NIOSH Construction Research Program

Implementation of the National Academies' Program Evaluation Recommendations:

A Report to the NIOSH Board of Scientific Counselors

August 2012

Updated July 2014

Introduction

The NIOSH Construction Program review by the National Academies was conducted during 2007-2008. The review focused on construction research and related activities conducted by and through NIOSH during 1996 -2006. At the conclusion of its review, the National Academies' committee assigned a score of 5 for relevance on the basis that the research was judged to be high priority in nature and that the program was significantly engaged in appropriate activities that transferred research findings to practice in the construction trades and on construction sites. The committee assigned the program a score of 4 for impact on the basis that NIOSH had made some contributions to construction health and safety as measured by either end outcomes or well-accepted intermediate outcomes. Committee members diverged, however, on whether these contributions could be classified as major contributions across the entire program.

The committee recommended improvements for the Construction Program, presented formally in six recommendations to NIOSH. The six formal recommendations were:

(1) Research-to-Practice (r2p) efforts should involve individuals with training or with the experience and skills to create strategic diffusion and social marketing plans for National Institute for Occupational Safety and Health research and to evaluate such plans' effectiveness.

(2) Consideration should be given to having the majority of research-to-practice efforts of the Construction Research Program conducted through the National Construction Center.

(3) High-level attention should be given to determine how to provide program resources that are commensurate with a more robust pursuit of the Construction Research Program's goals.

(4) The Construction Program Coordinator and the Construction Program Manager should both be devoted full-time to the Construction Research Program.

(5) The National Construction Center should continue to be used as an important component in the Construction Research Program.

(6) The program should establish a closer connection with the Occupational Safety and Health Administration and other regulatory standards organizations to help ensure that the program's research is applied effectively in rule-making efforts.

On August 26, 2009, the Construction Program presented to the NIOSH Board of Scientific Counselors (BSC) an initial implementation plan responding to the National Academies' recommendations. The BSC commented on the NIOSH plan and also provided an additional recommendation:

> The BSC recommends an increased focus on developing a specific R2P plan for construction in conjunction with the National Construction Center, the NORA Construction Sector Council and OSHA. The plan should focus on those areas where causes of injuries, illnesses and fatalities are known and solutions have been identified and are readily available. Dramatic impacts could be achieved in a relatively short time period.

In its August 2012 *Report to the NIOSH Board of Scientific Counselors*, the NIOSH Construction Program summarized its progress and impact in implementing five of the six recommendations made by the National Academies, and addresses the additional BSC's recommendation as well. This July 2014 document is an update of our progress toward the same five recommendations. The rationale for selecting the five recommendations[1] for the Implementation Plan include: (a) the selected recommendations address high priority issues for construction within NIOSH, including its intramural and extramural activities; (b) several of the recommendations encourage the Construction Program to foster continued collaboration with established partners, and aid in identifying new partners with whom expansion, enhancement and improvement of NIOSH's construction research and dissemination could take place; and (c) the selected recommendations afford an opportunity to showcase the impact that the NIOSH Construction Program has had in recent years. In its 2012 review, the BSC scored the Construction Program's progress on each recommendation in areas of Relevance, Sustainability, Progress and Potential for Impact. The score report for the 2012 review can be found in Appendix 2.

[1] The explanation for excluding one of the six recommendations appears in Appendix 1.

RECOMMENDATION 1

Efforts to influence practice based on research ("research-to-practice" or r2p) efforts should involve individuals with training or with the experience and skills to create strategic diffusion and social marketing plans for the National Institute for Occupational Safety and Health research and evaluate such plans' effectiveness.

2012 Report

Background

Status: *In Progress*

External Factors: None

Implementation of Recommendation

The NIOSH Construction Program noted in its August 2009 initial implementation plan report to the BSC that it would interact with the reorganized NIOSH r2p team to improve access to expertise and resources for enhancing r2p in the Construction Program. NIOSH responded also that the new cooperative agreement award for the national construction center (fiscal years 2009 to 2013) would have a specific focus on r2p. NIOSH has enhanced its research-to-practice efforts, especially in construction, based on the National Academies' and BSC's recommendations.

Activity A: Construction Dissemination Assessment

Description: NIOSH identified research-to-practice as a priority in 2004. The aim has been to ensure that NIOSH-generated research is relevant to acknowledged needs and is used by organizations to improve worker safety and health. The NIOSH Construction Program used a public health practice study conducted during 2009-2010 to examine previous dissemination practices for eleven NIOSH numbered publications addressing construction industry topics. The purpose of the study was to assess past practice over the previous decade and to provide practical guidance to improve targeted dissemination and transfer of research findings to workplace practice. The study examined web hits, use of mailing lists, and collaboration with organizations that provide information to the construction industry.

Progress: The study provided useful recommendations for improving diffusion of research materials to the construction industry. These included development of a NIOSH master construction contact list, involvement of partners in dissemination, and more active dissemination of reports and research products. These recommendations were shared with the National Construction Center, and were used to inform additional r2p planning.

NIOSH's Office of Extramural Programs receives qualitative and quantitative information on dissemination outputs annually from the National Construction Center. A list of dissemination outputs, in various forms and types of distribution, is shared regularly with NIOSH researchers. Also, NIOSH and the National Construction Center discuss dissemination strategies and coordination at their regularly scheduled meetings.

Impact: Beginning in 2011, both the study on dissemination and the efforts 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, and OSHA where relevant, in dissemination efforts.

Future Plans: a review of the impact of social media will help determine if adding outlets will be worthwhile. Dissemination of materials in Spanish and other languages as a standard approach is possible.

Activity B: Developing New Diffusion and Social Marketing Infrastructure

Description: The FY2009-2013 request for applications (RFA) for a national construction center included an objective to provide national leadership and coordination on research-to-practice (r2p) to effectively transfer research findings to construction stakeholders. Specifically, the RFA detailed a need for: (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 RFAs focus on research activities, limiting the ability to direct and support broader non-research r2p activities that can be considered critical to meaningful dissemination and marketing of research outputs in the construction sector. While these important activities are within the scope of the objectives for the national construction center, there was a gap in both funding and mechanisms to support them. This gap became recognized increasingly by external practitioners as an important public health shortcoming as well, as exemplified in a late 2009 commentary by Kreuter and Bernhardt. Their review of public health programs indicated a "near total absence of systems and infrastructure for marketing and distribution".[2] This capacity gap was evident in Construction Program activities and represented a fundamental obstacle in making an impact to improve construction safety and health.

Progress: The newly formed Office of Construction Safety and Health, established in December 2009, evaluated options for improving this situation as NIOSH began to conceive of a separate r2p announcement for construction. In their review, the National Academies committee noted that NIOSH had robust mechanisms in place to solicit, process, review, score, and fund research projects, but not comparable mechanisms to ensure that evidence-based research results were marketed, disseminated and implemented to influential intermediate construction organizations and end-users to the fullest extent possible. In 2010, the NIOSH Director made funds available (for four years) for a special announcement requesting applications, through the Office of Extramural Programs, for research topics in construction aimed at deriving impacts from r2p endeavors, including r2p dissemination, distribution channels, marketing, coordination strategies, and other activities not specifically identified in the previous national construction center RFA. The purpose of the special announcement was to address this gap, to support and expand r2p activities for the current cooperative agreement projects, and to better align the NIOSH Construction Program with the National Academies recommendations. CPWR—The Center for Construction Research and Training, which was competitively selected to be the National Construction Center for fiscal years 2009-2013, was competitively selected also for the special r2p funding.

With specific resources in place at the National Construction Center, efforts began to build additional r2p infrastructure. CPWR hired an r2p Director (see Activity C in the next section). A standing r2p meeting was initiated in 2011 involving the National Construction Center, the NIOSH r2p Office, the Directorate of Construction at the Occupational Safety and Health Administration (OSHA), and the NIOSH Office of Construction Safety and Health (CSH) to design and implement specific r2p activities for the building and construction trades and contractors based on NIOSH and/or CPWR research and OSHA policies. See next section for additional information.

[2] Kreuter, MW, and Bernhardt, JM. Reframing the Dissemination Challenge: A Marketing and Distribution Perspective. Am J Public Health 2009;99:12:2123-2127.

Impact: The emphasis on r2p in the construction sector at NIOSH has afforded the initiation of several activities that have been critical for improving safety and health in construction. These include:

- The NIOSH and Occupational Safety and Health Administration (OSHA) co-branded and co-published Nail Gun Safety: A Guide for Construction Contractors (http://www.cdc.gov/niosh/docs/2011-202/). OSHA printed 50,000 copies initially in September 2011, and has almost exhausted a second printing of 50,000. The number of downloads from the OSHA website is not available at this writing.
- Outreach through social media, specifically, Twitter, has been important. As of July 26, 2012, there were 4,758 followers for @NIOSHConstruct. Seven Nail Gun Guide launch-related tweets on the NIOSH Construction Twitter site generated 1,539 hits to the NIOSH topic page on the subject. As of the end of July 2012, 1,986 hits to the NIOSH topic page have come directly from the NIOSH Twitter site. The topic page also allows one to "recommend" on Facebook; 32 such "recommends" have occurred to date.
- The Guide has been a real help to the construction industry. As late as July 2012, members of an important construction stakeholder organization, the Associated General Contractors of America (AGC), expressed their pleasure with the document. In fact, one contractor called it the best document he has ever received from the [federal] government, and said that he has made it required reading for all of his staff.

Future Plans: The additional r2p infrastructure, and coordinated efforts among NIOSH, the National Construction Center and OSHA, will be used for future dissemination and diffusion activities of materials from the construction falls prevention campaign and the Spanish version of the Nail Gun Guide.

Activity C: Involving Individuals with Strategic Diffusion and Social Marketing Skills – Part 1

Description: CPWR hired Robin Baker, MPH, Director, Research to Practice at the Center for Occupational and Environmental Health at the University of California-Berkeley, to bring her considerable skills in advancing practical applications based on research to this area of focus within the National Construction Center. Later the National Construction Center hired Eileen Betit for supporting diffusion and social marketing activities relating to special projects, and Linda Goldenhar for assisting in dissemination activities resulting from intervention research.

Progress: Ms. Baker initiated a number of activities to improve r2p capabilities at the National Construction Center with NIOSH and for the construction sector generally. She met with NIOSH and CPWR staff and the NORA Construction Sector Council to discuss priorities and strategies. Over an 18-month period (fall 2010-spring 2012), she then worked with CPWR and NIOSH to initiate or facilitate several activities including:

(1) Created a coordinated r2p effort involving CPWR, NIOSH and OSHA including regular meetings to enhance the development and implementation of high priority r2p projects.

(2) (a) Designed and conducted a strategic r2p review of completed CPWR-sponsored construction research. Identify those research projects with the greatest potential to reduce injury and illness and which have other strategic impacts through development and validation of an r2p checklist ("triage tool") specific to the construction industry, and then set priorities among these projects for dissemination efforts.

(2) (b) Development, implementation, dissemination and/or marketing plans for those programs, products, interventions and other research results meriting diffusion using the process. The first three projects have been identified and initiated:

- Broad dissemination of nail gun safety information

- Creation of a silica safety information website for both workers and contractors
- Improving technology transfer opportunities to bring safety innovations in construction to market. The Best Practices for Health and Safety Technology Transfer in Construction Workshop was held on May 31, 2012

(3) Developed a master construction database to provide construction contact information for diffusion and dissemination.

(4) Enhanced r2p plans for current construction research projects by creating project-specific r2p "roadmaps." The conceptual "roadmap" was designed to guide the development of dissemination plans as an integral and proactive part of the research process.

