

The background of the entire page is a photograph of several large construction cranes. The cranes are primarily blue and red, with long, lattice-structured jibs extending upwards and outwards. The perspective is from a low angle, looking up at the cranes against a clear, light sky. The cranes are in various stages of operation, with some cables and pulleys visible. The overall scene is one of active construction work.

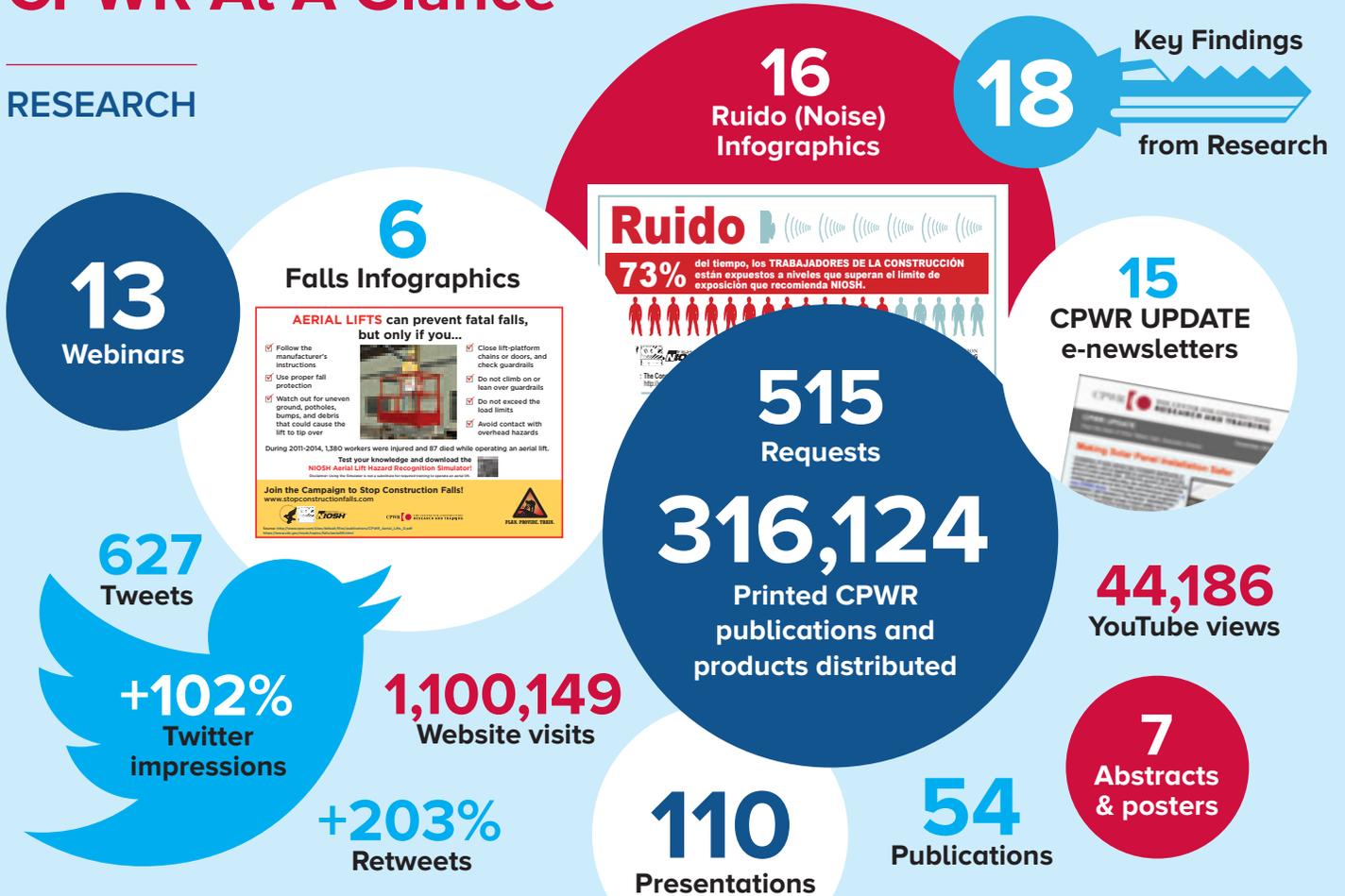
HIGHLIGHTS 2017

Advancing Construction Safety & Health

CPWR  THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

CPWR At A Glance

RESEARCH



TRAINING



SERVICE since program began...

36,000+
Construction worker screenings

4,000+
Low-dose CT scans

99%
Satisfaction rate

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Foreword

What makes CPWR unique? What makes CPWR's research program stand out among all the university departments and think tanks across the country where men and women are investigating workplace safety and health problems?



The answer to those questions is simple: CPWR never loses sight of the fact that our work isn't just an academic exercise – it's about **advancing construction safety and health**. CPWR researchers, whether university-based or on the CPWR staff, are keenly aware that the purpose of our work is to protect construction workers on the job.

Many academics consider their work a success if they publish the results in a respected journal. CPWR researchers think differently. To be sure, they publish many solid papers exploring construction safety and health topics – far more than any university department. But for our research team, that's just the beginning of our work. Until the research is translated into fewer injuries and diseases among our nation's construction workers, the job is not done.

CPWR is uniquely positioned to make that impact, because it is more than a research institution – it also provides service and training programs:

- ✓ CPWR and the NABTU affiliates operate the nation's largest construction occupational safety and health training network. Last year the network's trainers delivered safety and health instruction to tens of thousands of construction workers across the nation. Through the Trainers and Researchers United Network (TRU-Net) these trainers and their students provide valuable feedback to researchers working on safety and health issues related to their trades.
- ✓ Every year, our Building Trades Medical Screening Program (BTMed) provides exams for thousands of construction workers formerly employed on our nation's nuclear weapons sites. Many former workers owe their lives to this essential program because clinicians diagnosed early signs of cancer or respiratory ailments. The experience gained from administering this program has, in turn, given CPWR valuable information about chronic occupational illness in the construction workforce.
- ✓ To make an impact on the jobsite, contractors need effective and practical solutions to jobsite hazards. Through industry partnerships, such as our r2p partnerships in masonry and roofing, CPWR brings labor, large and small contractors, researchers, and other stakeholders together to address industry hazards and identify research needs. Leading general contractors are inviting CPWR experts to major projects for site visits, providing additional insight into the industry's safety and health climate in the field. All employers in our industry can improve their safety performance and jobsite safety climate by using our free *Safety Climate Assessment Tool* (S-CAT) and *Foundations for Safety Leadership* (FSL) training program.

Since 1990, CPWR has served as the National Construction Center under a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH). Every five years since, NIOSH has opened that role to competition – and each time has placed its confidence in CPWR to carry the program forward. NIOSH is looking for a partner that can do more than just study problems. They want to see the research make an impact on the nation's construction sites – and on that score, no one can compare to CPWR.

SEAN MCGARVEY

*Chairman of the Board and President, CPWR
President, NABTU*

Executive Director's Message

I am pleased to report that *CPWR Highlights: Advancing Construction Safety & Health* is just that – a record of achievement in research, training, and service promoting the safety and health of our nation's construction workers.

