



The Office of Construction Safety and Health
At the National Institute for Occupational Safety and Health—NIOSH

NIOSH’s Office of Construction Safety and Health: Accomplishments in our First Four Years

BACKGROUND

Creation and function of CSH

Since its inception in December 2009, the Office of Construction Safety and Health (CSH) has adhered to its mission in providing Institute-wide senior scientific and administrative leadership for construction research and related activities. CSH ensures that research elements from the National Construction Center are fully integrated and included in all designs and plans for construction research and its implementation. Together the CSH Director and Deputy Director formulate the strategic vision and goals, develop proposals; guide the direction of the National Occupational Research Agenda (NORA) Construction Sector Council; and implement research plans that ensure that the construction research program is responsive to comments and contributions from emerging research, the National Construction Center, stakeholders, external reviewers, and the NIOSH Director.

CSH actively develops partnerships within NIOSH and among its external stakeholders, and coordinates construction research and related activities among NIOSH divisions, labs and other offices. It extends this coordination within and among the NIOSH-funded National Construction Center¹ and other extramural construction researchers, with the Directorate of Construction in the Occupational Safety and Health Administration (OSHA), with OSHA's public Advisory Committee on Construction Safety and Health (ACCSH), the OSHA Construction Alliance, and with several trade associations.

Establishing the Construction Program Manager and Coordinator positions as dedicated full-time personnel within NIOSH through CSH has improved the Institute’s ability to align

¹ CPWR—The Center for Construction Research and Training has successfully applied to serve as the National Construction Center since 1994.

construction resources with the its national priorities. It has improved coordination among the NIOSH divisions and laboratories that are conducting research in construction, and has improved, as well, the coordination between those divisions and the National Construction Center. Much of this is accomplished through regular meetings with DLO representatives on the Construction Steering Committee, as well as with direct meetings with construction researchers and DLO management. Furthermore, this interaction has improved and enhanced the integration of research conducted by extramural researchers supported through the NIOSH Office of Extramural Programs. The personnel decision has led also to better management of the work of the NORA Construction Sector Council.

Stewardship of NORA Construction Sector Council

The NORA Construction Sector Council was the first council to develop a national research agenda in October 2008 (<http://www.cdc.gov/niosh/nora/comment/agendas/construction/>). This was the first national effort to create an occupational safety and health research agenda for the construction industry. Efforts are still underway to address the goal of answering the question: “What information do we need to be more effective in preventing injuries and illnesses in construction?” A description of research needs and information gaps was one important basis for the agenda. The other basis was “research to practice” (r2p); specifically, a description of how research findings could be used by construction stakeholders to bring about needed changes in the industry. The NORA Construction Sector Council seeks to promote the most important research, understand the most effective intervention strategies, and learn how to implement those strategies to achieve sustained improvements in workplace practice.

Developing the National Construction Agenda provided a vehicle by which construction industry stakeholders could describe the most relevant issues, gaps, and safety and health needs in the industry. The resulting agenda consists of 15 research strategic goals designed to address ten top problems in construction safety and health. These included seven “outcome” goals related to important sources of injury or illness, and eight “contributing factor” goals related to important influences that impact prevention and control measures throughout the industry. In a recent analysis conducted by the NIOSH Office of Extramural Programs, the Construction Sector had more strategic goals that were being addressed by both extramural and intramural researchers when compared to the other sectors. The Construction Sector currently has 12 out of its 13 active goals that are being addressed by either extramural or intramural researchers.

Beginning in 2010, the Manager and Coordinator of the NORA Construction Sector Council oversaw the selection of two of the 15 goals for priority activity. All 15 goals are important and relevant; however, making significant accomplishments in all areas within the decade is daunting given budgetary realities and other considerations. The selected goals were Goal 1 (Reduce Construction Worker fatalities and serious injuries caused by falls to a lower level), for

which a falls prevention campaign is an intermediate goal; and Goal 13 Increase the use of “prevention through design (PtD)” approaches to prevent or reduce safety and health hazards in construction, for which green jobs in construction is a component. The selection has allowed the Council to better harness its energies and work collectively to make significant progress and bring research accomplishments to the industry.

The Manager and Coordinator oversaw a mid-decade review by the Sector Council of all 15 goals to determine progress toward meeting the goals. The review began in 2011, the half-way point in the decade-long NORA effort. CSH and the NORA Construction Sector Council undertook a review of efforts to date, which provided an opportunity to take stock of overall developments; look at NORA projects and partnerships underway; examine the impact of the economic recession on construction generally, and on safety and health developments in construction; and to provide additional strategic direction and fine-tuning. The report of the mid-decade review is available upon request.

Progress on each goal was assessed, and goals were categorized into:

Exploratory - important issue but still defining problems and solutions

Developmental – some solutions are available but they are not ready for impact

Ready for Impact – sufficient solutions are available and we know what contractors need to do for impact in the industry

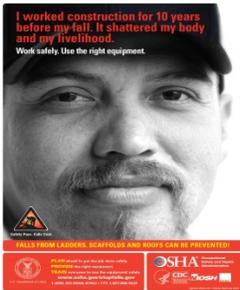
Six goals fall into the ‘Ready for Impact’ category. The Construction Sector Council reviewed the performance measures and roadmaps for each Ready for Impact strategic goal, and prepared a mid-decade report with the progress of each of these goals.

NORA Goals		
Ready for Impact	6	Falls (1); Struck by (3); Silica (5); Culture (8); Disparities (12); PtD (13)
Developmental	7	Electrocution (2); Noise (4) Welding Fumes (6) MSD (7) S&H Management (9) Training (11) Surveillance (14)
Exploratory	2	Industry Organization (10) Engage the Media (15)

This categorization has proven effective in moving forward, assessing progress, and, more importantly, assessing impact among the 15 second decade NORA goals in construction.

ACCOMPLISHMENTS – Office of Construction Safety and Health

I. Construction Falls Prevention Campaign



In 2011, the rate of fatal injuries in construction was the second highest of any U.S. industry. Within the industry, falls at construction sites are the leading cause of death, accounting for 35% of deaths among private sector construction workers (not including government or self-employed workers) in 2011; most of these deaths were attributed to falls from roofs, scaffolds, and ladders. Deaths and injuries from falls represent a major, persistent, yet preventable public health problem.