(5) Prepared new resources ("r2p tool kits") and other materials that contribute to a more comprehensive national system for effective information transfer, and make them available through CPWR's website (http://www.cpwr.com/r2p/index.php). Resources now include a guide to effective use of social marketing in occupational safety and health, and a guide to the effective use of training outlets to promote safety innovation.

(6) Enhanced National Construction Center communications through development of a CPWR electronic newsletter and a CPWR Facebook page, the latter of which currently has over 5000 friends.

(7) Promotion is ongoing for the effective use of private and public partnerships that include labor, contractors, government, owners, manufacturers and other stakeholders to implement multi-faceted, evidence-based interventions in the construction industry. Partnership case studies (e.g., the asphalt partnership) were conducted and a report produced. A new Masonry Industry Partnership has been created to help distribute information to and get feedback from that industry component. Partnership with two Latino groups facilitates distribution of the Spanish version of the falls prevention campaign materials.

(8) Consultation on dissemination and diffusion plans for ongoing projects with ready outputs.

(a) Development and implementation of dissemination and diffusion for the national construction falls prevention campaign.

(b) Development of evaluation scheme for the national construction falls prevention campaign.

Impact: Having Ms. Baker fully engaged provides the experience and skills to create strategic diffusion and marketing plans for CPWR. The two later hires demonstrate their greater commitment and potential impact. It positions CPWR to take a leadership role in providing resources and assistance across the NIOSH Construction Program. This work is already underway. The master construction database, the r2p review of CPWR-sponsored research, the silica safety website, and the technology transfer workshop have been embraced, scheduled, and completed as a direct result of these hires and other investments by the National Construction Center.

The silica safety website is expected to go live in August 2012. DC metropolitan area contractors, contractor associations, labor, and labor representatives participated in focus groups from which information was used to craft the site. A soft launch of the website has taken place, and CPWR has received favorable feedback. Limited outreach in New Jersey was very well received. The technology transfer meeting was well-received, and information from it is being compiled into a report. Next steps also include developing tools for construction stakeholders on how to develop a business case, and on how to prepare for patents and licensing, for example.

Future Plans: CPWR-OSHA-NIOSH Database Outreach Resource (CONDOR) is a unique tool developed by the CPWR r2p group, to disseminate information on critical health and safety innovations in construction. The database includes contact information for thousands of construction contractors, government officials, health and safety professionals, university-based researchers, labor representatives, trade press contacts and others. With CONDOR, targeted email, telephone or mail distribution networks can be prepared and distributed in order to get critical information to the right audiences, regardless of size. One of the goals of this effort is to build a communications infrastructure that allows for more efficient, broad dissemination and adoption of evidence-based solutions in the construction industry. Building an effective contact database is an essential element of this system.

The triage review of existing projects identified two focus areas for follow-up: Nail guns, for which additional products and evaluation are planned, and silica, for which a one-stop website for contractors is under development. Additional evaluation efforts are planned related to the NORA Construction Sector-initiated construction falls prevention campaign (2012-2014) which is described in a later section.

In future years, the synergy of intervention research findings and the r2p program at the National Construction Center will make for state-of-art strategic diffusion and practice.

Activity D: Involving Individuals with Strategic Diffusion and Social Marketing Skills – Part 2

Description: In an effort to support this objective, NIOSH's research-to-practice (r2p) office in January 2010 was renewed and realigned as a team within the Office of Health Communications. Staff with expertise in social marketing and diffusion is housed on the team. Also, Ms. Pietra Check, MPH, who is a member of the NIOSH Communication and Research Translation Office (Washington, DC location; formerly Office of Health Communications and Research to Practice Office), was assigned a portion of her time to work with CSH on construction sector activities to assist with general communications activities and r2p planning.

Progress: The Office of Construction Safety and Health has strengthened its r2p and communications internally by better-defining its relationship with the NIOSH Communications and Research Translation Office (CRTO). The NIOSH Construction Program depends on two individuals from CRTO to act as points of contact and consultants who provide guidance on r2p, marketing, dissemination, and other communication issues for specific Construction Program needs and strategic directions. This formalized relationship allows the Construction Program to be proactive about addressing communication and r2p needs in a timely manner as opportunities arise. CRTO also contributed expertise in designing the Nail Gun Guide, and with a campaign to prevent falls in construction, described later.

The NIOSH Construct Twitter site was launched in April 2011 and by June of 2012 had over 4500 followers. The NIOSH CSH and CPWR coordinate efforts to post timely announcements on both Twitters and Facebook, respectively. We have often coordinated with OSHA also to tweet their construction information because they do not have their own Twitter presence.

2014 Update

Activity A

Addition of or modification to activities since last review:

No additions or modifications to this activity took place.

Progress made or maintenance efforts since last review:

No additional studies were conducted on dissemination practices in the NIOSH Construction Program. The Construction Program and the National Construction Center (CPWR—The Center for Construction Research and Training (CPWR) is funded by NIOSH to function in this capacity), however, informally assess the benefits and challenges of engaging with social media. Because they have proven to be successful methods of dissemination, NIOSH and the National Construction Center have used social media (e.g., blogs, Twitter, including in Spanish via @NIOSHespanol), in addition to blast e-mails, newsletters (i.e., NIOSH e-*News* and *CPWR UPDATE*), and website postings as standard procedures to distribute respective English and Spanish documents and other information. Furthermore, we encourage NORA Construction Sector Council members and other construction stakeholders to further disseminate our messages and other pertinent construction safety and health information.

Impact(s) made since last review (process- or outcome-related):

Based on the feedback that we have received, especially as recorded through social media, the distribution of materials has been widespread. The construction sector has one of the highest tweet and retweet rates of all NORA sectors. Based on an evaluation of the Construction Program's twitter activity by the NIOSH Communications Research and Translation Office (CRTO) during August through September 2013, the Twitter account for the Construction Program (i.e., @NIOSHConstruct) was the second most popular in terms of followers of the 14 Twitter accounts associated with NIOSH, behind the main NIOSH account (@NIOSH). Among the sampled followers during the three months of the assessment 50% were construction businesses, 35% were OSHA-based Twitter users, 22% were personal accounts, and 13% were other businesses. The Construction Program's Twitter activity was determined to have a role as information broker rather than only being a content creator.

Future plans:

NIOSH will continue to use website postings, blast e-mail messages and social media to distribute its information in the construction sector.

Activity B

Addition of or modification to activities since last review:

No additions or modifications to this activity took place.

Progress made or maintenance efforts since last review:

The standing meetings among the National Construction Center, the OSHA Directorate of Construction (DoC) and the NIOSH Office of Construction Safety and Health (CSH) continue to date. Outputs and outcomes include improved and coordinated dissemination of:

- External communications and social media for documents and products from construction research activities
- Development of Dissemination Planning and Tracking Tools for use on each item intended for dissemination among the three organizations

- Years 1-3 of the construction falls prevention campaign (http://stopconstructionfalls.com/), and a related national safety stand-down that occurred the first week of June 2014. More details for the latter are available at https://www.osha.gov/StopFallsStandDown

- A study to improve the quality of health and safety education provided in post-secondary career technical education (CTE) construction programs

- Three short training videos created by CPWR, which used information obtained through the NIOSH Fatality Assessment and Control Evaluation Program (FACE). "Lessons to Go Home Safe" (https://www.youtube.com/channel/UCAC28BCIEBdALlJ8A--MhWw; the titles are "No New Year—Trench Collapse;" "Look Up and Live—Overhead Power Line Electrocution," and "A Simple Task—Fatal Ladder Fall") contain the videos which are based on the true stories of a fatal construction incidents. These two to three minute videos begin by describing the work being performed, the background of the crew and the worksite conditions, and then let the decisions made unfold." The videos received the 2014 Silver Telly Award. The winning category was: Internet/Online Programs, Segments, or Promotional Pieces – Safety

- The Buy Quiet prevention initiative, designed and launched by the NIOSH Division of Applied Research and Technology (DART) in June 2014 addresses the problem of preventable noise-induced hearing loss—the most common work-related injury in the United States. Buy Quiet encourages manufacturers to design quieter equipment, and encourages companies to purchase or rent quieter machinery and tools to reduce worker noise exposure. Through web resources (http://www.cdc.gov/niosh/topics/buyquiet/) the program highlights the benefits of a Buy Quiet approach; provides information on equipment noise levels; explains how to establish a program in a workplace; provides additional resources for finding quieter tools and machinery; and encourages manufacturers to design quieter equipment. NIOSH, including the Construction Program, CPWR, and OSHA coordinated dissemination of the web resources with DART.

NIOSH, CPWR, and increasingly OSHA, are using Twitter and other social media to disseminate timely documents, developments and other information to construction stakeholders. NIOSH Construction Twitter has 12,000 followers as of July 29, 2014. Compare this to the number of followers for other selected Twitter sites:

NIOSH: 232,000
CPWR: 283
NIOSH Protective Technology: 6,687
Department of Labor: 174,000
NIOSH Total Worker Health: 875
CDC: 328,000.

The Construction Program assisted NIOSH's Division of Safety Research and Division of Applied Research and Technology in disseminating, respectively, through both blast e-mails and Twitter, the Ladder Safety phone app (http://www.cdc.gov/niosh/topics/falls/); *Simple Solutions for Home Building Workers: A Basic Guide for Preventing Manual Material Handling Injuries (*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*) (http://www.cdc.gov/niosh/docs/2013-111/); and *Straight Talk About Nail Gun Safety* (also available in Spanish as *Plática Directa Sobre Seguridad Con Pistolas De Clavos)* (http://www.cdc.gov/niosh/docs/2013-149/).

Impact(s) made since last review (process- or outcome-related):

The feedback from stakeholders for all of our efforts has been quite positive. Some examples are:

For the *Straight Talk About Nail Gun Safety* document, a comment from the safety manager of a major home builder:

> I handed out [the documents] in Spanish and English after a couple of our safety meetings with our framers. The guys then took their lunch and started reading them. They were smiling and laughing and stated that it was fun to read. The feedback was positive.

For the *Simple Solutions for Home Building Workers* document, a comment from the Board of Certified Safety Professionals:

> I just wanted to let you know that BCSP appreciated the new NIOSH publication on home builder safety very much and that we are linking to it from our collaboration webpage. Thank you for connecting our certificants to the latest safety knowledge as we work to advance the professional status of safety.

For the Ladder Safety app, for which patented technology, innovative research, and input from industry were used in its development, the reception has been extremely good since its launch in June 2013. The app was recognized as a 2014 finalist for the NIOSH r2p/Bullard Sherwood, and as a finalist and Honorable Mention awardee for the HHS Innovates Awards in July 2014. As of May 2014, there were more than 20,000 downloads of this new tool.

Future plans:

The Construction Program will continue to use electronic, web and social media to disseminate its information. It is inexpensive, effective, and helps to warehouse the information in electronic form.

Activity C

Addition of or modification to activities since last review:

No additions or modifications to this activity took place.

