

**Annual Summary Report – FY17**  
**NIOSH-sponsored Center of Excellence for Construction Occupational Safety and Health Research and Translation**

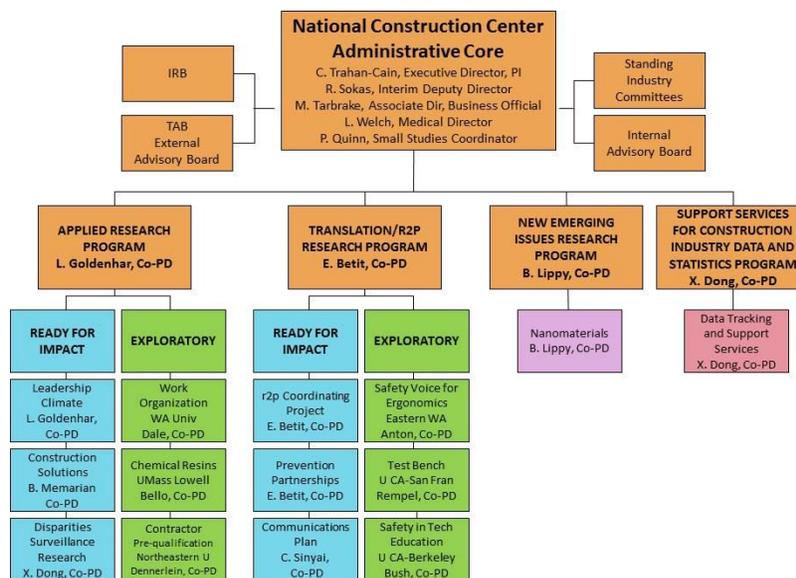


**SECTION I**

**Center Summary**

CPWR’s construction safety and health research program builds on our experience administering the Construction Center since 1990. As an integral part of the NIOSH Construction Research Program, our objective is to continue to reduce injuries and illnesses in the construction industry by: 1) creating new knowledge and intensifying and accelerating the identification and adoption of evidence-based best practices; 2) responding to the NORA Construction Sector Council goals and National Academy review; 3) focusing on research to practice (r2p); 4) responding rapidly to emerging issues and trends; 5) disseminating our findings in new and innovative ways and: 6) tracking industry changes and changes in safety and health outcomes.

The Construction Center is comprised of an Administrative Core that includes all planning, coordination, and administrative functions. It also houses the Small Studies Program, and has the primary responsibility of linking Construction Center investigators with construction industry stakeholders. In addition to the Administrative Core, there are four research program areas within the Construction Center: Applied Research, Translation/r2p Research, Emerging Issues Research, and Support Services for Industry Data and Statistics. There are 6 research projects within the Applied Research Program, 3 ready for impact and 3 exploratory (1 about to be completed and a replacement currently launched); 6 research projects within the Translation/r2p Research Program, 3 ready for impact and 3 exploratory; 1 project within the Emerging Issues Research Program focusing on nanomaterials; and 1 Data Tracking and Support Services project. All of the ready for impact projects in both the Applied Research Program and the Translation/R2P Program are led by CPWR investigators, reflecting the National Academies’ recommendation that the Construction Center focus on getting best practices adopted by the industry. Identified through a broad solicitation, the exploratory projects in both categories are being carried out by consortium partners. See Construction Center organization below:



**Figure 1 CPWR Construction Center Organization Chart**

## Relevance

The Construction Center targets NORA Goals 1-15 through 14 existing projects and one newly started project across the four Research Program Areas, in addition to Administrative Core activities that include the Small Studies Program. It also responds to National Academy recommendations that: 1) The National Construction Center should continue to be used as an important component in the Construction Research Program, and 2) Consideration should be given to having the majority of r2p efforts conducted through the National Construction Center.

## Key Personnel

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[To visit the Construction Center Website click here](#)

## SECTION II

### Selected Highlights and Accomplishments

CPWR's Construction Center follows a logic model developed to guide the administration of the program. It is derived from the NIOSH Construction Research Program logic model and supplements it. Each research project and activity of the Construction Center is directed at a NORA Construction Sector Goal and/or National Academies Recommendation. Each is expected to achieve one or more intermediate outcome(s) that eventually should impact occupational safety and health by reducing illness and injury. The Construction Center actively engages with each project and fosters information sharing, collaboration, and application. Each of the 14 research projects comprising the Construction Center have progressed well in Year 3 of the 5-Year agreement.

Our Administrative Core planning activities continue to facilitate collaboration among consortium researchers and workers, contractors, industry representatives, and insurance providers, connecting them to our Construction Center projects as well as to others engaged in safety and health research, including NIOSH scientists working in construction and in mining. These connections are fostered and highlighted at CPWR's annual r2p Conference. The Data Center has been extraordinarily productive, developing the latest Construction Chart Book, scheduled for completion and posting by January 2018, collecting information from a growing number of sources and providing answers to questions posed by government, labor and industry leaders. The Data Center has also been examining injury disparities to search for explanatory factors.

Selected Highlights and Accomplishments, with a focus on Year 3 progress and outcomes from the Construction Center's internal and external research programs, are as follows:

### **Concluding CTE Project, Beginning Policy Impacts Project**

In Year 3, University of California at Berkeley consortium partners completed the project "OSH Education in Post-secondary Career Technical Education (CTE) Construction Programs" and prepared for dissemination which is expected to be completed by December 31, 2017. The project assessed the state of current OSH in CTE Construction Programs, identified key elements for OSH training, developed a guidance document and self-assessment tool aimed at program administrators, and developed and implemented a dissemination partnership with the National Council for Workforce Education (NCWE), the Association of Career Technical Educators (ACTE), and an ongoing advisory group that includes OSH expertise. A new project under the direction of Dr. John Mendeloff at the University of Pittsburgh was awarded competitively as of August 1, 2017, and will continue through Years 4 and 5 of the agreement. This project, "Assessing Public Policy Intervention Impacts on Construction Fatality Rates," aims to explore the impact of OSHA enforcement activities and Workers' Compensation costs, their interaction, and contextual factors on occupational fatality rates by state.

### **Research to Practice and Communications: From Social Network Theory to Practice**

CPWR's continued focus on ensuring that research gets applied by stakeholders for maximum impact continued and deepened this year with projects that directly explore factors that promote dissemination. Active masonry and roofing partnerships continued to support research and dissemination, and CPWR's family of websites including ones for Fall Safety ([Stop Construction Falls Web-link](#)) and working safely with silica ([Work Safely with Silica Web-link](#)) recorded more than a million sessions. The CPWR r2p Coordination project and Prevention Partnership are integrating social network theory into projects that explore using networks to improve the construction industry's ability to engage in r2p, and to evaluate our r2p efforts. In the r2p Coordination project, a pilot using social network analysis (SNA) to evaluate the national CPWR/NIOSH/OSHA Falls Campaign is helping us learn about the relationships and connections between individuals and groups that we rely on for dissemination, how information flows through individual "networks," and what new relationships have been created because of the campaign.

### **TRU-Net Put to the Test**

CPWR's training programs encompass thousands of construction safety and health trainers across the nation. The Trainers and Researchers United Network (TRU-Net) brings these trainers together with internal, consortium, and NIOSH researchers in informal and formal ways. CPWR demonstrated its ability to gather, apply, and prepare to disseminate information through TRU-Net's formal structure. Researchers achieved a 21% response rate of a noise survey deployed to trainers. Working with trainers, researchers achieved an astonishing 84% response rate (4,195 responses) from trainees. Survey results are being analyzed for self-reported exposure, health outcomes, and training information, and are serving as the basis for training and outreach materials under development. An updated noise control hazard alert has recently been published.

### **Nanotechnology in Construction**

CPWR's nanotechnology research team continues to collaborate closely with NIOSH's Nanotechnology Research Center, has developed additional collaborations through the Small Studies Program, and is achieving international recognition as a source of research and information concerning engineered nanomaterials (ENMs) in the construction industry. CPWR and NIOSH investigators have contributed a chapter on managing construction exposure to ENMs in the U.S. to a European guidance document entitled "*Occupational exposure to manufactured nanomaterials in the construction industry: Strategy and guidelines (SCAFFOLD Handbook)*". Two projects involving nanomaterials have been awarded through CPWR's Small Studies program. Both are well underway. One is a survey of the awareness by California trades of nanomaterials and a pilot field study measuring the effectiveness of N-95 respirators for nanoparticles.

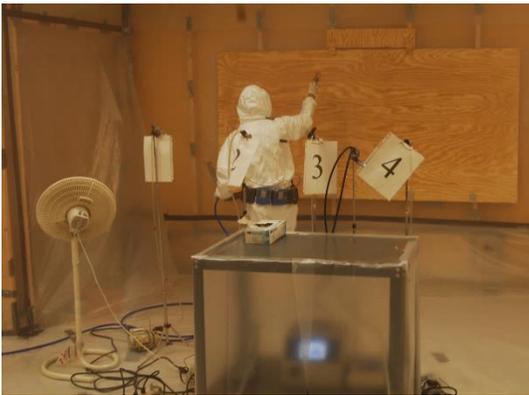


Figure 2. Industrial hygiene monitoring of worker exposures during spraying of a coating containing nanoparticles of zinc oxide inside a controlled chamber.

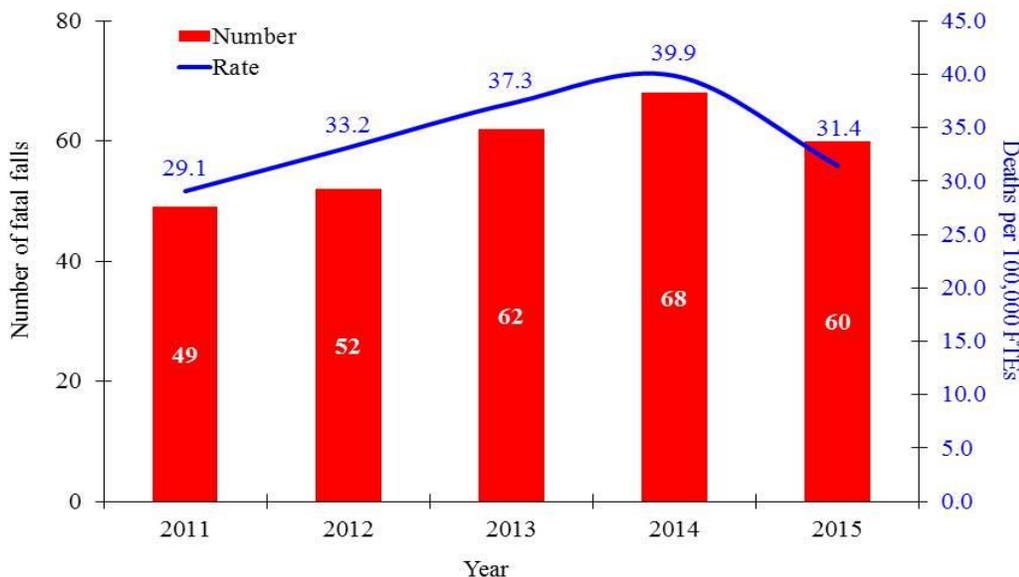
In Year 3 the eLCOSH Nano inventory grew to over 550 construction products that appear to be nano-enabled or nanostructured. The inventory is the largest in the world focused on the health and safety issues of nano-enabled commercial construction products.

Many of these products are used to coat or seal. CPWR researchers conducted air sampling of power sanding of plywood treated with a waterproofing sealant containing zinc oxide nanoparticles, and did not identify excess release of nanoparticles in comparison to power sanding the same plywood material without treatment of any kind. While the standard dust collection bag provided with the electric sander was not sufficient to reduce exposure to nanoparticles during sanding, local exhaust ventilation was effective, reducing nanoparticle exposures to near background levels. This research suggests that conventional controls may be effective. While the health outcomes remain unknown, NIOSH toxicologists are collecting dust samples CPWR studies for bench toxicology research. Their results should begin to address the health outcomes question. Ongoing surveys of trainers help us identify awareness levels and the most effective means to get information into the hands of workers and trainers, leading to the development of two toolbox talks and a hazard alert card.

### Data Center Tracking and Support Services and Disparities

The Data Center continues to increase the sources used and the stakeholders served through responses to information requests, peer reviewed publications, presentations, and extensive dissemination of information about all aspects of occupational safety and health in construction.

### 10. Number and rate of fatal falls to a lower level among roofers, 2011-2015



Source: Numbers were obtained from the BLS through special requests. Numbers of FTEs were estimated using the Current Population Survey. Calculations by the authors. The views expressed here do not necessarily reflect the views of the BLS.

The 6<sup>th</sup> edition of the Construction Chart Book is scheduled for release by January 2018. New information on fatal falls by height of fall, nanomaterials in construction, workers compensation costs in construction compared to other industries, health risk factors, and OSHA fall protection and health hazard enforcement activities, in addition to extensive safety and health exposure and outcome information will be added. Data Center publications, including Quarterly Data Reports and peer reviewed publications, continue to target priority areas such as vulnerable workers and fatal falls. Data Center information is also helping to assess the impact of national efforts, tracking the loss of employment during the Great Recession, and the unfortunate rebound in fatal traumatic injuries as the construction industry subsequently rebounded. Preliminary information (based on single year data) suggests that fatal falls among roofers may be moderating, as well as disparities among Latino workers, while the long term consequences of workplace injuries may be greater than previously anticipated for older workers. CPWR's Construction Fatality Map, hosted at [Stop Construction Falls Website](#), has garnered significant OHS and news coverage. Users have provided positive feedback and have used the map for Workers' Memorial Day activities and reports; the annual National Safety Stand-Down for Fall Prevention in Construction; incident-specific information requests and prevention efforts; and worker training resources.

CPWR continues to lead efforts to better understand trends in employer perspectives concerning safety and health. Our joint effort with Dodge Data & Analytics, the Construction Safety Management Survey (CSMS) was conducted again in 2017. This survey added new questions about awareness of prevention through design (PtD) and included a panel of architects for the first time. A total of 334 Construction Contractors, including 195 General Contractors and 139 Sub-contractors completed the surveys, as well as 108 architects. These data are currently being analyzed and will help assess industry safety and health practice as well as target opportunities for intervention and outreach.

### **Enhancing Job Site Safety Climate**

The importance of integrating research into practice is again demonstrated by CPWR's continued success at providing information and tools the industry can use to enhance safety climate on construction job sites. The message that indicators of safety climate are critical drivers of jobsite safety and health is being effectively disseminated with an updated version of the Safety Climate workbook (*Worksheets and a Rating Tool to Help You Strengthen Jobsite Safety Climate*) and the new English and Spanish versions the Safety Climate Assessment Tool (S-CAT) ([Safety Climate Assessment Tool Web-link](#)). The S-CAT has been completed by over 1300 individuals and 30 companies. The Department of Energy is currently conducting a pilot project using the S-CAT to first measure their safety climate in various departments, followed by using the workbook to identify feasible interventions to improve low-scoring indicators, with a final S-CAT measure a year later to measure intervention impact. The S-CAT is also going to be included in a new textbook on safety climate and safety management systems.

Although effective safety leadership from foremen and lead workers is directly related to a more positive jobsite safety climate and reduced adverse safety outcomes, only a small minority have had access to needed leadership training. To address this need, CPWR researchers collaborated with consortium researchers from the University of Colorado, industry partners and other construction stakeholders to develop the Foundations for Safety Leadership (FSL) training module. Over the past year, they have been evaluating the FSL with approximately 300 foremen and 1100 workers at 19 sub-contracting companies in three regions of the country. Preliminary findings show that after the FSL training, participating foremen had a significantly greater understanding of, and intention to practice, the 5 leadership skills and their crews reported an increase in their foremen's leadership skills as well as a more positive jobsite safety climate. On January 1, 2017, the FSL became an official elective in the OSHA 30-hour construction industry outreach program, the "*Outreach Training Program: Construction Industry Procedures*" document was updated specifying that the FSL is an approved elective stipulating 2.5-hour mandatory teaching time. ([OSHA Outreach Training Program Web-link](#)). Outreach trainers can access all the FSL materials on OSHA Directorate of Training and Education website as well as [CPWR's FSL webpage](#). This development has already resulted in FSL being incorporated into 175 OSHA-30 hour training programs reaching 3,378 construction workers and supervisors (as of 7/2017).

**Reactive Chemical Resins**  
**University of Massachusetts at Lowell**

Epoxies and isocyanates are widely used in construction, but there are occupational skin disorders and asthma risks associated with these products. Researchers surveyed field PPE use, identifying a high potential for dermal exposure, with greatest need for improvement among helpers and in small companies. Urinary MDA excretion was elevated in 26% of workers, despite airborne isocyanate exposure levels generally below the OSHA PEL, raising questions about resuspension of particulates, dermal exposure, or intermittent exposures to overspray aerosols. Importantly, glove and coverall permeation studies showed good protection with protection factors ranging from 100 – 1000 for nitrile gloves and breathable coveralls, noting better performance for nitrile gloves greater than 5 mil thickness to reduce tear.

**Test Bench**  
**University of California at San Francisco**

The noise, vibration, and dust generated by drilling into concrete can lead to injuries and illnesses. Researchers have developed a systematic, laboratory based, test bench robotic system that drives an active drill into concrete while simultaneously measuring these health-related exposures and productivity. In Year 3, extensive testing demonstrated the adverse impact of drill bit wear on silica exposure, noise exposure and productivity. Importantly, drill bit wear cannot be accurately assessed by visual inspection. Next steps will include working with industry and contractors to determine whether wear markers built into the drill bits or other approaches would make it feasible to identify appropriate times for users to replace them.