CPWR

THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

2024 R2P SEMINAR & PARTNERSHIP WORKSHOP

r2p

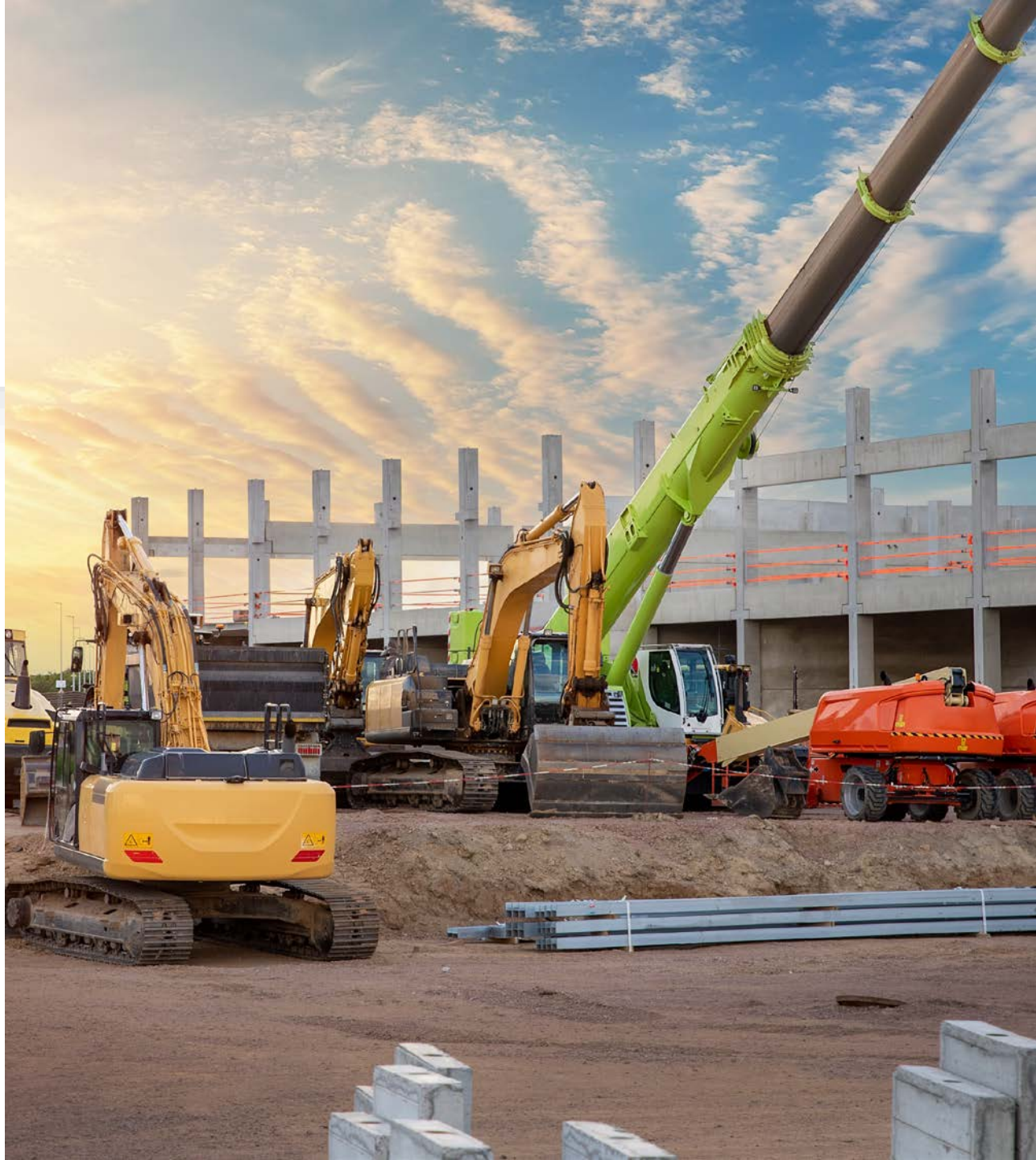
TUESDAY, JUNE 11TH

8:00 – 9:00	Breakfast
9:00 – 9:30	Welcome & Introductions
9:30 – 10:00	Updates from Our Partners
10:00 – 10:45	Research Session #1: Intervention Evaluation Outcomes
10:45 – 11:00	Break
11:00 – 12:00	Research Session #2: Lessons Learned from Research & Implementation
12:00 – 1:00	Lunch
1:00 – 2:00	Workshop #1: Moving Beyond Dissemination – Identifying Key Factors for Successful Industry Adoption
2:00 – 3:00	Research Session #3: Research to Practice Projects
3:00 – 3:15	Break
3:15 – 4:45	Workshop #2: Preventing Suicide and Overdose Fatalities in Construction
5:00	Reception

Updates from Our Partners

G. Scott Earnest, PhD, PE, CSP
Associate Director for Construction, Office of Construction Safety and Health, NIOSH

James Frederick
Deputy Assistant Secretary, OSHA,
US Department of Labor



NIOSH Construction Program Update

Scott Earnest, PhD, PE, CSP
Director, NIOSH Office of Construction Safety and Health
Manager, NORA Construction Sector

Doug Trout, MD
Deputy Director, NIOSH Office of Construction Safety and Health

Christina Socias-Morales, DrPH
Research Epidemiologist, NIOSH, DSR

Scott Breloff, Ph.D.
Senior Biomechanical Research Engineer, NIOSH, DFSE

June 2024

NIOSH Office of Construction Safety & Health