Under the auspices of the NORA Construction Sector Council, a campaign, national in scope, to prevent falls among construction workers was conceived, developed and led to address one of the NORA 'Ready for Impact' goals "Reduce Construction Worker fatalities and serious injuries caused by falls to a lower level" (Strategic Goal #1). The Sector Council identified the campaign as one of two goals on which to focus. A National Construction Campaign Coordinating Committee was formed with the charge to: (1) Explore how various campaigns have been used to advance safety and health goals; (2) Gather basic information needed to identify and address fundamental questions on planning and implementation of a construction fatality campaign; and (3) Prepare options for discussion by the full NORA Construction Sector Council. The goal of the campaign, in part, was to develop a national campaign aimed at construction contractors, onsite supervisors, and workers to address and reduce falls, fall-related injuries, and fall-related fatalities among construction workers. The scientific underpinnings of the campaign were prepared during 2010-2011 by Sector Council members working in groups, along with staff in CSH, the NIOSH Communication and Research Translation Office (CRTO),² the National Construction Center and OSHA. The latter two are represented on the Council, and played key roles in developing the campaign. The National Construction Center hired a social marketing firm to prepare an environmental scan of construction fall prevention campaigns in the United States and abroad. CSH hired the same social marketing firm to prepare a social marketing plan. Because the campaign relies heavily on completed research, it is a major r2p endeavor. The National Construction Center then hired the same social marketing expert to conduct focus groups to test messages that could be used in a campaign. The campaign theme and messages were determined by NIOSH, OSHA and the National Construction Center. The national construction falls prevention campaign (also described as Safety Pays, Falls Cost) is a remarkable accomplishment among NIOSH, OSHA and the NORA Construction Sector Council.

² CRTO changed organizationally to become the Office of Communications (OC) in September 2014.

The campaign kickoff was hosted by U.S. Department of Labor Secretary Hilda Solis on Workers Memorial Day on April 26, 2012.

The National Construction Center hosts the non-government principal web presence supporting the campaign (<http://www.stopconstructionfalls.com>) and responds to inquiries about the campaign through e-mail (falls@cpwr.com). Their website contains fall prevention information and materials, and allows stakeholders to share their own campaign success stories. Print campaign materials are available through OSHA (www.osha.gov/stopfalls). Other resources, including research findings, training aides and videos, are available on the three official campaign websites: www.osha.gov/stopfalls/, www.cdc.gov/niosh/construction/stopfalls.html, and www.stopconstructionfalls.com. OSHA's campaign website, www.osha.gov/stopfalls/ is now available in both English and Spanish.³ With simple language, clear illustrations, and easy-to-follow instructions, our campaign materials include posters, factsheets, safety videos, stickers, and public service announcements, spot-the-hazards cards.

The campaign was re-launched on Workers Memorial Day on April 28, 2013 with new products for active dissemination, including a "Local Partners Manual" for persons or organizations at the local, state or regional levels who wish to start their own local campaigns. The National Association of Counties, for example, mentioned the campaign in their April 2013 newsletter (<http://www.naco.org/newsroom/countynews/Current%20Issue/4-8-2013/Pages/OSHA-launches-safety-campaign-to-prevent-falls.aspx>). Having the information about the campaign posted for city and county officials across the country, has been expected to assist dissemination, especially at permit and registration offices where construction contractors frequent. Several local areas have made the campaign a priority, and have created innovative ways to disseminate campaign messages. Boston, Massachusetts and Montgomery County, Maryland, for example, have worked with the public transportation systems to post some of the campaign posters on busses, metro-rail trains and highway digital billboards. State agencies have been encouraged to support the campaign, and several have spearheaded their state's efforts in collaboration with NIOSH's Fatality Assessment and Control Evaluation (FACE) program.

The momentum of this extremely well-received campaign has been such NIOSH, OSHA and the National Construction Center agreed to add a third year (2014). The focus of the campaign in Year 3 was expanded to all types of construction, and no longer focused only on residential construction. In support of Year 3, NIOSH announced the campaign in CDC's *Morbidity and Mortality Weekly Report* (MMWR) (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a7.htm?s_cid=mm6316a7_e). Also, a video, "A construction framer talks about protecting his crew from falls"

³ Campaign fact sheets are available on the OSHA website in English, Spanish, Polish, Portuguese and Russian.

(<http://www.youtube.com/watch?v=MFthzInDdLQ&feature=youtu.be>) was posted to the NIOSH website in May 2014. The footage was taken on a visit to residential construction sites in Phoenix, Arizona to which NIOSH was invited by a LeBlanc Building Company., Inc. based on their practice of requiring all of their workers to use fall protection when working at height. A national **Construction Safety Stand-Down** (June 2-6, 2014) was also added in Year 3. The stand-down was conceived as a voluntary event for employers to talk directly to employees about hazards, protective methods, and the company's safety policies, goals and expectations. CPWR created an easy, cost-free, day-by-day list of suggested activities that could be tailored to individual jobsites, and posted these to www.stopconstructionfalls.com.

Impact: The research to support the strategic planning and execution of the national construction falls prevention campaign was awarded the 2012 Thoth Award in the category of Research/Evaluation from the Public Relations Society of America. The three campaign websites (NIOSH, OSHA and CPWR) received over half a million page views in 2012. Campaign partners and stakeholders also spread the campaign's message to thousands of employers (the primary target audience) and construction workers through blast e-mails, radio and television broadcasts, webinars, publications, trainings and outreach events.

The National Construction Center designed an evaluation plan for the campaign. The evaluation of the campaign's first year served three key purposes: (1) assess audience response to the campaign messages and materials (focus groups); (2) document campaign reach (metrics); and (3) examine partnership quality. The evaluation was conducted among small residential construction contractors, owners, supervisors, and foremen to assess exposure to campaign messages and materials at the four-month point from the campaign launch. Conducted in August 2012 in the Washington, DC metropolitan area, the evaluation findings suggested that the campaign did not have a high level of awareness among contractors four months after the campaign was first launched. Some summary recommendations informed by the focus group results are included in Appendix I. Subsequent campaign efforts were aimed to improve dissemination to the primary target audience.

To examine partnership quality, eight pre-selected campaign partners (representing a range of unions, academia, business and government) were surveyed to assess the success of campaign partnerships in implementing the first year of the campaign. The summary conclusions from this component of the evaluation are listed in Appendix I.

Some metrics of interest are visits to websites designed to support the construction falls prevention campaign.

- 51,676 products were downloaded from www.stopconstructionfalls.com in the first year of the campaign.

