographic, or web page created using plain language principles.

Before and After recognizes a revised NIOSH fact sheet, brochure, infographic, or web page that includes both an original, difficult to read document, and the revised version that uses plain language principles. Judges consider the improvements.

Plain Language Award Finalists

Projects are listed by category, alphabetically by project name.

Original Product

Fatal Falls Overboard, United States, 2000–2016 Infographic
Case S, Teske T, Kloczko D, Lincoln JM, Lucas DL

Understanding the Difference: Surgical Mask vs N95 Respirator Infographic
Cichowicz JM, Fries ML, Williams V, Newman S

What Wildland Fire Fighters Need to Know about Rhabdomyolysis Factsheet
Eisenberg J, Butler C, Dalsey EJ, Tyrawski J

Before and After

Designing Safe Mobile Equipment Access Areas Web Page
Nasarwanji M, Pollard JP, Schall J, Coughanour V

Increase Your Chances of Surviving a Vessel Sinking Infographic
Case S, Kloczko D, Teske T, Lincoln JM, Lucas DL, Watson JR

NIOSH Chemical Index Topic Pages Revision Project Web Pages
Novakovich, J, Hamilton C, Lentz, TJ

Original Product Honorable Mention

Understanding the Difference: Surgical Mask vs N95 Respirator Infographic

Cichowicz JM, Fries ML, Williams V, Newman S

Surgical masks and N95 respirators are frequently used in healthcare settings. Many healthcare workers do not know the difference between the two types of respirators. Although they may look similar, these masks are different and offer different levels of protection. The infographic walks through the differences step-by-step, using simple terminology. The side-by-side comparison of these two similar-looking devices lays out stark differences and important considerations for the user. Using simple terms and short phrases, the infographic quickly communicates important differences in the devices.

Original Product Winner

What Wildland Fire Fighters Need to Know About Rhabdomyolysis Factsheet

Eisenberg J, Butler C, Dalsey EJ, Tyrawski J

The rhabdo factsheet is one of a set of products designed to educate structural fire fighters, wildland fire fighters, and their healthcare providers on rhabdomyolysis, often called rhabdo, a serious medical condition. Fire fighters have an increased risk for rhabdo. They need to be able to identify rhabdo signs and symptoms and understand the need for prompt medical treatment.

Separate sets were created for the different types of fire fighters, because despite similar risk factors, each group views themselves as a unique workforce. This fact sheet focused on what wildland fire fighters need to know about rhabdo.

The products, including this factsheet were released in June 2018 and have approximately 2,000 downloads. During the first month after release, the documents were seen on social media by more than 10,000 people. We have conducted multiple webinars based on these educational materials, and they have been adopted into multiple trainings. The use of plain language principles have created documents that are useful for their target audiences and can help save lives.

Before and After Honorable Mention

Designing Safe Mobile Equipment Access Areas Web Page

Nasarwanji M, Pollard JP, Schall J, Coughanour V

"Designing Safe Mobile Equipment Access Areas" encourages mine operators and mine managers to provide a safe environment for parking mobile equipment, by providing examples of what features are necessary for safety. This webpage also communicates safe work behaviors to mine workers and mine safety and health personnel. It uses the injury scenarios and contributing factors identified in the peer-reviewed journal paper and provides recommendations to remediate these risks.

The webpage was evaluated using the CDC Clear Communication Index Score Sheet. Using the federal language principles, the goal of plain language is to ensure users can find what they need, understand what they find, and use what they find to meet their needs. In the original, peer-reviewed journal paper, all of these goals would have been a challenge. Finding scientific publications can be difficult and is further complicated by scientific titles or lack of access to journals. Using the plain language principles, we were able to create a webpage that is written for an audience of mine workers. The tone is conversational and the image shows an exemplary mobile equipment access area that is feasible (both realistically and economically) for many mine sites.