Progress made or maintenance efforts since last review:

- All National Construction Center projects, including all consortium and small studies projects, have been examined using its Dissemination Planning and Tracking Tools (in the 2012 report these were referred to as the" r2p checklist" or "triage tool"). These include:
    - A **Triage Tool** is used to assess the readiness of completed research projects and their findings to be disseminated and transferred into practice. Each project is scored to identify innovations of the highest priority for further dissemination and adoption
    - The **Roadmap** helps researchers begin planning for r2p early in the research phase. Researchers use the tool to map how health and safety change will occur; and to identify project outputs, strategic audiences, partners and promising dissemination methods that will be essential in making a broader impact
    - A **Dissemination Planning Tool** is used when research outputs or information are ready for widespread use. The tool prompts researchers to detail messages, audiences, partners, strategies, and evaluation methods for a specific dissemination effort

- In 2012 CPWR launched the Work Safe with Silica website (http://www.silica-safe.org/), which is designed to describe construction silica hazards, explain regulations, and guide workers through the steps of creating a plan to help reduce their silica exposures. The website is an output from the r2p work group comprised of NIOSH, CPWR and OSHA's Directorate of Construction

- CSH assisted NIOSH's Division of Applied Research and Technology in disseminating *Straight Talk About Nail Gun Safety* (also available in Spanish as *Plática Directa Sobre Seguridad Con Pistolas De Clavos)* (http://www.cdc.gov/niosh/docs/2013-149/)

- The CONDOR database is used regularly by CSH, the National Construction Center, and DoC for their coordinated dissemination of information, resources, and in all of the efforts described in the 2014 update of Activity C

- Eileen Betit, at CPWR, was instrumental in developing a partnership and all of the materials that have been produced for the Masonry Research to Practice Partnership among CPWR and the masonry trades and contractors (http://www.cpwr.com/research/masonry-research-practice-partnership). The partnership prepared information on the hazards in the brick, block, tile, etc. trades, and ways by which these parties can work together to reduce hazardous exposures (e.g., silica), implement ergonomic solutions, and work together as partners

- In February 2014, the National Construction Center conducted a half-day training session for all NIOSH researchers involved in projects with more than 50% attribution to the construction sector. CPWR staff guided NIOSH researchers through the Roadmap and Dissemination Planning exercises to assist them, along with the communications staff in their division, lab or office, in developing project-level r2p options. The training session was received well, and, because of the positive reception and usefulness of information, it is being considered as a training model for NIOSH researchers in other industry sectors.

Impact(s) made since last review (process- or outcome-related):

By virtue of their staff that has full-time engagement, the National Construction Center (CPWR) now moves quickly from product development to dissemination. Their efforts have positively affected NIOSH (e.g., Buy Quiet) and OSHA, in turn.

Future plans:

By including communications staff in the February 2014 training session that the National Construction Center conducted for NIOSH construction researchers, some researchers have begun to use the r2p planning and dissemination tools, and it is our hope that more of them will use the materials in the future. NIOSH Communications and Research Translation Office leaders posted the r2p planning and dissemination tools on the NIOSH intranet site to make them available for other NIOSH researchers who might need help in organizing their own r2p efforts.

Activity D

Addition of or modification to activities since last review:

NIOSH has ensured that construction social marketing and diffusion efforts are continuously supported by staff trained in health communications.

In the early days of the r2p Office within the NIOSH Communications and Research Translation Office, each division, lab and office was assigned an r2p representative, but as staff was dispersed to other assignments, that approach was no longer viable. Hands-on training developed specifically for NIOSH construction researchers, like that offered by CPWR, has not been offered by NIOSH's r2p Office. Instead the latter offers a number of r2p resources, including:

- Open consultations (i.e., one-on-one or project specific consultations)
- Written r2p resources that are available on the Institute's intranet page
- An r2p Forum, which began in late 2013, which allows r2p Office staff to engage with divisions, labs and offices on specific r2p needs.

Progress made or maintenance efforts since last review:

The National Construction Center has developed additional metrics for r2p. The following are being used by CSH, CPWR, and since the February 2014 training, NIOSH construction researchers as well:

- Reach of outputs (i.e., # orders for products or outputs; # responses/conversation generated through new media use; # requests for additional information, web hits, downloads)
- Number of times output/information is used (by other publications, organizations, etc.)
- Change in policy, e.g., creation of a voluntary or binding standard
- Change in awareness, attitudes, or behaviors
- Documented adoption of a practice/tool on a small or large scale (# or % of employers who adopt)
- Change in exposures
- Change in injury/illness rates

For nail gun safety, the NIOSH Construction Program, the National Construction Center and other partners are working diligently together to alert construction contractors and workers to the preventable hazards associated with nail guns. New efforts to raise awareness have been developed (http://www.cpwr.com/publications/cpwr-updates/replacing-guesswork-nail-gun-facts), including a dedicated web topic page and by regularly promoting nail gun safety through social media. It is reasonable to expect a reduction in the number or rate of construction nail gun injuries as a result of our collective efforts. *Impact(s) made since last review (process- or outcome-related):*

Based on NIOSH research and the NORA Construction Sector Council's purposeful focus on construction falls, OSHA decided to support and become materially engaged in the construction falls prevention campaign is order to alert and help educate construction contractors in advance of a planned increased effort to inspect construction sites for falls standards compliance nationwide.

Future plans:

The Communications and Research Translation Office is critically assessing NIOSH's r2p needs and how it might address them, with a plan to prepare solutions during 2014.

Implementation of Additional NIOSH Board of Scientific Counselor December 2009 Recommendation:

2012 Report:

The BSC recommended an increased focus on developing a specific research-to-practice plan for construction, and specified that it be developed in conjunction with the National Construction Center, the NORA Construction Sector Council and the Occupational Safety and Health Administration (OSHA). The BSC recommended that the plan focus on those areas where causes of injuries, illnesses and fatalities are known and solutions have been identified and are readily available.

This recommendation is discussed below, and it is relevant as well to National Academies' recommendations 2, 5, and 6. The NIOSH Construction Program has strategically engaged the NORA Construction Sector Council, OSHA, and the National Construction Center to target three specific areas for r2p emphasis. These are nail guns, falls, and green construction.

Progress on Nail Guns: A decade of NIOSH-funded research by CPWR consortium member Dr. Hester Lipscomb identified key risk factors associated with nail gun use, and demonstrated the effectiveness of trigger and training interventions. This information, however, was not being adopted by nail gun manufacturers or users. Furthermore, there were no OSHA regulations explicitly addressing 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 study the issue. NIOSH 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 unanimous motion asking OSHA to develop guidance and/or regulations.

In addition, the NORA Construction Sector Council's goals related to "struck by" incidents addressed preventing these injuries by developing guidance. NIOSH took the lead role in working with OSHA to create co-branded guidance for contractors.

The NIOSH-OSHA co-branded document, "Nail Gun Safety: A Guide for Construction Contractors" (http://www.cdc.gov/niosh/docs/2011-202/) was released in September of 2011. The publication provides the latest information on how nail gun injuries occur; worksite accounts on actual nail gun incidents; specific training recommendations; and practical advice that contractors can use to prevent nail gun injuries. A decade of 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 strategic diffusion and marketing plan was developed based on the National Academies' recommendations regarding active dissemination. A dissemination plan was designed cooperatively by the National Construction Center, OSHA Directorate of Construction, the NIOSH Communication and Research Translation Office, and the NIOSH Office of Construction Safety and Health.

Impact: By design, most requests for the publication were routed through OSHA and NIOSH websites, respectively. As a result of effective dissemination efforts, the Guide received over 108,000 unique visitors at the OSHA website containing information about the Guide, and over 5000 unique visitors at the equivalent NIOSH website. Also, NIOSH, OSHA and CPWR 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 a month later 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 CPWR Consortium researcher Hester Lipscomb at Duke University and her carpenter colleagues. The site is funded by the National Construction Center.

Future Plans: Additional diffusion efforts are planned for 2012.

- NIOSH will publish the Spanish translation of "Nail Gun Safety: A Guide for Construction Contractors" in the fall of 2012.
- Additional materials designed for workers, and based on much of the same research as the "Nail Gun Safety: A Guide for Construction Contractors," will be published by NIOSH and CPWR in 2012.

Progress on Falls: Under the auspices of the NORA Construction Sector Council, a campaign to prevent falls among construction workers was developed. The Sector Council identified the campaign as one of two goals on which to focus, selected from among its 15 strategic goals. The scientific underpinnings of the campaign were prepared during 2010-2011 by Sector Council members working in groups. The National Construction Center and OSHA, both of which are represented on the Council, played key roles in developing the campaign. Using a small amount of resources within its budget, the NIOSH Office of Construction Safety and Health hired a social marketing expert to prepare an environmental scan and a social marketing plan. Because the campaign relies heavily on completed research, it is a major r2p endeavor. The National Construction Center hired the same social marketing expert to conduct focus groups, thus investing in these additional skills and experience. The national construction falls prevention campaign, a remarkable Sector Council accomplishment, was launched on Workers Memorial Day on April 26, 2012 by U.S. Department of Labor Secretary Hilda Solis.

The National Construction Center is taking a lead role in the construction falls prevention campaign by co-leading the effort under the auspices of the NORA Construction Sector Council; by being involved in every facet of the campaign development; by steering the design of and funding for the focus group research used to design the campaign. The Center also agreed to host the non-government principal web presence supporting the campaign (http://www.stopconstructionfalls.com) and inquiries about the campaign through e-mail (falls@cpwr.com).

Impact: At this writing, evaluation metrics are being finalized, but the National Construction Center is designing a full evaluation plan. Other metrics of interest are visits to websites designed to support the construction falls prevention campaign. As of June 29, NIOSH had 2500 visits to its www.cdc.gov/niosh/construction/stopfalls.html. The National Construction Center at CPWR hosts the main web presence supporting the campaign (www.stopconstructionfalls.com) as well as inquiries about the campaign through e-mail (falls@cpwr.com). As of June 29, CPWR has experienced 23,208 website views (8,399 unique visits) to www.stopconstructionfalls.com and 111 e-mail inquiries. For the print materials, OSHA has distributed 12,800 posters and 10,500 fact sheets in English, and an equal number of each in Spanish. A Facebook page was developed for the campaign by a NORA Construction Sector Council member at Washington University School of Medicine in St. Louis. There have been over 15,000 visits to the site (8,479 unique visits) as of July 3.

Future Plans: The construction falls prevention campaign is expected to continue distributing information and provide outreach through the fall of 2013.

Progress on Integrating Safety and Health into Green Construction: One of the 15 NORA Construction Sector Council goals relates to green construction (Goal 13.0: Increase the use of "prevention through design (PtD)" approaches to prevent or reduce safety and health hazards in construction). The Sector Council narrowed its focus to this (and one other) goal to accelerate progress (a fuller explanation is provided on page 19). "Prevention through Design" (PtD) has been the linchpin of NIOSH's efforts to integrate occupational safety and health into green and sustainable construction. The NIOSH Construction Program, and particularly the Office of

Construction Safety and Health, has taken a number of key steps to advance this issue. The program helped articulate the case for why green construction represents an opportunity to promote worker safety and health as a fundamental dimension of true sustainability. For example, an 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 of 2010 following the NIOSH "Making Green Jobs Safe" Workshop. Additional outreach to the safety and health community has been performed by organizing several roundtables and presentations at national and regional conferences.

In addition, NIOSH formally approached the U.S. Green Building Council (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 is working with them on strategies to incorporate safety and health into LEED as the rating system evolves to LEED version 4.

Impact: The NIOSH Construction Program views this as an important initiative that will take time to deliver results. The Program has established a working relationship with the USGBC and we expect 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 as it updates the most recent version of LEED, which was originally scheduled for 2012, but has now been delayed until late 2013. Since the USGBC's LEED is the most widely used rating system in green construction, it makes our discussions with USGBC prodigious.

Future Plans: 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).

The NIOSH Office of Construction Safety and Health is working through the NIOSH Office of Global Collaborations to engage the World Health Organization (WHO) Collaborating Centres in Occupational Health and the Pan-American Health Organization (PAHO) in their growing interests in sustainability, and their wish to see occupational safety and health included.