NORA Construction Sector Work Groups

Preventing Falls

Co-Chairs:

Rich Trewyn

Cheryl Ambrose

http://stopconstructionfalls.com/

Preventing Struck-by

Co-Chairs:

Brad Sant

Alanna Klein

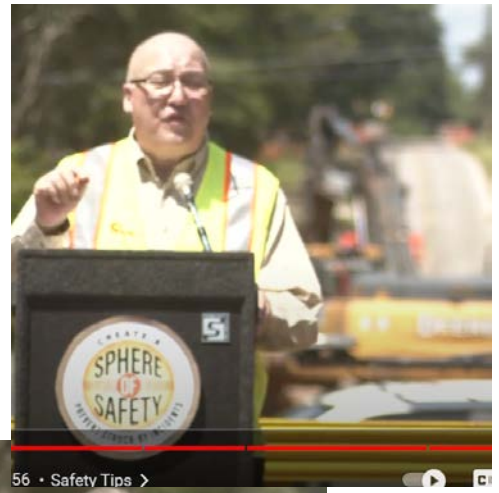
https://www.cpwr.com/struck-by-hazards

Monthly Zoom meetings

*If interested in joining, reach out to Doug Trout DTrout@cdc.gov

NORA

https://www.cpwr.com/struck-by-hazards



National Stand-Down to Prevent Struck-By Incidents

Mobile, AL • April 15, 2024 • 1:30 PM CDT

CREATE A SPHERE OF SAFETY PREVENT STRUCK-BY INCIDENTS

NATIONAL WORKZONE SAFETY INFORMATION CLEARINGHOUSE

https://www.cpwr.com/struck-by-hazards

2024 Stand-Down to Prevent Struck-by Incidents Webinar:

Developing and Enforcing Internal Traffic Control Plans

Hosted by CPWR & the NORA Construction Sector Council Struck-by Work Group

Welcome: Bradley M. Sant, JD, CSP, ASP, Senior Vice President of Safety and Education, ARTBA

Moderator: David Fosbroke, Research Statistician, Division of Safety Research, NIOSH

Panelists:

- **Mandy Kustra,** Safety Director, Ajax Paving
- **Olja Correa, MBA,** Compliance Assistance Specialist, Tampa Area Office, OSHA
- **Phillip Russell,** Board Certified OSHA Attorney for Contractors, Ogletree Deakins
- **Travis Parsons,** Director of Occupational Safety & Health, Laborers' Health & Safety Fund of North America