As President McGarvey observed, CPWR works with the NABTU apprenticeship and training programs to deliver OSHA outreach training to construction workers across the nation. But we are developing new training materials, as well. Among the year's most important achievements: CPWR launched an Infection Control Risk Assessment (ICRA) Awareness program for workers renovating hospitals and nursing homes. Several union training programs are using the curriculum to prepare workers to do this work while protecting patients from infection – and staying safe themselves. Research and training staff also teamed up to develop noise hazard awareness training materials, informed by a large-scale survey of trainers and union members.

I take a special pride in the work we do for former workers in the Department of Energy complex. For decades, thousands of our nation's construction workers served our country by working on building projects located on nuclear weapons sites operated by DOE. These workers helped us win the Cold War – often at the expense of their own health. In this report you'll read how we have provided more than 36,000 free medical screening exams to these at-risk former workers, helping many to obtain timely care for serious illnesses.

We are now in the third year of our five-year research program. The preliminary research is complete, and many of our researchers are leveraging the results of their studies to develop and test practical applications to make tomorrow's worksites safer than those of today. One team has completed their work assessing construction safety and health training offered through Career and Technical Education (CTE) programs across the United States. They have produced a guide for CTE administrators and instructors, *Your Construction Safety Program: Safe Students, Safe Workers*, that will help these programs prepare their students for safety before they even set foot on the jobsite.

In the research section of the report you will also learn about other ways we are **advancing construction safety and health**:

- ✓ More than 15,000 users a month are turning to *Work Safely with Silica*, our one-stop web resource for information on the hazard and an online tool contractors can use to generate the written control plan required by the silica standard.
- ✓ Safety trainers have used CPWR's *Foundations for Safety Leadership* (FSL) elective module in more than 400 OSHA 30-hour Construction Industry Outreach Training classes, reaching more than 4,000 construction foremen and lead workers with lessons on how to be safety leaders on the job.
- ✓ Early research findings are proving that safety and productivity can go hand-in-hand: replacing dull bits with sharp ones when drilling concrete has been found to speed up the work while reducing the drill operator's exposure to harmful noise, dust, force, and vibration.

On a personal note, I want to thank everyone who helped make my first year as executive director a success, including our federal agency, employer, and union partners. I am especially appreciative of CPWR's amazing staff and our former executive director for making CPWR a truly exceptional organization. I am proud to share with you the many ways CPWR is **advancing construction safety and health** – in 2017 and into the future!

Chris Cain, CIH
Executive Director

RESEARCH

Making an Impact through Research and Practice

Working in close coordination with NIOSH, our current research program is **advancing construction safety and health** by developing and evaluating new interventions, and actively promoting their use with target audiences – those who could benefit the most – using novel and diverse dissemination methods.



COURTESY OF WASHINGTON UNIVERSITY IN ST. LOUIS

In year three of our current grant cycle, we increased our work with intermediaries, including tool and equipment manufacturers, safety and health trainers, Career Technical Education instructors, and insurance companies, to help us reach the workers and contractors in a position to take action. We completed one research project, launched several new research-based tools and resources, further explored emerging hazards, and evaluated new programs and equipment. Throughout, we engaged industry partners to ensure the *real-world* usefulness and viability of research findings and products, increase our understanding of r2p (Research to Practice) and p2r (Practice to Research), and position our research to have a positive impact on construction safety and health.

Safe Students, Safe Workers

Career Technical Education (CTE) construction programs are one of the few places outside apprenticeship programs where new construction workers receive training or preparation before their first day on the job. Until now we knew little about the quality and effectiveness of the safety and health training these programs provide.

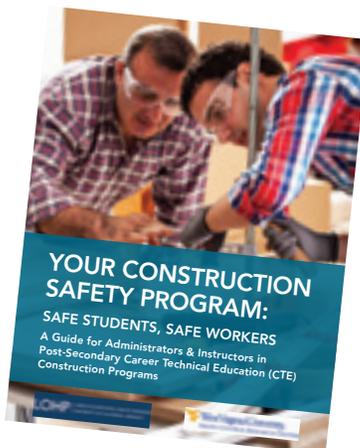
Through this project, we set out to identify the core program elements of quality safety and health education in construction CTE programs, and surveyed the field to assess their use. With help from partners such as the National Council on Workforce Education (NCWE) and the Association for Career and Technical Education

(ACTE), we collected 71 administrator surveys and 201 instructor surveys across 63 CTE programs.

We found some good news. Instructors are aware of the need for quality health and safety training

and committed to hands-on skills training. They feel supported by their administrators and, to some extent, by their Industry Advisory Councils. Administrators and instructors care about their students, want them to be protected in their programs, and want them to learn the skills needed to work safely on the jobsite. Many schools also earned high marks for supporting instructors in their professional development and ensuring effective classroom teaching.

However, CTE programs face challenges as well. Systems for health and safety at many community colleges and technical schools are not as strong as they need to be.



We learned that:

- ✓ Each school's safety and health management system sets the tone for what students learn – leading by example is critical. Yet a significant number of the schools had gaps in their own safety programs. Some lacked systems of regular inspections for hazards and near-misses; some failed to involve key players in investigations of hazards and injury or near miss incidents; and others did not show a clear commitment to implementing engineering controls rather than relying on personal protective equipment (PPE).
- ✓ A substantial minority of instructors lacked support for developing their teaching skills, as well as training and resources to ensure effective integration of safety and health training – including the Occupational Safety and Health Administration (OSHA) 10-hour training so widely adopted in the industry.
- ✓ In a number of classrooms, OSH critical thinking skills such as job hazard analysis and the importance of using engineering controls where possible were not well-covered, and many programs devoted little time to self-advocacy and problem-solving skills students need on the job.

Using what we learned, we developed *Your Construction Safety Program: Safe Students, Safe Workers*, a guide designed specifically for CTE administrators and instructors. The guide provides information about 14 key program elements that support strong safety and health training for students – elements aimed at the school, instructor, and classroom/curriculum levels, as well as those needed in internship or work-based learning experiences. For each

COURTESY OF DIANE BUSH/SKILLSUSA

CTE construction students compete at the 2017 SkillsUSA National Leadership and Skills Conference



“I am going to send the guidebook out and incorporate it as part of my professional development plan for my teachers and have them turn in their safety plan, including how they would conduct investigations.”

– Workshop Participant and State Program Director, Skilled Trades and Technical Sciences

program element, the guide includes: a description of the element based on our research and recommended practices; selected data from the survey results describing how CTE construction programs are doing today; action steps and recommendations for improvement; and links to resources that will help CTE administrators and instructors implement these steps. We also created online self-assessment tools and short handouts for both administrators and instructors. After a 10-minute assessment, individuals receive a short report about where their program is doing well and where improvements are needed.

Since publication we have worked to promote safety and health awareness

among the nation's CTE community. We sent links to the guide and assessment tools to 850 CTE construction administrators and instructors at post-secondary programs around the country, and have conducted six webinars and workshops at leading CTE events such as the SkillsUSA, NCWE, and ACTE conferences. Using our media packet (sample newsletter articles, social media and email communications, and a postcard), the research team and partner organizations continue to spread the word about the research and resources for improving OSH in CTE construction programs.