2014 Update

Nail Guns

Addition of or modification to activities since last review:

The Spanish version of the *Nail Gun Safety: A Guide for Construction Contractors* was published in October 2012 as planned. Furthermore, *Straight Talk about Nail Gun Safety* (also available in Spanish as *Plática Directa Sobre Seguridad Con Pistolas De Clavos)* (http://www.cdc.gov/niosh/docs/2013-149/) was published in June 2013. The latter document was recognized for excellence during the 2014 NIOSH Alice Hamilton Award ceremony.

Progress made or maintenance efforts since last review:

Since early 2013, NIOSH, and Drs. Hester Lipscomb (Duke University) and Mark Fullen (West Virginia University) have been engaged in discussions with the International Staple, Nail and Tool Association (ISANTA), the trade association for nail gun manufacturers and the secretariat for ANSI standard SNT-101 (Safety Requirements for Portable, Compressed Air-Actuated Fastener Driving Tools). SNT-101 is a draft consensus standard that applies to nail guns and staple tools that are commonly used in construction.

Impact(s) made since last review (process- or outcome-related):

Nail Gun Safety: A Guide for Construction Contractors and *Straight Talk About Nail Gun Safety* are important documents that appear to be having an impact on construction contractors as well as workers. For the PDF version of the *Guide* has been downloaded 5,120 and 482 times, in English and Spanish, respectively, as of July 15, 2014 (NIOSH data only). Furthermore, there have been 13,984 and 1,075 page views for the English and Spanish versions, respectively, of the *Guide* web pages.

By engaging with ISANTA on proposed modifications to SNT-101, NIOSH and its partners are making progress in opening discussions about the merits of making decisions on standards based on scientific evidence.

Future plans:

A brief educational video on nail gun safety has been developed by the staffs of NIOSH's Communications and Research Translation Office, Education and Information Division and Division of Applied Research and Technology researchers. The video is expected to be released on the NIOSH YouTube website in August 2014.

Progress on Falls

Addition of or modification to activities since last review:

In Year 3 of the construction falls prevention campaign, a national construction safety stand-down (June 2-6, 2014) was added. The stand-down was conceived as a voluntary event for employers to talk directly onsite to employees about hazards, protective methods, and the company's safety policies, goals and expectations. Companies, regardless of size, were encouraged to conduct a safety stand-down by stopping work for a period of time, and by providing focused toolbox talks on a safety topic such as ladder safety, fall protection equipment, or scaffold safety (https://www.osha.gov/StopFallsStandDown/). OSHA asked employers, governmental agencies, trade associations, sub-contractors, independent contractors, and many others to participate. OSHA encouraged employers, furthermore, to provide feedback about their stand-down activities, and to sign up to receive a certificate of participation to be signed by the Secretary of Labor, Thomas E. Perez. CPWR created an easy, cost-free, day-by-day list of suggested activities that contractors could tailor to individual jobsites (www.stopconstructionfalls.com).

Progress made or maintenance efforts since last review:

Campaign posters and fact sheets are available in English and Spanish. Since the first launch of the campaign in 2012, OSHA has made the fact sheets available also in Polish and Russian.

The second year of the national construction falls prevention campaign began on Workers Memorial Day on April 28, 2013 with new products for active dissemination, including a flyer for homeowners (http://stopconstructionfalls.com/wp-content/uploads/2013/05/Homeowner-Contractor-Awareness-Flyer.pdf), developed by the National Construction Center, to educate homeowners on questions they should ask prospective contractors when having work done on a roof. The three campaign websites hosted by NIOSH, OSHA and CPWR received over half a million page views in 2012.

Also in Year 2, the National Association of Counties 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). The National League of Cities mentioned the campaign in their January 2013 newsletter as well. Having the information about the campaign posted for county and city officials across the country was expected to assist dissemination, especially at permit and registration offices where construction contractors visit. 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, worked with their public transportation systems to post some of the campaign posters on busses, subway trains, and highway digital billboards.

The National Construction Center designed an evaluation plan for the campaign. The evaluation of the campaign's first year served three key purposes: (1) to assess audience response to the campaign messages and materials (focus groups); (2) to document campaign reach (metrics); and (3) to examine partnership quality. The evaluation was conducted among small residential construction contractors, owners, supervisors, and foremen to assess exposure to campaign messages and materials four months after the campaign was first launched. The evaluation was conducted in August 2012 in the Washington, DC metropolitan area, and the findings suggested that the campaign did not have a high level of awareness among contractors four months after the campaign was first launched. 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 evaluate the success of campaign partnerships in implementing the first year of the campaign.

The momentum of this extremely well-received campaign has been such that NIOSH, OSHA and the National Construction Center agreed to add a third year with its launch on Workers' Memorial Day 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" (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 companywide practice of requiring all of their workers to use fall protection when working at height.

Impact(s) made since last review (process- or outcome-related):

The research to support the strategic planning and execution of the construction falls prevention was awarded the 2012 Thoth Award in the category of Research/Evaluation from the Public Relations Society of America.

For Year 3 of the campaign and the stand-down, we observed more and broader engagement by contractors of all sizes. 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 was expected to be available through mid-July, so data collection will continue.

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 in Year 3 and in the stand-down, including involvement 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 at Air Force base would be reached.

Future plans:

During the 2014 summer, the National Construction Center is planning a qualitative survey of self-selected participants in the national safety stand-down.

Integrating Safety and Health into Green Construction

Addition of or modification to activities since last review:

The NIOSH Office of Construction Safety and Health entered a contractual arrangement with Virginia Tech to complete a report analyzing potential mechanisms that could be used to leverage trends in green construction to address occupational safety and health risks..

Progress made or maintenance efforts since last review:

CSH contracted with Drs. Annie Pearce and Brian Kleiner, both of the Myers-Lawson School of Construction at Virginia Polytechnic University (Virginia Tech), to complete an analysis of potential mechanisms that could be used to leverage growing trends in green construction to address occupational safety and health risks associated with green construction projects. The study and report are still undergoing NIOSH internal review. Plans are underway to post the report on a green construction topic page that will be linked to the NIOSH website in the fall of 2014.

Also, researchers from Virginia Tech, working with colleagues from the University of Tennessee and RMIT University (Australia) conducted a study on construction hazard prevention (Wakefield R, Lingard H, Blismas N, Pirzadeh P, Kleiner B, Mills M, McCoy A, Saunders L. Construction Hazard Prevention: The Need to Integrate Process Knowledge into Product Design; paper presented at the CIB W099 International Conference: Achieving Sustainable Construction Health and Safety, June 2014 in Lund, Sweden). Their preliminary evidence suggests that integrating construction process knowledge into pre-construction decision-making [prevention through design] produces better occupational safety and health outcomes. The paper was selected as the "Best Paper" at the conference.

After the release of Leadership in Energy and Environmental Design (LEED) version 4 in 2012, U.S. Green Building Council (USGBC) leaders seemed eager to embrace the notion of integrating occupational safety and health into LEED in earnest. In January 2013, CSH was invited to participate in USGBC's Summit on Green Buildings and Human Health which was organized in part to build the knowledge base on health and the built environment among USGBC's stakeholders. CSH took advantage of the Summit to reintroduce the notion of making OSH an integral and important part of human health and responsible sustainability. At the time of the Summit, the President and CEO of USGBC reiterated his commitment to working with NIOSH on these issues, and directed his Senior Vice President for Marketing & Strategy, along with their Director of LEED to meet with CSH to continue to forge the relationship between our two organizations. Furthermore, Christine Branche, Matt Gillen and Mike Behm (East Carolina University) conducted a well-received session on *Life Cycle Safety: What Is It and How Does It Support Social Equity Goals* at Greenbuild 2013 in November 2013.

Impact(s) made since last review (process- or outcome-related):

The developing relationship between NIOSH and the USGBC has helped the USGBC understand that worker safety and health is part of USGBC's broader interests in human health. CSH was invited to submit an entry to USGBC's blog describing the latter in 2013 (http://www.usgbc.org/articles/summit-green-building-and-human-health).

Future plans:

Based on the excellent reception of the session at Greenbuild 2013, key senior leaders responsible for module development for LEED version 4 have participated in a series of meetings with NIOSH to develop OSH-centered modules for the LEED credit library. CSH plans to prepare an online topic page on green construction. The draft modules developed for the LEED credit library and the study report from Virginia Tech are some of the items that we expect to include on the upcoming green construction topic page.

RECOMMENDATION 2

Consideration should be given to having the majority of research-to-practice efforts of the Construction Research Program conducted through the National Construction Center.

2012 Report

Background

Status: *In Progress*

External Factors: None

Implementation of Recommendation

In its December 2009 response, NIOSH's Construction Program responded that while the National Construction Center would have a major focus on r2p, "NIOSH must continue to assume responsibility in this area as well." NIOSH indicated, furthermore, that all intramural research projects must include r2p plans in every phase.

Activity A: Shift Research-to-Practice Efforts in Construction to the National Construction Center

Description: Since submitting the response to the BSC in 2009, NIOSH has considered thoroughly its r2p activities and the proper place for them. With its award of the special construction r2p funding through 2014, the National Construction Center was required to specifically design r2p dissemination, distribution channels, marketing, coordination strategies, and other activities not specifically identified in the previous national construction center request for applications. Hence, NIOSH has executed steps that shift r2p activities to the National Construction Center. This r2p shift places a much greater responsibility for r2p in construction for NIOSH on the National Construction Center, thus fulfilling the recommendation from the National Academies.

The primary objective of the r2p in construction funding is to ensure that evidence-based research results are marketed to, disseminated to, and implemented by influential intermediate construction organizations and end-users (e.g., construction companies, labor unions, and organizations offering training to construction workers). In making the specific construction r2p funding available, NIOSH identified the following priority research impact topics:

- Conduct an impact review of all ongoing research project outputs given that earlier NIOSH-funded research projects were designed to contain an r2p element. The National Construction Center was required to include triage questions and a triage process for identifying those research projects with impact potential or construction audience interest that merit additional strategic follow-up.
- A Dissemination Planning and Tracking Tool that will help prepare marketing plans, and help promote research-tested interventions.
- Build distribution and support capacity (e.g., web portals, online databases and repositories, inventories, and partnerships) to support enhanced dissemination and transfer of information products).
- Establish evaluation measures and processes that will be routinely applied.
- Coordinate with the NIOSH Construction Program and contribute to r2p efforts across all NIOSH-funded construction research. While the primary focus of this funding is to support and expand r2p activities for current cooperative agreement projects, there is a need for program-wide collaboration on r2p. A portion of the funding, therefore, is being directed to support r2p activities for at least one recently completed intramural applied research project (i.e., internal NIOSH) and one other extramural project over the duration of the supplemental support period.

Progress: Much of the progress on this Activity is discussed under Recommendation 1, Activity C (page 8). Additionally, a work group has been formed within the NIOSH Communications and Information Dissemination

Cross-Sector Program with a plan to use the Tool and determine how it can be adapted and applied generally at NIOSH.

The distribution and support capacity component of the construction r2p project is underway but not complete. Beginning in FY2010 to present and through a series of administrative requests, however, NIOSH approved the National Construction Center to increase expenditures for construction r2p program development activities, data and other information collection, and communication and marketing materials in order to achieve accelerated capacity (e.g., formative research) and impact for construction r2p.

Impact: CONDOR, described in Recommendation 1, Activity C, was formed to assist with active dissemination. Also, in September 2011, CPWR launched a monthly electronic newsletter, *CPWR Update*, providing another outlet for disseminating research findings and practical applications.

Future Plans: The National Construction Center will launch a website on silica safety, Silica-Safe, in 2012. The website is intended to be a repository of silica information for both workers and contractors.

Activity B: Research-to-Practice Efforts through other NIOSH Extramural Funding

Description: NIOSH uses extramural funds to support investigator-initiated and other university-based research in the construction sector. Fortunately, many projects have research-to-practice elements that have had positive impacts on construction in the United States. There are several projects underway, but a few are described as examples here.