- The three campaign websites hosted by NIOSH, OSHA and CPWR received over half a million page views in 2012.
- As of October 2014 NIOSH had 13,411 page views (9,880 visits) to its www.cdc.gov/niosh/construction/stopfalls.html. Five of the 'top ten' tweets from Construction@NIOSH were centered on construction falls.
- As of October 2014, www.stopconstructionfalls.com hosted by National Construction Center CPWR had 900,215 page views (96,892 unique visits). The campaign also generated 503 email inquiries and 62 campaign partners.
- A Facebook page "Stop Construction Falls" was developed for the campaign by a NORA Construction Sector Council member at Washington University School of Medicine in St. Louis. The Facebook page has 315 'likes,' and has reached 14 states in the U.S. and 44 countries worldwide.
- As of June 12, 2014, OSHA's compilation of data indicated that 4,399 certificates were obtained online; that 729,032 workers were engaged through the stand-downs; and that there were 186,324 page views on the web page that OSHA developed for the stand-down (there were more than 282,770 views for campaign and stand-down pages together for during 03/17/14 to 06/11/14). The stand-down page will be available through mid-July, so data collection will continue.

For Year 3 of the campaign and the stand-down, we observed more and broader engagement by contractors of all sizes. Safway (<http://www.safwaygroup.com/>) is the largest provider of construction access equipment (e.g., scaffolds) in North America. Safway became a partner with the construction falls prevention campaign in 2014 (<http://www.safway.com/Press/newsDetail.asp?id=104>). They invested approximately \$100,000 to adapt existing and develop new company-specific campaign materials (e.g., mailers, promotional items) for their staff, trainees, and business partners.

All U.S. Air Force Ground Safety forces based in the United States and abroad participated in the campaign (year 3) and the stand-down, including through their training activities, audits, internal newspaper articles, internal television network, posters, and briefings at the Air Force Ground Safety Commander's calls. All 2,000 Air Force Ground safety professionals were required to focus on fall protection awareness during the entire week of the stand-down, with an expectation that the 650,000 Ground Safety staff at every Air Force base would be reached.

The construction falls prevention campaign will continue distributing information and providing outreach. This includes a partnership with two Latino groups facilitates distributing the Spanish version of the falls prevention campaign materials.

II. Nail Gun Safety

Dr. Hester Lipscomb at Duke University identified key risk factors associated with nail gun use through a decade of NIOSH-funded research,⁴ and demonstrated the effectiveness of trigger and training interventions. Such interventions, however, have not been adopted by nail gun manufacturers or users. There were no OSHA regulations, furthermore, that explicitly address nail guns. In response to these practice gaps, the issue was brought before OSHA's Advisory Committee for Construction Safety and Health (ACCSH), and a work group was formed to examine the issue in more detail. CSH worked with the work group co-chairs to arrange for presentations by Dr. Lipscomb so that she could share study findings. ACCSH eventually passed a motion unanimously asking OSHA to develop guidance and/or regulations.



In addition, the NORA Construction Sector Council's Strategic Goal #3 (related to "struck by" incidents) addresses preventing these injuries by developing guidance.¹ NIOSH took the lead role in working with OSHA to create co-branded guidance for contractors to address this goal. The NIOSH-OSHA co-branded document, *Nail Gun Safety: A Guide for Construction Contractors* (<http://www.cdc.gov/niosh/docs/2011-202/>) was published in September of 2011. The Spanish language version was published in October 2012.

The publication provides the latest information on how nail gun injuries occur; descriptions of worksite nail gun incidents; specific training recommendations; and practical advice that contractors can use to prevent nail gun injuries. NIOSH and CPWR-funded research, identifying both the problem and effective interventions, was used substantially in the publication. Expertise in both research and communication was used to customize content for the target audience. For example, the Guide used sidebar sections to provide both key research findings ("You should know") and actual cases ("Worksite story") to help convey key messages. A dissemination plan was designed cooperatively by the National Construction Center, OSHA Directorate of Construction, and CRTO and CSH in NIOSH.

Using some of the information in the *Nail Gun Safety: A Guide for Construction Contractors* in June 2013, NIOSH released an innovative new publication, *Straight Talk About Nail Gun Safety* (<http://www.cdc.gov/niosh/docs/2013-149/>), which is also available in Spanish. The publication was designed and developed by James Albers while he was with the Division of Applied Research and Technology, and uses a comic format to illustrate the potential risks of traumatic injury using nail guns, and how these risks can be reduced. Real-life examples from

⁴ Through its responsibilities as the National Construction Center, CPWR hosts a research consortium of which Dr. Lipscomb is a member.

residential building construction are used to explain nail gun traumatic injury risks related to the two different nail gun triggering systems and a variety of residential framing nailing tasks. The information in this publication is based on focus group discussions with residential building subcontractors, safety specialists and workers; NIOSH supported research; and *Nail Gun Safety: A Guide for Construction Contractors*. As a safety awareness publication, *Straight Talk About Nail Gun Safety* provides potential and new nail gun users with basic information to help them recognize potentially unsafe conditions and nail gun features that increase the risk of traumatic nail gun injury. The publication can be used in conjunction with safety training required by OSHA, or to reinforce previous nail gun safety training.

Impact: By design, most requests for the *Nail Gun Safety: A Guide for Construction Contractors* publication were routed through OSHA and NIOSH websites, respectively.

- As a result of effective dissemination efforts, the English version of the *Nail Gun Safety: A Guide for Construction Contractors* received 14,578 page views (10,606 visits) to the NIOSH website while the Spanish version of the Guide received 1173 page views (874 visits). The English version of *Straight Talk About Nail Gun Safety* received 9,542 page views (6,867 visits) to the NIOSH website, while the Spanish version of the comic received 1,007 page views (724 visits).
- OSHA has had over 108,000 unique visitors at the OSHA website containing information about the Guide. OSHA printed 50,000 copies of the Guide initially in September 2011, and has almost exhausted a second printing of 50,000.
- NIOSH, OSHA and the National Construction Center partnered to present a nail gun safety webinar under the auspices of the American Society of Safety Engineers (ASSE).

As part of the diffusion plan, a dedicated nail gun safety website (www.nailgunfacts.org) was launched in October 2011 to provide additional videos, worker testimonials, and news reports about nail gun injuries, training resources, and research information to construction audiences. The website was developed and launched by Dr. Lipscomb and her carpenter colleagues. The site is funded by the National Construction Center.