The impact of using plain language principles is that we took a nine-page technical report and changed the message from one geared toward researchers to be a message appropriate for mine workers. We used mining terms and provided clear, concise, actionable statements. The tone is active voice with calls to action for the user. We also used graphics to supplement the message as a means of reinforcing what may otherwise be a hard to understand idea. In additional to the webpage format, the information is also available as a pdf, for easing sharing or printing of content.

Before and After Winner

Increase Your Chances of Surviving a Vessel Sinking Infographic

Case S, Kloczko D, Teske T, Lincoln JM, Lucas DL, Watson JR

This infographic was designed to support the dissemination of findings from a peer-reviewed journal article titled, "Factors Associated With Crewmember Survival of Cold Water Immersion due to Commercial Fishing Vessel Sinkings in Alaska," which analyzed factors related to surviving a fishing vessel disaster in Alaska from 2000 to 2014. It is designed to be shared across social media platforms such as Facebook, Twitter, and Instagram. The infographic was needed in order to simplify findings from a more complex analytical study for a non-scientific audience.

Using plain language principles with this infographic allowed us to develop a message and format focused on the preferences of the target audience. The iterative design process and A/B testing allowed us to discern the most relevant results in the eyes of our audience instead of making an assumption based on our own judgement. The resulting product now has better applicability to a broader portion of our audience. Even though the analysis focused on events in Alaska, we have seen this infographic used and shared by fishermen and marine safety trainers around the country because the guidance can apply to events anywhere there is a threat of cold water immersion.

Director's Intramural Award for Extraordinary Science

Background

Science excellence is the foundation upon which NIOSH generates new knowledge to assure safe and healthful work for all. The Director's Intramural Award for Extraordinary Science (DIA) recognizes outstanding contributions by intramural scientists and support staff to science excellence at NIOSH. Winners of the award will receive a monetary award that augments the discretionary budget for the recipient for the following fiscal year.

The DIA honors individuals for their scientific contributions through a collective body of work. The collective body of work recognized in the DIA represents extraordinary individual performance that clearly goes above and beyond past and present basic job requirements.

The award serves as a tribute to NIOSH employees whose dedication to science excellence has made significant contributions to the NIOSH mission. Award categories recognize distinguished career scientists, early career scientists, and scientific support staff.

Director's Intramural Award for Extraordinary Science Finalists

Names are listed alphabetically.

Distinguished Career Scientist

Paul Henneberger

Lynne Pinkerton

Christine Whittaker

Early Career Scientist

Samantha Case

Rebecca Guerin

Jennifer Tyrawski

Scientific Support

Travis Markle

Carl Sunderman

Richard Whisler

Director's Intramural Award Winner for Distinguished Career Scientist

Christine Whittaker

Dr. Christine Whittaker is a laboratory-trained toxicologist and chief of the Risk Evaluation Branch in the NIOSH Education and Information Division. Her extraordinary dedication and contributions to the science of occupational risk assessment and protection of workers spans nearly 30 years. Throughout her scientific career, Dr. Whittaker has been a leader in the field of occupational risk assessment, both domestically and internationally. She is the key NIOSH representative to several federal agencies, including the Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA), in the field of risk assessment.

Dr. Whittaker has led a diverse group of interdisciplinary scientists to common goals in risk assessment, including developing NIOSH risk assessments, developing new risk assessment methods, and consulting with key government agencies, industries, and labor. She has maintained a strong commitment to mentoring, formally and informally. High quality science is a hallmark of work produced by her branch, and she is committed to improving transparency and consistency of NIOSH publications.

Dr. Whittaker has served a critical role in developing NIOSH science policy. Of note are her contributions to the development of pioneering risk assessments and the basis of the recommendations for the *NIOSH Current Intelligence Bulletin: Occupational Exposure to Titanium Dioxide* (2011) and the *NIOSH Criteria for a Recommended Standard: Occupational Exposure to Diacetyl and 2,3-Pentanedione* (2016). These important documents broke new policy for NIOSH. The titanium dioxide risk assessment was the first recommended exposure limits (REL) for nanoparticles and pigment grade dusts. Dr. Whittaker was the primary author and led publication efforts on the *NIOSH Chemical Carcinogen Policy* (2017), which extensively revised NIOSH policies for developing recommendations on protecting workers against chemical carcinogens. This new policy changed how NIOSH classifies carcinogens, leveraging the hazard identification processes of three other organizations: the EPA, the National Toxicology Program, and the International Agency for Cancer Research. Dr. Whittaker continues to serve in a major

role in leading the NIOSH responses to the EPA on chemical determinations made under the new Toxic Substances Control Act (TSCA), which is the major controlling legislation to address hazardous chemicals.