Progress and Impact:

Hearing Loss. Researchers at Virginia Polytechnic University (Virginia Tech) conducted a study to reduce impediments to speech communication and signal detection in the construction industry. The work included an evaluation of commercially available hearing protection devices, including audible speech and perception of direction warning signals from heavy equipment used in the construction industry. The research has implications for hearing protection in the construction industry, as well as signal detection and signal localization. Findings of this laboratory and field research were presented to the National Academies (http://www.nap.edu/openbook.php?record_id=12928&page=167 and http://www.nap.edu/openbook.php?record_id=12928&page=42) in their assessment of hearing loss research for NIOSH. The findings of this research have been shared with standard-setting organizations in an effort to encourage the revision of the backup alarm standard in an effort to further reduce the incidence of runovers in construction.

Workforce Development. Researchers from Purdue University have been educating future engineers and construction safety personnel through the long-term study of nighttime construction operations on highways. The study was conducted in cooperation with the Indiana Department of Transportation.

Future Plans: Based on discussions with NIOSH's Office of Extramural Programs, an emphasis on r2p will continue to be a key feature of future funding announcements for a national construction center.

Activity C: Research-to-Practice (r2p) Activities within NIOSH

Description: Even with an emphasis on r2p for construction at the National Construction Center, construction-related research and r2p are underway within NIOSH divisions. Assistance with r2p is provided by the NIOSH Communications and Research Translation Office (CRTO). The Office of Construction Safety and Health also provides researchers with ideas on target audiences, partners, and active dissemination. It also facilitates referrals

to the National Construction Center. The meetings among NIOSH, CPWR and OSHA for r2p occur roughly every two months and are used also to brainstorm ideas with researchers.

Progress and Impact: Several pivotal projects are worthy of note:

Protection for roofers: Researchers within NIOSH's Division of Safety Research (DSR) designed, developed, and patented (*U.S. Patent No. 7,509,702*) a multi-functional guardrail system that can be used on numerous residential and commercial-industrial work sites. This guardrail system is capable of providing protection to personnel who must work near (1) unguarded roof surfaces—flat and seven different residential slopes, (2) unguarded skylights, (3) unguarded roof and floor holes, and (4) on stairs that have not yet had handrails installed. The fall-prevention system was designed to meet all OSHA safety requirements for guardrails. During 2009-2011, NIOSH discussed with eight companies the potential to partner and commercialize this system. During June 2011, an exclusive licensing agreement was signed by NIOSH-CDC and AES Raptor LLC, North Kansas City, MO. AES Raptor is primarily focused on manufacturing fall protection products for flat commercial-industrial roofs, and in their partnership with NIOSH, their intention was to use the NIOSH guardrail system to establish a presence in the sloped residential construction market. The company did not have their commercial prices available until the end of 2011, however, and to date only one sale has been made. With the residential housing market still somewhat stagnant, the company is proceeding cautiously.

Highway Work Zone Safety: Division of Safety Research staff for many years have been examining the significant risk of injuries and fatalities that highway construction workers experience while working at the street or highway jobsite. These workers are also at substantial risk of injury from the movement of construction vehicles and equipment within the work zone. DSR researchers designed detailed diagrams illustrating areas around various construction vehicles and equipment that are unable to be seen from the operator's position ("blind areas"). NIOSH provides the blind area diagrams on its website. The Construction Equipment Standards & Regulations Committee of the Association of Equipment Manufacturers (AEM) recently decided to (a) request the AEM publications staff to draft boilerplate language and generic graphics depicting blind areas around classes of construction equipment that are included in AEM safety manuals; and (b) develop an ad hoc group to identify other projects that the Committee can undertake to raise the awareness of workers of the hazards created by blind areas around heavy construction machinery. Furthermore, Caterpillar, Inc. has begun to place blind area diagrams into equipment operator manuals.

Future Plans: A plan will be devised with the NIOSH Division of Safety Research to actively disseminate a pending mobile phone application on ladder safety that has been in development for a few years. Dissemination through the construction falls prevention campaign will occur as well.

The NIOSH Office of Construction Safety and Health plans to review pending and completed research projects to identify several for additional attention and resources. The intent is to further explore options on how the National Construction Center can be used to assess such projects for r2p.

2014 Update

Addition of or modification to activities since last review:

No additions or modifications were made to this activity.

Progress made or maintenance efforts since last review:

The prospects have been good for projects beyond nail gun safety, which was an initiating venture, as has been described in the update for Recommendation 1 (pages 10-12). Since the 2012 report to the Board of Scientific Counselors, NIOSH's Construction Program, and CSH, in particular, have moved much of their construction research-to-practice activities to the National Construction Center, which currently is CPWR—The Center for Construction Research and Training. Some examples include:

- Research-to-practice training by the National Construction Center for NIOSH construction researchers in February 2014 was described in detail on page 12. Please note that identification of NIOSH's pending or completed projects for r2p did not take place until the workshop, and that the invitation was extended to only those NIOSH researchers whose projects were 50% or more related to construction.
- As planned, in 2012 CPWR launched the Work Safe with Silica website (http://www.silica-safe.org/), which is designed to describe construction silica hazards, explain regulations, and guide workers through the steps of creating a plan to help reduce their silica exposures. The website is an output from the r2p work group comprised of CSH, the National Construction Center and DoC
- Based on research from NIOSH's Division of Applied Research and Technology and other sources, CPWR launched a Choose Hand Safety website (http://www.choosehandsafety.org/) in 2014 to assist workers in selecting hand tools and hand protection in their construction work
- As mentioned on page 15, the National Construction Center hosts the main website for the construction falls prevention campaign. The CPWR website links with the NIOSH and OSHA websites, and provides a wealth of additional information, making it the most helpful source of information about the campaign. CPWR also hosts the (sole) location where partners can join the campaign effort
- The NORA Construction Sector Council goal on safety culture (Goal 8)[3] has generated a lot of interest on the topic, as the industry strives to understand what specific elements drive safety culture organizationally and safety climate on the jobsite. In 2013 the National Construction Center teamed with NIOSH and the NORA Construction Sector Council in planning and hosting a Safety Culture Workshop in Washington, D.C. More than 70 industry thought-leaders attended, along with a mix of government, employers, associations, labor, academia, and safety and health professionals
- The National Construction Center organized and hosted a "Tech Transfer" symposium in May 2012, bringing researchers together with government, manufacturing, contractor associations, labor, and insurance industry representatives to discuss barriers and strategic approaches to diffuse health and safety technologies and best practices across the construction industry. Symposium participants identified the need for a basic guide for construction safety and health investigators on the steps and options in moving proven interventions to market in the U.S. construction industry. In response to this recommendation, in 2013 the National Construction Center developed the *Intellectual Property Patent & Licensing Guide for Construction Safety and Health* (http://www.cpwr.com/publications/intellectual-property-patent-licensing-guide-construction-safety-health-researchers).

[3] Goal 8.0: Increase understanding of factors that comprise both positive and negative construction safety and health cultures; and, expand the availability and use of effective interventions at the policy, organizational, and individual level to maintain safe work practices 100% of the time in the construction industry.

Highway Work Zone Safety: A new NIOSH workplace solutions publication, *Highway Work Zone Safety update: Preventing Worker Injuries and Deaths from Backing Construction Vehicles and Equipment at Roadway Construction Worksites* http://www.cdc.gov/niosh/docs/wp-solutions/2014-125/, was published by the Division of Safety Research in May 2014.

Impact(s) made since last review (process- or outcome-related):

Moving the research-to-practice efforts of NIOSH's Construction Program to the National Construction Center has been beneficial. So much so that NIOSH enhanced its r2p expectations in its cooperative agreement funding announcement for the National Center for Construction Safety and Health Research and Translation 2014-2018 (RFA-OH-13-001).

Ladder Safety App: As mentioned under Recommendation 1, the NIOSH Ladder Safety app is another key r2p development since 2012. The app is the first of its kind for NIOSH. Within five weeks of its launch, the app was in the top nine percent of all apps by "download popularity" (reported by OttoCat, a categorizing site for Apple). The app and a related journal article written by the NIOSH developers also received in 2014 the Alice Hamilton and Bullard-Sherwood Award, and received an honorable mention in the U.S. Department of Health and Human Services HHS Innovates Awards Ceremony (the app was one of six finalists among over 500 entries from within HHS). The app, available for both Apple and Android phones, is still popular, and anecdotal evidence suggests that the app is helpful. The app was included in the Year 3 construction falls prevention campaign and in the national safety stand-down.

Occupational Falls: An article describing worksite falls from ladders was included in the dedicated Workers Memorial Day issue (April 2014) of CDC's *Morbidity and Mortality Weekly Report.* "Occupational Ladder Fall Injuries — United States, 2011" was written by Christina M. Socias, Dr.PH., Cammie K. Chaumont Menéndez, Ph.D., James W. Collins, Ph.D., and Peter Simeonov, Ph.D., who are in NIOSH's Division of Safety Research (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6316a2.htm?s_cid=mm6316a2_w).

Future plans:

A move from research to practice (i.e., implementing CPWR's dissemination tools and wide dissemination) is being planned for NIOSH's workplace solutions publication on highway work zone safety, OSHA's efforts to protect workers from demolition hazards (USDOL July 10, 2014 press release, http://content.govdelivery.com/accounts/USDOL/bulletins/c3514d), and fact sheets related to safety culture and safety climate.

The National Construction Center will launch a "Trainers and Researchers United Network" (TruNet) in October 2014. TruNet promises to provide a network through which research can be pushed into and ideas can be pulled from the field more quickly. Also, TruNet is expected to be a forum through which researchers will be able to query and engage in ongoing discussions with construction trainers; and provide easier access to interact with construction workers across the United States.

The Engineering Controls for Asphalt Milling project stems from the Silica/Asphalt Milling Machine Partnership, which is one in which NIOSH construction researchers have played a critical leadership role. The partnership is coordinated by the National Asphalt Pavement Association (NAPA) and includes all domestic and foreign manufacturers of pavement-milling machines currently sold in the United States. Other members of the partnership include paving contractors, the International Union of

Operating Engineers, the Laborers International Union of North America, the Association of Equipment Manufacturers, and government organizations including OSHA, the Federal Highway Administration, and NIOSH. Many of the partners are the same members of an earlier, highly successful partnership to control asphalt fume exposures that successfully implemented engineering controls on all highway-class pavers to reduce exposure to asphalt fumes. A similar partnership strategy is being used to implement engineering controls on pavement milling machines to reduce silica exposures. NIOSH researchers are releasing a Best Practices Engineering Control Guideline document on this topic later in 2014. The Silica/Asphalt Milling Machines Partnership members have agreed to install silica dust controls on all new half-lane and larger cold-milling machines by January 2017. The engineering controls will include ventilation and water-spray systems for hazard reduction, including dust suppression.

RECOMMENDATION 4

The Construction Program Coordinator and the Construction Program Manager should both be devoted full-time to the Construction Research Program.

2012 Report

Background

Status: *Completed*

External Factors: The BSC enumerated several concerns about assignments of several roles to the Construction Program Manager and Coordinator.

In the initial plan presented to the NIOSH Board of Scientific Counselors in August 2009, NIOSH essentially rejected this recommendation altogether, citing the need for Program Managers to assume many roles, and that a "multi-hat" approach had strengths as an "effective management strategy." The December 2009 BSC response, however, noted that

- The NIOSH response did not adequately address the National Academies recommendation;
- Construction is being given inadequate resources to accomplish its mission;
- Mining has an Assistant Director and full-time facilities in Pittsburgh and Spokane to address a dangerous but much smaller sector;
- Construction research is spread across the Institute. Having the head of the [then] Division of Safety Research as program manager makes it difficult for her to devote the time needed to the program, given all her other responsibilities. The Program Coordinator is primarily full time with this program but this should be acknowledged through creation of a full time position, as recommended by the National Academies report.

Implementation of Recommendation

The NIOSH Office of Construction Safety and Health was established in December 2009 to fully respond to the National Academies' recommendation.

Description: The director of the NIOSH Office of Construction Safety and Health is also the Manager of the Construction sector program (85%-90% of effort). The deputy director of this Office is the Construction Program Coordinator (100% of effort). Both positions are located in NIOSH's Washington, DC headquarters location.

Progress: The Program Manager/Office Director provides Institute-wide senior scientific and administrative leadership. Along with the Sector Coordinator/Deputy Director, she ensures that research elements from the National Construction Center are fully integrated, and are included in all designs and plans for research and its implementation. Together the Manager/Director and Sector Coordinator/Deputy Director formulate the strategic vision, the strategic goals, develop proposals, 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. They actively develop partnerships within NIOSH and among its external stakeholders, and coordinate construction research and related activities among NIOSH divisions, labs and other offices. As well, the Manager of the Construction Sector co-leads the National Occupational Research Agenda (NORA) Construction Sector Council. The range and breadth of representation of

researchers, federal and state government agencies, labor organizations, trade associations, and insurance and private industries, makes the NORA Construction Sector Council a true government-labor-management entity.

Impact: Establishing the Construction Program Manager and Coordinator as personnel dedicated to construction activities within NIOSH through its Office of Construction Safety and Health has improved the Institute's ability to align resources with the its national priorities. It has improved coordination among the NIOSH divisions that are conducting research in construction, and improved as well the coordination between those divisions and the National Construction Center. Furthermore, it has improved and enhanced the integration of research conducted by extramural researchers supported through the NIOSH Office of Extramural Programs, including with the National Construction Center.

The personnel decision has led also to better management of the work of the NORA Construction Sector Council. For example, beginning in the summer of 2010, the Manager and Coordinator oversaw the selection of two goals for priority activity from the list of 15 goals for the Sector. 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 the 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 the 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.

Future Plans: The Manager and Coordinator are overseeing a mid-decade review within the Sector Council of the 15 NORA construction goals to determine the likelihood of meeting the goals. Progress on each 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 is reviewing them, and will prepare a mid-decade report.

2014 Update

Addition of or modification to activities since last review:

No additions or modifications to this activity took place.

Progress made or maintenance efforts since last review:

A Mid-Decade Review was completed for the NORA Construction Sector in early 2014.

- 2011 was the half-way point in the second decade of the National Occupational Research Agenda (NORA). CSH and the NORA Construction Sector Council undertook a review of efforts to date.

The review provided an opportunity to take stock of overall developments; examine ongoing NORA projects and partnerships; and to provide additional strategic direction and fine-tuning. The economic recession that began in 2008 had significant impacts on construction, including a large drop in building activity and employment. CSH was concerned that these reductions potentially could impact a wide variety of construction partners. The recession also reduced federal governmental agency research and travel budgets. These economic developments were viewed as external factors affecting capabilities to move forward on an ambitious National Construction Agenda consisting of 15 strategic goals. The NORA Construction Sector Council organized the 15 goals into the following categories:

- Exploratory - important issue but still defining problems and solutions (strategic goals = construction industry and work organization; engaging the media to raise awareness and improve safety and health in construction)
- Developmental – some solutions are available but they are not ready for impact (strategic goals = electrocution; noise and hearing loss; welding fumes and illnesses; musculoskeletal disorders; construction safety and health management; training and education issues; improving surveillance of hazards and outcomes)
- Ready for Impact – sufficient solutions are available, and we know what contractors need to do for impact in the industry (strategic goals = falls; struck-by hazards; silica exposures and illnesses; construction culture; disparities in health and safety in construction; construction hazards prevention through design). In this latter category, performance measures were examined and changed if warranted.

Note that the Mid-Decade Review was not intended to provide a summary of research projects or completed outputs to date, but rather to identify and describe research-to-practice partnership activities and opportunities that can drive changes, using the roadmap, in the construction industry for each strategic goal. Changes were made to either the goal statement and/or the performance measures for five of the six ready-for-impact goals (Appendix 3). The report was completed in March 2014, and provides guidance for CSH staff on what issues are ripe for pursuit as the second decade of NORA comes to a close. Currently, NIOSH and/or the National Construction Center are engaged in either research or other activities for every goal in the Ready for Impact category.

Staffing components of this Recommendation were completed in 2012; however, some new developments have emerged:

- After over 24 years of dedicated service at NIOSH and the Environmental Protection Agency (EPA), Matt Gillen, CIH retired on March 31, 2014. His responsibilities over the span of his career included industrial hygienist, senior scientist, Construction Program Coordinator, and the Deputy Director of the NIOSH Office of Construction during which time he earned the respect of many colleagues and peers.

- In our succession planning, CAPT G. Scott Earnest, Ph.D., P.E., C.S.P., Chief, Engineering and Physical Hazards Branch, Division of Applied Research and Technology was detailed to CSH beginning in January 2014 so that he could begin working with CSH before Mr. Gillen's retirement. Beginning on April 1, 2014, CAPT Earnest became the Acting Deputy Director, CSH, and the Acting Coordinator for the NIOSH Construction Program. CSH is working diligently with CDC's Human Capital and Resources Management Office to fill the position permanently.

- After serving for four years, Nancy Romano, Division of Safety Research, needed to turn her attention full-time to her responsibilities with the Fatality Assessment and Control Evaluation (FACE) program, and relinquished her responsibilities as the Assistant Coordinator for the NIOSH Construction Program. In January 2014, LCDR Elizabeth Garza, MPH, who joined CSH in September 2012, took on the responsibilities for the Assistant Coordinator role.

Impact(s) made since last review (process- or outcome-related):

The Mid-Decade Review is being used to guide priority activities for the NORA Construction Sector Council and CSH in the remaining two years of NORA's Second Decade, helping both to focus precious resources on those identified goals and activities that are likely to have the most impact on safety and health in the construction industry.

Future plans:

Progress on the 15 strategic goals will be used to make recommendations for how NIOSH specifically and the construction sector generally should pursue research after 2016.

RECOMMENDATION 5

The National Construction Center should continue to be used as an important component in the Construction Research Program.

2012 Report

Background

Status: *In Progress*

External Factors:

Limits on travel resources at NIOSH make the current location of the National Construction Center in the Washington, DC metropolitan area convenient for frequent and consistent face-to-face and other meetings with the NIOSH Office of Construction Safety and Health, but not for NIOSH staff engaged in construction research at our other locations. CSH uses several alternative methods for staying in touch with construction stakeholders, including conference calls, and web and video conferences.

Implementation of Recommendation

Description: In its evidence package for the National Academies review, NIOSH described the role of the National Construction Center as a key component of its Construction Research Program. The foci for NIOSH itself are basic research, surveillance, methods research, and exposure assessments and controls research. The foci that NIOSH identified for the National Construction Center are industry characterization, applied research (coordinated with but not duplicative of NIOSH intramural research), creating liaisons with the industry, and developing research-based interventions. This scheme is working well. As the Construction Program has matured over time, in addition to shifting a majority of its r2p activities to the National Construction Center, NIOSH works closely with it to address persistent and emerging problems in the Construction Sector. Research-to-practice elements have been addressed earlier in this report. In an effort to highlight other construction activities at the National Construction Center, a few are noted here.

Progress: NIOSH and the National Construction Center work together in tracking industry trends, in research-to-practice endeavors, as described earlier in this report, outreach to the industry, and efforts related to the NORA Construction Sector Council. For the latter, for example, the Center is playing a substantial role in developing and supporting the construction falls prevention campaign.

NIOSH and the National Construction Center partnered to co-edit and produce a special *Journal of Safety Research* construction issue in 2010 to help commemorate the 20th anniversary of the NIOSH Construction Program.

NIOSH intramural scientists consult with scientists at the National Construction Center or with scientists who are part of its collaborating network (i.e., CPWR Consortium, which is a group of researchers working collaboratively with or under the auspices of CPWR). In May 2012, the National Construction Center hosted a Tech Transfer Symposium in an effort to facilitate moving laboratory and other research findings on technologies that protect workers to practical application at construction sites. NIOSH researchers, academics, other researchers, construction professionals, and tool and other manufacturers participated in the meeting.

Based on the National Academies recommendation, NIOSH amended its expectations for the National Construction Center so that the role of the Center is strengthened. Specific enhancements in the RFA include:

> The National Construction Center is expected to serve as a national leader for the advancement of knowledge and impact in construction safety and health. Accordingly, it is expected to generate, facilitate, and manage hypothesis-driven research that addresses three construction research topic areas, namely the NORA National Construction agenda goals, emerging issues, and tracking and dissemination. The Center is expected to forge strong working relationships through partnerships, many of which would involve stakeholders in research projects and strategic collaboration. The Center is expected to support and coordinate collaboration among researchers and construction stakeholders to implement and achieve NORA National Construction Agenda goals for the nation. The Center is expected to maintain and expand tracking so as to understand emerging trends; track overall industry performance; and track progress towards NORA goals and performance measures.

With these expectations, and the National Construction Center's performance, NIOSH uses the Center as an important component of its Construction Research Program. The Center adds to the NIOSH Construction Research Program's capability to help uncover and adapt to emerging issues.

Impact: Three examples are provided.

Reducing silica exposure and injury. The National Construction Center has supported research by Dr. David Rempel, University of California-San Francisco, designed to reduce physical stress on workers engaged in awkward concrete drilling tasks. They have supported also Pam Susi's work aimed at reducing workers' inhalation of dangerous substances. Laborers engaged in horizontal drilling are at risk of both exposures. A worker engaged in repetitive heavy pneumatic rock drilling can sustain injuries when drilling horizontally the thousands of holes needed for various dowels and rods used in constructing foundations for major buildings, roads or bridges. The drilling process also can fill the air with crystalline silica particles which can damage lung tissue when inhaled. Rempel designed a horizontal highway drill jig, and working with Susi and Michael Cooper, outfitted the jig with a shroud around the drill bit and a vacuum system for local exhaust ventilation. This two-way solution reduces impacts on the body, and reduces silica exposure (Cooper MR, Susi P, Rempel D. Evaluation and Control of Respirable Silica Exposure During Lateral Drilling of Concrete. *Journal of Occupational and Environmental Hygiene* 2012; 9(2);35-41; and http://www.tandfonline.com/doi/abs/10.1080/15459624.2011.640303).

Mast scaffolds. The National Construction Center established a work group of representatives from industry, government, including NIOSH, and labor to examine the problems associated with mast climbing work platforms (mast climbers), and to discuss solutions that would improve safety. Mast climbers are power-driven work platforms that climb a vertical tower mast, allowing both work at and carrying larger loads to higher elevations than traditional scaffolds. There are other advantages for contractors to use mast climbers, including that they potentially reduce the risk of shoulder and lower back injuries to workers because the work platform can be adjusted to an optimum height. When installed and used correctly, mast climbers are considered to be as safe as other types of scaffolds. When they fail, however, the sequelae can be tragic, involving multiple deaths and serious injury, but the true rate of deaths and injuries is not well documented. The work group developed recommendations that have been directed to regulators, as well as to parties responsible for specifying and contracting construction work that would involve mast climbers. The National Construction Center published *Reaching Higher—Recommendations for the Safe Use of Mast Climbing Work Platforms* (December 2010); used several venues to disseminate the recommendations, devoted part of their website to the issue; developed

partnerships with industry; and presented the report to the OSHA Advisory Committee on Construction Safety and Health (ACCSH). (http://www.tandfonline.com/doi/abs/10.1080/15459624.2011.640303).

Lifetime risk of injury and death in construction. Dr. Xiuwen (Sue) Dong, Data Center Director, CPWR, used multiple years of data from several national sources to estimate the likelihood of a construction worker experiencing a disabling injury during a 45-year career. Dr. Dong's analyses showed that there is a 75% likelihood of said injury. She found also that an individual who begins construction work at age 20 years has a 15% chance of developing chronic obstructive pulmonary disease (COPD) over a lifetime. Furthermore, Dr. Dong determined that over the course of a career in construction, the same worker has a one in 200 chance of dying from a work-related injury over a 45-year career (a Hispanic worker has a 20% higher likelihood of dying from a work-related injury). To put this finding in perspective, OSHA considers a lifetime risk of one death among 1,000 workers to be a significant level of risk (Stayner, 1992; Adkins, 1993).

Additional information on projects conducted by staff or sponsored through the National Construction Center can be found at http://www.cpwr.com/highlights/highlight_pdfs/CPWRHighlights2011.pdf.

Future Plans: The National Construction Center is preparing a Silica-Safe website, jointly with NIOSH and OSHA, under the auspices of the CPWR-NIOSH-OSHA r2p work group. The website will contain information on the hazards of silica exposure and on controls, information which is currently available through a myriad of websites and publications but heretofore not organized well for ease of use. Through this effort, the National Construction Center expects to inform stakeholders of the seriousness of silica hazards and the feasibility of methods by which to control silica dust.

In October 2012, the National Construction Center will host the XXXth International Symposium on Safety and Health in the Construction Industry (http://www.issaboston2012.org/index.html), and has invited NIOSH researchers to participate.

Because the enhanced role of the National Construction Center has been successful, NIOSH intends to continue and strengthen this role and structure in future funding announcements for a national construction center.

2014 Update

Addition of or modification to activities since last review:

Safety Culture (NORA Strategic Goal 8) is a topic that the National Construction Center, NIOSH, and the NORA Construction Sector Council embraced beginning in 2013. CPWR and NIOSH convened a 1½ day stakeholder workshop during June 11-12, 2013 to discuss safety culture and safety climate, and to explore paths for bringing research to bear on industry practices. The National Construction Center took the lead responsibility for writing and publishing (April 2014) the report stemming from that workshop, *Safety Culture and Climate in Construction: Bridging the Gap between Research and Practice*, was published in spring 2014 and is available online at CPWR's website (http://www.cpwr.com/publications/safety-culture-and-climate-construction-bridging-gap-between-research-and-practice). Given the positive response to the Safety Climate and Safety Culture workshop last year, and in an effort to continue discussions and move forward, CPWR, NIOSH and the NORA Construction Sector Council hosted a one-year anniversary webinar on June 12, 2014.

Progress made or maintenance efforts since last review:

A timetable was difficult to conceive in 2012 because our venture into r2p specifically for construction was so new, and it was focused centrally on one activity—the NIOSH-OSHA "Nail Gun Safety: A Guide for Construction Contractors." CSH, the National Construction Center and OSHA work together in planning, announcing and disseminating publications and interventions for which they have applied the dissemination tool(s) and developed full dissemination strategies. Since 2014, these entities have become quite nimble in planning, but, more importantly, NIOSH and OSHA are planning better for r2p in advance of publishing research findings or policy changes, respectively.

In 2012, CWPR published the fifth edition of *The Construction Chart Book,* which presents current and complete statistics on all aspects of the U.S construction industry (e.g., demographic, employment, income, training and economic data). International comparisons are included, as well as data on woman and immigrant (including Hispanic) construction workers. Each chart is now available in both PDF and power-point ready forms (http://www.cpwr.com/publications/construction-chart-book).

A webinar was hosted by the National Construction Center at the one year anniversary of the construction Safety Culture and Safety Climate workshop (June 2014) to assess what participants have done to implement findings resulting from the workshop.

The National Construction Center designed the *Partnership Toolkit* to facilitate health and safety partnerships in construction, including groups interested in establishing new r2p collaborations and those intended to strengthen existing ones. Heretofore, there have been a few cases that were posted as examples of partnerships (http://www.cpwr.com/research/health-and-safety-partnerships-construction-case-examples), but the full toolkit is still in draft form.

IMPACT Cards highlight specific CPWR projects; the use of interventions to reduce injuries and illnesses on construction jobsites; and the impact they are having on worker, contractor and other stakeholders' awareness of hazards. Topics include overhead drilling, nail gun safety, ergonomic solutions for masonry workers, and carbon monoxide.

In 2013, the National Construction Center adapted and posted 52 new tool box talks on their website based on information and material originally created by NIOSH's Education and Information Division. For details, please see: http://www.cpwr.com/publications/handouts-toolbox-talks.

The National Construction Center's Work Safe with Silica website is now operational (http://www.silica-safe.org/). The site contains information on the hazards of silica exposure and on controls—information which has been available through a myriad of websites and publications but was not organized well until this website was created. The website informs stakeholders of the seriousness of silica hazards and the feasibility of methods for controlling silica dust.

The National Construction Center hosted the XXXth International Symposium on Safety and Health in the Construction Industry (ISSA) (http://www.issaboston2012.org/index.html) in October 2012. Global construction researchers and contractor safety and health leaders participated.

Impact(s) made since last review (process- or outcome-related):

The ISSA Symposium resulted in the development of a Declaration of Boston, which created an internationally recognized new benchmark for continuous improvement in construction safety and health (https://www.issa.int/details?uuid=ae11dc1d-809e-4807-834a-6f7214b18c78). The new

benchmark, called “Going Beyond Gold in the Construction Industry,” is based on the experience in the United Kingdom in designing and constructing sustainable facilities in an environment that was safe for construction workers for the London 2012 Olympics.

The Construction Safety Culture and Safety Climate workshop was a tremendous success, resulting in consensus by construction industry stakeholders and researchers on key elements and factors in establishing a positive safety and health culture and climate in the construction sector. One stakeholder who participated from a not-for-profit organization called the workshop one of the most effective activities of its type in which he had engaged in his career. And a private sector colleague was so engaged and enthusiastic about what he learned during the workshop that he has volunteered to fund a follow-up workshop.

Future plans:

From the Safety Climate and Safety Culture workshop in 2013, the National Construction Center is developing a booklet of fact sheets on each of the eight elements identified at the workshop, i.e., worker involvement, for broad distribution throughout the industry.

Discussions during the Safety Culture and Safety Climate workshop in 2013 raised the importance of considering the unique challenges that small businesses have in implementing construction safety and health research, and keeping pace with recommended improvements for construction workers. CSH and the NORA Construction Sector Council are examining these issues, drawing on the expertise of the NORA Small Business Cross-Sector, and looking for ways by which our organizations can provide meaningful avenues for change.

RECOMMENDATION 6

The Program should establish a closer connection with the Occupational Safety and Health Administration and other regulatory or consensus standards organizations to help ensure that the Program's research is applied effectively in rule-making efforts.

2012 Report

Background

Status: *In Progress*

External Factors: Limited resources and travel restrictions at NIOSH reduce opportunities to meet in person. A key rationale for establishing NIOSH's Office of Construction Safety and Health in Washington, DC was because the location would facilitate frequent engagement with the Directorate of Construction Occupational Safety and Health Administration (OSHA). Frequent contact with NIOSH staff in other locations is accomplished through telephone calls, conference calls, and web and video conferences. A few times each year, CSH supports travel to conferences or relevant meetings for NIOSH staff engaged in construction research.

Implementation of Recommendation

In August of 2009, NIOSH responded to the BSC by summarizing the various ways it is working with OSHA and voluntary standards groups, and shared its plans to deepen those relationships in the future. The NIOSH Construction Program believes it has established a closer working relationship with both OSHA and key consensus standards organizations.

Activity A: Directorate of Construction, OSHA

Description: The NIOSH Construction Program works closely with OSHA.

Progress: In January 2010, OSHA installed a new permanent director for its Directorate of Construction, after several years of iterative temporary appointments. With stable leadership at OSHA in place, the NIOSH Office of Construction Safety and Health has been able to meet regularly and plan dissemination of joint efforts with OSHA as it concerns construction.

Preparing for and publishing the NIOSH-OSHA co-branded "Nail Gun Safety: A Guide for Construction Contractors" (http://www.cdc.gov/niosh/docs/2011-202/) in September 2011 was an accomplishment that would have been difficult to conceive before 2010.

The Deputy Director, Office of Construction Safety and Health, represents NIOSH on ACCSH, giving NIOSH researchers a voice in formal stakeholder recommendations to the Directorate of Construction and OSHA. In addition, OSHA participates in and presents at NORA Construction Sector Council meetings.

The Deputy Director also participates on OSHA's Federal Advisory Committee for Occupational Safety and Health (FACOSH) Training Subcommittee related to a specific project involving the Federal Building Personnel Training Act (FBPTA) of 2010. He co-chairs a workgroup to identify core safety and health competencies for stationary engineers and facility managers to ensure that worker safety and health is included as a core competency under FBPTA. Facility renovation and maintenance activities often involve construction workers, and the FBPTA requires that affected workers be able to demonstrate core competencies. The law also applies to

private sector contractors working in federal buildings. In June of 2012, the Secretary of Labor sent the FACOSH approved safety competencies to the US General Services Administration for consideration and inclusion.

Impact and Future Plans: By virtue of meeting frequently, a degree of ease and comfort has emerged between CSH and the Directorate of Construction. Joint dissemination efforts for the Nail Gun Guide and the construction falls prevention campaign have amplified our outreach. For example, by including the Directorate of Construction and OSHA's Office of the Administrator, the Department of Labor Secretary became involved in the launch of the construction falls prevention campaign, thus greatly elevating the profile. We plan to continue meeting and to continue preparing joint efforts as occasion serves.

Activity B: Consensus Standards Organizations

Description: The NIOSH Construction Program has expanded its active participation on the American National Standards Institute (ANSI) Committee on Safety Requirements for Construction and Demolition Operations (ANSI A10), and its affiliated workgroups. This provides an important mechanism for ensuring research to practice. NIOSH participates on standards work groups and provides comments on draft standards. Examples of recent standards with NIOSH involvement or comments include A10.1 (Pre-Project & Pre-Task Safety and Health Planning); A10.46 (Hearing Conservation); A10.10 (Heaters); A10.38 (Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment); A10.21 (Safe Construction and Demolition of Wind Generation/Turbine Facilities) and A10.33 (Safety and Health Program Requirements for Multi-Employer Projects). NIOSH is helping to develop the draft ANSI A10.49 (Control of Health Hazards) control banding-based standard for addressing construction chemical and toxic substance hazards.

The Program participates in other ANSI standards as well. For example, NIOSH provided comments to ensure that construction language was included in ANSI TR-Z790.001 (Prevention through Design: Guidelines for Addressing Occupational Risks in Design and Redesign Processes). NIOSH is currently participating in the revision process for ANSI SNT-101 (Safety Requirements for Portable, Compressed-Air-Actuated, and Fastener Driving Tools) standard that addresses nail guns. In addition, a number of NIOSH researchers are working with ANSI and ISO standards groups such as A92.9 (Mast-Climbing Work Platforms Subcommittee) and ANSI A10.14 (Ladders).

N.B. Representatives of the National Construction Center also participate in both ACCSH and the ANSI A10 committee, thus providing additional synergies towards meeting this recommendation.

Future Plans: The NIOSH Construction Program considers strengthening these relationships as an ongoing activity.

2014 Update

Addition of or modification to activities since last review:

No additions or modifications to activities were made.

Progress made or maintenance efforts since last review:

NIOSH has continued its participation on ANSI standards committees and on ACCSH.

In addition to working together on disseminating documents advising of the hazards of nail gun use in construction, NIOSH's Construction Program and OSHA's Directorate of Construction have worked together closely on other topics. Namely:

- Materials and dissemination plans for the construction falls prevention campaign, including the 2014 national safety stand-down, were designed by NIOSH and OSHA working together closely and regularly, and with the National Construction Center. Critical and unique roles were played by all three parties, and the resulting campaign and stand-down have been more effective because of the collaboration. It is hard to imagine how successful this would have been if any one organization shouldered all of the responsibility

- CSH has also been actively involved with the OSHA Alliance Program Construction Roundtable. This group of industry, labor, and government representatives meets biannually and NIOSH is a regular participant that provides an update on its construction research activities

- In March 2014, OSHA convened its informal public hearings for the proposed rule in occupational exposure to respirable crystalline silica. NIOSH has a long history of research and recommendations on preventing worker exposure to silica. During the testimony, NIOSH researchers addressed the health effects of exposure to respirable crystalline silica, and extensive NIOSH efforts to develop recommendations and controls for preventing worker exposures. 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.

Impact(s) made since last review (process- or outcome-related):

Since 2010, the directors of CSH and DoC have worked diligently to improve collaboration and create an environment that is collegial and makes for an easy and regular flow of information and ideas. The good working relationship that has been forged sets a good example for our staffs, and has aided in the development of projects. There is now earlier inclusion of NIOSH research in DoC planning, and earlier (informal) notice of DoC policies for NIOSH.

Future plans:

NIOSH is working with DoC on an update of decompression tables, and efforts to protect temporary, cell phone tower workers and demolition workers.

Appendix 1

National Academies' Recommendations to the NIOSH Construction Program that were Not Selected for Discussion in this Report.

Recommendation 3

High-level attention should be given to determine how to provide program resources that are commensurate with a more robust pursuit of the Construction Research Program's goals.

Background

Establishing the Construction Program Manager and Coordinator as personnel dedicated to construction activities within NIOSH through its Office of Construction Safety and Health has improved the Institute's ability to align resources with the its national priorities. In addition, the creation of the Office has increased coordination across NIOSH divisions and improved collaboration with extramural partners such as the National Construction Center to leverage existing resources to the fullest and to ensure that maximum impact is achieved. Therefore this recommendation was not chosen for Government Performance Results Act tracking purposes.

Appendix 2

Review of Progress Implementation Report for

NIOSH Construction Program

Submitted by Board of Scientific Counselors

November 30, 2012

BSC Working Group Members

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Construction Score Sheet

Directions: For each recommendation listed below, please circle a score for each scoring element and provide a brief justification for the assignment of that score. The work group may provide scores in .5 increments where they deem appropriate. If the group chooses to do that, please put a .5 next to the corresponding number and circle that number.

Recommendations In Progress:

Recommendation #1
Efforts to influence practice based on research ("research-to-practice" or r2p) efforts should involve individuals with training or with the experience and skills to create strategic diffusion and social marketing plans for the National Institute for Occupational Safety and Health research and evaluate such plans' effectiveness.

Relevance: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
This recommendation should be attended to well as new individuals with relevant skills for "research-to-practice" have been hired.

Sustainability: 1 2 3 4 5 **– SCORE: 4**

Brief Justification:
It appears that NIOSH may need more resources to follow-up with these initiatives to see what their impact has been on practices and injury and illness outcomes. Over time and with the addition of new personnel, it is expected that changes in practice will be affected and long-time with integration.

Progress: 1 2 3 4 5 **– SCORE: 4**

Brief Justification:
There is lack of evidence that, beyond counting various measures of dissemination and hits, the r2p has led to changes in practices and changes in injuries or illnesses. It is recommended that more diverse evaluation metrics be developed to capture changes.

Potential Impact: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:

The changes made have already begun to bear fruit.

Recommendation #2
Consideration should be given to having the majority of research-to-practice efforts of the Construction Research Program conducted through the National Construction Center.

Relevance: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
The r2p efforts appear to merit expansion and this response does that. There has been substantial use of the Center and it is anticipated that this will continue with relevant outcomes.

Sustainability: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Although nothing is guaranteed about the future, the steps appear to be well-integrated into the programs that have already been established

Progress: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Major steps have been taken to implement this recommendation.

Potential Impact: 1 2 3 4 5 **– SCORE: 4**

Brief Justification:
As reflected in the other categories for Recommendation #2, the emphasis on the use of the Center has been implemented quite well. One element that should be strengthened is the strategic perspective of the r2p program. The program focuses on cases where substantial evidence has accumulated about the merits of the practice. What are the prospects for additional cases beyond nail gun safety? Is there a bank of other practices that are ready for similar dissemination? What are the expectations for the program? Are there ways that its potential can be realized more quickly or thoroughly?

Recommendation #5
The National Construction Center should continue to be used as an important component in the Construction Research Program.

Relevance: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
The Center is an integral part of the Construction Research Program and it is anticipated that this will continue into the future. Excellent partnerships have been established.

Sustainability: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Strategies for sustainability appear to be well-integrated into the programs that have already been established.

Progress: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Implementation this recommendation has been achieved.

Potential Impact: 1 2 3 4 5 **– SCORE: 4**

Brief Justification:
The strategic perspective of the r2p program should be strengthened . This would include a focus on developing a cadre of practice areas that can be emphasized for development of dissemination messages. A timetable for strategic implementation should be considered.

Recommendation #6
The Program should establish a closer connection with the Occupational Safety and Health Administration and other regulatory or consensus standards organizations to help ensure that the Program's research is applied effectively in rule-making efforts.

Relevance: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
We think that the objective here is important. Given OSHA's key role in prevention, better integration of research and analysis with policymaking would move the idea of r2p into the realm of public policy.

Sustainability: 1 2 3 4 5 **– SCORE:** 4.**5**

Brief Justification:
Several factors impede better use of NIOSH resources to assist OSHA. They are in different cabinet-level agencies and they have different goals and political circumstances. In addition, there are the usual agency concerns about autonomy. Figuring out how to build a more sustainable partnership remains a difficult task.

Progress: 1 2 3 4 5 **– SCORE:** 3.**5**

Brief Justification:
Although it appears that there have been more meetings with OSHA staff, we don't see much more integration of effort with respect to core functions of OSHA. Of course, progress here depends upon the actions of OSHA at least as much as it depends on actions of NIOSH.

Potential Impact: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Fuller cooperation could, we believe, lead to substantial impacts.

Recommendations Completed:

Recommendation #4

The Construction Program Coordinator and the Construction Program Manager should both be devoted full-time to the Construction Research Program.

Achievement: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
This has been accomplished.

Sustainability: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
It appears that this can be sustainable assuming resources are available.

Impact: 1 2 3 4 5 **– SCORE: 5**

Brief Justification:
Although it is hard to track cause and effect, it appears that the changes have led to greater focus on construction issues within NIOSH.

Appendix 3

Changes to "Ready for Impact" National Occupational Research Agenda (NORA) Construction Strategic Goals and/or Performance Measures based on NORA Construction Sector Mid-Decade Review

STRATEGIC GOAL 3

STRATEGIC GOAL 3.0 - Reduce fatal and serious injuries associated with struck-by incidents associated with objects, vehicles, and collapsing materials and structures.

Revised Performance Measure One - Identify risk factor gaps, develop new interventions, and increase dissemination and use of interventions to reduce the rate of construction-related struck-by fatalities associated with construction vehicles by 25%, and the rate of non-fatal injuries associated with nail guns by a similar 25%.

Performance Measure Two (New) - By 2016, document the use of NORA "struck-by" program outputs by 240,000 individuals/companies/organizations in the construction industry as a proxy for increased awareness of struck-by hazards and safe work practices. Documentation is based on actions taken by individuals and organizations to obtain NORA struck-by outputs, including web page hits, product downloads, peer-review citations, requested training programs and materials, and individuals taking training.

STRATEGIC GOAL 5

STRATEGIC GOAL 5.0 - Reduce silica exposures and future silica-related health risks among construction workers by increasing the availability and use of silica dust controls and practices for tasks associated with important exposures.

Performance Measure - A performance measure cannot be set for this strategic goal until better baseline information can be obtained and analyzed. Intermediate goal 1 will address this need and is expected to support a performance measure such as "Increase use of silica control solutions and exposure reduction practices by the construction community by 33% over baseline in ten years."

Revised STRATEGIC GOAL 5.0 – Reduce silica exposures and future silica-related health risks among construction workers by increasing the availability and use of silica dust controls and practices for 5 tasks associated with important exposures.

Revised Performance Measure - Increase the use of silica control solutions and exposure reduction practices for 5 important tasks by 25% by 2016

STRATEGIC GOAL 8

STRATEGIC GOAL 8.0 - Increase understanding of factors that comprise both positive and negative construction safety and health cultures; and, expand the availability and use of effective interventions at the policy, organizational, and individual level to maintain safe work practices 100% of the time in the construction industry.

Performance Measure - This goal will be successfully achieved if by 2016, NIOSH, its stakeholders, and the construction industry as a whole increase their recognition and understanding of the complexity of safety and

health culture and strive to use successful measurement and intervention tools to create a positive culture at the worksite.

Revised STRATEGIC GOAL 8.0 - Increase understanding of factors that contribute to safety culture and climate in the construction industry and improve sector capabilities to evaluate and improve practices at the policy, organizational, and individual level. Promote increased attention to safety culture and climate as a way to improve the effectiveness of safety and health programs and practices.

Revised Performance Measure - Support safety culture research and organize at least three activities that advance understanding and exchange of knowledge and which can serve to promote good practices to create a more positive safety culture and climate in the construction industry.

STRATEGIC GOAL 12

STRATEGIC GOAL 12.0 - Reduce injury and illness among groups of construction workers through improved understanding of why groups of workers experience disproportionate risks in construction work and expanding the availability and use of effective interventions.

Performance Measure - This goal will be successfully achieved if by 2016, there is improvement in the understanding of what contributes to health disparities in construction; expansion of the existing knowledge base of injury, illness, and exposure of at-risk worker populations; and increased distribution of effective interventions.

Revised STRATEGIC GOAL 12.0 - Reduce injury and illness among groups of construction workers through improved understanding of why groups of workers experience disproportionate risks in construction work and expanding the availability and use of effective interventions.

Revised Performance Measure - This goal will be successfully achieved if by 2016, progress is demonstrable in three areas:

1) Support research to expand the existing knowledge base of injury, illness, exposure, and risk factors for at-risk construction worker populations by 50% over a 2006 baseline.

2) Support research and collaboration to identify, evaluate, and inventory interventions relevant for construction. Develop and maintain an accessible resource list of research, reports, interventions, researchers, practitioners and other key contacts, groups and other resources relevant to construction safety and health disparities.

3) Support exchange and dissemination of construction disparities-related information between researchers, practitioners, and at-risk worker groups. Engage groups via at least 5 activities or outputs such as workshops, webinars, training materials, publications, or development of social media approaches.

STRATEGIC GOAL 13

STRATEGIC GOAL 13.0 - Increase the use of "prevention through design (PtD)" approaches to prevent or reduce safety and health hazards in construction.

Performance Measure - Increase the use of CHPtD by 33% over the next 10 years.

Revised Performance Measure - Increase awareness about and use of PtD in construction and maintenance by 33% over the next 10 years.