APRIL 15-19, 2024

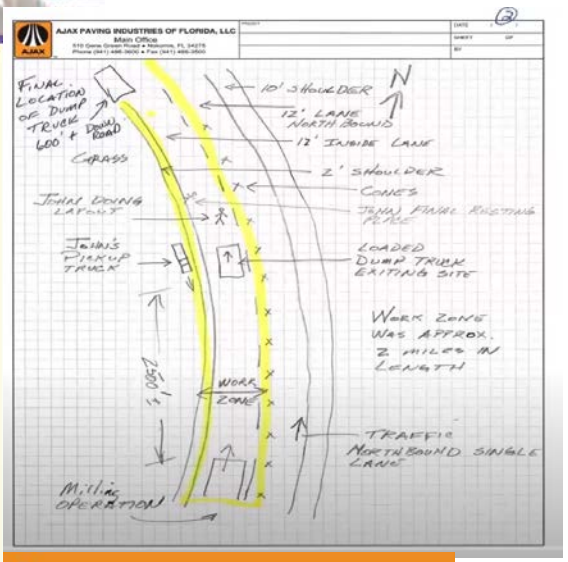
NATIONAL STAND-DOWN

TO PREVENT STRUCK-BY INCIDENTS

STOP. TALK. ACT.

CPWR

FOR MORE INFORMATION VISIT:



3:21 / 59:34

March 19, 2024

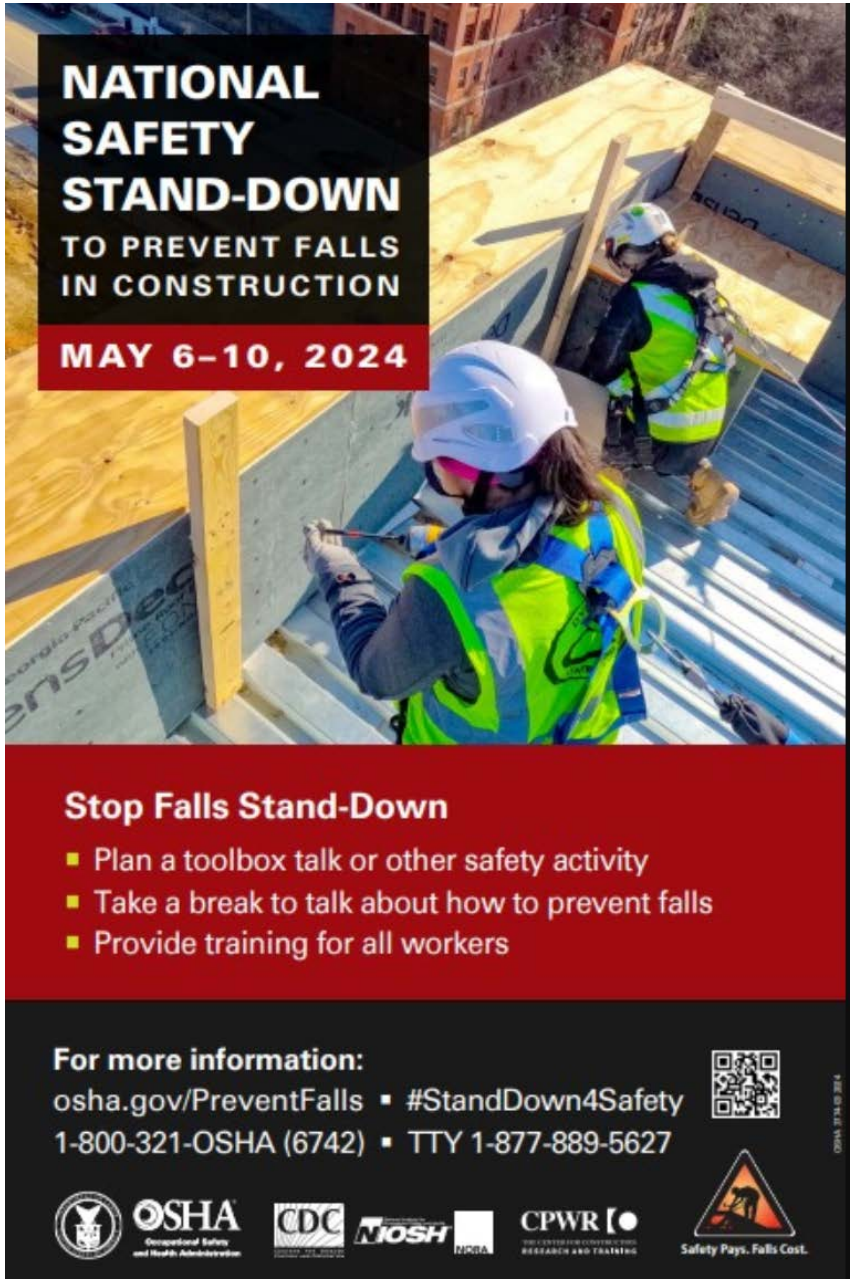
Tuesday, May 7th at 2:00 pm Eastern (1 hour)
2024 OSHA-NIOSH-CPWR National Safety Stand-Down to Prevent Falls in Construction Webinar
Beyond Fall Prevention Planning: Being Prepared for Fall Rescue