The NIOSH Office of Construction Safety and Health conducted an informal evaluation of the *Nail Gun Safety: A Guide for Construction Contractors* by reaching out to nine stakeholders to get feedback on the Guide, stories about its impact, or other ideas on dissemination. From what we have heard, the Guide has been a real help to the industry. Members the Associated General Contractors of America (AGC), an important stakeholder and member of the NORA Construction Sector Council, expressed their pleasure with the document. In fact, one contractor called it “the best document he has ever received from the [federal] government,” and he said that he has made it required reading for all of his staff. The findings from this evaluation are included in Appendix II.

III. Green Jobs in Construction

Integrating Safety and Health into Green Construction: One of the six “Ready for Impact” goals of the NORA Construction Sector Council relates to green construction (Goal 13.0: Increase the use of “prevention through design” approaches to prevent or reduce safety and health hazards in construction). Under the auspices of the NORA Construction Sector Council, an ad hoc work group was formed with the charge go: (1) Explore strategies and tactics that are or can be used to integrate safety and health into green building and construction initiatives in the United States; (2) Review the draft NIOSH White Paper, “NIOSH Perspectives on Sustainable Buildings: GREEN ...AND SAFE,” and draft recommendations and other suggestions for action among construction safety and health stakeholders, including members of the NORA Construction Sector Council; (3) Explore other relevant green construction issues, not covered in the NIOSH white paper, that might be appropriate for discussion and action among construction safety and health stakeholders; and (4) Prepare options for discussion by the full NORA Construction Sector Council.

NIOSH’s Prevention through Design (PtD) national initiative addresses design-related occupational injuries and illnesses by encouraging the elimination of hazards and minimizing risks to workers across all industry sectors and settings. CSH has used PtD principals that examine the potential for hazards throughout the life cycle of work premises, tools, equipment, machinery, substances, and worker processes. This includes their construction, manufacture, use, maintenance, and ultimate disposal or reuse. PtD has been the linchpin of NIOSH’s efforts to integrate occupational safety and health into green and sustainable construction. Together, the NIOSH Construction and PtD programs collaborate on efforts to increase the use of design interventions to address safety and health hazards early in the pre-design and design processes in the construction sector. As part of the PtD initiative, CSH and its construction stakeholders developed a framework to create awareness, provide guidance, and address occupational safety and health issues associated with green jobs and sustainability efforts. CSH has taken a number of key steps to advance this issue, articulating the case for why green construction represents an opportunity to promote worker safety and health as a fundamental dimension of true sustainability.

For example, CSH staff assisted in writing the entry to NIOSH’s Science Blog, “Going Green: Safe and Healthy Jobs” (<http://blogs.cdc.gov/niosh-science-blog/2010/01/green-2/>) was published in January 2010 following the NIOSH “Making Green Jobs Safe” Workshop held in December 2009. At the Workshop, 170 representatives from the occupational safety and health and environmental communities within industry, labor, academia, government agencies, and nongovernment organizations met to consider how to emphasize that green jobs should be

safe and healthy for workers. Several NORA Construction Sector Council members participated in the Workshop, and found the discussions in the construction track to be very stimulating.

In addition, armed with its white paper, NIOSH formally approached the USGBC in February 2011 about the merits of integrating occupational safety and health generally, and PtD specifically, into its Leadership in Energy and Environmental Design (LEED) rating system. NIOSH, with colleagues from the NORA Construction Sector Council, prepared a "credit-by-credit" review of the 2009 LEED credits, and identified six credits that could be enhanced by inserting additional language to the credit to address safety and health. Additional reference material was also developed. NIOSH shared these materials with USGBC in 2011 and continues to work with them on strategies to incorporate safety and health into now LEED version 4. The USGBC is working with NIOSH to outline other modes by which the USGBC stakeholders can become knowledgeable about the merits of integrating occupational safety and health into other LEED credits (e.g., June 26, 2012 seminar on integrating occupational safety and health into LEED by Christine Branche and Matt Gillen to USGBC headquarters staff in Washington, DC). In January 2013, CSH participated in the USGBC's Summit on Green Buildings and Human Health. The Summit was very successful, and USGBC is open to including worker issues into their initiatives. At USGBC's invitation, NIOSH authored a blog that appears on their website. This blog on "Green Building and Human Health" was co-posted on the NIOSH Science blog in June 2013.



In April 2013, CSH presented at the Good Jobs, Green Jobs Conference delivering a presentation using a "Life Cycle Safety" approach to ensure that green buildings are safe buildings. In June 2013, CSH presented at the Associated General Contractors of America (AGC) Environmental Conference delivering a presentation on integrating safety and health into green buildings and rating systems. Also in June 2013, CSH presented at the American Society of Safety Engineers (ASSE), Professional Development Conference delivering a presentation on integrating safety and health into green construction. In November 2013, the CSH presented at the USGBC National Conference (Greenbuild) on the topic of life cycle safety and its role in social equity issues.

NIOSH is working with Virginia Tech on designing a “safe roof design guide” to serve as stand-alone guidance material in the LEED version 4 Reference Guide or as input for several LEED credits that relate to roofs and skylights. The safe roof design concepts presented in this guide are aimed at owners, developers, and designers; they are to be used in the design phases. There are specific design suggestions specific to roofs and tools and processes that designers can use. NIOSH worked with Virginia Tech to develop a pilot credit (“Safe Roof Plan”) and is discussing its potential use with USGBC.

On the state and local levels, the California Fatality Assessment and Control Evaluation (FACE) program responded to a rash of deaths among construction workers installing solar panels by producing a video and fact sheets about risks and preventive measures. These include using fall protection systems and ensuring that lifts are available to hoist solar panels to the roof, so that workers aren’t trying to manually carry panels up ladders. One of their digital stories, “Preventing Falls Through Skylights,” won the 2012 APHA Digital Technology Award Contest. Two of the co-workers of the roofing supervisor who died tragically after he fell through a skylight decided to be part of this digital story. They highlight the events that led up to his death and explain what could have been done to prevent it. The moving video will be used by roofers and others in trainings to prevent similar fatalities from occurring. This video was promoted as a part of the 2013 Workers Memorial Day events commemorating workers who gave their lives for their work and highlight efforts to prevent workplace deaths.

CSH views this as an important initiative that will take time to deliver results. CSH has established a working relationship with the USGBC and expects this to provide insights and perspectives on how best to move ahead. This effort faces many challenges such as the lack of architect, designer or owner involvement in safety. The USGBC itself is in the process of rethinking its approach to several issues now that LEED version 4 has been released and users are commenting on it. Because the USGBC’s LEED is the most widely used rating system in green construction, it makes our discussions with USGBC prodigious. NIOSH has made progress in working with the USGBC and others to integrate worker health and safety into green building design; more information can be found on our [Prevention through Design](#) site.

IV. Residential Construction Safety Guard Rail System

Driven by the prevalence of fatalities and severe injuries caused by workers falling through roof and floor openings, and existing skylights, NIOSH worked with residential carpenters to develop a multi-functional guardrail system that could be used in numerous work situations to prevent workers from falling to lower levels. Researchers within NIOSH's Division of Safety Research (DSR) designed, developed, and patented (U.S. Patent No. 7,509,702, issued on March 29, 2009) a multi-functional guardrail system that can be used on numerous residential and commercial-industrial work sites. This research is being led by Dr. Thomas Bobick⁵ and supports NORA Construction Sector 'Ready for Impact' Strategic Goal #1 to "Reduce Construction Worker fatalities and serious injuries caused by falls to a lower level." This guardrail system is capable of providing protection to personnel who must work near (1) unguarded roof surfaces, (2) unguarded skylights, (3) unguarded roof and floor holes, and (4) on stairs that have not yet had handrails installed. The easy-to-install fall-prevention system was designed to meet all OSHA safety requirements for guardrails. Through extensive testing in NIOSH labs, the final design will support more than twice the OSHA 200-pound top-rail strength requirement for a worker falling against it. It can be used on commercial, industrial, and residential flat roofs, as well as being adjustable to 7 different residential roof slopes (from 6-in-12 [27°] to 24-in-12 [63°]). In addition, four other variations were developed for installation on flat and vertical surfaces that are unprotected, including staircases before the handrails are installed.

Impact: The impact of using the NIOSH guardrail system is an adaptable fall-prevention system that is readily available to improve safety conditions for residential and commercial construction workers. The safety intervention can be installed to protect workers in situations where fall protection is not normally used. From September 2011 to October 2012, a field evaluation was conducted by the West Virginia University Safety and Health (WVUS&H) Extension Office. One local WV residential contractor was evaluated during this time.⁶ The contractor used the system on a variety of homes to meet the requirements of the OSHA fall-protection standards. Through a contract with NIOSH, the WVUS&H Extension Office provided training in the use of the fall-prevention system, using installation instructions developed by the project team. The owners of the contracting firm commented that they normally do not use guardrails during residential construction; however, after the training session, all crew

⁵ Dr. Bobick was chosen in 2013 as CDC's Civilian Engineer of the Year.

⁶ During the field study, the contractor used the guardrail system, both externally on the roof and internally on stairs and for internal edge protection.

members felt very positive about using the system,⁷ and the contractor plans to continue using the system in their home as well as a commercial business. Verbal feedback from workers and management indicate high acceptance of this system.

V. Ladder Application

Falls from ladders are an important source of preventable construction injuries. Misjudging the ladder angle is an important risk factor for a fall. If the ladder is set too steeply, it is more likely to fall back or slide away during use, and if it is set too shallow then the bottom can slide out.

Researchers within NIOSH's Division of Safety Research (DSR) designed and developed the first NIOSH construction related application (app). This research is being led by Dr. Peter Simeonov and supports NORA Construction Sector 'Ready for Impact' Strategic Goal #1 to "Reduce Construction Worker fatalities and serious injuries caused by falls to a lower level." The NIOSH Ladder Safety phone app is designed to improve extension ladder safety and has an angle of inclination indicator making it easy to set an extension ladder at the proper angle of 75.5 degrees. This free and popular app became available in June 2013 through the NIOSH website (<http://www.cdc.gov/niosh/topics/falls/>), the Apple App-store (<https://itunes.apple.com/WebObjects/MZStore.woa/wa/viewSoftware?id=658633912&mt=8>), and the Android Market (<https://play.google.com/store/apps/details?id=gov.cdc.niosh.dsr.laddersafety>). The science that led to the development of the app received awards in 2014 from both NIOSH and the Department of Health and Human Services.

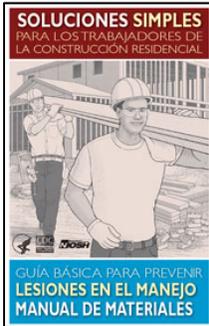


The app's inclination indicator allows most cell phones to provide both a visual and an audible signal when the ladder angle is correctly set. NIOSH's Division of Safety Research tested and patented the concept of the app's inclination indicator. They compared existing ladder positioning methods and found that the indicator improved both the accuracy and efficiency for ladder positioning. The Ladder Safety app also includes other handy information about ladder safety, i.e., ladder selection, inspection, accessorizing, and use. The science and research behind the development of the ladder safety app can be found at <http://www.cdc.gov/niosh/topics/falls/>. A Spanish language version of the Ladder Safety app has also been released.

⁷ Training included a hands-on practice installing the system on three typical construction situations (sloped, horizontal, and vertical orientations).

VI. Safety Solutions – Home Building Booklet

Home building is physically demanding work and manual material handling may be the most difficult part of the job. These activities increase the risk of painful strains and sprains and more serious soft tissue injuries.



NIOSH’s Division of Applied Research & Technology designed and developed Simple Solutions for Home Building Workers: A Basic Guide for Preventing Manual Material Handling Injuries, which is also available in Spanish as Soluciones Simples: Para los Trabajadores de la Construcción Residencial: Guía Básica Para Prevenir Lesiones en el Manejo Manual de Materiales. This project supports NORA Construction Sector Strategic Goal #7 to “Reduce Construction Worker fatalities and serious injuries caused by falls to a lower level.”

Simple Solutions for Home Building Workers was made available June 2013 as a web publication for printing or download at <http://www.cdc.gov/niosh/docs/2013-111/> and http://www.cdc.gov/spanish/niosh/docs/2013-111_sp/. The publication was written especially for young and less experienced home building workers. Original drawings and non-technical language are used to describe manual material handling injury risks and how these risks can be reduced and/or eliminated for certain activities. It provides basic information about readily-available work practices and equipment that can help both new and experienced workers, contractors and builders prevent serious manual material handling injuries.

VII. NIOSH Research Guidance Targeted Towards OSHA’s Needs

In March 2014, OSHA convened its informal public hearings for the proposed rule in occupational exposure to respirable crystalline silica. NIOSH researchers provided testimony, addressing the health effects of exposure to respirable crystalline silica based on its long history of research and extensive efforts to develop recommendations and controls for preventing worker exposures to silica. NIOSH researchers have studied the use of engineering control technology for grinding concrete, sandblasting, rock drilling, hydraulic fracturing (fracking), concrete floor polishing, cutting fiber cement siding, tuck pointing, and asphalt milling. In fact, NIOSH construction researchers played a significant role in helping to develop Table 1 of OSHA’s proposed rule concerning “Exposure Control Methods for Selected Construction Operations.” NIOSH has also promoted the prevention of silicosis through model partnerships and cooperative agreements with government, industry, labor and academia. NIOSH methods research has shown that the proposed OSHA standard is measurable by techniques that are valid, reproducible, attainable with existing technologies, and available to industry and government agencies.

NIOSH provided comments to the OSHA Request for Information (RFI) Standards Improvement Project - Phase IV (SIP-IV) published in the Federal Register (FR) in 2012 [77 FR 72781]. NIOSH supports updating the decompression tables in Appendix A of the OSHA Underground Construction, Caissons, Cofferdams and Compressed Air standards (29 CFR part 1926, subpart S) in SIP-IV (page 72783 of the RFI). Early studies by Kindwall et al. found that the OSHA decompression tables were not sufficiently protective of worker health. Alternative decompression tables are available that are more protective than the current OSHA tables. NIOSH supported research to develop and test four new tables in 1981, including one based on oxygen use, that are now accessible to the construction and safety and health community via a new NIOSH topic page <http://www.cdc.gov/niosh/topics/decompression/nioshDeveloped.html>. These tables, known as the “Edel-Kindwall” tables, have been used for variances to the OSHA standard and have been shown in laboratory and field trials to decrease the incidence of dysbaric osteonecrosis (Downs and Kindwall 1986). Use of the alternative tables may be more cost-effective because (1) they reduce the need for time-consuming variances; (2) they use staged decompression and oxygen decompression which potentially shorten decompression times for employees and employers; and (3) they may result in fewer health complications and lower associated medical costs (Downs and Kindwall 1986). NIOSH is working with OSHA to determine if additional data are needed to protect workers on tunneling projects at pressures greater than 50 psi.

VIII. NIOSH Funded Extramural Research

NIOSH Extramural funded construction research continues to ensure relevant applied research, translational research, and research-to-practice activities through a mix of investigator-initiated grants and cooperative agreements. NIOSH funding continues to stimulate quality research and research-to-practice efforts for addressing new and ongoing challenges in the construction sector.

Relationship with the National Construction Center

The National Construction Center provides national leadership and coordination on research-to-practice (r2p) to effectively transfer research findings to construction stakeholders by: (a) translating research recommendations and outputs for use by consensus organizations, regulatory agencies, professional associations, and construction employers, unions, and workers; (b) facilitating the adoption of or hastening the transfer of research recommendations and outputs, technologies, and information into practice or to worksites; and (c) expanding the body of knowledge about r2p in the construction sector. NIOSH intramural scientists consult with scientists at the National Construction Center or with scientists who are part of its collaborating network. CPWR—The Center for Construction Research and Training has successfully applied to serve as the National Construction Center since 1994.

In FY2010, CPWR began increasing its research-to-practice capabilities and capacity through an r2p program supplement. One facet of the plan is improving program infrastructure for distribution and support of r2p products to- and with intermediary organizations. An interagency workgroup is steering planning processes including coordination with NIOSH. Outputs include Guidance for the selection of completed research ready for r2p (and triage tool), 'best practices' information, specialty trade 'toolkits', CPWR Impact (tri-fold) card, and CPWR Data Brief (Hispanic worker injury data), and CPWR Update e-bulletin.

In 2013 CPWR published the fifth edition of ***The Construction Chart Book: The U.S. Construction Industry and its Workers***. The *Chart Book* is widely regarded as a leading resource for U.S. construction industry data and statistics and has been a go-to reference for construction stakeholders for 16 years. The *Chart Book* characterizes the changing American construction industry and workforce, monitors the impact of such changes on worker safety and health, and identifies priorities for future safety and health interventions. The *Chart Book* includes statistics on traditional construction topics, but it also addresses green construction, the aging workforce, employment projections, as well as OSHA inspections, violations, and citations. It contains approximately 250 charts and tables on 55 topic pages.



@CPWR

From: The Construction Chart Book, Page 38, Chart 38a

The restructured eLCOSH.org was released in October 2012 containing a free national repository of construction safety and health information. In 2013, the site broke 15 million page views since its launch in 2000. The website provides user-friendly safety and health

information, in English and Spanish, for construction workers and others on a wide range of topics and sources. Some 850 documents and videos, including more than 150 in Spanish, are posted. eLCOSH is a global resource for construction safety and health training and management documents, with more than 50 annotated site links provided. The eLCOSH Facebook page has developed an avid community of active followers and over 10,000 Facebook users “like” the page.

CPWR partnered with McGraw-Hill Construction to survey hundreds of construction contractors of various sizes and trades to learn about their safety management practices. Respondents, drawn from McGraw-Hill’s contractor research panel, participated in the survey in December 2012. Developing a site-specific health and safety plan; analyzing potential site safety hazards before construction begins; and assigning project safety personnel before construction begins were the leading topics identified by contractors as especially effective methods by which to increase project safety. While large firms reported extensive use of critical safety practices, fully-inclusive safety programs were much less common in smaller firms.

CPWR organized two national workshops: one on safety culture and climate and another on r2p partnerships. CPWR took the lead responsibility for writing and publishing (April 2014) the Safety Culture and Climate report stemming from that workshop, *Safety Culture and Climate in Construction: Bridging the Gap between Research and Practice*, available online at CPWR’s website. It also published several reports including an ***Intellectual Property Patent & Licensing Guide for Construction Safety & Health Researchers***.

IX. SOCIAL MEDIA

Beginning in 2011, a study of the use of social media by CSH, conducted by NIOSH OC, as well as work by the National Construction Center shaped efforts to disseminate outputs from NIOSH's construction program. It is now standard practice to use social media and to involve the National Construction Center, as well as other partners such as OSHA where relevant, in dissemination efforts.

Twitter

Outreach through social media, specifically, Twitter, has been important. As of October 2014, there were 12,400 followers for Construction@NIOSH. Of the 14 Twitter accounts associated with NIOSH, @NIOSHConstruct is the second most popular account in terms of followers, behind the main NIOSH account, @NIOSH. To understand more about the makeup of our followers, an evaluation of 2.5% of our followers was performed and showed:

- 50% in construction
- 22% personal accounts
- 13% other businesses
- 13% OSH practitioners
- 2% political/social/academic

As far as Twitter engagement, for every original tweet we've had on average about 4 interactions (retweets or replies). Interactions on Twitter are key indicators as to whether users on Twitter are responding to content. Five of the 'top ten' tweets were centered on construction falls and were sent out as part of our Construction Falls Prevention Campaign messaging. As far as Twitter reach, of the 135 different Twitter accounts that had either retweeted or replied to a @NIOSHConstruct tweet (during a sample 2 month period), there were 334,748 Twitter accounts following them.

Facebook

The National Construction Center has enhanced communication through development of two Facebook pages which as of October 2014 have a combined total of 14867 'likes'.

For the Construction Falls Prevention Campaign, a Facebook page "Stop Construction Falls" was developed by a NORA Construction Sector Council member at Washington University School of Medicine in St. Louis. The "Stop Construction Falls" Facebook page has 235 'likes' and has reached 14 states in the U.S. and 44 countries worldwide.

Appendix I – Construction Falls Prevention Campaign – Evaluation Summary Findings

As informed by the focus group results, moving forward with *Safety Pays, Falls Cost* campaign outreach strategies and products, we recommend the following:

Channels of Dissemination

- Partner with home improvement stores such as Home Depot or Lowes to post and disseminate campaign messages and materials.
- Identify an OSHA or related official that is able to distribute campaign materials in person and provide brief mini-demonstrations on campaign topics.
- Distribute products directly to contractors.
- Hold events such as “construction safety block parties” where campaign products can be distributed in-person.

Product Types

- Use real contractors in materials whose facial expressions match the copy of the material.
- Depict individuals who are in obvious physical discomfort if they are relaying a story in which they were injured.
- Provide materials that are easy to distribute such as stickers and business cards.
- Laminate products such as one-page information sheets so they have a long shelf-life.
- Keep copy brief and provide correct procedures (not only incorrect procedures).

Campaign Website

- Reduce the amount of information on any one Page; create click-thru Pages to specific topics.
- Create separate Pages for roofs, scaffolds and ladders.
- Provide a search capability.
- Place the compelling CPWR “Don’t Fall For It” video on the home page.
- Either move the map on the home page or make it more active – e.g., show where users can access campaign materials in their geographic region.
- Add short safety video clips.

The following conclusions can be drawn from the *Safety Pays, Falls Cost* Campaign partner interviewee and survey findings.

Partner Level of Effort

- Partners reported primarily disseminating existing *Safety Pays, Falls Cost* Campaign materials through their own media channels and by posting the stopconstructionfalls.com link on their websites.
- Partners reported that they had *not*, at least as of the writing of this document, produced special safety events as part of the *Safety Pays, Falls Cost* Campaign.

Partner Receipt of Campaign Products

- The disbursement of Safety Pays, Falls Cost Campaign materials to partners appears to have occurred only on a one-time basis.
- Partners, across the board, did not appear to receive the same amount of products or the same type of products.

Rewarding and Challenging Aspects of the Campaign

- Partners reported feeling satisfied and rewarded for participating in a campaign to promote height safety in the construction arena. They believed in the importance of the campaign and found it rewarding that their organization is part of a larger effort to promote construction safety.
- Partners reported feeling very gratified when there was evidence that campaign messages are being forwarded by other organizations.
- Partners reported feeling it will be challenging to sustain their participation in the *Safety Pays, Falls Cost* Campaign over time because they did not receive additional materials to distribute throughout the year.
- Partners reported challenges in finding vehicles and venues for delivering materials directly into the hands of small residential contractors and employees.
- Partners reported not knowing or being uncertain as to whether campaign messages, materials, and other products influence the way small residential contractors and their employees conduct their work duties.

Areas for Improvement

- Some partners reported wanting to receive materials more frequently so that, subsequently, they could distribute those materials and have much more touch-points with the target audience.
- Some partners reported wanting materials emailed to them as frequently as weekly or monthly.
- Some partners reported wanting materials that provided motivators for small residential contractors to raise awareness of height-safety procedures on construction sites including:
 - Statistics on injuries and fatalities
 - Cost points associated with injuries resulting from work-related falls
- Partners reported not having received any technical assistance. However, the challenges articulated by partners as to the difficulties in reaching small residential contractors indicate that they could use assistance in:
 - Identifying possible locations in their communities that are frequented by small residential contractors and employees
 - Exploring existing activities targeting small residential contractors and employees that partners could leverage to distribute messages, materials and products.

Continued Partner Involvement after the Campaign's First Year

- Most partners reported intending to continue their involvement in the *Safety Pays, Falls Cost* Campaign after the first year.
- Most partners said that their organization's involvement will be similar to that of the first year of the campaign and mostly include distribution of campaign materials and website links.
- A couple of partners stated that their organizations will incorporate new strategies in their campaigns to disseminate messages, materials and products including:
 - Transit ads
 - Tool box talks
 - Community outreach events
 - Medial outreach
 - Outreach to local apprenticeship programs and community health centers.

Recommendations for Potential Campaign Partners

- Many partners suggested that potential partners with access to small residential contractors and their employees included local chapters of national associations in the industry such as local chapters of the National Roofing Contractors Association, the Home Builders Association, and the National Safety Council.

Appendix II – Nail Gun Evaluation: Findings

Several common themes emerged based on our stakeholder interviewees. This section will address these commonalities as well as cover some other key findings.

Spanish outreach

Three of the nine stakeholders we reached out to were primarily focused on reaching Spanish-speaking construction workers. We wanted to ensure we were able to get feedback from this target audience since we developed a Spanish-speaking version of the nail gun guide and actively worked to disseminate this guide to construction organizations focused on reaching Spanish-speaking construction workers.

From talking to these three stakeholders, some significant findings are highlighted below.

El Nuevo Constructor (only Spanish-language magazine in the construction industry):

We thought this information would be of interest as we serve as a portal to Hispanic construction workers.

Hispanic Contractors Association de Tejas (largest contractors association in the country)

When asked about reaching small and hard to reach residential contractors, our respondent mentioned that they have a have a program to try and reach this workforce called the “OSHA 10 hour marathon” where they train 400-500 of these types of workers in a day. They are planning to distribute the nail gun safety guide to all of these workers at this training.

National Hispanic Construction Association

There was some turnover in this organization during our survey period, but have since followed up with this organization and their new CEO is very interested in promoting the nail gun guidance document as well as any other safety documents for workers in the construction industry. After our initial conversation on the nail gun guide, he has since asked if his organization could be a formal partner in the construction falls prevention campaign.

Extending the reach

One of our main objectives was to try and gauge how many people have seen this nail gun guide. We asked each of our stakeholders if they had further disseminated the nail gun guide and what methods did they use to extend the reach. All of the respondents said that upon receiving the email with the link to this new product, they then shared this resource within their organization and often times outside their organization. Each organization disseminated the information in a slightly different fashion. We’ve captured below how each organization further distributed the information in the nail gun guide.

National Association of Home Builders (NAHB)	-posted on our website & sent out via electronic newsletter to our members (140,000 members)
The Associated General Contractors of America (AGC)	-included in our Safety & Health e-newsletter which reaches ~ 10,000 people; -shared it with the Safety & Health Committee as a safety alert
Liberty Mutual Insurance	-devoted a quarterly construction newsletter to it -posted on our web -worked with a group of construction specialists to distribute (access 700 companies)
SkillsUSA	-sent to all 300,000 of our members (20% Hispanic/Latino) -sent to state directors who then sent out to their advisors and the schools/teachers
Carpenters' District Council of Greater St. Louis and Vicinity	-sent it to all the carpenter training schools -take to the various job sites (several 100) -promote on www.nailgunfacts.org
National Hispanic Construction Association	-incorporated into our November newsletter -posted in the "newflash" section of our website -posted update with link on our Facebook page
Hispanic Contractors Association de Tejas	-posted on our website -sent via email blast to our members (2500 people, which includes about 90 OSHA 500 trainers)
El Nuevo Constructor	-posted on our website -incorporated the update with the link into our weekly "info-bulletin" that we send out

This information allowed us to get an estimate on how many people have heard of or seen the information in the nail gun guide which gives us a sense of the reach we've been able to have with this document. It also informed us on the various mechanisms construction stakeholders have in place to get messages out to their organizations. This could help shape future outreach dissemination strategies for our office by knowing the various ways people receive information across the construction industry.

Impressions

Another area we were interested in gaining further insight was on each stakeholder's impression of the nail gun guide. We were interested in any feedback they had or any feedback they had received on the content/layout of the document. All of the stakeholders mentioned a favorable impression. We wanted to highlight some of the actual impressions we heard in the below.

*NIOSH took the extra step to go out to the residential construction sites and **capture images with these nail guns** being used like they normally would be. This adds great value to the publication.*

*The part on **actual accidents** that occurred rings very true;
I liked that you didn't pull all the fatality accidents and have more of a mix.*

*The **six steps to nail gun safety** are practical and comprehensive.*

*I like the columns with **useful terms** you should know and **worksites stories**.*

*The **photograph on the front page** really helped get workers to share stories from guys they knew that had nail gun injuries and that's what sold them on it.*

*The **cover is really dramatic**. It absorbs a person to read what's inside.
You don't see "gore" you see the result.*

*NIOSH did a great job at the translation of this document to make it **easily understandable by Spanish-speaking construction workers**.*

We heard from several respondents that the way the nail gun guide was written made complex information easily understandable. We also received a lot of positive feedback about the layout of the guide.

We did receive a few technical comments from one of the stakeholders that had experience working as a nail gun user. He offered a few potential modifications to include:

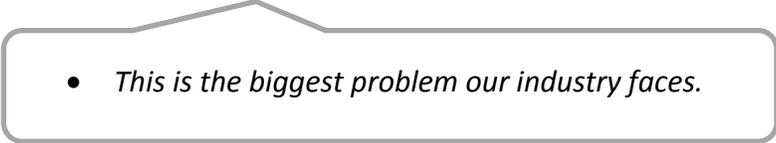
- *The advice to keep your hand 12 inches away – may not be practical, often is 6 inches.*
- *The advice on 'only using the nail gun with the dominant hand'. You can operate with your non-dominant hand just like a cell phone. It doesn't matter what hand when you hold it six hours a day.*
- *As far as the information on full sequential vs. single actuation: a table may be better for our guys. Most have a high school education or less and may have hard time understanding this aspect.*
- *Another aspect that wasn't really covered that contributes to injury from nail guns is the air compressor. A lot of times they skip or double pass if there is too much pressure or not enough. Knowing the pressure required to operate the nail gun and how to make it happen with the tools you have is important.*

How do we get workers to "pick it up and read it"?

Besides this being a great document, we heard that the challenge really is on how we get people to "pick it up and read it". A few of the respondents mentioned developing additional materials targeted at the average construction worker (simpler format, shorter read). One person even mentioned the need to develop this into a nail gun safety app where users could

download the pertinent information onto a smart phone. Also we heard from a several respondents that we should look to develop this into a short video that could be accessed via YouTube. One organization said they'd be willing to work with us to develop an educational video on nail gun safety. A lot of construction workers just use YouTube to type in the topic they want to learn about and listen/watch someone tell them how to do whatever it is they're interested in.

How to get to those small 'hard-to-reach' residential contractors?

- 
- *This is the biggest problem our industry faces.*

A lot of our respondents mentioned that targeting the small 'hard-to-reach' residential contractors was also a challenge for their organizations. A common theme we heard was working at the local level with community organizations that these types of workers go to for trusted safety and health information & resources. We also heard that getting out this information in multiple ways is useful using different avenues and media outlets. One innovative idea we heard was getting a "NIOSH nail gun safety racecar".

Who else should we reach out to?

Several respondents mentioned NIOSH should reach out to Home Depot and Lowe's at the national level. It was mentioned that Home Depot has a nail gun buyer's guide that doesn't mention triggers.

- ✓ One of the respondents mentioned it would be nice to have this "cutting edge NIOSH produced brochure to accompany the nail gun buyer's guide."
- ✓ Another mentioned these stores should be "handing out this guide to those buying framing tools".

ISANTA (the International Staple, Nail, And Tool Association), the manufacturers of nail guns were also mentioned as an organization NIOSH should reach out to. Their nail guns are pictured in the nail gun guide.

- ✓ "It's in their best interest and their members' best interest".

Habitat for Humanity was an organization that was also mentioned for us to reach out to.

To target some of the "hard-to-reach" workers, we heard it would be worthwhile to find a way at the local level to reach out to community organizations where many of these workers go for educational materials.

All of the respondents mentioned that it was still too early to identify any cases of impact as far as behavior change of workers (switching to sequential triggers) due to the release of this new nail gun guidance document. Several respondents did mention that they will be incorporating

this new nail gun guidance into their training curriculums. They mentioned they will be capturing feedback during their trainings and would share any stories of impact.