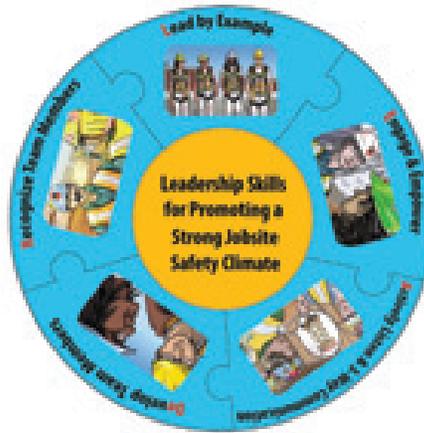
PROJECT: OSH Education in Post-secondary CTE Programs (University of California, Berkeley)

Organizing the Work to Protect Workers

We can go a long way towards **advancing construction safety and health** with training, procurement, and safety and health management choices. CPWR researchers are exploring how to use these opportunities to improve safety culture and climate and reduce occupational injuries and illnesses on America’s worksites.

Foundations for Safety Leadership (FSL) Training Takes off as OSHA Outreach Elective

Many foremen and other frontline supervisors learn about common construction safety hazards by taking the OSHA 30-hour outreach training course – but until recently they were not learning the skills they needed to be effective jobsite safety leaders. To address this need, we partnered with industry stakeholders and academics to create the 2.5-hour *Foundations for Safety Leadership* (FSL) training course. The FSL helps construction companies have a strong safety program and safety climate by teaching their foremen and lead workers to understand and use safety leadership skills on the jobsite. Since its release,



the FSL has taken off across the building industry. On January 1, 2017, OSHA included the FSL as an elective

in the 30-hour Construction Outreach Training Program. OSHA reports that outreach instructors have taught over 400 FSL classes, reaching close to 4,000 foremen and lead workers. In addition, a growing number of companies have incorporated the FSL curriculum into their own training programs. This year, the research team enhanced the FSL with new supplemental materials, including toolbox talks and a train-the-trainer presentation, and promoted awareness of the program with industry audiences across the U.S. and Canada.

Project: Enhancing Safety Climate through Leadership (CPWR)



Dimeo Site Safety Manager Justin Griffith teaches project crew leaders about safety leadership with the FSL.

“Foremen seem a lot more engaged with the employees now. So they’re actually getting input, ‘How can we fix this?’ So somebody brings something to them and they come up with ideas on how to get it corrected.”

–Richard Coakley, Corporate Safety Director, Gaston Electrical

Using Leading Indicators to Select Safe Contractors

COURTESY OF RESEARCH TEAM



Jamie Tessler and Alvin Liu from the ACES research team visit a Gilbane Construction site during Safety Week.

Our ACES (Assessing Contractor Safety) project aims to **advance construction safety and health** by making *leading* safety indicators – rather than lagging indicators, such as injury rates – a practical tool for screening contractors and subcontractors. The ACES pre-qualification procedure helps buyers of construction services evaluate and score the safety management systems of prospective contractors and subcontractors. In year three, the team pilot-tested and refined the ACES method with project owners, general contractors, and subcontractors, with additional input from labor unions, safety professionals, and insurance providers. The team also began taking the next step: proving that ACES can predict safety performance. An analysis of 2,198 construction companies from an existing pre-qualification tool showed that those with better safety management systems in place also experienced fewer recordable occupational injuries.

Project: Development and Evaluation of Contractor Safety Pre-Qualification Tool (Northeastern University)



Online Tool Lets Contractors Compare Safety Climate with Industry Benchmarks

In August 2016, we published the second version of our safety climate workbook, *Worksheets and a Rating Tool to Help You Strengthen Jobsite Safety Climate*, which includes the *Safety Climate Assessment Tool* (S-CAT). To increase the availability and use of the S-CAT, in year three we developed the S-CAT website. Contractors, safety and health professionals, and others can use the website to learn about safety climate, get ideas for how to improve their safety climate, and – most importantly – take the S-CAT. Once they complete

the 36 items in the S-CAT they receive an individual or company report comparing their scores to those of other respondents in the database. To date we have more than 1,400 responses in the S-CAT database. We are now in the process of creating

tailored versions of the S-CAT for particular audiences by translating the S-CAT into Spanish and working with our Roofing r2p Partnership on an S-CAT for Small Contractors (S-CAT^{SC}) (page 13).

Project: Improving Jobsite Safety Climate through Research and Research-to-Practice (CPWR)

“This survey and the suggestions for improvement have been a great tool for strategic planning of our safety program.”

–Steve Huntzinger, Director, Environmental, Health & Safety, IPS-Integrated Project Services

Protecting a New Generation

All too often, construction workers who have spent a career in the trades suffer from painful and disabling musculoskeletal disorders. Our *Safety Voice for Ergonomics* (SAVE) project seeks to teach masonry apprentices just starting their careers how to identify ergonomic hazards and use their “safety voice” to speak up and take action. The Masonry r2p Partnership (page 14) is working with the researchers and helped review and pilot-test the curriculum. In year three, the research team began a randomized control trial of the completed training program. Bricklayer apprentices at twelve training centers across the country received the full program (ergonomics and safety voice training), ergonomics training alone, or no training (the control group). Participants



COURTESY OF EASTERN WASHINGTON UNIVERSITY

The SAVE program teaches apprentices to talk to their foremen about ergonomic hazards on the job.

completed follow-up questionnaires at two weeks, three months, and six months to measure the maintenance of knowledge and SAVE adoption. In

year four, the team will begin analyzing results from the trial.

Project: SAVE (Eastern Washington University)



COURTESY OF WASHINGTON UNIVERSITY IN ST. LOUIS

Project lead Ann Marie Dale consults with Clayco Inc. superintendent Bob Hohlman and his colleague Scott Sams.

Moving from Words to Actions on Ergonomic Hazards

In St. Louis, we are exploring how general contractor safety and health management programs shape the safety climate and safety practices of their small and medium-sized subcontractors. Year three saw some promising early findings: general contractors with strong safety programs require their subcontractors to adopt new injury prevention practices, and the subcontractors often retain those practices after they move on to new work. However, we are learning that even the best safety and health management programs are not effectively tackling injuries that could be prevented by better work design. At one contractor, for example, even though sprains and strains accounted for 30% of injury and disability costs, only 3% of safety talks addressed ergonomic issues. In year three, the team worked with general contractor Clayco Inc. to integrate ergonomics into all levels of the company’s safety and health management plan. The company has adopted the program, and the team will analyze the results in year four.

Project: Interventions to Improve Safety Climate and Ergonomics in Construction Small and Medium Sized Contractor Enterprises (Washington University in St. Louis).



CPWR Creates New Data Source from NIOSH FACE Reports

Our Data Center researchers developed the Construction FACE Database to tap the rich information from the NIOSH Fatality Assessment and Control Evaluation (FACE) program. The contents cover construction fatalities reported between 1982 and 2015 by FACE investigators. An analysis of the FACE data found that falls accounted for 42% of the fatalities in the database. More than half (54%) of the construction workers who suffered a fatal fall had no personal fall arrest system (PFAS) available.

Project: Data Tracking (CPWR)

Crunching the Numbers

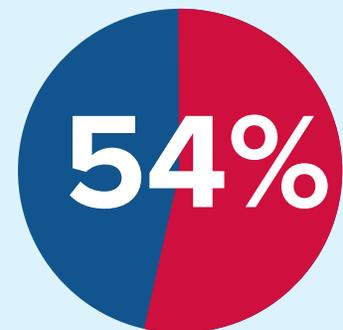
CPWR's Data Center works tirelessly to examine data from the Bureau of Labor Statistics, the Census Bureau, OSHA, and many other sources to identify injury and illness trends and study issues related to safety and health among construction workers.

Since 2015, the Center's well-received *Quarterly Data Reports* and webinars have provided updated data and user-friendly materials to construction stakeholders. These reports, including an ongoing series covering each of OSHA's "Focus Four" construction hazards, have informed multiple stories in trade publications. The coming year will see publication of the sixth edition of *The Construction Chart Book: The U.S. Construction Industry and its Workers*.

Data Center Discovers Construction Workers Are Postponing Retirement

The ability to work is a major issue for older workers in the construction industry. Our Data Center analyzed data from the *Health and Retirement Study* and found that workers in the baby boomer generation expect to retire later than their predecessors, with some 43% of construction workers planning to work past age 65.

Project: Disparities Research (CPWR)



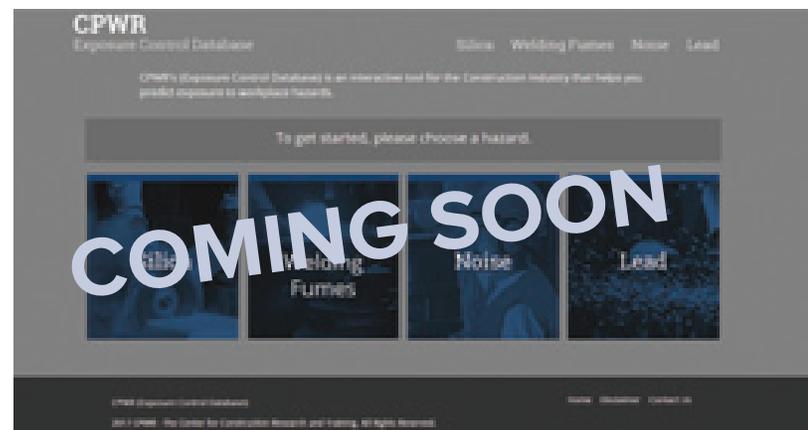
A review of NIOSH FACE Reports between 1982 and 2015 found that more than half the construction workers who died in workplace falls had no personal fall arrest system available.

Practical Solutions for Worker Safety

Basic research can help inform the breakthroughs of the future, but the building industry needs solutions to prevent occupational injuries and illnesses today. CPWR is leading the way, **advancing construction safety and health** with practical ways contractors can protect workers from harmful exposures on the job.

Exposure Control Database Will Give Contractors a New Tool to Target Health Hazards

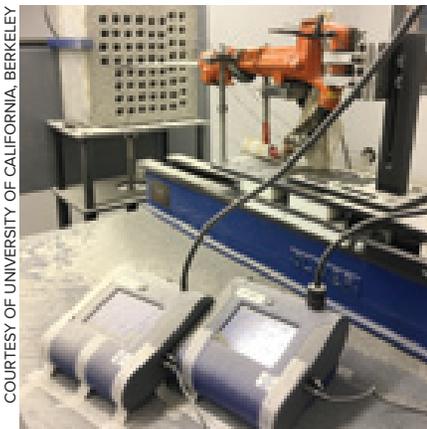
Our **Construction Solutions** program is designed to get actionable information into the hands of construction contractors. During year three, we continued to grow the Construction Solutions database, adding 24 evidence-based solutions for common construction hazards – including overhead power line proximity warning devices to prevent electrocution, guards to prevent falls through skylights, and tool lanyard systems to prevent injuries caused by dropped objects. We are also **advancing construction safety and health** by building an exposure control database of common construction health hazards, beginning with silica and welding fumes. By mining peer-reviewed publications and government reports, our research team has gathered real-world exposure data for dust- and fume-generating tasks. In year four, we will build on this foundation with exposure data submitted by construction contractors and other stakeholders, and expand the contents to include noise and lead. The completed database will permit



contractors, construction professionals, and others to review past exposure assessment data for a particular task, predict worker exposure to the hazard, and choose the right controls to keep workers safe on the job.

Project: Construction Solutions (CPWR)

Protecting Workers while Improving Productivity



Researchers proved that using sharp drill bits reduced worker exposure to dust, noise and vibration, while improving productivity.

Rotary hammers and hammer drills are used extensively in commercial construction for drilling into rock and concrete. They also generate noise, dust, force and vibration that can harm the drill operator's health. Using an automated test bench system, CPWR is measuring these exposures and exploring how to reduce them. This year we examined drill performance using both sharp and dull drill bits. Our researchers found that the dull bits generated about twice as much airborne silica dust as sharp ones, and that sharp bits were quieter and caused less handle vibration. Moreover, the sharp bits were significantly more productive than dull ones, penetrating the material quicker. The research points to an immediate application in the field: a drill bit replacement program that swaps dull bits out sooner can protect worker health while improving productivity.

Project: Test Bench for Evaluating Concrete Drilling Methods (University of California, San Francisco)

Looking Toward the Future – Safeguarding Construction Worker Health

New technologies are transforming construction materials and methods. While these advancements can make our structures more durable and energy-efficient, emerging technologies can create new hazards. Our researchers are exploring new materials to identify and address the hazards early in order to protect worker health.

Nanomaterials in Construction: Spreading Awareness and Managing Risk

Although rarely listed on Safety Data Sheets, tiny engineered nanoparticles are being added to a growing number of construction materials – with unknown health consequences for the workers who use them. Our nanotechnology in construction team has already identified 560 construction products on the market that are reported to contain nanomaterials, and has made the growing list available to stakeholders and the public through the **eLCOSH Nano** website. This year, we began producing a series of toolbox talks to increase contractor and worker awareness of the potential risk and protective

measures. We also presented findings to audiences as diverse as the National Roofing Contractors Association, the International Union of Operating Engineers, and the Society for Risk Analysis. The team is continuing exposure testing of nano-enabled construction materials and supporting small studies examining worker awareness of nanotechnology applications in construction (page 15) and assessing the effectiveness of N95 respirators against airborne nanoparticles.

Project: Nanomaterials in Construction: Tracking Product Diffusion and Measuring Exposures (CPWR)



EARL DOTTER/CPWR

CPWR researchers are measuring worker exposures to paints and stains containing nanomaterials.

Protecting Workers from Reactive Chemicals in Insulation



COURTESY OF RESEARCH TEAM

Workers applying paints and coatings are also exposed to reactive chemicals.

The chemical resins used to cure spray-polyurethane foam (SPF), including isocyanates, can put workers at risk of occupational asthma and skin disorders. Previous CPWR research documented this hazard. Today we are **advancing construction safety and health** by measuring worker exposures during construction tasks and testing protective measures. Researchers used air sampling, glove testing, and urinary biomarkers to assess the isocyanate and flame retardant exposures faced by workers spraying and trimming SPF insulation. They found that these workers had a high risk of exposure through the skin, and that proper gloves and coveralls can protect workers from exposure through this route. The team also began testing worker exposure to reactive chemicals when applying paints and coatings.

Project: Assessment and Control of Exposures to Reactive Chemical Resins in Construction (University of Massachusetts, Lowell).

Making an Impact through r2p and Partnerships

Through our Research to Practice (r2p) initiative we continued to promote use of research findings with target audiences, develop translational products, and explore new ways to **advance construction safety and health** and measure impact.

This year's r2p Seminar and Partnership Workshop, *From Research to Practice: The Impact*, once again received high marks from participants, and provided stakeholder partners, Research Consortium members, and NIOSH researchers – including ones from the Mining Program – with an opportunity to share their research findings, learn about new tools and resources, and discuss the potential for impact. As one participant noted, it was an “[e]xcellent program. [I] attended both afternoon breakout sessions & felt there was great dialogue in both.”

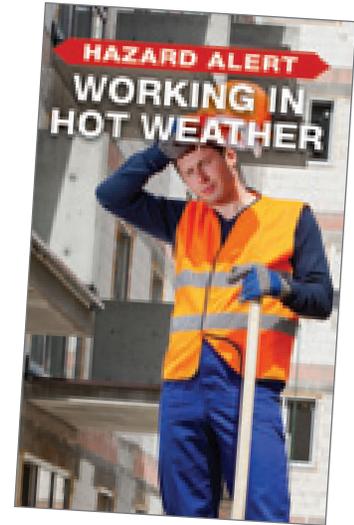


Online Construction Safety & Health Network: Sharing Solutions – Making Connections

Successful collaborations and r2p partnerships prove that when organizations and individuals work together, they can reach and influence a larger number and wider variety of stakeholder audiences than they could on their own. Our new online Construction Safety & Health Network (Network) builds on lessons learned by creating a mechanism to more efficiently connect safety- and health-minded individuals and organizations, and providing a central platform for easily sharing and disseminating

research findings. Since 2015, we have solicited input from potential participants on the Network's concept, structure, and function. This year we held a web-based meeting with a group of individuals who participated in the 2016 r2p Partnership Workshop to get their advice as we moved from the conceptual to the developmental phase. So far, 45 individuals have filled out the form to join the Network, which is scheduled for an early 2018 launch.

Project: Prevention Partnerships in r2p (CPWR)



CPWR Hazard Alerts are designed with clear communication in mind and targeted to construction worker audiences.

Clear Communication for Key Audiences

Our work to identify best practices for communicating with different construction audiences continued to progress. Using tested health communications instruments including the *CDC Clear Communication Index (CCI)*, we assessed the readability and suitability of several types of construction worker safety training materials already in use. The findings indicated both strengths and weaknesses in these materials and informed both the development of new materials for workers and a new communications tool for researchers and safety trainers, *Clear Writing for a Construction Audience*. In addition, we continued to expand the list of construction opinion leaders subscribing to our e-newsletter, attending our webinars, engaging with our social media channels, and requesting our Hazard Alert cards for training classes or toolbox talks.

Project: Communications Plan (CPWR)

Our industry partnerships continued to provide opportunities to disseminate research, develop and pilot new translational products, and identify research needs.

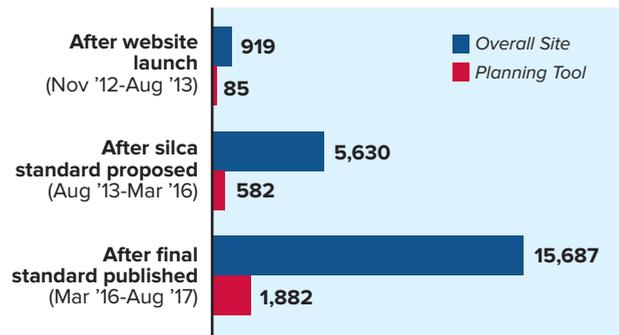
r2p Working Group’s Work Gets Industry Attention

The **Work Safely with Silica** website, one of the first translational projects undertaken by the OSHA-NIOSH-CPWR **r2p Working Group**, was included in OSHA’s *Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction* as “a tool to help employers develop written exposure control plans” required by the standard, and is listed as a recommended external resource on OSHA’s website. Use of the site, which had increased steadily since its launch, exploded to more than 15,000 sessions per month after the standard was released. Contractor associations, unions, insurance companies, and equipment manufacturers have actively promoted the site. Tool giant Hilti translated a white paper on silica that we co-authored into Spanish, distributed it to clients, and promoted it at *World of Concrete*. Bosch’s redesigned website and promotional materials feature our silica website and our research prominently. The r2p Working Group also initiated a pilot social network analysis of the *National Campaign to Prevent Falls in Construction*. This innovative evaluation approach will help us learn about the network of relationships utilized in support of the Campaign, including increasing our understanding of how information flows through the network and contributes to a campaign’s success. In addition, we successfully completed the pilot of our Trainers and Researchers United Network (TRU-Net) and related noise and hearing loss surveys, and developed a series of training resources on noise hazards and hearing loss prevention (page 16).

Project: r2p Coordinating Project (CPWR)



Work Safely with Silica Website Activity Average Sessions per Month



Roofing r2p Partnership: Responding to Small Contractors’ Needs



The *RF Radiation Program for the Construction Industry*, the first project developed under the guidance of our **Roofing r2p Partnership**, continued to generate strong interest from roofing and other industry sectors. More than 5,700 of the Program’s Hazard Alert cards were distributed during the year, the video was viewed 2,355 times, and the other Program elements were downloaded 1,817 times. In addition, 70 trainers, representing a cross-section of trades, participated in a train-the-trainer session and were given the entire Program on a flash drive to use with their trainees. This year the Partnership began focusing on the needs of small contractors by adapting CPWR’s *Safety Climate Assessment Tool* (S-CAT) for use by small employers (page 7). The **S-CAT^{SC}** includes a workbook and online survey instrument to collect information, generate reports, and identify where small contractors need help. We have pre-tested the S-CAT^{SC} with roofing industry representatives, and are now pilot-testing the revised tool. This new product is already generating interest from other construction sectors.

Project: Prevention Partnerships in r2p (CPWR)

Masonry r2p Partnership: Measuring Impact

A survey of the International Union of Bricklayers and Allied Craftworkers' Labor-Management Craft Committees documented the **Masonry r2p Partnership's** success in promoting resources such as the **Work Safely with Silica** (page 13) website: 85% of respondents were aware of the website, and 80% had either used it or planned to use it. A separate survey conducted by the Partnership of masonry

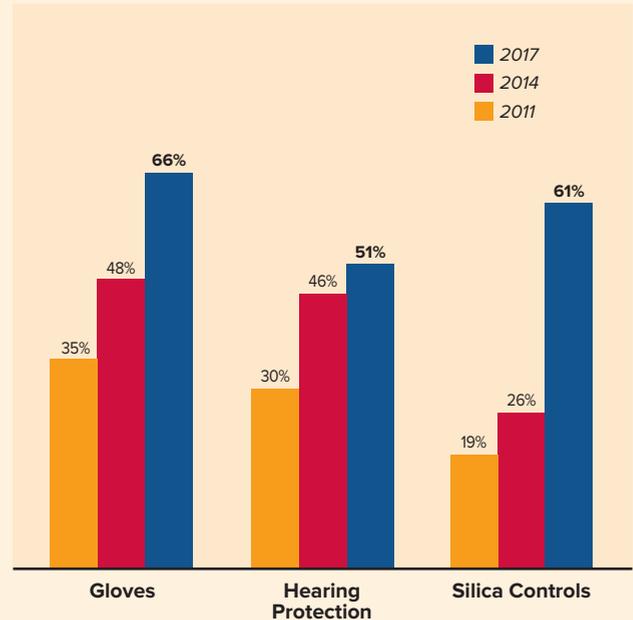


workers also showed increasing awareness of hazards and use of selected interventions. Since the 2011 baseline survey, **the percentage of workers saying they “always” use gloves (to prevent dermatitis and hand injuries) increased from 35% to 66%**; use of hearing protection

increased from 30% to 51%; and use of water or vacuums to control silica dust increased from 19% to 61%. The Partnership continues to support CPWR and NIOSH research projects on ergonomics, silica controls, and mast climbers.

Project: Prevention Partnerships in r2p (CPWR)

Masonry r2p Partnership Survey Workers Saying They “Always Use...”



Research to Practice in Action

Work progressed on our Ergonomics Community of Practice's social marketing initiative to reduce manual materials handling (MMH) – a leading cause of disabling injuries. Interviews with leading safety-minded contractors



identified new opportunities to promote safe MMH practices and informed development of new planning tools – and innovative worker training resources, such as microgames, that reinforce safe lifting practices. This new program, *Best Built Plans*, also offers a platform for disseminating other CPWR ergonomics research findings and products (page 8) and

addressing industry partner priorities. A survey of labor and contractor representatives conducted by the Masonry r2p Partnership, for example, identified reducing back and shoulder injuries as one of their top two priorities (controlling silica dust was the highest). Survey participants said they needed more information on work practices and

equipment available to prevent these types of injuries, and jobsite training materials such as toolbox talks and handouts – all of which are included in the new MMH social marketing program. We will work with intermediaries to implement the program in 2018.

Project: Prevention Partnerships in r2p (CPWR)



A “microgame” lets workers practice safe lifting skills on a smartphone.

Small Studies Address Wireless, Solar Technologies

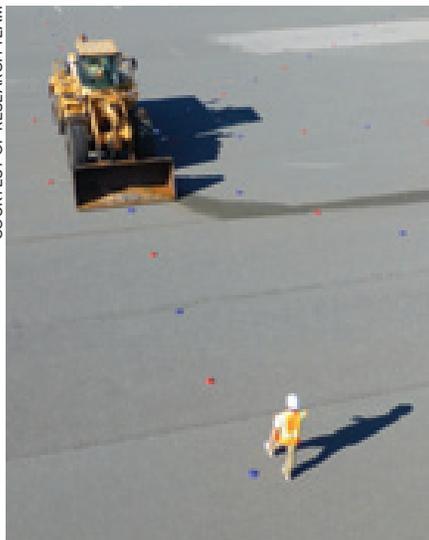
Our Small Study Program creates opportunities for members of our Research Consortium and others interested in doing safety and health research for the construction industry to explore promising new technologies and investigate emerging hazards and issues.

A Wireless Warning System to Reduce Heavy Equipment Struck-by Injuries

OSHA describes struck-by injuries as one of construction's "Fatal Four" leading causes of death on the job. To reduce the risk of workers being struck by heavy equipment on busy jobsites, researchers designed and tested a proximity sensing and alert system using Bluetooth Low Energy (BLE) technology. In field tests the system successfully monitored the location, direction, and speed of moving equipment, and alerted equipment operators and workers on the ground to approaching collision hazards.

Project: Improving Work Zone Safety Utilizing a New Mobile Proximity Sensing Technology (Georgia Institute of Technology)

COURTESY OF RESEARCH TEAM



Researchers test the proximity warning system using different approach angles.

Using Prevention through Design (PtD) to Protect Solar Panel Installation Workers

Installation of solar panels has increased significantly in recent years, and is expected to continue to grow. The workers who install the rooftop panels are at risk of falls and electrical hazards. The research team interviewed workers, contractors and engineers in the industry to identify choices during the design process that can reduce worker exposure to injury during construction. Based on the findings, the team created a short guide for industry use – *Safety Protocol: Prevention through Design for Safety in Solar Installations*.

Project: Applying Prevention through Design (PtD) to Solar Systems in Small Buildings (University of Washington and Oregon State University)

What's Next?

Small studies currently underway are looking at a wide range of issues, including:

✓ **Holographic visual interaction and remote collaboration in construction safety and health.**

Researchers at West Virginia University are assessing the feasibility of applying the mixed-reality technology in safety and health communication at construction jobsites.

✓ **Nanotechnology: Assessing awareness/training needs among California construction trades.**

Researchers at the California State Building and Construction Trades Council are evaluating workers' current understanding and use of nanotechnology applications in construction to identify training needs.

✓ **Ergonomic stressors and back injury risk factors in construction glass and glazing work.**

Researchers at the University of Nebraska, Lincoln are identifying and ranking ergonomic risk factors, focusing on back stresses that can lead to work-related injuries.

For a complete list of small studies underway visit www.cpwr.com/small-study-program/whats-next.



TRAINING

Training Advances Construction Safety and Health on the Worksite

Working in collaboration with NABTU, we operate the nation’s largest safety and health training network. Thousands of trainers across the United States are **advancing construction safety and health** by delivering training to construction workers in every trade. This year our training programs collectively conducted 6,133 classes, providing training directly or through our affiliated unions to 1,177 trainers and 78,702 workers.

Through the Trainers and Researchers United Network (TRU-Net), CPWR engaged our extensive network of safety and health trainers in collecting valuable data and in identifying future research needs. As part of an effort to tackle noise hazards in construction, we surveyed 4,195 trainees across a variety of construction trades to assess their awareness of noise hazards and to learn about current noise and hearing loss prevention training. This survey, which was a follow-up to an earlier survey of trainers, showed that workers benefit from noise and hearing loss prevention training, and supported the earlier finding that trainers need additional noise training materials to improve worker retention of safety messages.

OSHA Training

Program Brings Hazard Awareness to More Than 67,000

Our training program brings essential OSHA 10-hour and OSHA 30-hour training to tens of thousands of construction workers each year by tapping into NABTU’s extensive network of apprenticeship and training programs. As an OSHA Training

Institute Education Center, we team up with the master trainers from every trade, who in turn train a small army of outreach instructors. The outreach instructors fan out to deliver safety and health training in every corner of the nation. The numbers are staggering.

This year we delivered 57 OSHA 500, 502, and 510 “Train the Trainer” classes to 892 trainers. Our network of outreach trainers delivered 5,407 OSHA 10- and 30-hour classes to 67,533 construction workers, foremen, and supervisors.

Year of Record Storms – A Timely Reminder to Be Prepared



In a year when deadly storms battered many U.S. states, CPWR continued teaching our nation’s construction workers how to avoid special hazards created by natural disasters.

Harvey. Irma. Maria. Americans won’t soon forget the series of hurricanes that laid waste to stretches of Texas, Florida and Puerto Rico during 2017. Our Hazmat Disaster Preparedness Training Program ensures that construction workers clearing disaster zones and rebuilding devastated communities are prepared for the occupational hazards they will encounter. This year, we used the *Disaster Site Worker Curriculum* to conduct 81 classes for 1,156 students. Policymakers tapped our expertise in this area as well – we participated in National Advisory Committee on Occupational Safety and Health (NACOSH) efforts to draft regulatory text for an *Emergency Response and Preparedness Standard*. This committee has recommended that the Secretary of Labor adopt the draft standard.

Environmental Hazard Training

The National Institute of Environmental Health Sciences (NIEHS) supports our Environmental Hazard Training Program, Environmental Career Worker Training Program, and Hazmat Disaster Preparedness Training Program through a cooperative agreement.

From Toxic Chemicals to Infectious Diseases, CPWR Training Keeps Construction Workers Safe

In collaboration with our network of 12 international unions, we provide environmental hazard training to ensure workers’ safety when cleaning up hazardous waste. Many of those who receive hazardous waste training are past, present, or future workers on various Department of Energy, EPA Superfund, state-regulated, and privately funded clean-up sites. The courses offered include: asbestos and lead abatement; renovation, repair, and painting of lead-contaminated structures; permit-required confined space entry; disaster cleanup; and work involving chemical and biological hazards. This year we conducted 527 classes and trained 10,832 workers, technicians, and support staff.

Through these training programs, CPWR is able to introduce participants to innovative training resources such as the Wireless Information System for Emergency Responders (WISER) smartphone app. This tool, a product of the National Library of Medicine, puts an encyclopedia of information in the palm of a worker’s hand. WISER enables real-time mapping of simulated hazardous chemical releases, hazardous substance information, and containment and suppression advice.

Our ongoing review of curricula and offerings ensures they include the latest research, regulations, and practices. This year we substantially updated our *Hazardous Waste Instructor Guide*, and portions of

the related training course, and the *Confined Space Instructor Guide*. We also developed an enhanced 24-hour Infection Control Risk Assessment (ICRA) training program for those who work in healthcare facilities.



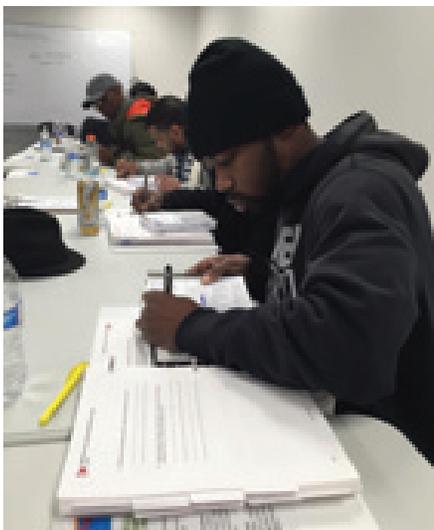
Environmental Career Worker Training Program

The Environmental Career Worker Training Program (ECWTP) gives workers in struggling communities an opportunity to train for a promising career in construction or environmental remediation. In year three, our ECWTP program trained 73 disadvantaged workers in four locations (East Palo Alto, CA; New Orleans, LA; St. Paul, MN; and Flint, MI) in both trade skills and the safe handling of hazardous waste. Participation was a life-changing opportunity for many who had suffered long-term unemployment or underemployment. More than three quarters of the graduates (77%) were placed in jobs at an average wage of \$17.81 an hour. These opportunities last: we have remained in contact with 91% of last year's graduates and learned that 74% of them are still working in construction or environmental remediation careers.



COURTESY OF SARAH LECHOWICH

ECWTP students practice decontamination in St. Paul, MN.



COURTESY OF SARAH LECHOWICH

The ECWTP program includes both classroom and hands-on training. Above, participants do an exercise using the NIOSH Pocket Guide to Chemical Hazards.

In East Palo Alto, ECWTP a Path to Carpentry Career

For Lushorn Lee, a 38-year-old mother of seven, the East Palo Alto, California ECWTP has been a ticket to a career as a skilled carpenter. After being lauded for perfect attendance and winning “trainee of the month,” she graduated in 2014 and entered the United Brotherhood of Carpenters’ (UBC) apprenticeship program. Lee is now a second-year apprentice carpenter with the UBC, earning an hourly wage of \$42. Her new career is opening opportunities for her children: she’s using her salary to send two of them to college.

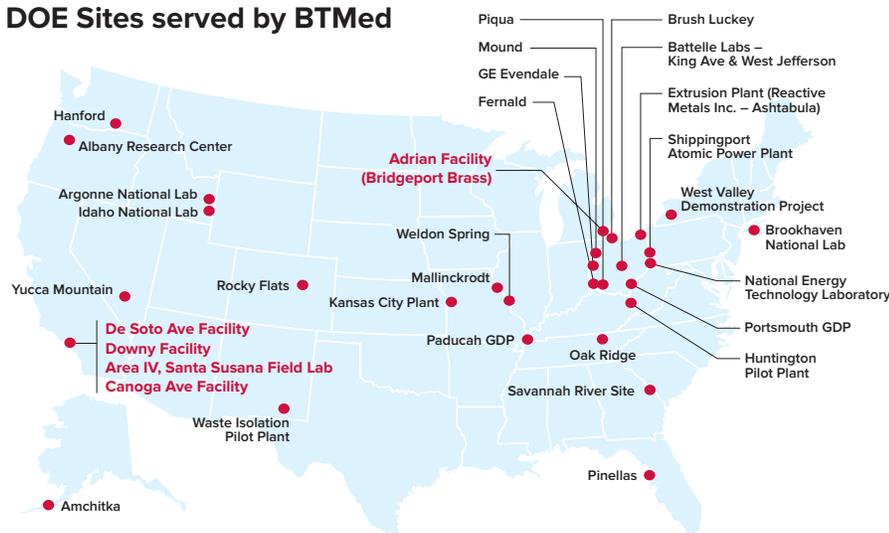


SERVICE

BTMed Expands Screenings to Five New Sites

The Building Trades National Medical Screening Program (BTMed) provides no-cost medical exams to construction workers formerly employed on Department of Energy (DOE) nuclear facilities.

DOE Sites served by BTMed



These sites, where nuclear fuel was processed, were vital to our national defense – but too often, workers on these sites were exposed to chemical and radiation hazards, putting them at elevated risk for occupational illness. Our BTMed program, supported by a DOE cooperative agreement, offers free medical screening services for conditions such as lung cancer, Chronic Obstructive Pulmonary Disease (COPD), and hearing loss. For some workers, this screening can be the difference between life and death (page 20).

BTMed is **advancing construction safety and health** by bringing this important program to more former workers every year. During 2017, BTMed added service at five new DOE sites – four in Southern California and one in Michigan – bringing the total number to 34.

The Numbers

Since its start, BTMed has delivered more than 36,000 exams to more than 25,000 workers across the country. BTMed’s Early Lung Cancer Detection (ELCD) program has conducted more than 4,000 low-dose CT scans for workers at risk of lung cancer. According to the DOE’s latest *Former Worker Medical Screening Program Annual Report*, BTMed conducted more than one fourth of the program’s former worker medical exams. BTMed’s dedication to providing these often life-saving services has earned them a 99% satisfaction rating from the workers they serve.

The importance of BTMed screenings is reflected in the numbers. Of those screened to date:

- ✓ 20% had abnormal chest x-ray findings
- ✓ 40% had abnormal pulmonary function test findings
- ✓ 64% demonstrated hearing loss
- ✓ 1.5% had at least one abnormal beryllium lymphocyte proliferation test (BeLPT)

BTMed’s early lung cancer detection program has identified 32 participants with primary lung cancer – 23 of them in early stages when treatment is most effective. In addition to identifying potentially life-threatening conditions,

this program has contributed to the industry’s understanding of other health issues that affect a worker’s quality of life, including hearing loss.



BTMed CT Scans have identified 23 cases of early-stage lung cancer among workers served by the program.



“You guys provide great service. It gives you peace of mind that someone is aware of problems you might have come across in the industry. I can’t say enough good things about the program. They really care about you.”

–Dwight Threepersons, Hanford, Boilermakers Local 104



“I worked as an electrician at Rocky Flats at various times from 1992 until it closed in 2005. After leaving the plant I took advantage of BTMed. It is a useful exam that monitors important medical conditions.”

–James Perrizolo, Rocky Flats, IBEW Local 68

Oak Ridge Asbestos Worker Goes from BTMed Participant to BTMed Interviewer

“When I started out there, they told me nothing would hurt you.”

When Johnny Ballinger looks at the photograph of the 28 insulators he worked alongside in 1961 at the Oak Ridge Reservation, the impact of the job hits home. Of those 28 men, Ballinger and his brother are the only ones still alive.

“When I started out there, they told me nothing would hurt you,” Ballinger explains. “We didn’t wear but the clothes on our backs.”

During three decades working at Oak Ridge as an asbestos worker out of Local 46, he witnessed the gradual introduction of safety measures. When the EPA took action on asbestos in 1978, respiratory protection came into common use on the site – but by then, it was too late for Ballinger and many of his fellow workers.

“As far as I know, I had the first case of asbestosis in Tennessee back in November of 1968. They say the latency period is 15 years, but it was only seven for me. The doctor even kept the lower lung he removed from me to use as a model.”

Such an experience makes it clear why BTMed is so important to Ballinger and other former DOE construction workers.



Johnny Ballinger, of Heat and Frost Insulators Local 46, worked at Oak Ridge.

Today, Ballinger is helping other former DOE workers by conducting BTMed work history interviews that precede the medical exam.

“Through BTMed, I received the best physical exam I’ve ever had,” says Ballinger. “Any DOE construction worker needs to get in the program right away whether they worked at Oak Ridge or some other DOE site.”

Ballinger has seen many BTMed participants discover illnesses before the symptoms become apparent, in time for early treatment. Moreover, by documenting these work-related illnesses, the screening program has also enabled many workers to file claims with the

U.S. Department of Labor under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA). EEOICPA offers workers medical coverage for the illness from the date the claim was filed and a compensation lump-sum payment.

“It also helps out our local,” Ballinger points out, “because those medical expenses are then covered by DOL instead of our health and welfare fund. That’s a really big asset to our union.”

CPWR Research Project Leads

EXTERNAL

Assessing Public Policy Intervention Impacts on Construction Fatality Rates
John Mendeloff, PhD
University of Pittsburgh

Assessment and Control of Exposures to Reactive Chemical Resins in Construction
Dhimiter Bello, ScD
University of Massachusetts, Lowell

Development and Evaluation of Contractor Safety Pre-Qualification Tool
Jack Dennerlein, PhD
Northeastern University

Interventions to Improve Safety Climate and Ergonomics in Construction Small and Medium Sized Contractor Enterprises
Ann Marie Dale, PhD
Washington University in St. Louis

OSH Education in Post-secondary Career Technical Education (CTE) Construction Programs
Diane Bush, MPH
University of California, Berkeley

Safety Voice for Ergonomics (SAVE)
Daniel C. Anton, PhD
Eastern Washington University

Test Bench for Evaluating Concrete Drilling Methods
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INTERNAL

Communications Plan
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Construction Solutions
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Disparities Surveillance Research; Data Tracking and Support Services
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Enhancing Safety Climate through Leadership
Linda Goldenhar, PhD
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Nanomaterials in Construction: Tracking Product Diffusion and Measuring Exposures
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r2p Coordinating Project; Prevention Partnerships in r2p
Eileen Betit
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Applying Prevention through Design (PtD) to Solar Systems in Small Buildings
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Oregon State University

USGBC's PtD Pilot Credit: Evaluating Effectiveness and Building a Foundation for Implementation
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Annie Pierce, PhD
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Improving Work Zone Safety Utilizing a New Mobile Proximity Sensing Technology
Yong Cho, BSc, MSc, PhD
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Mistakeproofing the Design of Construction Process
Iris Tommelein, PhD
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Nanotechnology: Assessing Awareness/Training Needs among California Construction Trades
Debra Chaplan, BA, MS and Laura Boatman, BA
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Aluminet: Preventing Heat-Related Illness among Construction Workers
Mark Schall, PhD
Auburn University

Silica Nanoparticle Exposures and Respiratory Protection in Construction Jobsites
Atin Adhikari, PhD
Georgia Southern University

Reducing Highway Construction Fatalities Through Improved Adoption of Safety Technologies
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Oregon State University

Holographic Visual Interaction and Remote Collaboration in Construction Safety and Health
Fei Dai, PhD
West Virginia University

Ergonomic Back Injury Risk Factors in Construction Glass and Glazing Work
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iSafe: Using Panoramic Augmented Reality to Create A Virtual Safety Training Environment
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CONTRACTOR ASSOCIATIONS

Associated General Contractors

The Association of Union Constructors

International Council of Employers of
Bricklayers and Allied Craftworkers

Mechanical Contractors
Association of America

National Electrical Contractors Association

National Roofing Contractors Association

North American Contractors Association

Sheet Metal and Air Conditioning
Contractors' National Association

U.S. GOVERNMENT AGENCIES

U.S. Department of Energy

U.S. Department of Labor

Environmental Protection Agency

National Institute for Occupational Safety
and Health, CDC

National Institute of Environmental Health
Sciences

State Departments of Health

LABOR ORGANIZATIONS

NABTU and Affiliated Councils

International Association of Bridge, Structural,
Ornamental and Reinforcing Iron Workers

International Association of Heat and Frost
Insulators and Allied Workers

International Association of Sheet Metal,
Air, Rail and Transportation Workers

International Brotherhood of Boilermakers,
Iron Ship Builders, Blacksmiths, Forgers
and Helpers

International Brotherhood of Electrical Workers

International Brotherhood of Teamsters

International Union of Bricklayers
and Allied Craftworkers

International Union of Elevator Constructors

International Union of Operating Engineers

International Union of Painters
and Allied Trades

Laborers' International Union of North America

Operative Plasterers' and Cement Masons'
International Association of the United
States and Canada

United Association of Journeymen
and Apprentices of the Plumbing and
Pipe Fitting Industry of the United States
and Canada

United Brotherhood of Carpenters
and Joiners of America

United Union of Roofers, Waterproofers
and Allied Workers

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Online Resources



cpwr.com – The first stop for information on our research, training, and service programs, and related products and resources.



elcosh.org – An online library of safety and health materials for construction workers, employers, researchers, and other stakeholders.



safeconstructionnetwork.org – Use this site to connect with others interested in advancing construction safety & health, find new resources or share your own, and identify new research or community partners.



stopconstructionfalls.com – Visit our website and join the ongoing Campaign to Prevent Falls in Construction.



silica-safe.org – A one-stop source of information on how to prevent a silica hazard and comply with the standard, including a free online planning tool to create a silica control plan.



safetyclimateassessment.org – Use this tool to help your company gain a more detailed understanding of its safety climate.



cpwrconstructionsolutions.org – Find practical control measures to reduce or eliminate a variety of construction hazards.



safecalc.org – Evaluate the financial impact of a safer solution using this free online calculator.



nailgunfacts.org – Learn about the potential injuries workers face when using nail guns and how to reduce and eliminate the risks.



ChooseHandSafety.org – Find information on the risk of hand injuries and ways to prevent them, including what to look for when choosing hand tools and gloves.



btmed.org – Learn about the Building Trades National Medical Screening Program and its goal to provide free medical screenings to construction workers who helped build our nation's nuclear defense sites.



esmartmark.org – Contact your international union to access this site created by NABTU to distribute the Smart Mark training curriculum.



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