Falls can occur in the blink of an eye, even when being careful and using proper fall prevention and protection methods. If a fall does occur and a worker is suspended in a harness for longer than a few minutes, a lack of circulation can lead to nausea, unconsciousness, suspension trauma, and even death. It's critical to have a rescue plan that includes more than just calling 911 – especially because of these time limitations.

As part of this year's National Safety Stand-Down to Prevent Falls in Construction, CPWR – The Center for Construction Research and Training (CPWR), the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA) are hosting this virtual event devoted to educating employers and crew leaders on how rescue planning can save lives. Attendees will learn more about identifying a competent person to lead fall prevention and rescue planning, incorporating key components of a rescue plan into the pre-job planning process, and using FREE resources and templates to tailor your plans to each unique jobsite.

Panelists:

- **Scott Earnest, Ph.D., PE, CSP**, Associate Director for Construction, Office of Construction Safety and Health, NIOSH
- **Timothy S. Irving**, Deputy Director, Directorate of Construction, OSHA
- **Richard Trewyn**, Co-Chair, NORA Construction Sector Council Falls Work Group
- **Chris Trahan Cain, CIH**, Executive Director, CPWR



National Falls Prevention Campaign Kick-off

2024 National Campaign to Prevent Falls in Construction & Safety Stand-Down

Scott Earnest, Ph.D., PE, CSP
Associate Director for Construction, Office of Construction Safety and Health, NIOSH

Timothy S. Irving
Acting Director, Directorate of Construction, OSHA

Richard Trewyn
Co-Chair, NORA Construction Sector Council Falls Work Group

Chris Trahan Cain, CIH
Executive Director, CPWR

PLAN. PROVIDE. TRAIN. Three simple steps to preventing falls. | NORA | NIOSH | CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING | OSHA

Suspension Trauma

1. Fall arrested by a harness
2. Blood flow impeded by leg straps and gravity
3. Blood collects in large leg muscles
4. Blood return to heart decreases
5. Heart rate increase and hormone release from pain and danger response
6. Heart pumping action reduced because of decreased blood return
7. More blood collects in legs
8. Heart rate and blood pressure decrease
9. Blood flow to brain decreases
10. Victim loses consciousness
11. Blood flow to brain continues to decline dangerously
12. Brain damage
13. Death

- Can occur when legs don't move and legs are lower than the heart
- May be complicated by other injuries from a fall, such as a neck trauma, broken bones, cuts, etc.

miércoles 8 de mayo de 2024 a las 2 pm hora del este
Evento de la Campaña Nacional de Prevención de Caídas 2024

Las caídas son la principal causa de muerte relacionada con el trabajo en la construcción, pero no tiene por qué ser así. Todas las caídas se pueden prevenir. Inscríbase en el seminario web para la Campaña Nacional para Prevención contra Caídas 2024 para aprender sobre análisis de riesgos, mejores prácticas de prevención, efecto del peso en una caída y el síndrome del arnés. Participe junto a muchos otros trabajadores y trabajadoras de todo Estados Unidos y Puerto Rico. Una colaboración de OSHA, NIOSH, CPWR y OTIECs: la Administración de Seguridad y Salud Ocupacional (OSHA) de Estados Unidos, el Instituto Nacional de Seguridad y Salud Ocupacional (NIOSH) de Estados Unidos, "The Center for Construction Research and Training" (CPWR), el Instituto de Educación Ambiental de la Universidad Ana G. Méndez en Puerto Rico / Atlantic OSHA Training Center (el AOTC es un OTIEC, Centro Educativo autorizado por el OSHA Training Institute), "Center for Public Health Workforce Development" de Rutgers University, la Asociación de Contratistas Generales (AGC) Capítulo de Puerto Rico y "Associated General Contractors of America" (AGC).

Libre de costo. Espacios limitados. Habrá un tiempo para contestar preguntas de los asistentes.

pulse aquí para registrarse

NIOSH Science Blogs

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Search

NIOSH Science Blog

NIOSH Science Blog: The Problem of Falls from Elevation in Construction and Prevention Resources

May 1, 2024 by Christina Socias-Morales, DrPH; G. Scott Earnest, Ph.D, PE, CSP; Jessica Bunting, MPH; Rosa Greenberg, MPH; Scott P. Breloff, Ph.D; Asha Brogan, MS; Douglas Trout, MD, MHS

The Current Situation with Falls

In 2022 falls from elevation represented approximately 81% of all fatal and 20% of all nonfatal slips, trips, and falls for all industry workers (BLS 2023a, BLS 2023b). Many of these falls occurred in the construction industry, and significantly impact construction employers, workers, and their families. In fact, construction workers made up nearly half (49%) of all fatal occupational slips, trips, and falls (BLS 2023). Since 2013, construction workers have suffered approximately 300 fatal and 20,000 nonfatal fall-related injuries per year (CPWR 2024). Four out of 10 of the Occupational Safety and Health Administration's (OSHA) top citations involved falls, including general fall protection, ladders, scaffolding, and fall protection training.

Roofing contractors, residential building construction, and commercial/institutional building construction had the highest number of fatalities in 2022 compared to previous years and other industries (CPWR 2024). In addition, approximately 70% of all fatal falls in construction occurred to those working for employers with less than 10 employees (CPWR 2024).

Causes of Falls

Using Internal Traffic Control Plans to Prevent Construction Worker Injuries and Fatalities in Work Zones

April 10, 2024 by Amber Trueblood, David Fosbroke, Ryan R. Papariello, Nancy Romano, Scott Breloff, Scott Earnest, Douglas Trout

Struck-by injuries are the leading cause of nonfatal injuries and second most common cause of fatalities among construction workers. From 2011 to 2022, there were 1,462 fatal occupational injuries that occurred at road construction sites .[1] Of these, 68% (n=1,000) were among workers in the construction industry (See figure) followed by workers in transportation and warehousing (11%; n=168) and professional and business services (9%; n=132) industries. Forty-four percent of the occupational fatalities at road construction sites (n=650) involved a worker struck-by a vehicle in a work zone. [1]

Fatal Occupational Injuries at Road Construction Sites by Industry, 2011 to 2022

*Averaged fatalities in 2019 and 2021, to produce an estimate for 2020 due to missing data.
Source: U.S. Bureau of Labor Statistics, 2011-2022 Census of Fatal Occupational Injuries. https://www.bls.gov/iif/data.htm.
Calculations by the CPWR Data Center.

National Safety Stand-Down to Prevent Struck-by Incidents

The National Safety Stand-Down to Prevent Struck-by Incidents is being held during this year's National Work Zone Awareness Week, April 15-19, 2024. The week will kick off with a Stand-Down on Monday, April 15 in Mobile Alabama at 1:30 pm. Watch on YouTube.

A webinar, *Developing and Enforcing Internal Traffic Control Plans,*

Construction | Blogs | CDC

New FACE Reports and Videos

KENTUCKY State FACE Program
Fatality Assessment & Control Evaluation

Kentucky Injury Prevention and Research Center
Bona fide agent for Kentucky Department for Public Health
333 Waller Avenue, Suite 242 • Lexington, KY 40504 • 859-257-5839

E6INCIDENT HIGHLIGHTS

DATE: January 17, 2023
TIME: 12:11 p.m.
VICTIM: 27-year-old roofing worker
INDUSTRY/NAICS CODE: Roofing contractors/238160
EMPLOYER: Roofing contractor
SAFETY & TRAINING: Unknown
SCENE: Commercial office building
LOCATION: Kentucky

REPORT#: 23KY005 REPORT DATE: 12/12/23

Roofer in Boom Lift Electrocuted by Overhead Electrical Line — Kentucky

SUMMARY

Two roofers were using a telescoping boom lift to descer when they contacted overhead electrical lines. The head operator, a 27-year-old roofing worker, contacted one o lines and was fatally electrocuted. The other roofer in th male, suffered 2nd degree electrical burns to his left elb hand.

... READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investiga

- *Overhead electrical hazards in work area*
- *Windy conditions*
- *Exposure to energized lines*
- *Lack of appropriate personal protective equipme*
- *Need for electrical hazards training*

...LEARN MORE> (p.9)

RECOMMENDATIONS

CALIFORNIA State FACE Program
Fatality Assessment & Control Evaluation

Occupational Health Branch • California Department of Public Health
850 Marina Bay Pkwy, P-3, Richmond, CA 94804
510-620-5757 • fax 510-620-5743

INCIDENT HIGHLIGHTS

DATE: September 14, 2022
TIME: 11:30 a.m.
VICTIM: 34-year-old day laborer
INDUSTRY/NAICS CODE: Plumbing / 238220
EMPLOYER: Plumber
SAFETY & TRAINING: None
SCENE: Walkthrough within a mobile home park
LOCATION: California

REPORT#: 22CA003 REPORT DATE: November 1, 2

Day Laborer Dies in a Collapsed Trench Bei Dug to Repair a Sewer Line — California

SUMMARY

On September 14, 2022, a 34-year-old Hispanic day laborer, along with three other day laborers, dug an eight-foot-deep trench to expose a damaged sewer line. Unexpectedly, while digging, they exposed and broke a water line. Water and dirt filled the trench and created a thick mud. The victim became submerged under the mud and was unable to be extracted by co-workers or rescue personnel.

READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

- Lack of competent person onsite.
- Permits were not requested or issued for the work being performed.
- Workers were in an eight-foot-deep trench with no shoring.
- Water line was not turned off before or during work.
- Lack of training for workers in trenching safety.

LEARN MORE> (p.6)

RECOMMENDATIONS

KENTUCKY State FACE Program
Fatality Assessment & Control Evaluation

Kentucky Injury Prevention and Research Center
Bona fide agent for Kentucky Department for Public Health
333 Waller Avenue, Suite 242 • Lexington, KY 40504 • 859-257-5839

INCIDENT HIGHLIGHTS

DATE: August 9, 2023
TIME: 2:45 p.m.
VICTIM: 52-year-old Hispanic carpenter
INDUSTRY/NAICS CODE: Finish carpentry contractor / 238350
EMPLOYER: Finish carpentry contractor
SAFETY & TRAINING: No formal program
SCENE: Commercial restaurant dining room
LOCATION: Kentucky

REPORT#: 23KY096 REPORT DATE: November 3, 2023

Carpenter Dies After Fall from 6-Foot Ladder—Kentucky

SUMMARY

On August 9, 2023, a 52-year-old carpenter (victim) and his co-worker were obtaining measurements in preparation for a plywood installation project in a restaurant being constructed. In the process, the victim's ladder overturned and he fell and struck the concrete surface below.

READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Unrecognized job hazards,
- Safety training,
- Reaching outside ladder side rails.

LEARN MORE> (p.9)

RECOMMENDATIONS

CDC - NIOSH Fatality Assessment and Control Evaluation(FACE)Program: Investigation Reports - NIOSH Workplace Safety and Health Topic

Articles of Interest- Falls

It's not a surprise: Falls continue to be the leading cause of death in the construction industry.

A recent report from CPWR – The Center for Construction Research and Training shows the number of fatal falls in the industry rose more than 50% during a recent 12-year period.

"It's definitely a difficult issue and it's hard to change, quite frankly," said G. Scott Earnest, associate director of the NIOSH Office of Construction Safety and Health. "We're just trying to communicate with the industry at large on the steps they should take to prevent falls in the future."

Here are five factors that contribute to construction worker falls.

1 Not making time for safety

A CPWR analysis of Bureau of Labor Statistics data found that 397 fatal falls to a lower level occurred in the construction industry in 2022. That's a 52.7% increase from 2011.

Especially vulnerable: workers employed by smaller construction companies. CPWR says 70% of the fatal falls occurred within organizations with 10 or fewer employees.

Why?

"I think some of it relates to the fact that they're so busy just trying to get the next job," Earnest said. "Some of these small businesses are not putting the resources and the time into safety because they're so busy just trying to go from one job to the next and bring money into the organization.

"And for that matter, that could be the case with the workers, too, where they're just trying to put food on the table for their family, so they're not really taking time to really consider their own safety."

The 11th annual National Safety Stand-Down to Prevent Falls in Construction – an initiative created by NIOSH, OSHA and CPWR – is slated for May 6-10 (see box). A poster created for the event encourages employers to:

- Train all workers.
- Plan a toolbox talk or other safety activity.
- Take a break to talk about how to prevent falls.

2 Not wearing PPE

A 2022 CPWR survey of 495 people who either were involved in, witnessed or investigated a fall incident showed that workers who believed fall protection was required by their employer were eight times more likely to use it.

"What we hear a lot from contractors is: 'Well, we provide the fall protection and then I come to the jobsite and it's still on the truck. The workers aren't using it. They have a brand-new harness and it's on the ground while they're on the roof," said Jessica Bunting, director of the Research to Practice initiative at CPWR. "While this may be true on the surface, our survey findings showed that if you enforce that employees need to wear the fall protection, then they'll do it. Just giving it to them isn't enough.

"They have to be trained on its use. They have to know that it's required by their employer, and there's that expectation from their leadership."

Doug Trout, deputy director of the NIOSH Office of Construction Safety and Health, says employers should examine the safety climate at their jobsites. Do workers' perceptions of what the company says or writes about safety and health align with what's practiced?

"That's something employers can be working on regularly to decrease falls and improve all safety and health issues on the job," Trout said.

3 Not focusing on leading edges

OSHA requires workers constructing leading edges at least 6 feet above a lower level to be protected by a guardrail, safety net or personal fall arrest system.

Experts find, however, that because the opportunity for overhead anchorage doesn't exist, workers may tie off at foot level. This can lead to problems. Although ANSI Class II self-retracting lifelines designed for leading-edge use are tested to withstand greater fall forces, those not approved for abrasive-edge use may eventually fray – and snap.

"It's still a complicated topic because there really isn't a great one-size-fits-all solution out there," Bunting said. "It is an area, I think, that needs some more research and that maybe could benefit from some new advancements from manufacturers. It's a challenging issue to address."

The recent death of a worker whose lanyard was severed by an exposed edge as he fell prompted OSHA to issue a hazard alert. Recommendations include:

- Identify and document all potentially hazardous edges during the safety evaluation and walkarounds at the jobsite.
- When possible, avoid working in areas where lifelines could contact potentially hazardous edges if a fall occurred.
- Identify possible solutions to prevent establishing anchors at foot level.
- