NIOSH Science Awards 2014

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

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Contents

NIOSH Presents 2014 Awards for Significant Scientific Contributions

Today, the National Institute for Occupational Safety and Health (NIOSH) presented science awards to several NIOSH researchers and their partners for their significant contributions made to the fields of occupational safety and health over the past year.

John Howard, MD, NIOSH Director

The annual NIOSH Science Awards are an opportunity for NIOSH to honor researchers for excellence in science. The awards include the following:

- The Alice Hamilton Award, for scientific excellence of technical and instructional materials by NIOSH scientists and engineers.
- The James P. Keogh Award, for outstanding service by an individual in the occupational safety and health field.
- The Bullard-Sherwood Research-to-Practice Award, for exceptional efforts by NIOSH researchers and partners in applying occupational safety and health research to the prevention of workplace fatalities, illnesses, or injuries.
- The Director's Award for Extraordinary Intramural Science.

"Much as our Nation commemorated Workers' Memorial Day earlier this week, today NIOSH honors the innovative and impactful work demonstrated by our researchers and their commitment to preventing work-related injuries, illnesses, and deaths," said NIOSH Director John Howard, MD. "As the workforce becomes increasingly diverse, it is critical that scientific research be conducted by dedicated and passionate researchers, like those we honor today, ready to address the challenges we face in ensuring the safety and health of all people who work."

Alice Hamilton Award

Named after Dr. Alice Hamilton, a pioneering researcher and occupational physician, the Alice Hamilton Award is given for outstanding NIOSH contributions in the areas of biological sciences, engineering and physical sciences, human studies, and educational materials. The submissions go through a rigorous review by panels of scientific experts, including peers from both outside and inside NIOSH. The awardees for 2014 have contributed to an array of sectors, highlighting the broad range of occupational safety and health. This year's awardees have contributed to the fields of workplace violence prevention, ladder safety, taxicab security, occupational exposures to respirable crystalline silica, and nanotechnology.

James P. Keogh Award

The James P. Keogh Award for Outstanding Service in Occupational Safety and Health recognizes a current or former employee of NIOSH whose career "exhibits respect and compassion for individual workers, with tireless leadership, courage, and a fierce determination to put knowledge into practice to enhance their well-being." For 2014, NIOSH honors Dr. Albert E. Munson, a pioneer in toxicology, and one of the founding fathers of immunotoxicology. Dr. Munson is the first director of NIOSH's Health Effects Laboratory Division, which has grown into an organization of more than 200 staff dedicated to interpreting the causes and mechanisms of occupational disease. Dr. Munson contributed to the science that supported a clean and safe environment under the Clean Water Act and Superfund. He developed standard approaches to assessing the adverse effects of chemicals on the immune system, and he served on eminent expert panels that produced authoritative scientific reports on immunotoxicology and the effects of dioxin. Dr. Munson is also a leader in nurturing new generations of young scientists. He set a high standard for NIOSH, in training and encouraging talented students and post-doctoral fellows.

Bullard-Sherwood Research-to-Practice Award

The Bullard-Sherwood Research-to-Practice Award is named for Edward W. Bullard, the inventor of the hard hat, and R. Jeremy Sherwood, the inventor of the personal industrial hygiene sampling pump. This award is given to recognize recipients for outstanding contributions in three categories: Knowledge, Interventions, and Technology. This year, the awards went to the following projects:

- A project that used 3-D body scans to update specifications for seat belts, fire truck cabs, and personal protective equipment to better fit today's firefighters.
- Research that examined the potentially explosive environment of underground coal mines and battery safety.
- An innovative ladder app that provides employers and workers with a convenient, real-time tool for positioning ladders safely and preventing serious falls on the job.

The awards were presented by Jed Bullard, grandson of Edward W. Bullard.

Director's Award for Extraordinary Intramural Science

The Director's Award for Extraordinary Intramural Science recognizes outstanding collective contributions to science excellence at NIOSH by individual intramural scientists and support staff. Three award recipients earned recognition:

- Distinguished Career Scientist award was presented to Mark Stephenson, senior research audiologist in the Division of Applied Research and Technology, and the coordinator of the NIOSH Hearing Loss Prevention Program. Dr. Stephenson is a recognized leader in work-related hearing loss research and prevention. In his

capacity at NIOSH, Dr. Stephenson was one of the first practitioners to apply health communication theory to hearing conservation. He spearheaded developing two NIOSH numbered publications that continue to serve as standard references in hearing conservation. In recognition of Dr. Stephenson's leadership, the American Academy of Audiology has asked Dr. Stephenson to develop recommendations to update audiometric monitoring procedures for the first time in more than 50 years.

- The Early Career Scientist award was presented to Mike Flynn, social scientist in the Education and Information Division. Mr. Flynn is a leader in innovative research that seeks to improve the occupational health of immigrant workers, a growing segment of the U.S. workforce. He serves as the NIOSH assistant coordinator for the Priority Populations and Health Disparities Program, he is the principal investigator for several major field studies, and he is a member of the National Advisory Committee for the Ventanillas de Salud health promotion program operating in Mexican consulates across the United States. His research and participation recognizes the role of work as a critical health determinant for Mexican workers and their families in the United States, and incorporates that dimension into effective strategies for preventive care. Mr. Flynn is co-editor of a forthcoming book from the American Psychological Association on research needs and directions for addressing occupational health disparities. He has widely presented at professional meetings and published numerous journal articles and book chapters in this area of research and outreach, and he is increasingly recognized as a leader in research translation.
- The Scientific Support award was presented to John Clark, biological sciences laboratory technician in the Division of Applied Research and Technology. Mr. Clark most recently has worked on studies assessing the effects of occupational exposures on human reproductive health. As a senior technician, with 42 years of federal service at NIOSH, Mr. Clark executes the critical research tasks of organizing human field studies and collecting and processing biological specimens in the field. Mr. Clark's talents are in great demand by investigators across NIOSH, and he is widely recognized for his resourcefulness, his initiative, and his perseverance.

Charles C. Shepard Award

Earlier this year, NIOSH announced its nominations for the Charles C. Shepard Award. Named for Charles C. Shepard, an internationally recognized microbiologist, this award is given in five categories, including the Lifetime Scientific Achievement Award. NIOSH nominated 12 papers for the 2014 award, and for the Lifetime Scientific Achievement Award nominated Dr. Paul Schulte, director of the NIOSH Education and Information Division (EID) and a pioneer in the field of molecular epidemiology.

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 biological science, engineering and physical science, human studies, and educational materials.

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

Education and Guidance Category

Winner

Workplace Violence Prevention for Nurses

Hartley D, Ridenour M, Craine J, Costa B

NIOSH [2013]. Workplace violence prevention for nurses. CDC Course No. WB1865. 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. 2013-155.

NIOSHTIC-2: 20043051 | NORA: Healthcare and Social Assistance / Transportation, Warehousing and Utilities

Abstract

The purpose of this course is to help healthcare workers better understand the scope and nature of violence in the healthcare workplace. Participants learn how to recognize the key elements of a comprehensive workplace violence prevention program, how organizational systems impact workplace violence, how to apply individual strategies, and develop skills for preventing and responding to workplace violence. Content is derived from content experts and from the OSHA 2004 "Guidelines for Preventing Workplace Violence for Health Care & Social Service Workers" (OSHA 3148-01R 2004).

Honorable Mention

Straight Talk about Nail-gun Safety

Albers J, Hudock S, Lowe B, Thorkelson N

NIOSH [2013]. Straight talk about nail-gun safety. 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. 2013-149.
NIOSHTIC-2: 20042682 | NORA: Construction

Abstract

This publication provides the following nail gun safety tips in a comic book format. Nail Gun Trigger Safety: 1. Removing the safety tip spring or disabling any safety device increases the risk of injury. OSHA prohibits doing these things. 2. Use the "single shot" trigger (also called full sequential trigger) when possible. 3. Ask your employer for nail gun safety training if you are a new user. OSHA requires this training. Ask how the different triggers and safety devices work. 4. Know what type of trigger you are using before you start working. Nail Gun Use: 1. Hold and carry the nail gun with your Finger OFF the trigger. 2. Keep co-workers out of your line of fire. 3. Clear a nail jam after you disconnect the hose. 4. Shoot the bottom nail first when fastening a stud to a plate. 5. Know where the studs or joists are when shooting plywood or OSB. 6. Keep your free hand, not holding the gun, as far from the nailing location as possible (12 inches or more is best). 7. Use extra care when toe nailing, nailing in tight spaces, from a ladder, or with the gun above your head. 8. Allow space for nail gun recoil ("kickback") and don't try to stop or fight this recoil. 9. Use your dominant hand to operate a nail gun. 10. Always wear eye protection, hard hat, safety shoes, hearing protection as required by OSHA. 11. Never horseplay or fool around with nail guns. 12. Seek medical treatment immediately if injured with a nail gun. 13. Work only as fast as you can safely control the nail gun. Resist pressure to work faster. Lumber and building materials: 1. Check lumber for knots, nails, straps, or other things that can cause a nail ricochet or deflection. 2. Only use a hammer, palm nailer or positive placement teco nailer for fastening metal straps or other connectors. 3. Use extra care with warped or twisted lumber. 4. Good planning of material storage and layout can save more job time than the choice of trigger. Compressors/hoses: 1. Check your nail air hose, hose fittings, and compressor to make sure they work properly. Use only tools and equipment that work properly. 2. Make sure your air pressure is in the recommended range, usually 80 to 120 psi. 3. Nail guns should be lubricated on a regular basis. 4. Don't lift, lower, or carry your nail gun by the air hose. 5. Disconnect the air hose when clearing a nail jam or doing any maintenance on the nail gun.

Honorable Mention

Clinical Guidelines for Occupational Lifting in Pregnancy: Evidence Summary and Provisional Recommendations

MacDonald LA, Waters TR, Napolitano PG, Goddard DE, Ryan MA, Nielsen P, Hudock SD

> MacDonald LA, Waters TR, Napolitano PG, Goddard DE, Ryan MA, Nielsen P, Hudock SD [2013]. Clinical guidelines for occupational lifting in pregnancy: evidence summary and provisional recommendations. Am J Obstet Gynecol *209*(2):80–88.
> **NIOSHTIC-2:** 20042308 | NORA: Manufacturing / Wholesale and Retail Trade

Abstract

Empirically-based lifting criteria established by the National Institute for Occupational Safety and Health (NIOSH) to reduce risk of overexertion injuries in the general U.S. working population were evaluated for application to pregnant workers. This report proposes criteria to guide decisions by medical providers about permissible weights for lifting tasks performed at work over the course of an uncomplicated pregnancy. Our evaluation included an extensive review of the literature linking occupational lifting to maternal and fetal health. Although it has been 29 years since the American Medical Association's (AMA) Council on Scientific Affairs published its report on the "Effects of Pregnancy on Work Performance," these guidelines continue to influence clinical decisions and workplace policies. Provisional clinical guidelines derived from the NIOSH lifting criteria are presented that account for recent evidence for maternal and fetal health, and they aim to improve the standard of care for pregnant workers.

Engineering and Control Category

Winner

Research to Improve Extension Ladder Angular Positioning

Simeonov P, Hsiao H, Powers J, Kim I-J, Kau T-Y, Weaver D

> Simeonov P, Hsiao H, Powers J, Kim I-J, Kau T-Y, Weaver D [2013]. Research to improve extension ladder angular positioning. Appl Ergon *44*(3):496–502.
> **NIOSHTIC-2:** 20041827 | NORA: Construction

Abstract

A leading cause for extension ladder fall incidents is a slide-out event usually related to suboptimal ladder inclination. An improved ladder positioning method or procedure could reduce the risk of ladder stability failure and the related fall injury. The objective of the study was to comparatively evaluate the effectiveness of a multimodal angle indicator with other existing methods for extension ladder angular positioning. Twenty experienced and 20 inexperienced ladder users participated in the study. Four ladder positioning methods were tested in a controlled laboratory environment with 4.88 m (16 ft) and 7.32 m (24 ft) ladders in extended and retracted positions. The positioning methods included a no-instruction method, the current standard anthropometric method, and two instrumental methods—a bubble level indicator, and a multimodal indicator providing direct feedback with visual and sound signals. Performance measures included positioning angle and time. The results indicated that the anthropometric method was effective in improving the extension ladder positioning angle ($P < 0.001$); however, it was associated with considerable variability and required 50% more time than no instruction. The bubble level indicator was an accurate positioning method (with very low variability), but it required more than double the time of the no-instruction method ($P < 0.001$). The multimodal indicator improved the ladder angle setting as compared with the no-instruction and anthropometry methods ($P < 0.001$) and required the least time for ladder positioning among the tested methods ($P < 0.001$). An indicator with direct multimodal feedback is a viable approach for quick and accurate ladder positioning. The main advantage of the new multimodal method is that it provides continuous feedback on the angle of the device and hence does not require repositioning of the ladder. Furthermore, this indicator can be a valuable tool for training ladder users to correctly apply the current ANSI A14 standard anthropometric method in ladder angular positioning. The multimodal indicator concept has been further developed to become a hand-held tool in the form of a smart phone application.

Honorable Mention

Head-and-face Shape Variations of U.S. Civilian Workers

Zhuang Z, Shu C, Xi P, Bergman M, Joseph M

Zhuang Z, Shu C, Xi P, Bergman M, Joseph M [2013]. Head-and-face shape variations of U.S. civilian workers. Appl Ergon *44*(5):775–784.
NIOSHTIC-2: 20042175

Abstract

The objective of this study was to quantify head-and-face shape variations of U.S. civilian workers using modern methods of shape analysis. The purpose of this study was based on previously highlighted changes in U.S. civilian worker head-and-face shape over the past few decades—touting the need for new and better fitting respirators—as well as the study's usefulness in designing more effective personal protective equipment (PPE)—specifically in

the field of respirator design. The raw scan three-dimensional (3D) data for 1,169 subjects were parameterized using geometry processing techniques. This process allowed the individual scans to be put in correspondence with each other in such a way that statistical shape analysis could be performed on a dense set of 3D points. This process also cleaned up the original scan data such that the noise was reduced and holes were filled in. The next step, statistical analysis of the variability of the head-and-face shape in the 3D database, was conducted using principal component analysis (PCA) techniques. Through these analyses, it was shown that the space of the head-and-face shape was spanned by a small number of basis vectors. Fewer than 50 components explained more than 90% of the variability. Furthermore, the main mode of variations could be visualized through animating the shape changes along the PCA axes with computer software in executable form for Windows XP. The results from this study in turn could feed back into respirator design to achieve safer, more efficient product style and sizing. Future study is needed to determine the overall utility of the point cloud-based approach for the quantification of facial morphology variation and its relationship to respirator performance.

Epidemiology and Surveillance Category

Winner

Effectiveness of Taxicab Security Equipment in Reducing Driver Homicide Rates

Menéndez CKC, Amandus HE, Damadi P, Wu N, Konda S, Hendricks SA

Menéndez CKC, Amandus HE, Damadi P, Wu N, Konda S, Hendricks SA [2013]. Effectiveness of taxicab security equipment in reducing driver homicide rates. Am J Prev Med *45*(1):1–8.

NIOSHTIC-2: 20042730 | NORA: Transportation, Warehousing and Utilities

Abstract

Background: Taxicab drivers historically have had one of the highest work-related homicide rates of any occupation. In 2010 the taxicab driver homicide rate was 7.4 per 100,000 drivers, compared with the overall rate of 0.37 per 100,000 workers. Purpose: Evaluate the effectiveness of taxicab security cameras and partitions on citywide taxicab driver homicide rates. Methods: Taxicab driver homicide rates were compared in 26 major cities in the U.S. licensing taxicabs with security cameras (n = 8); bullet-resistant partitions (n = 7); and cities where taxicabs were not equipped with either security cameras or partitions (n = 11). News clippings of taxicab driver homicides and the number of licensed taxicabs by city were used to construct taxicab driver homicide rates spanning 15 years (1996–2010). Generalized estimating equations were constructed to model the Poisson-distributed homicide rates on city-specific safety equipment installation status, controlling for city homicide rate and the concurrent decline of homicide rates over time. Data were analyzed in 2012. Results: Cities

with cameras experienced a threefold reduction in taxicab driver homicides compared with control cities (RR = 0.27; 95% CI = 0.12, 0.61; $P = 0.002$). There was no difference in homicide rates for cities with partitions compared with control cities (RR = 1.15; 95% CI = 0.80, 1.64; $P = 0.575$). Conclusions: Municipal ordinances and company policies mandating security cameras appear to be highly effective in reducing taxicab driver deaths due to workplace violence.

Honorable mention

Mortality and Cancer Incidence in a Pooled Cohort of U.S. Firefighters from San Francisco, Chicago and Philadelphia (1950–2009)

Daniels RD, Kubale TL, Yiin JH, Dahm MM, Hales TR, Baris D, Zahm SH, Beaumont JJ, Waters KM, Pinkerton LE

Daniels RD, Kubale TL, Yiin JH, Dahm MM, Hales TR, Baris D, Zahm SH, Beaumont JJ, Waters KM, Pinkerton LE [2013]. Mortality and cancer incidence in a pooled cohort of U.S. firefighters from San Francisco, Chicago and Philadelphia (1950–2009). Occup Environ Med: Epub ahead of print, 2013 Oct.
NIOSHTIC-2: 20043263 | NORA: Services: Public Safety

Abstract

OBJECTIVES: To examine mortality patterns and cancer incidence in a pooled cohort of 29,993 U.S. career firefighters employed since 1950 and followed through 2009. METHODS: Mortality and cancer incidence were evaluated by life table methods with the U.S. population referent. Standardized mortality ratios (SMR) and standardized incidence ratios (SIR) were determined for 92 causes of death and 41 cancer incidence groupings. Analyses focused on 15 outcomes of *a priori* interest. Sensitivity analyses were conducted to examine the potential for significant bias. RESULTS: Person-years at risk totaled 858,938 and 403,152 for mortality and incidence analyses, respectively. All-cause mortality was at expectation (SMR = 0.99, 95% CI 0.97 to 1.01, n = 12,028). There was excess cancer mortality (SMR = 1.14, 95% CI 1.10 to 1.18, n = 3,285) and incidence (SIR = 1.09, 95% CI 1.06 to 1.12, n = 4,461) comprised mainly of digestive (SMR = 1.26, 95% CI 1.18 to 1.34, n = 928; SIR = 1.17, 95% CI 1.10 to 1.25, n = 930) and respiratory (SMR = 1.10, 95% CI 1.04 to 1.17, n = 1096; SIR = 1.16, 95% CI 1.08 to 1.24, n = 813) cancers. Consistent with previous reports, modest elevations were observed in several solid cancers; however, evidence of excess lymphatic or haematopoietic cancers was lacking. This study is the first to report excess malignant mesothelioma (SMR = 2.00, 95% CI 1.03 to 3.49, n = 12; SIR = 2.29, 95% CI 1.60 to 3.19, n = 35) among U.S. firefighters. Results appeared robust under differing assumptions and analytic techniques. CONCLUSIONS: Our results provide evidence of a relation between firefighting and cancer. The new finding of excess malignant mesothelioma is noteworthy, given that asbestos exposure is a known hazard of firefighting.

Exposure and Risk Assessment Category

Winner

Occupational Exposures to Respirable Crystalline Silica During Hydraulic Fracturing

Esswein EJ, Breitenstein M, Snawder J, Kiefer M, Sieber WK

Esswein EJ, Breitenstein M, Snawder J, Kiefer M, Sieber WK [2013]. Occupational exposures to respirable crystalline silica during hydraulic fracturing. J Occup Environ Hyg *10*(7):347–356.

NIOSHTIC-2: 20042606 | NORA: Mining: Oil and Gas Extraction

Abstract

This report describes a previously uncharacterized occupational health hazard: work crew exposures to respirable crystalline silica during hydraulic fracturing. Hydraulic fracturing involves high pressure injection of large volumes of water and sand, and smaller quantities of well treatment chemicals, into a gas or oil well to fracture shale or other rock formations, allowing more efficient recovery of hydrocarbons from a petroleum-bearing reservoir. Crystalline silica ("frac sand") is commonly used as a proppant to hold open cracks and fissures created by hydraulic pressure. Each stage of the process requires hundreds of thousands of pounds of quartz-containing sand; millions of pounds may be needed for all zones of a well. Mechanical handling of frac sand creates respirable crystalline silica dust, a potential exposure hazard for workers. Researchers at the National Institute for Occupational Safety and Health collected 111 personal breathing zone samples at 11 sites in five states to evaluate worker exposures to respirable crystalline silica during hydraulic fracturing. At each of the 11 sites, full-shift samples exceeded occupational health criteria (e.g., the Occupational Safety and Health Administration calculated permissible exposure limit, the NIOSH recommended exposure limit, or the ACGIH threshold limit value), in some cases, by 10 or more times the occupational health criteria. Based on these evaluations, an occupational health hazard was determined to exist for workplace exposures to crystalline silica. Seven points of dust generation were identified, including sand handling machinery and dust generated from the work site itself. Recommendations to control exposures include product substitution (when feasible), engineering controls or modifications to sand handling machinery, administrative controls, and use of personal protective equipment. To our knowledge, this represents the first systematic study of work crew exposures to crystalline silica during hydraulic fracturing. Companies that conduct hydraulic fracturing using silica sand should evaluate their operations to determine the potential for worker exposure to respirable crystalline silica and implement controls as necessary to protect workers. [Supplementary materials are available for this article. Go to the publisher's online edition of *Journal of Occupational and Environmental Hygiene* for the following free supplemental

resource: a file containing controls and recommendations to limit worker exposures to respirable crystalline silica at hydraulic fracturing work sites.].

Honorable mention

Occupational Exposure to Carbon Nanotubes and Nanofibers. Current Intelligence Bulletin 65.

Zumwalde R, Kuempel E, Birch E, Trout D, Castranova V

> NIOSH [2013]. Occupational exposure to carbon nanotubes and nanofibers. Current intelligence bulletin 65. By Zumwalde R, Kuempel E, Birch E, Trout D, Castranova V. 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. 2013-145.
> **NIOSHTIC-2:** 20042517 | NORA: Manufacturing

Summary

This NIOSH CIB, (1) reviews the animal and other toxicological data relevant to assessing the potential non-malignant adverse respiratory effects of CNT and CNF, (2) provides a quantitative risk assessment based on animal dose-response data, (3) proposes a recommended exposure limit (REL) of 1 μg/m^3 elemental carbon as a respirable mass 8-hour time-weighted average (TWA) concentration, and (4) describes strategies for controlling workplace exposures and implementing a medical surveillance program. The NIOSH REL is expected to reduce the risk for pulmonary inflammation and fibrosis. However, because of some residual risk at the REL and uncertainty concerning chronic health effects, including whether some types of CNTs may be carcinogenic, continued efforts should be made to reduce exposures as much as possible.

Just prior to the release of this CIB NIOSH reported at the annual meeting of the Society of Toxicology [03/11/2013] preliminary findings from a new laboratory study in which mice were exposed by inhalation to multi-walled carbon nanotubes (MWCNT) (see New Findings on Lung Tumor Formation in Laboratory Mice Exposed to Multi-Walled Carbon Nanotubes). The study was designed to investigate whether MWCNT have the potential to initiate or promote cancer. Mice receiving both an initiator chemical plus inhalation exposure to MWCNT were significantly more likely to develop tumors (90% incidence) and have more tumors than mice receiving the initiator chemical alone. These results indicate that MWCNT can increase the risk of cancer in mice exposed to a known carcinogen. The study did not indicate that MWCNTs alone cause cancer in mice. This research is an important step in our understanding of the hazards associated with MWCNT, but before we can determine whether MWCNT pose an occupational cancer risk, we need more information about workplace exposures, the types and nature of MWCNT being used in the workplace, and how that compares with the material used in this study. Research is under way at NIOSH to learn more about worker exposures and the potential occupational health risks associated with exposure

to MWCNT and other types of CNTs and CNFs. As results from ongoing research become available, NIOSH will reassess its recommendations for CNT and CNF and make appropriate revisions as needed.

Methods and Laboratory Science Category

Winner

Extrapulmonary Transport of MWCNT Following Inhalation Exposure

Mercer RR, Scabilloni JF, Hubbs AF, Wang L, Battelli LA, McKinney W, Castranova V, Porter DW

Mercer RR, Scabilloni JF, Hubbs AF, Wang L, Battelli LA, McKinney W, Castranova V, Porter DW [2013]. Extrapulmonary transport of MWCNT following inhalation exposure. Part Fibre Toxicol *10:*38.
NIOSHTIC-2: 20043086 | NORA: Manufacturing

Abstract

BACKGROUND: Inhalation exposure studies of mice were conducted to determine if multi-walled carbon nanotubes (MWCNT) distribute to the tracheobronchial lymphatics, parietal pleura, respiratory musculature and/or extrapulmonary organs. Male C57BL/6 J mice were exposed in a whole-body inhalation system to a 5 mg/m3 MWCNT aerosol for 5 hours/day for 12 days (4 times/week for 3 weeks, lung burden 28.1 ug/lung). At 1 day and 336 days after the 12 day exposure period, mice were anesthetized and lungs, lymph nodes and extrapulmonary tissues were preserved by whole body vascular perfusion of paraformaldehyde while the lungs were inflated with air. Separate, clean-air control groups were studied at 1 day and 336 days post-exposure. Sirius Red stained sections from lung, tracheobronchial lymph nodes, diaphragm, chest wall, heart, brain, kidney and liver were analyzed. Enhanced darkfield microscopy and morphometric methods were used to detect and count MWCNT in tissue sections. Counts in tissue sections were expressed as number of MWCNT per g of tissue and as a percentage of total lung burden (Mean S.E., n = 8 mice per group). MWCNT burden in tracheobronchial lymph nodes was determined separately based on the volume density in the lymph nodes relative to the volume density in the lungs. Field emission scanning electron microscopy (FESEM) was used to examine MWCNT structure in the various tissues. RESULTS: Tracheobronchial lymph nodes were found to contain 1.08 and 7.34 percent of the lung burden at 1 day and 336 days post-exposure, respectively. Although agglomerates account for approximately 54% of lung burden, only singlet MWCNT were observed in the diaphragm, chest wall, liver, kidney, heart, and brain. At one day post exposure, the average length of singlet MWCNT in liver and kidney was comparable to that of singlet MWCNT in the lungs, 8.2 0.3 versus 7.5 0.4 um, respectively. On average, there were 15,371 and 109,885 fibers per gram in liver, kidney, heart, and brain at 1 day and 336 days post-exposure, respectively. The burden of singlet MWCNT in the lymph nodes,

diaphragm, chest wall and extrapulmonary organs at 336 days post-exposure was significantly higher than at 1 day post-exposure. CONCLUSIONS: Inhaled MWCNT, which deposit in the lungs, are transported to the parietal pleura, the respiratory musculature, liver, kidney, heart, and brain in a singlet form and accumulate with time following exposure. The tracheobronchial lymph nodes contain high levels of MWCNT following exposure and further accumulate over nearly a year to levels that are a significant fraction of the lung burden 1 day post-exposure.

Honorable mention

Carbon Nanotube Dosimetry: From Workplace Exposure Assessment to Inhalation Toxicology

Erdely A, Dahm M, Chen BT, Zeidler-Erdely PC, Fernback JE, Birch ME, Evans DE, Kashon ML, Deddens JA, Hulderman T, Bilgesu SA, Battelli L, Schwegler-Berry D, Leonard HD, McKinney W, Frazer DG, Antonini JM, Porter DW, Castranova V, Schubauer-Berigan MK

Erdely A, Dahm M, Chen BT, Zeidler-Erdely PC, Fernback JE, Birch ME, Evans DE, Kashon ML, Deddens JA, Hulderman T, Bilgesu SA, Battelli L, Schwegler-Berry D, Leonard HD, McKinney W, Frazer DG, Antonini JM, Porter DW, Castranova V, Schubauer-Berigan MK [2013]. Carbon nanotube dosimetry: from workplace exposure assessment to inhalation toxicology. Part Fibre Toxicol *10:*53.
NIOSHTIC-2: 20043362 | NORA: Manufacturing / Services: Public Safety

Abstract

Background: Dosimetry for toxicology studies involving carbon nanotubes (CNT) is challenging because of a lack of detailed occupational exposure assessments. Therefore, exposure assessment findings, measuring the mass concentration of elemental carbon from personal breathing zone (PBZ) samples, from eight U.S.-based multi-walled CNT (MWCNT) manufacturers and users were extrapolated to results of an inhalation study in mice. Results: Upon analysis, an inhalable elemental carbon mass concentration arithmetic mean of 10.6 μg/m3 (geometric mean 4.21 μg/m3) was found among workers exposed to MWCNT. The concentration equates to a deposited dose of approximately 4.07 μg/d in a human, equivalent to 2 ng/d in the mouse. For MWCNT inhalation, mice were exposed for 19 d with daily depositions of 1970 ng (equivalent to 1000 d of a human exposure; cumulative 76 yr), 197 ng (100 d; 7.6 yr), and 19.7 ng (10 d; 0.76 yr) and harvested at 0, 3, 28, and 84 d post-exposure to assess pulmonary toxicity. The high dose showed cytotoxicity and inflammation that persisted through 84 d after exposure. The middle dose had no polymorphonuclear cell influx with transient cytotoxicity. The low dose was associated with a low grade inflammatory response measured by changes in mRNA expression. Increased inflammatory proteins were present in the lavage fluid at the high and middle dose through 28 d post-exposure. Pathology, including epithelial hyperplasia and peribronchiolar inflammation, was only noted at the high dose. Conclusion: These findings showed a limited pulmonary inflammatory

potential of MWCNT at levels corresponding to the average inhalable elemental carbon concentrations observed in U.S.-based CNT facilities, and estimates suggest considerable years of exposure are necessary for significant pathology to occur at that level.

Alice Hamilton Award Top Finalists for 2014

The names are not necessarily listed in the order in which they were ranked.

Education and Guidance

NIOSH [2013]. Straight talk about nail-gun safety. 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. 2013-149.
NIOSHTIC-2: 20042682 | NORA: Construction

NIOSH [2013]. Workplace violence prevention for nurses. CDC Course No. WB1865. 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. 2013-155.
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Alice Hamilton Award
Research Updates for 2013 Winning Projects

Education and Guidance Category

Ergonomic Hazards and Controls for Elevating Devices in Construction

This article, authored by Christopher S. Pan, PhD, Sharon Chiou, PhD, Hongwei Hsiao, Ph.D., and Paul Keane, M.A., Division of Safety Research, constitutes a book chapter of ergonomic case studies in the book *Occupational Ergonomics*. This chapter presents both the history of NIOSH research into the safe use of elevating devices and future research directions related to these devices. NIOSH has extensive research experience in mechanisms of elevation, and the history of this fall-from-elevation research is presented in this chapter. The chapter also includes findings from NIOSH research studies related to the use of falls from

elevated devices (aerial lifts, stilts, scaffolds, and mast-climbing work platforms) and future directions in research. This book chapter was nominated and awarded the Alice Hamilton Award for seminal work in the Education and Guidance Category in 2013.

The use of elevating devices in construction is well established in the course of human endeavor to erect buildings and structures. Elevating devices have long been used to access heights above normal reach level and to store construction materials and tools. Students of world culture believe that even such notable edifices as the Great Pyramids at Giza and the Great Wall of China employed scaffolding and various elevating devices in their construction. The use of stilts, aerial lifts, mast-climbing work platforms, and scaffolds to provide access to elevated areas under construction has occurred in various ways throughout history and continues to this day.

However, the use of elevating devices in construction has an equally lengthy history of exposing workers to hazardous conditions, particularly to the dangers of falls from a higher level, in addition to other exposures to a common source of injury, such as struck-by injuries and overexertion. Construction work is itself characterized by high rates and numbers of fatal and non-fatal injury, and the greatest number of fatal injuries to this workforce is occasioned by falls. However, other sources of injury remain and are extensively detailed in the IIF database, maintained by the U.S. Bureau of Labor Statistics.

Currently, the U.S. Bureau of Labor Statistics considers construction to have the leading number of fatal injuries, the highest rate of injury with associated days away from work, and the fourth-highest number of injuries with days away from work. Falls accounted for 24,720 events in 2008. To address the factors leading to increased hazardous exposure to injury from work involving elevating devices, NIOSH has embarked on various lines of research, some of which have been recognized by peers as being exemplary and worthy of widespread recognition.

NIOSH has built upon the strong foundation of research summarized in this book and has largely focused upon mechanized elevating devices as representing the future focus of safety research studies. To date, ongoing research has focused on the increasing usage and application of aerial lifts and mast-climbing work platforms in construction. NIOSH has had various levels of involvement in this area and has had numerous opportunities to present findings, to establish collaborative research efforts, and to examine the epidemiology, case characteristics, engineering parameters, and common fault scenarios related to the use of this equipment, which has led to increasing numbers and rates of injury to workers.

Activities to date include an ongoing public health practice project on aerial lift safety, entitled, “Information Transfer and Technology for Aerial Lift Safety.” Preliminary findings from this research effort have been developed, and a dissemination strategy is currently being planned.

Two further NIOSH projects related to the use of mast-climbing work platforms have been funded or proposed: "Injury Assessment for Emerging Mast Scaffold Technology" and "A Follow-up Study for Anchored Mast Climbing Work Platform." Each of these ongoing or proposed projects are in response to the stated needs and industry-wide demands for NIOSH involvement in emerging and widely used elevating technology.

In addition, NIOSH researchers have continued their involvement with the distribution and dissemination of findings related to the continued, safe use of aerial lifts and mast-climbing work platforms in construction through the following five mechanisms:

- The principal investigator has served as the NIOSH representative to the Mast Climbing Work Platform Subcommittee, Building and Construction Trades Department Safety and Health Committee, AFL-CIO.
- The principal investigator has served as the NIOSH representative to the (1) ANSI A92.6 Self-Propelled Elevating Work Platform and (2) ANSI A92.9 Mast Climbing Work Platform subcommittees.
- Letters of agreement have been signed with leading manufacturers of both aerial lifts and mast-climbing work platforms.
- The principal investigator and assignees have developed a dissemination plan (hazard recognition simulator and NIOSH aerial lift website) with the concurrence and guidance of the NIOSH r2p office.
- The project team has presented three invited presentations (Pan 2013a, b; Wimer and Pan 2013) at the request of stakeholders. A draft manuscript is ongoing (Wimer et al., in preparation).

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Epidemiology and Surveillance Category

The Diesel Exhaust in Miners Study: A Cohort Mortality Study With Emphasis on Lung Cancer

Attfield MD, Schleiff PL, Lubin JH, Blair A, Stewart PA, Vermeulen R, Coble JB, Silverman DT

This paper presented an analysis of mortality, focusing on lung cancer, among non-metal miners exposed to diesel exhaust. Research was conducted jointly by NIOSH and the National Cancer Institute (NCI). The study provided rare, complete, and reliable estimates of individual worker exposure to diesel exhaust. The Diesel Exhaust in Miners Study (DEMS) was challenging to complete because of its size, detail, and related critiques and comments from industry and others. However, it is considered of major importance and relevance for both occupational and environmental public health. In part based on this study, the International Agency for Research on Cancer (IARC) went on to classify diesel exhaust as carcinogenic to humans (Group 1), based on sufficient evidence that exposure is associated with an increased risk for lung cancer. This evaluation received worldwide attention. After publication, NIOSH and NCI have been collaborating to provide the means for external researchers to access the data for re-analysis without jeopardizing worker privacy. The authors are exploring the potential of further mortality follow-up of the study cohort.

Exposure and Risk Assessment Category

Multi-walled Carbon Nanotubes: Sampling Criteria and Aerosol Characterization

Chen BT, Schwegler-Berry D, McKinney W, Stone S, Cumpston JL, Friend S, Porter DW, Castranova V, Frazer DG

This paper described how to apply in the field a sampling strategy and characterization methodology developed for industrial hygiene applications in the inhalation exposure laboratory. Since publication, this approach has been widely used in inhalation toxicology studies of engineered and incidental nanomaterials. The paper drew attention, when characterizing airborne nanomaterials, to the mechanisms and consequent biological effects of particle coalescence and coagulation. It demonstrated the limitations of using direct-reading instruments and the need to conduct microscopic analysis when characterizing nanoparticles for risk assessment. In addition, it included a practical shape classification of multi-walled carbon nanotubes (i.e., isometric, fiber-like, and irregularly-shaped fractions) that can be used to develop lung deposition models. Currently, the authors are investigating whether scanning mobility particle analyzers, which are widely used direct-reading instruments, can be used to characterize aerosols containing different nanoparticles. Further research on this may help to develop a simple test to monitor workers for potential adverse health effects from exposure to emerging nanomaterials.

Methods and Laboratory Science Category

Respiratory and Olfactory Cytotoxicity of Inhaled 2,3-Pentanedione in Sprague-Dawley Rats

Hubbs AF, Cumpston AM, Goldsmith WT, Battelli LA, Kashon ML, Jackson MC, Frazer DG, Fedan JS, Goravanahally MP, Castranova V, Kreiss K, Willard PA, Friend S, Schwegler-Berry S, Fluharty KL, Sriram K

This paper demonstrated that two volatile butter flavorings, diacetyl and 2,3-pentanedione, caused comparable damage to airways lining, likely leading to flavorings-related lung disease. The paper had continuing public health impact both within NIOSH and for the larger public health field. The findings reported in the paper supported findings by others on the relationship between the olfactory region of the nose and the central nervous system. The paper provided data that were used to draft NIOSH recommendations to control exposures to both substances (Occupational Exposure to Diacetyl and 2,3-Pentanedione), and supported NIOSH recommendations on the need to evaluate the toxicity of substitute flavorings before selecting them. In addition, the data presented in this paper helped to influence e-cigarette manufacturers in the decision to begin offering diacetyl and pentanedione-free e-cigarettes. Follow-up studies are identifying potential individual susceptibility factors and biomarkers of airway injury. This helps to clarify the toxicity of volatile reactive carbonyl compounds and may lead to faster identification of respiratory hazards in workplaces that make or use flavorings.

History of Alice Hamilton, MD

Alice Hamilton, MD

(February 27, 1869–September 22, 1970)

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 is 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 numbers 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. There she served two terms on the Health Committee of the League of Nations. When she retired from Harvard at the age of 66, she became 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 located at 5555 Ridge Avenue in Cincinnati, Ohio, to the memory of Alice Hamilton, M.D. 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 the Fall of 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, until by 1973, the entire building was leased for federal offices and laboratories. In September of 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. It now houses the Division of Physical Science and Engineering and the Division of Surveillance, Hazard Evaluations and Field Studies. More than 200 people work in 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.

Bullard-Sherwood Research-to-Practice (r2p) 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 individuals who have 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 use of steam during the hat manufacturing process. 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 in the building of the bridge oxidized during transport to San Francisco from Pennsylvania, and it therefore 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. Today, approximately 6 million hard hats are sold annually throughout the world to protect workers. Bullard's family-owned company, now entering its fifth generation, 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.

Knowledge Category

Winning Submission

Sizing Firefighters and Fire Apparatus—Safe by Design

Hsiao H, Whisler R, Zwiener J, Weaver D, Amendola A, Powers J, Guan J, Simeonov P, Current R, Newbraugh B, and Hill G

Source: Division of Safety Research (DSR)

Background: In 2010, more than 1.1 million firefighters worked in the United States. The average rate of fatal workplace injuries among firefighters was 4 times higher than the rate of all workers in 2006. In addition, firefighters suffered 71,875 injuries in 2010. The National Fallen Firefighters Foundation (NFFF) in 2006 recognized the need to integrate firefighter anthropometry (body size and shape information) with fire apparatus and equipment designs (cabs, seats, body restraints, egress, bunker gear, etc.). Firefighters rely heavily on their gear, equipment and vehicles to help protect them from being injured or killed in crashes and rollover incidents, falls from vehicles, and excessive thermal and chemical exposures. However, incorrect fit of personal protective equipment (PPE) and ensembles can reduce their level of protection.

Relevance: The NFFF, National Fire Protection Association (NFPA), International Association of Women in Fire and Emergency Services (IAWFES), and the Fire Apparatus Manufacturers' Association (FAMA) advocated for an anthropometric survey of U.S. firefighters to address fire-apparatus design issues and to update the NFPA standards for fire apparatus and PPE. In response, NIOSH collaborated with the firefighter community, fire apparatus manufacturers, and standards committee in the planning and execution of an anthropometric survey, as well as transfer of data and knowledge into design processes, products, and standards.

NIOSH produced a comprehensive database that was shared with 27 firefighter associations and fire fighter apparatus manufacturers for updating specifications and designs of seat belts, fire truck cabs, gloves, boots, seats, helmets, and respirators. Additionally, NIOSH developed a series of advanced theories in quantifying human body sizes and shape and human-equipment interfaces to assist the fire apparatus industry in equipment size determination.

The NIOSH national firefighter anthropometry data, along with the robust partnerships established throughout this effort, contributed to the NFPA 1901 standards section 14.1.3 (seatbelt specifications) update, which resulted in science-based modifications to seatbelt length, configuration, and retracting systems. As well, a fire department in a very large metropolitan area retrofitted older fire apparatus with new seatbelt systems based on the NIOSH data.

Much of the success and impact of the firefighter anthropometric survey is credited to the strong collaboration between NIOSH and its partners throughout the study, from planning and execution to knowledge transfer. Their combined efforts resulted in a rich database for designing science-based fire apparatus and PPE and updating current fire apparatus- and PPE-related standards. The improved fire apparatus and PPE designs will better fit today's firefighters and help protect them against injuries and hazardous exposures.

More information about NIOSH's firefighter research or other PPE-related topics is available at the following websites:

- Fire Fighter Fatality Investigation and Prevention Program
- Directory of NIOSH Fire Fighter Resources
- National Personal Protective Technology Laboratory (NPPTL)
- NIOSH Directory of Personal Protective Equipment

Intervention Category

Winning Submission

Battery Safety Enhancements for Underground Coal Mines

Dubaniewicz T Jr., DuCarme J, Srednicki J

Source: Office of Mine Safety and Health Research (OMSHR)

Background: Coal mining is one of the most dangerous industries. According to the Bureau of Labor Statistics, the coal mining industry had a work-fatality rate of 24.8 per 100,000 in 2007 [BLS 2010a]. This was nearly 6 times the death rate for all private industry workers. Coal miners often work underground and endure harsh working conditions such as confined spaces, poor lighting, wet surroundings, explosive gas, airborne dust, high noise levels, and uncertain roof conditions. In 2010, nearly two-thirds (65%) of mining fatalities occurred in an underground mine [NIOSH 2014a]. In addition, ignition and explosion of gas or dust accounted for a third (33%) of underground mining fatalities between 2006 and 2010 [NIOSH 2014b].

Relevance: Miners regularly operate and interact with equipment that may inadvertently introduce hazards to the workplace. Lithium-ion cells power equipment that is used in potentially explosive coal mine atmospheres. While participating in discussions with the federal Lithium Battery Technical/Safety Group, Underwriters Laboratories (UL), and ISA 12 Committee, NIOSH learned about gaps in safety and protection standards related to lithium-ion technology. As a result, NIOSH investigated potential hazards of lithium-ion cells in equipment for use in underground coal mines.

NIOSH researchers developed new methods to assess the safety of lithium-ion cells that power coal mining equipment. They developed techniques for identifying and distinguishing between less safe and safer cells. In 2013, NIOSH research was referenced in the revised ANSI safety standard to support a new lithium-ion battery safety recommendation. The standard now indicates that lithium cobalt oxide ($LiCoO_2$) cells, similar to the cells NIOSH researchers found to be potential hazards, are no longer recommended for use in explosion protected equipment.

The impact of the developed test methods stretches beyond the mining industry. The methods may be applied to various industries that use lithium-ion cells, such as aviation, automotive, health, and consumer products.

More information about lithium ion cells and other mining topics can be found at the following websites:

- Mining Publication: Are lithium ion cells intrinsically safe?
- Office of Mine Safety and Health Research (OMSHR)
- Mining Topic: Explosions

Technology Category

Winning Submission

Effectiveness of Extension-ladder Safety Innovations: Development and Dissemination of the First NIOSH Smartphone App—Ladder Safety

Simeonov P, Hsiao H, Powers J, and Weaver D

Source: Division of Safety Research (DSR)

Background: Each year, more than 500,000 people in the United States are treated for ladder-related fall injuries. In addition, about 300 people die from ladder-related falls every year. Falls-from-ladders is a leading cause of work-related fatal falls among all industries. The construction industry experiences the highest frequency of fall-related fatalities. In 2009, more than 40% of fatal falls occurred in the construction industry [BLS 2010b]. The estimated financial burden of ladder injuries is $11 billion, including work loss, medical, legal, liability, and pain and suffering expenses.

Relevance: Earlier studies suggested that ladder users tend to position extension ladders at suboptimal angles, which increases the risk of ladder slide-out events and associated fall injuries. NIOSH researchers developed, evaluated, and patented an innovative, effective, and efficient method and technology for positioning extension ladders at an optimal angle. They then developed the NIOSH Ladder Safety smartphone application, a science-based app for

improving the safety of ladder users. The application provides easy access to graphic aids, safety checklists, and reference information to promote safe ladder use.

This technology is the first NIOSH smartphone application and is available on Apple and Android mobile devices in English and Spanish. As of December 2013, the app has been downloaded more than 12,700 times and was among the top 9% of most-downloaded apps on the Apple App Store. The app has received considerable international attention, and it has been highly rated and widely adopted by more than 50 organizations, many state officials, industry leaders, and safety professionals. Many have incorporated use of the app into safety policies.

Links to the Android and Apple (iOS) versions of the app were spotlighted on the NIOSH topic page, "Fall Injuries Prevention in the Workplace." In the 10 months before the addition of the app links, the page had been viewed 31,110 times. In the 10 months following their inclusion, the app links helped to nearly double traffic to the topic page (60,219 views). The two links to the app were overwhelmingly the most-clicked items on the page. The topic page also linked to user manuals for the Apple and Android devices.

More information about the NIOSH Ladder Safety App and other Construction-related topics can be found at the following websites:

- Fall Injuries Prevention in the Workplace
- Ladder Safety: There's an App for That
- Construction

Honorable Mention

Development and Validation of a Consensus Standard Test Method for Measurement of Airborne Metal and Metal Oxide Nanoparticle Surface Area Concentration in Inhalation Exposure Chambers Using Krypton Gas Adsorption

Stefaniak A, LeBouf R, Chen T, Frazer D, Virji MA

Source: Division of Respiratory Disease Studies (DRDS) and Health Effects Laboratory Division (HELD)

Background: Nanotechnology is a rapidly growing area of research and development, cross-cutting many sectors, such as medicine, consumer products, energy, materials, and manufacturing. Although it shows great promise for scientific advancement, nanotechnology is relatively new, with many unknown characteristics. NIOSH and its Nanotechnology Research Center (NTRC) lead the charge in addressing knowledge gaps, developing strategies, and providing recommendations in nanotechnology and occupational health.

There are approximately 400,000 workers worldwide in the field of nanotechnology, with an estimated 150,000 of those in the United States. The National Science Foundation has estimated that approximately 6 million workers will be employed in nanotechnology-related industries worldwide by 2020 [NIOSH 2014c].

Relevance: An increasing number of nanomaterials and products are used in the manufacturing sector, including powders, solutions, and suspensions. Complete understanding of worker exposure to nanomaterials involves three distinct phases that research must take into account: "as produced" (e.g., bulk material sold by the supplier); "as administered" (e.g., the exposure form to a worker or test subject); and "as delivered" (e.g., at the site of deposition in a worker or a test subject). Standards exist to determine "as produced" surface area of bulk metal oxide powers. However, during the delivery of nanomaterials in inhalation exposure chambers the bulk material may be altered (e.g., by use of a size classifier before the aerosol enters the exposure chamber). There were no standard methods to evaluate the properties of "as delivered" aerosols. Thus, the potential occupational hazards could not be assessed or controlled.

Stakeholder input to NORA sector and cross-sector councils identified the need to address this knowledge gap. In 2009, NIOSH researchers began to develop a method to measure airborne nanomaterial surface area from a filter sample. The project involved collaboration across NIOSH, drawing expertise from the Health Effects Laboratory Division (HELD), Division of Applied Research and Technology (DART), and the Office of Mine Safety and Health Research (OMSHR). The successful methodology was published in a peer-reviewed journal in 2011. Because the method is not limited to a specific compound, it is broadly applicable to metal oxide nanomaterials, emphasizing its robustness and utility.

NIOSH worked with the American Society for Testing Materials (ASTM) Committee E56: Nanotechnology to translate the research into an international consensus standard. In 2013, the standard was approved by ASTM as "E2864 – 13: Standard Test Method for Measurement of Airborne Metal and Metal Oxide Nanoparticle Surface Area Concentration in Inhalation Exposure Chambers Using Krypton Gas Adsorption."

ASTM standards are internationally recognized. ASTM has members from more than 150 countries, and more than 7,000 ASTM standards have been adopted as the basis of national standards or referenced in regulations in countries outside the United States. In addition, the process to develop ASTM standards requires unanimous support. One single vote from the 170 stakeholder members in ASTM committee E56 would stop the process until the issue was resolved. Therefore, the standard reflects the sound research and diligence of NIOSH and ASTM Committee E56. Through ASTM, the standard has the ability to make a long-term impact on an international platform. More accurate characterization of the "as delivered" properties of nanomaterials in inhalation toxicology studies will lay the foundation for better quality data, risk assessment, and controls to protect workers.

More information about nanotechnology and other manufacturing topics can be found at the following websites:

- Nanotechnology
- Nanotechnology at NIOSH
- Manufacturing: Program Description
- National Personal Protective Technology Laboratory (NPPTL)

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NIOSH [2014a]. Mining fatalities, underground, 2001–2010. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Retrieved from http://www.cdc.gov/niosh/mining/UserFiles/statistics/AllMining/f_b1_u_a.JPG.

NIOSH [2014b]. Mining fatalities, underground, by accident class, 2006–2010. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Retrieved from http://www.cdc.gov/niosh/mining/UserFiles/statistics/AllMining/f_p1_u_a.JPG.

NIOSH [2014c]. Nanotechnology: frequently asked questions. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Retrieved from http://www.cdc.gov/niosh/topics/nanotech/faq.html.

Bullard-Sherwood Research-to-Practice (r2p) Award Top Finalists

Projects are listed in alphabetical order by category. Order of listing does not necessarily reflect the order in which the projects were ranked.

Knowledge Category

Adult Blood Lead Epidemiology and Surveillance Program

Project Officer and Key Contributors: Alarcon W, Henn S, Wall D, Boal W, Calvert G, Haring Sweeney M, Cooper S, Hamade A, Davidson S, Lewis K, Eckles D, Rigler J, Dufour B, Payne S, Materna B, Meister R, Harrington D, Pettijohn J, Towle M, Warner A, St. Louis T, DeLoreto A, Watkins S, Cavicchia P, Chalmers J, Lurry J, Sadiq B, Staley F, Kuriatnyk C, Brooks B, Mealey M, Nguyen V, Wamack J, Turner J, Leinenkugel K, Gergely R, Walker R, Steinbauer S, Langham A, Lawson S, Lackovic M, Smith A, Walleigh L, Keyvan-Larijani E, Nicotera R, Kica J, Rosenman K, Symonik D, Olson L, Yendell S, Braun C, Norris Zanto S, Gillespie D, Stover D, Lakevicius P, Armenti K, Lumia M, Singh D, Fagliano J, Krapfl H, Schwarcz L, Toth B, Fletcher A, Gelberg K, Marion D, Higgins S, Clarke J, Stephens K, Alexander C, Quigley S, Douglas J, Cain D, Dreher D, Arunachalam S, Makowski M, Logue J, Bruckshaw J, Corley HR, Keel M, Woodard P, Hinds B, Karnik J, Willis T, LeFevre S, Jones M, Sullivan M, Haugen A, Schoonover T, Bonauto D, Ghaffar R, Anderson H, Coons M, Melia S

NIOSH Location: Cincinnati, OH

Sizing Firefighters and Fire Apparatus—Safe by Design

Project Officer and Key Contributors: Hsiao H, Whisler R, Zwiener J, Weaver D, Amendola A, Powers J, Guan J, Simeonov P, Current R, Newbraugh B, Hill G

NIOSH Location: Morgantown, WV

Advanced Headforms for PPE Design and Fit Evaluation

Project Officer and Key Contributors: Zhuang Z, Shaffer R, Bergman M, Joseph M

NIOSH Location: Pittsburgh, PA

Intervention Category

Battery Safety Enhancements for Underground Coal Mines

Project Officer and Key Contributors: Dubaniewicz T Jr., DuCarme J, Srednicki J

NIOSH Location: Pittsburgh, PA

Technology Category

Helmet-CAM: A Tool for Assessing Miners' Respirable Dust Exposures

Project Officer and Key Contributors: Cecala A, Reed W, Joy J, Noll J, Helfrich W, Kwitowski A, Cole G

NIOSH Location: Pittsburgh, PA

Effectiveness of Extension-Ladder Safety Innovations: Development and Dissemination of the First NIOSH Smartphone App—Ladder Safety

Project Officer and Key Contributors: Simeonov P, Hsiao H, Powers J, Weaver D

NIOSH Location: Morgantown, WV

Development and Validation of a Consensus Standard Test Method for Measurement of Airborne Metal and Metal Oxide Nanoparticle Surface Area Concentration in Inhalation Exposure Chambers using Krypton Gas Adsorption

Project Officer and Key Contributors: Stefaniak A, LeBouf R, Chen T-H, Frazer D, Virji MA

NIOSH Location: Morgantown, WV

Previous Bullard-Sherwood Research-to-Practice (r2p) Award Winners and Honorable Mentions

View the previous Bullard-Sherwood Research-to-Practice (r2p) Award Winners and Honorable Mentions.

Director's Intramural Award for Extraordinary Science (DIA)

Background

Science excellence is the foundation upon which NIOSH generates new knowledge to assure safe and healthful work for all. The purpose of the Director's Intramural Award for Extraordinary Science (DIA) is to recognize outstanding contributions by intramural scientists and support staff to science excellence at NIOSH. Winners of the NIOSH Director's Intramural Award for Extraordinary Science (DIA) will receive a monetary award that augments the discretionary budget for the recipient for the following fiscal year. Winners will also receive recognition at the annual ceremony celebrating the Alice Hamilton Award for Excellence in Occupational Safety and Health.

The CDC-wide Charles C. Shepard Science Award and the NIOSH Alice Hamilton and Bullard-Sherwood Research-to-Practice Award recognize the scientific contributions of a single research project or activity. The Director's Intramural Award for Extraordinary Science (DIA) honors individuals for their scientific contributions through a collective body of work. Although the James P. Keogh Award also recognizes a collective body of work, it is more oriented towards service than science as it focuses on dedicated service, training, and research translation to achieve tangible effects on public health practice. The collective body of work recognized in the Director's Intramural Award for Extraordinary Science (DIA) represents extraordinary individual performance that clearly goes above and beyond past and present basic job requirements.

The Director's Intramural Award serve as a tribute to NIOSH employees whose dedication to science excellence has made significant contributions to the NIOSH mission. Award categories will recognize experienced scientists, early career scientists, and scientific support staff.

Director's Intramural Award for Extraordinary Science (DIA) for 2014

Distinguished Career Scientist

Mark R. Stephenson

Mark R. Stephenson, PhD, is a senior research audiologist and coordinator of the NIOSH Hearing Loss Prevention Program (HLPP). His extraordinary career includes 20 years of active duty service in the U.S. Air Force (USAF), followed by civilian service at NIOSH. His contributions in hearing loss prevention have shaped the field and will improve the hearing health and consequent quality of life of many people for years to come. During his Air Force service, he helped establish hearing damage risk criteria for exposures exceeding 8 hours in duration. These criteria were adopted by the Department of Defense, OSHA, NIOSH, and NASA, and they remain in effect today. While serving in the Philippines, he established the first neonatal auditory brainstem screening program among Department of Defense installations in the eastern hemisphere; today, every USAF medical center with a neonatal nursery conducts newborn hearing screening. In 1986, Dr. Stephenson was an audiology consultant to the Voyager aircraft mission, a 9-day, around-the-world, nonstop and non-refueled flight. Because of the extreme noise from the aircraft's engine, he recommended protective measures and monitored the hearing thresholds of the crew.

After joining NIOSH in 1993, he was among the first to apply health communication theory to spearhead the development of two NIOSH publications on hearing conservation, "Preventing Occupational Hearing Loss—A Practical Guide" (96-110) and "Criteria for a Recommended Standard: Occupational Noise Exposure" (98-126). These publications are still standard references in hearing conservation. He has authored dozens of peer-reviewed articles, technical reports, and book chapters. When he was appointed coordinator in 2005, HLPP was the first NIOSH program reviewed by the National Academies. Dr. Stephenson's response to the National Academies review provided a template that would serve as a model for subsequent reviews of NIOSH programs. This response also created a model strategic plan for NIOSH hearing loss research from 2006 through 2016. His research has significantly impacted practices to prevent hearing loss, helping to move hearing protector fit-testing from being an obscure laboratory procedure to becoming a practical tool. The American Academy of Audiology has asked Dr. Stephenson to lead the update of its current standard of practice for audiologists. His work has also influenced the academy's recommendations that fit-testing be a component of all hearing conservation programs. Dr. Stephenson has also significantly impacted recommendations for audiometric monitoring programs. As a result, the American Academy of Audiology has tasked Dr. Stephenson with developing recommendations for the first major update to audiometric monitoring procedures in more than 50 years. Additionally,

he serves on numerous working groups and technical committees helping to develop and improve standards on noise and hearing. He has mentored, developed, and supported scientific staff both inside and outside of NIOSH. Funding from this award will be used to expand the field data collection for his project, "Hearing Protector Performance in the Workplace. "

Early Career Scientist

Michael Flynn

Michael Flynn is a social scientist and serves as the project officer for a program of research to improve the occupational safety and health (OSH) of immigrant workers. He also serves as the NIOSH assistant coordinator for the Priority Populations and Health Disparities Program. He is the principal investigator for several multi-year field studies, and he is a member of the National Advisory Committee for the Ventanillas de Salud health promotion program, which operates in Mexican consulates across the United States. Since coming to NIOSH in 2005, he has established a substantial record of publications and reputation both nationally and internationally as an expert in his field. He has authored 13 journal articles and book chapters and has given 49 presentations at professional meetings. Currently, he is co-editing a book for the American Psychological Association entitled *Occupational Health Disparities among Racial and Ethnic Minorities: Formulating Research Needs and Directions*. His research has also produced Spanish-language educational materials (six print documents and six videos) on a range of occupational health issues. He is currently serving as a consultant and scientific advisor on eight external projects, including the following: an NIH-funded project through the University of Oregon, a research translation project by the American Academy of Dermatology, and a study on occupational injury among Mexican immigrants run by New York University's Medical School. He also was invited to author a chapter for *Migration and Health Research Methodologies: A Handbook for the Study of Migrant Populations* and was invited to coauthor an article on ethical considerations for research with immigrants for the *Ethics & Behavior* journal. Mr. Flynn is increasingly recognized as a leader in developing creative and original solutions to research translation of health and safety information. An article describing the partnership he has spearheaded between NIOSH and the Mexican Foreign Ministry was recently published in a supplement of Public Health Reports dedicated to innovative approaches to applying social determinants of health to public health practice. He has successfully competed for NORA funding and has become adept at leveraging partnerships to create research opportunities or access to data that advance the goals of the NIOSH Program Portfolio at minimal cost to NIOSH. Originally hired as a project manager with a bachelor's degree, he diligently sought out training in anthropology at the Master's level. He received his Master's degree in 2010 from the University of Cincinnati and is now planning to pursue a doctorate in applied anthropology.

Funding from this award will be used to further the currently unfunded collaboration with the Mexican government to document the occupational health experiences of Mexicans working in the United States.

Scientific Support

John Clark

John Clark is a 42-year veteran of government service with NIOSH. Prior to that, Mr. Clark served as a U.S. Marine in the Vietnam War. He is an active member of the Ohio Army National Guard, and he was called to service again from 2003 to 2004 in the Iraq War. During his time at NIOSH, Mr. Clark has risen from a biological laboratory aide to biological science laboratory technician, and he is currently at the top grade in this series. During his career at NIOSH, he has conducted toxicological studies of pulmonary and reproductive function using laboratory animal models. Recently, he has worked on studies that assess the effects of occupational hazards on human reproductive health, focusing primarily on the conduct of human biomonitoring studies. He has organized scientific human field studies and the collection and processing of biospecimens in the field. His talents have been recognized across multiple NIOSH branches and divisions and, consequently, are now in high demand. Mr. Clark epitomizes the best qualities of professional staff at NIOSH. He works closely with project officers to ensure samples are collected, processed, and shipped on time and without error. It is his professionalism, resourcefulness, and ability to take initiative on projects that shines through in all his work. These are critical qualities, as field investigations are ever-changing and routinely require last-minute adjustments. Mr. Clark is outstanding at meeting these challenges. These qualities, combined with his keen intelligence, lead to innovation to get the job done, and done correctly. He continues to bring that same dedication to field investigations after 44 years of public service. As a senior technician, he also patiently and effectively mentors and shares his years of experience with other NIOSH employees and collaborators. In summary, Mr. Clark is an exemplary technician who continues to serve as a role model and mentor. He has coauthored 15 peer-reviewed scientific publications, including four within the past 2 years. Funding from this award will be used to purchase supplies for future biomonitoring studies conducted by his team.

Director's Intramural Award for Extraordinary Science (DIA) Top Finalists

The names are listed alphabetically, and not necessarily in the order in which they were ranked.

Scientific Support

John Clark

Bradley Newbraugh

Brenda Proffitt

Early Career Scientist

Michael Flynn

Yunyi Yang

Distinguished Career Scientist

John Myers

John Sammarco

Mark Stephenson

Director's Intramural Award for Extraordinary Science (DIA) Updates

Distinguished Career Scientist 2012

Dr. Hongwei Hsiao

Dr. Hongwei Hsiao, chief of the Protective Technology Branch of the NIOSH Division of Safety Research (DSR), was honored to receive the 2012 Distinguished Career Scientist Award for his work in advancing the NIOSH program in safety, human factors, and engineering science. The award was in recognition of Dr. Hsiao's efforts to ensure that NIOSH engineers and researchers were making use of the most advanced technology and methods to address the difficult task of increasing worker safety. To that end, Dr. Hsiao was instrumental in enhancing the NIOSH Human Factors and Safety Engineering program and planning new laboratories for virtual reality, three-dimensional digital scanning anthropometry, impact testing, motion studies, sensor development, and human modeling research. He introduced the concept of immersed virtual reality simulation to study human behavior, physical response, and decision-making skills during elevated work. His research has been cited

frequently in the scientific literature and has been featured in the media several times. He pioneered 3-dimensional anthropometric procedures for quantifying human body shapes and for their applications in personal protective equipment sizing for various occupational groups, which have received multiple prestigious international scientific awards, bringing national and international recognition to the Division and Institute.

Since receiving the 2012 Award, Dr. Hsiao has diligently continued the program and has used the honorarium to support enhancing DSR laboratories and research-to-practice (r2p) efforts, including supplementing anthropometry research, advancing virtual reality simulation for vehicle safety applications, and augmenting fall prevention research.

Ongoing efforts in anthropometry research, under Dr. Hsiao' leadership, have included developing firefighter anthropometry databases, the findings of which have been disseminated to firefighter associations and fire apparatus manufacturers. This essential research ultimately has facilitated national development efforts of a new generation of fire apparatus, including new and anthropometrically accurate seat belts, fire truck cabs, gloves, boots, seats, and respirators. A seminal article that Dr. Hsiao authored on anthropometric procedures for protective equipment sizing and design received the 2012 Human Factors Prize from the Human Factors and Ergonomics Society, the leading professional association in this area. The findings of this research effort have been influential, and are now being applied in both industrial practice and academic training. Dr. Hsiao's branch also established a new mobile anthropometry lab that increased the capacity for anthropometric research by overcoming a logistical issue of workers needing to go to a stationary lab. Using the mobile anthropometry lab, DSR scientists are currently conducting a national anthropometry study on emergency medical service (EMS) persons for improved designs of ambulance and protective gear to reduce their ambulance crash-related injuries and health risk in performing their jobs.

In vehicle safety research, Dr. Hsiao has led staff in advancing DSR capacity to conduct motor vehicle safety research in the DSR Virtual Reality Laboratory. This effort will facilitate research on occupational drivers and specialty work vehicles that would not otherwise be possible, advancing NIOSH and CDC progress on the Motor Vehicles Winnable Battle Priority.

In fall prevention research, Dr. Hsiao's branch developed and patented a multimodal ladder safety device and advanced the concept to become a software application for mobile phones. This application, which features a multimodal indicator and a graphic-oriented guide for ladder selection, inspection, positioning, and safe use, has been downloaded more than 14,000 times since its release in June 2013. It has had impact on various industrial trades and home owners. It has also been widely promoted by state officials, safety professionals, and international entities to combat the substantial ladder-injury-related burden to society. In addition to ladder safety research, Dr. Hsiao played leadership roles in revising NIOSH traumatic injury goals for fall prevention and has provided scientific input to a variety of NIOSH programs, international organizations, and industrial entities on fall prevention

applications, fostering the use of research findings by partners positioned to improve worker safety. In 2013, he delivered invited keynote presentations on fall prevention strategies at three international scientific meetings.

Dr. Hsiao continues to be an exemplar for advancing public health collaborations and partnerships. He remains actively involved in research functions, both as an administrator and a researcher, and he is internationally recognized as a senior scientist who brings recognition to NIOSH and provides outstanding scientific leadership to his staff. He is also recognized as an outstanding manager who leverages resources and continually strives for organizational efficiencies and program effectiveness. Among his most recent publications and new research activities are the following:

Guan J, Hsiao H, Bradtmiller B, Kau T-Y, Reed MR, Jahns SK, Loczi J, Hardee HL, Piamonte DPT [2012]. U.S. truck driver anthropometric study and multivariate anthropometric models for cab designs. Hum Factors *54*(5):849–871.
NIOSHTIC-2: 20040731 | NORA: Transportation, Warehousing and Utilities

Hsiao H [2013]. Anthropometric procedures for protective equipment sizing and design. Hum Factors *55*(1):6–35.
NIOSHTIC-2: 20041957 | NORA: Construction; Services: Public Safety

Hsiao H, Turner N, Whisler R, Zwiener J [2012]. Impact of harness fit on suspension tolerance. Hum Factors *54*(3):346–357.
NIOSHTIC-2: 20040657 | NORA: Services: Public Safety

Hsiao H, Whitestone J, Kau T-Y, Whisler R, Routley J, Wilbur M [2014]. Sizing firefighters: method and implications. Hum Factors: Epub ahead of print, 2014 Jan.
NIOSHTIC-2: 20043661

Kim IJ, Hsiao H, Simeonov P [2013]. Functional levels of floor surface roughness for the prevention of slips and falls: clean-and-dry and soapsuds-covered wet surfaces. Appl Ergon *44*(1):58–64.
NIOSHTIC-2: 20040878 | NORA: Construction

Nimbarte AD, Sun Y, Jaridi M, Hsiao H [2013]. Biomechanical loading of the shoulder complex and lumbosacral joints during dynamic cart pushing task. Appl Ergon *44*(5):841–849.
NIOSHTIC-2: 20042499 | NORA: Construction; Services: Public Safety

Simeonov P, Hsiao H, Kim IJ, Powers JR, Kau T-Y [2012]. Factors affecting extension ladder angular positioning. Hum Factors *54*(3):334–345.
NIOSHTIC-2: 20040879 | NORA: Construction

Simeonov P, Hsiao H, Powers J, Kim IJ, Kau T-Y, Weaver D [2013]. Research to improve extension ladder angular positioning. Appl Ergon *44*(3):496–502.
NIOSHTIC-2: 20041827 | NORA: Construction

van der Molen HF, Lehtola MM, Lappalainen J, Hoonakker PLT, Hsiao H, Haslam R, Hale AR, Frings Dresen MHW, Verbeek JH [2012]. Interventions to prevent injuries in construction workers. Cochrane Database Syst Rev (12):CD006251.
NIOSHTIC-2: 20041955 | NORA: Construction; Services: Public Safety

Among his research activities are improving the compatibility of fire truck aerial apparatus systems to firefighters, fire apparatus design and PPE (personal protective equipment) sizing knowledge and technology transfer, sizing law enforcement officers for safe vehicle operation and personal protection, intersection traffic-driver interface evaluation for occupational driver safety, emergency medical service person anthropometry for ambulance equipment design, and reducing firefighter vehicle crashes through simulation and intervention.

Early Career Scientist Winner 2012

Dr. Taekhee Lee

Since receiving the 2012 Director's Award for Extraordinary Intramural Science in the category of Early Career Scientist, Dr. Taekhee Lee has continued to work to improve sampling and analytical procedures for the measurement of Respirable Crystalline Silica, especially to optimize high flow rate samplers to aid in assessing lower concentrations. He has been able to use the $5,000 award to conduct field sampling using high-flow samplers at construction sites, training centers in local labor unions, and at a silica sand producing company. Statistical analysis of the collected data is currently being conducted, and the results will be reported in a manuscript for publication.

His international collaborators from the National University of Ireland at Galway completed their field work with his assistance, and a joint paper has been published in American Society for Testing and Materials (ASTM International) Selected Technical Papers (STP) 1565, while a joint paper with collaborators from the Health and Safety Laboratory (United Kingdom) has been recently published in Annals of Occupational Hygiene. He also has an ongoing collaboration with the NIOSH Office of Mine Safety and Health Research (OMSHR) on a project using high flow rate samplers for end-of-shift silica measurement, and a paper describing this work has been submitted to the 10th International Mine Ventilation Congress, Sun City, South Africa, 2014.

He served as a co-chair with Dr. Martin Harper for the Second ASTM International Symposium on Silica and Associated Respirable Mineral Particles held at the Hyatt Regency, Atlanta, GA, sponsored by ASTM International Committee D22 on Air Quality and Subcommittee D22.04 on Workplace Air Quality and co-edited STP 1565, Silica and Associated Respirable Mineral Particles (ISBN 978-0-8031-7551-8).

He has participated in other NIOSH projects with various principal investigators. He has authored and co-authored the following 10 papers since 2012:

Carrieri M, Bartolucci GB, Lee T, Barbero A, Harper M [2014]. Chemical markers of occupational exposure to teak wood dust. Ann Occup Hyg: Epub ahead of print, 2014 Feb.
NIOSHTIC-2: 20044000

Chisholm WP, Lee T, Chirila M [2014]. Determination of crystalline silica in dust at low concentrations by low-temperature infrared spectrometry. In: Silica and associated respirable mineral particles, STP 1565. ASTM International, pp. 169–179.
NIOSHTIC-2: 20044094

Chisholm WP, Lee T, Slaven JE, Nelson J, Harper M [2012]. Comparison of filter and wall deposits from samplers used to collect airborne lead-containing dusts at field sites. Aerosol Sci Tech *46*(4):411–418.
NIOSHTIC-2: 20040055

Kim SW, Lee EG, Lee T, Lee LA, Harper M [2014]. Exposure to chlorpyrifos in gaseous and particulate form in greenhouses: a pilot study. J Occup Environ Hyg: Epub ahead of print, 2014 Jan.
NIOSHTIC-2: 20043780

Kwon CW, Chirila MM, Lee T, Harper M, Rando RJ [2013]. Determination of airborne wood dust in Button samples by diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS). Int J Environ Anal Chem *93*(13):1356–1366.
NIOSHTIC-2: 20042025 | NORA: Manufacturing

Lee EG, Lee T, Kim SW, Lee L, Flemmer MM, Harper M [2014]. Evaluation of pump pulsation in respirable size-selective sampling: part II. Changes in sampling efficiency. Ann Occup Hyg *58*(1):74–84.
NIOSHTIC-2: 20043256 | NORA: Mining

Lee T, Chisholm WP, Kashon M, Key Schwartz RJ, Harper M [2013]. Consideration of kaolinite interference correction for quartz measurements in coal mine dust. J Occup Environ Hyg *10*(8):425–434.
NIOSHTIC-2: 20042791 | NORA: Construction; Mining

Lee T, Lee EG, Kim SW, Chisholm WP, Kashon M, Harper M [2012]. Quartz measurement in coal dust with high-flow rate samplers: laboratory study. Ann Occup Hyg *56*(4):413–425.
NIOSHTIC-2: 20040182 | NORA: Construction

Stacey P, Lee T, Thorpe A, Roberts P, Frost G, Harper M [2014]. Collection efficiencies of high flow rate personal respirable samplers when measuring Arizona road dust and analysis of quartz by X-ray diffraction. Ann Occup Hyg *58*(4):512–523.
NIOSHTIC-2: 20044061

Chisholm WP, Lee T, Chirila M [2014]. Determination of crystalline silica in dust at low concentrations by low-temperature infrared spectrometry. In: Silica and associated respirable mineral particles, STP 1565. ASTM International, pp. 169–179.
NIOSHTIC-2: 20044094

Dr. Lee is developing a study on surgical smoke exposure in operating rooms in collaboration with surgeons from the Department of Surgery at West Virginia University Hospital and the NIOSH National Personal Protective Technology Laboratory, which will use a combination of sampling in operating rooms: actual sampling during normal surgery as well as controlled experiments with human tissues with operation of local exhaust ventilation and determination of the cytotoxicity of surgical smoke. A proposal has been submitted as a Letter of Intent for Fiscal Year 2015 funding under the Small NORA competition. He is also planning to develop a user-friendly respirable size selective sampler that provides smaller particle deposit diameter to allow end-of-shift silica measurement for timely feedback to coal and non-coal miners' silica exposure for engineering control and/or self-compliance with collaboration with Dust, Ventilation and Toxic Substances Branch in OMSHR. A proposal has also been submitted as a Letter of Intent for Fiscal Year 2015 funding under the Small NORA competition.

Previous Director's Intramural Award for Extraordinary Science (DIA) Winners

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

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

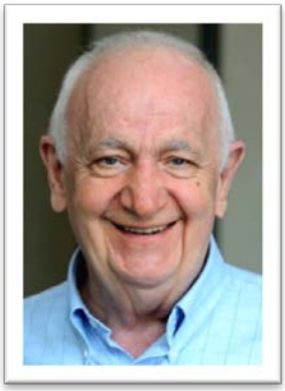
Background

The National Institute for Occupational Safety and Health (NIOSH) 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 was able to make this determination 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 did the same. 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 for 2014

Albert E. Munson, PhD



Albert E. Munson, PhD, is a pioneer in the toxicology field and considered one of the "founding fathers" of immunotoxicology. Over his career, Dr. Munson has created a lasting legacy in the occupational and public health fields. Beginning his career in academia, Dr. Munson's research contributed to an understanding of the toxicology of chemicals in drinking water. He established the Health Effects Laboratory Division (HELD) in 1997, fostering an integrated, interdisciplinary approach. The success of HELD researchers is demonstrated by the significant contributions they have made to the understanding and prevention of many occupational health diseases. Dr. Munson has championed the work of translating laboratory research into practical occupational safety and health methods for tools and disease prevention in a wide variety of occupations. He is also committed to the

training of students and post-doctoral fellows within HELD, helping to ensure the standard of excellence in occupational safety and health for future generations. We are proud to celebrate Dr. Munson as an embodiment of the Keogh Award's spirit of putting scientific knowledge into practice for the benefit of all workers.

Previous James P. Keogh Award Winners

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

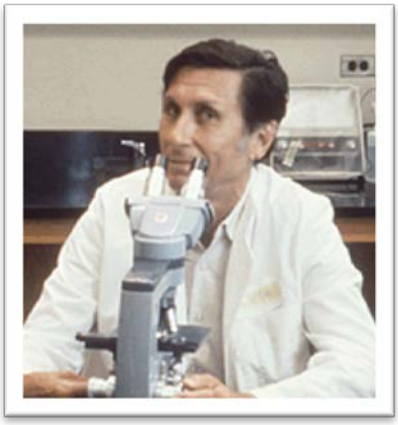
2002: Philip J. Landrigan

2001: William Edward Halperin

2000: Richard A. Lemen

NIOSH Nominations for the Charles C. Shepard Science Award Nominations

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 Award recognizes scientists who have made important research contributions to public health. The awards are given in five categories: one individual award—Lifetime Scientific Achievement—and four for journal articles during the previous year in the following categories:



- Assessment
- Data Methods and Study Design
- Laboratory Science
- Prevention and Control

NIOSH Nominations for the Charles C. Shepard Science Award for 2014

Scientific Publications

Category: Assessment

Cummings KJ, Fink JN, Vasudev M, Piacitelli C, Kreiss K [2013]. Vocal cord dysfunction related to water-damaged buildings. J Allergy Clin Immunol: Pract *1*(1):46–50.
NIOSHTIC-2: 20041979

Esswein EJ, Breitenstein M, Snawder J, Kiefer M, Sieber WK [2013]. Occupational exposures to respirable crystalline silica during hydraulic fracturing. J Occup Environ Hyg *10*(7):347–356.
NIOSHTIC-2: 20042606 | NORA: Mining: Oil and Gas Extraction

Hall RM, Achutan C, Sollberger R, McCleery RE, Rodriguez M [2013]. Exposure assessment for roofers exposed to silica during installation of roof tiles. J Occup Environ Hyg *10*(1):D6-D10.
NIOSHTIC-2: 20041821

Masterson EA, Tak SW, Themann CL, Wall DK, Groenewold MR, Deddens JA, Calvert GM [2013]. Prevalence of hearing loss in the United States by industry. Am J Ind Med *56*(6):670–681.
NIOSHTIC-2: 20041127 | NORA: Construction; Manufacturing

Wang ML, Beeckman Wagner LA, Wolfe AL, Syamlal GP-EL [2013]. Lung-function impairment among US underground coal miners, 2005 to 2009: geographic patterns and association with coal workers'pneumoconiosis. J Occup Environ Med *55*(7):846–850.
NIOSHTIC-2: 20042945 | NORA: Mining

Category: Data Methods and Study Design

Hsiao H [2013]. Anthropometric procedures for protective equipment sizing and design. Hum Factors *55*(1):6–35.
NIOSHTIC-2: 20041957 | NORA: Construction; Services: Public Safety

Wheeler MW, Bailer AJ [2013]. An empirical comparison of low-dose extrapolation from points of departure (PoD) compared to extrapolations based upon methods that account for model uncertainty. Regul Toxicol Pharmacol *67*(1):75–82.
NIOSHTIC-2: 20042926

Category: Laboratory Science

Mercer RR, Scabilloni JF, Hubbs AF, Wang L, Battelli LA, McKinney W, Castranova V, Porter DW [2013]. Extrapulmonary transport of MWCNT following inhalation exposure. Part Fibre Toxicol 10:38.
NIOSHTIC-2: 20043086 | NORA: Manufacturing

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Lifetime Scientific Achievement Award Nomination for 2014

Paul Schulte, PhD

Since joining NIOSH in 1975, Dr. Paul Schulte has been at the leading edge of advancing scientific knowledge and occupational safety and health (OSH) policy in numerous areas, including molecular epidemiology, genetics in the workplace, risk communication, prevention through design, and nanotechnology. Dr. Schulte was one of the pioneers in opening the field of molecular epidemiology, and his papers published over three decades—including his seminal text, *Molecular Epidemiology: Principles and Practice*—helped define the emerging field that utilized biological markers in epidemiologic research. Today, molecular epidemiology is a standard course offering, and Dr. Schulte has taught courses and lectured on molecular epidemiology at universities worldwide. Dr. Schulte particularly focused on four areas of molecular epidemiology: ethical issues, use of biomarkers in medical surveillance, use of biomarkers in occupational cancer research, and use of genetic biomarkers in occupational health. Dr. Schulte also played a prominent role in developing a framework for considering genetic biomarkers in the occupational safety and health field. He has presented and published broadly on the topic culminating with a major role in developing the NIOSH publication "Genetics in the Workplace." He coordinated the development of a major community demonstration project to reduce needle sticks in healthcare workers. Additionally, he studied TB in corrections officers and recommended preventive actions, and he served as one of the CDC liaisons to the U.S. Postal Service during the anthrax crisis. In the past decade, Dr. Schulte has been instrumental in protecting the workforce, and by extension the whole population, as the new field of nanotechnology emerged and nanomaterials became increasingly used in all commercial sectors from materials to medicine. In 2006, Dr. Schulte became manager of the NIOSH Nanotechnology Research Center (NTRC) and since then, NIOSH research and guidance have been critical to the world's knowledge of hazards of nanomaterials. Dr. Schulte authored one of the most widely cited papers in the field on occupational risk management for nanomaterials. Dr. Schulte has also been instrumental in working with colleagues to develop numerous initiatives including a national initiative known as Prevention through Design (PtD), a detailed protocol for identifying the immediately dangerous to life and health levels, guidance on dermal exposure for more than 100 high volume chemical substances, and promoted the effort to consider the occupational hazards of green jobs.

Nomination for this prestigious award recognizes not only Dr. Schulte's outstanding contribution to occupational safety and health, but also his dedication and commitment to the NIOSH mission.

Previous NIOSH Nominations for the Charles C. Shepard Science Award