Director's Intramural Award Winner for Early Career Scientist

Rebecca Guerin

Dr. Rebecca Guerin is a research social scientist in the Training Research and Evaluation Branch of the NIOSH Education and Information Division. Dr. Guerin has been leading young worker research and outreach at NIOSH for a decade. She is recognized as a highly productive, independent researcher in research design and evaluation that addresses the disproportionate burden of young worker injury. Her leadership in social science is demonstrated in the launch of the NIOSH Safe-Skilled-Ready Workforce (SSRW) program, a key director's initiative to equip all workers with critical life skills and knowledge for safe and healthy work.

Dr. Guerin's research has focused on filling significant gaps in the literature regarding occupational safety and health (OSH) training for young workers and other vulnerable groups. One significant contribution is the formulation of the theoretical framework for the NIOSH core competencies—foundational OSH knowledge and skills all young and new workers need to contribute to a safe and healthy workplace. The main vehicle for delivery of these core competencies is the evidence-based curriculum, *Youth@Work-Talking Safety*. The curriculum was evaluated through a large-scale intervention with more than 8,000 middle school students in the Miami-Dade Public School System. The curriculum had a positive impact on OSH knowledge, attitudes, self-efficacy and intention to enact OSH skills. Dr. Guerin is the lead author for 54 editions of Talking Safety, which have been customized for U.S. states and territories, are available in Spanish, have been downloaded more than 25,000 times and used in schools nationwide. Further, Talking Safety is promoted through landmark state legislation in Oklahoma and Texas.

Dr. Guerin is well-published with more than 50 presentations, 9 peer-reviewed publications, 11 NIOSH publications and training curricula, and more than a dozen NIOSH products including training videos, book chapters, and blogs. She is a reviewer for high-impact journals and provides her expert input as a NIOSH representative to six external groups including the Occupational Safety and Health Administration Alliance Partners Young Worker Workgroup, the Federal Interagency Working Group on Youth

Programs, and the CDC School Networking Group. She was invited by SESI (Serviço Social da Indústria), a NIOSH global partner, to adapt Talking Safety to the Brazilian context and advise on their online training. Dr. Guerin has presented the competencies to the Finnish Institute for Occupational Health to guide young worker interventions in vocational high schools.

Director's Intramural Award Winner for Scientific Support

Carl Sunderman

Carl Sunderman is an electrical engineer in the NIOSH Spokane Mining Research Division. His expertise has laid the foundation for many highly successful NIOSH mining research projects in wireless mine communications, ground support for underground mines, and aerosol research.

Mr. Sunderman played an important role in NIOSH research into wireless communications and tracking technologies and capabilities in response to the Mine Improvement and New Emergency Response (MINER) Act of 2006. His efforts were critical to the overall successes of the ultra high frequency (UHF) wireless signal propagation and through the earth (TTE) wireless signal propagation research projects. As part of the UHF wireless signal propagation research team, he provided significant guidance and input on the design of a highly sensitive propagation measurement test apparatus.

Mr. Sunderman also developed software, which streamlined the tedious and time-consuming task of post-processing acquired data, reducing the time from days to hours. This research has resulted in over a dozen peer-reviewed publications, including "RF Propagation in Mines and Tunnels," published in the Institute of Electrical and Electronics Engineers—*Antennas and Propagation Magazine*, which is the accepted reference for UHF propagation in underground mines and tunnels.

In support of the TTE wireless signal propagation team, Mr. Sunderman took the initiative to leverage the limited commercially available electronic technologies to rapidly develop test equipment. When this was no longer an option, he developed new, highly specialized electronic test equipment, sensors, and test methodologies capable of evaluating TTE performance through thousands of feet of earth. He designed and fabricated specialized devices to perform in-house calibration, as well as software and associated algorithms to acquire and process real-time TTE sensor data.

To support the Division's Induced Seismicity and Stability Team, Mr. Sunderman developed the Internet of Things (IoT) based ground support roof bolts to evaluate ground stresses during blasting activities and the IoT time of wetness sensor for use in

mines with ground support corrosion problems. He took the lead on designing a user interface and control system for the eventual commercialized version of a nanoparticle sampling instrument. He assisted in drafting the "Employee Invention Report" and licensed the technology to a vendor. This device is now sold and used worldwide and is a significant contribution to science that enables detailed characterization of airborne hazards in the workplace. He recently provided consultation in the design and building of a field-portable measurement system capable of collecting vibration data in the frequency domain with high resolution over time. This type of system had never been built, and the data generated during testing are helping pave the way toward better understanding of the role of vibrations in hearing loss among workers.

Director's Intramural Award for Extraordinary Science 2017 Winner Updates

Distinguished Career Scientist

Chuck Geraci

Dr. Geraci used the discretionary funds from the 2017 Distinguished Career Scientist award to support a science policy fellow, Cassidy Pomeroy-Carter, at the Science and Technology Policy Institute. Cassidy took on a special project to develop the base content needed for NIOSH to gain a better understanding of the rapid evolution of biology-based manufacturing, referred to as biomanufacturing, and the potential impacts this emerging technology might have on worker health and safety.

Her initial efforts focused on scoping and defining the technology-enabled changes taking place in the manufacturing sector, referred to in the United States as "advanced manufacturing." Cassidy laid the foundation for a special panel session at the Tech Connect World Innovation Conference and a subsequent JOEH publication in 2018: "Launching the Dialogue: Safety and Innovation as Partners for Success in Advanced Manufacturing."

Her next activity explored the scope and current state of biomanufacturing. She accomplished this by surveying peer-reviewed literature, business and economic forecasting reports, and websites of companies claiming to participate in the development and deployment of various elements of biomanufacturing. Cassidy identified a lack of a unified definition of biomanufacturing and an incomplete characterization of the elements of biomanufacturing as key gaps in knowledge.

Throughout 2018, Cassidy developed the base content needed for a technical report to NIOSH that defined biomanufacturing, laid out an orderly classification of the materials and processes (taxonomy), and developed a tool for biomanufacturing organizations to self-identify. This base content will provide NIOSH researchers a foundation to identify and address worker health and safety issues to help biomanufacturers safely and responsibly develop and deploy this vital technology. Cassidy was recently accepted into the Harvard School of Law and said that her work with NIOSH helped shape her plans to focus on the impact of emerging technologies on workers and the environment.

Early Career Scientist

Candice Johnson

Since receiving the 2017 Director's Award for Extraordinary Intramural Science in the category of Early Career Scientist, Dr. Johnson has continued to lead studies in reproductive health, women's health, and epidemiologic methods.

Dr. Johnson used the $5,000 award for three career development activities. First, she attended the annual meeting of the Society for Pediatric and Perinatal Epidemiologic Research in Baltimore, MD, where she presented a poster based on findings from her NORA project, "Impact of Rotating Night Shift Work on Biomarkers of Women's Health." Second, she traveled to Santa Fe, NM, to attend a weeklong scientific writing workshop taught by science writers and editors from major news outlets. The workshop focused on explaining complex scientific topics to lay audiences. At the workshop, she developed a *NIOSH Science Blog* with the help of former New York Times science editor, Cornelia Dean. Third, she met with a CDC University coach over 2 months to discuss leadership challenges and strategies to overcome them.

Over the past 2 years, Dr. Johnson has led new research describing how healthy worker effects, well-known sources of bias in occupational epidemiology, occur in studies of women. To date, most research on healthy worker effects has been conducted in male worker populations. She recently published a study in *Annals of Epidemiology* showing that healthy worker effects are counteracted by women's departure from the workforce to care for children. In a second study in the *American Journal of Epidemiology*, she demonstrated how healthy worker effects apply to studies of occupational exposures in pregnancy and recommended specific study designs and analytic methods to account for these biases.

She also continues productive collaborations with Harvard University on the Nurses' Health Studies and with CDC's National Center on Birth Defects and Developmental Disabilities on the National Birth Defects Prevention Study and the Zika en Embarazadas y Niños (Zika in Pregnant Women and Children) Study.

In 2018, Dr. Johnson was selected as one of 20 inaugural participants in the CDC Emerging Leaders Certificate Program. Over 5 months, she traveled to Atlanta to attend courses and workshops, complete assessments, and work on group projects. Participants included early career employees in scientific and non-scientific positions throughout CDC who have the potential to assume leadership positions at CDC later in their careers.

Scientific Support

Vanessa Williams

Thankful for the award: It was honor to receive the Directors Intramural Award for Extraordinary Science. This acknowledgement was gratifying and appreciated. My team designs a variety of products for wide-ranging audiences, from decision-makers and leaders in the field to the workers in the field we aim to protect. With this in mind, I sought to learn strategies, insights, and creative problem-solving skills that would address the challenges of designing and producing the variety of communication products NIOSH disseminates.

Application of the award: To meet the challenges posed by emerging technologies in the field of graphic design, my team of visual communicators at NIOSH must continuously expand our skillsets. Engaging in professional development and training ensures that we are able to provide the quality products and services that are in demand.

During our weekly team meetings, individual members share drafts-in-progress. As a team, we conceptualize each product design. Presenting our individual content and design challenges to the visual communication team provides valuable clarity and insight that a graphic designer would not gain when thinking out design problems alone. This method contributes to our professional development and helps us visualize data content in unexpected and pleasing ways.

With each project, we grow. We gain knowledge from the content, we learn about our audiences, and we collaborate. We ask our clients, NIOSH communicators, for feedback on our individual projects prior to, during, and post production.

There is so much more we can learn about producing brand identity graphics for NIOSH's internal programs, designing infographics, developing animation products for social media, and more. We are working to tackle these creative design and production challenges by expanding our visual communication tools, staying connected with graphic design trends, building best practices, engaging in critical problem solving, and identifying relevant resources. For this reason, I sought training that would inspire and empower creative professionals.

Training: I attended the American Institute of Graphic Arts (AIGA) 2017 conference. This conference provided attendees with access to experts on a vast range of communication products, such as strategic graphic design, marketing, data visualization, digital media, and emerging design trends and tools.

Expert designers and leaders at the conference shared insights from their work in the Obama White House, and at Gap, Amazon, and other prestigious brands. I learned that audience assessment, experimentation, and tracking impact are elements we can build into our projects. The experts at the conference inspired me to explore new ideas and techniques, which I now apply to product development and collaborations with NIOSH communicators. I shared this information with my team members and other visual information specialists at NIOSH.

How are you impacting NIOSH after receiving the award? Improving the quality of work from my team of visual communicators at NIOSH is an ongoing process. It requires me, it requires all of us on the team, to stretch beyond basic graphic design production practices and engage more with the content and communicators we serve.

One way to approach this task is by prepping for design by learning more about audiences through data analytics. I am currently facilitating this discussion with team members. I believe understanding and applying analytics will benefit our approach to the design and production of many of our products, such as infographics, animation, and presentation materials. I also plan to use analytics to conduct design experiments.

Conclusion: I look forward to further contributing to a creative culture at NIOSH through collaboration with my team members and other communicators at NOSH, where everyone can have ideas and feel valued.

View the previous winners of the Director's Intramural Award for Extraordinary Science (DIA).

NIOSH Nominations for the 2019 Charles C. Shepard Science Award

CDC/ATSDR established the Charles C. Shepard Science Award in 1986 in honor of Dr. Charles C. Shepard, MD, an internationally recognized microbiologist whose career was marked by a pursuit of scientific excellence. He served as chief of the Leprosy and Rickettsia Branch at CDC for more than 30 years, until his death on February 18, 1985. The Charles C. Shepard Science Awards recognize excellence in science at CDC and ASTDR. An award is presented for scientific publications in the following areas: Assessment, Prevention and Control, Laboratory Science, Data Methods and Study Design. An award is also presented for Lifetime Scientific Achievement.

NIOSH Nominations for the Charles C. Shepard Science Award

Scientific Publications

Assessment

Blackley DJ, Reynolds LE, Short C, Carson R, Storey E, Halldin CN, Laney AS [2018]. Progressive massive fibrosis in coal miners from 3 clinics in Virginia, J Am Med Assoc *319*(5):500–501.

Daniels RD [2018]. Occupational asthma risk from exposures to toluene diisocyanate: a review and risk assessment. Am J Ind Med *61*(4):282–292.

Data Methods and Study Design

Kim B-H, Larson MK, Lawson HE [2018]. Applying robust design to study the effects of stratigraphic characteristics on brittle failure and bump potential in a coal mine. Int J Min Sci Technol *28*(1):137–144.

Laboratory Science

Stefaniak AB, Bowers LN, Knepp AK, Virji MA, Birch ME, Ham JE, Wells JR, Qi C, Schwegler-Berry D, Friend S, Johnson AR, Martin SB Jr., Qian Y, LeBouf RF, Birch Q, Hammond D [2018]. Three-dimensional printing with nano-enabled filaments releases polymer particles containing carbon nanotubes into air. Indoor Air *28*(6):840–85.

Falcone LM, Erdely A, Kodali V, Salmen R, Battelli LA, Dodd T, McKinney W, Stone S, Donlin M, Leonard, HD, Cumpston JL, Cumpston JB, Andrews RN, Kashon ML, Antonini JM, Zeidler-Erdely PC [2018]. Inhalation of iron-abundant gas metal arc welding-mild steel fume promotes lung tumors in mice. Toxicology *409*:24–32.

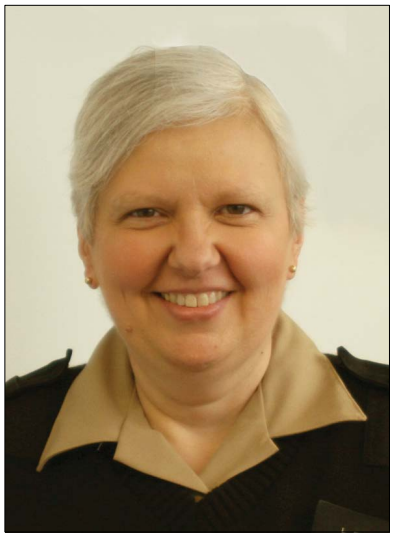
Stueckle TA, Davidson DC, Derk R, Kornberg TG, Battelli L, Friend S, Orandle M, Wagner A, Dinu CZ, Sierros KA, Agarwal S, Gupta RK, Rojanasakul Y, Porter DW, Rojanasakul L [2018]. Short-term pulmonary toxicity assessment of pre- and post-incinerated organomodified nanoclay in mice. ACS Nano *12*(3):2292–2310.

Yorio PL, Laney AS, Halldin CN, Blackley DJ, Moore SM, Wizner K, Radonovich LJ, Greenawald LA [2018]. Interstitial lung diseases in the U.S. mining industry: using MSHA data to examine trends and the prevention effects of compliance with health regulations, 1996–2015. Risk Anal *38*:1962–1971.

Park J-H, Cho SJ, White SK, Cox-Ganser JM [2018]. Changes in respiratory and non-respiratory symptoms in occupants of a large office building over a period of moisture damage remediation attempts. PLoS One *13*(1):e0191165.

Lifetime Scientific Achievement Award

Dr. Lynne Pinkerton



Since joining NIOSH, Captain Lynne Pinkerton has made significant contributions to the field of occupational safety and health, public health, and the protection and well-being of the workforce worldwide. Throughout Dr. Pinkerton's career at the National Institute for Occupational Safety and Health (NIOSH), she has shown continuous outstanding leadership in conducting high quality, high impact cancer research and prevention activities. Dr. Pinkerton is a skilled and extremely productive researcher who has led some of the most highly visible occupational cancer and chronic health research in the institute.

Dr. Pinkerton's intuitive research ability and sustained leadership in addressing problems with coding of death certificate data resulted in improving the accuracy of NIOSH research concerning causes of death from cancer and other chronic diseases. She led a joint NCHS-NIOSH team in developing recommendations to address the problems associated with errors in codes and arranged for experts from NCHS to provide training on death certificate coding to approximately 20 NIOSH researchers, resulting in a change in the way NIOSH researchers handled their data.

Although there are many examples of how Dr. Pinkerton's research has led to further research at NIOSH, one of the most striking examples is from the study in Endicott, NY, where Dr. Pinkerton led a high visibility assessment of the feasibility of a cancer study in former IBM employees. Congressional representatives from New York State (then-U.S. Sen. Hillary Clinton and U.S. Rep. Maurice Hinchey) asked the CDC for NIOSH assistance in addressing concerns about potential health effects resulting from chemical contamination at a former IBM facility. Rep. Hinchey's request specifically noted concerns about the health of current and former workers at the facility. NIOSH also received a request for assistance from a community advocacy group for a study of IBM workers. Because of her unique combination of expertise and leadership in occupational epidemiology, Dr. Pinkerton was called upon to lead the study. To complete this assessment, Dr. Pinkerton had to address the scientific issues and effectively interact with and address the concerns of the community, elected officials, other governmental

agencies involved in the public health response to the environmental contamination, the media, and IBM. Dr. Pinkerton concluded that there was enough information to conduct a study of approximately 28,000 former IBM employees and addressed the key questions about study design and cost estimates in coordination with ATSDR and the New York State Department of Health.

Dr. Pinkerton has participated in several important activities related to emergency response and preparedness. From 2002 to 2003, Dr. Pinkerton represented NIOSH in a workgroup of national experts to develop the 2003 CDC guidelines for hospital response to mass casualties resulting from a radiologic incident. CDC disseminated these guidelines to facilitate emergency preparedness across the nation and incorporated the guidelines into emergency preparedness training. In 2002, Dr. Pinkerton represented NIOSH on the CDC Radiation Guidance Document Committee and CDC Chemical Communications Working Group to develop guidance to use in the event of a radiological incident and to provide information on priority chemicals identified as potential agents of terrorism. In 2001–2002 and 2005–2006, Dr. Pinkerton provided medical, workplace safety and health, and epidemiologic guidance and support for the response to the anthrax attacks and Hurricane Katrina.

Capt. Pinkerton received the PHS Distinguished Service Medal in recognition of an exemplary career in occupational safety and health from June 1993 to September 2017. Over her 25-year career, Capt. Pinkerton received 15 PHS honor awards, authored over 30 journal articles and government publications, and contributed to agency guidance documents. She received the DHHS Secretary's Award for Distinguished Service (2005), an Alice Hamilton Award honorable mention (the second-highest NIOSH award for scientific excellence, 2014), and the Bullard-Sherwood Research to Practice Award (the highest NIOSH award for applying research to protect worker health, 2015).

Throughout Dr. Pinkerton's career at NIOSH, she has served the institute in a number of capacities to support junior and fellow scientific or support staff. She continues to mentor and recruit EIS officers; and since 2004, Dr. Pinkerton has served on the Commissioned Corps Awards Boards, as a member, branch point of contact, and acting chair.

This nomination recognizes not only her outstanding contribution to occupational safety and health, but also her dedication and commitment to the NIOSH mission.

View the previous NIOSH Nominations for the Charles C Shepard Science Award

This page intentionally left blank.

Promoting productive workplaces through
safety and health research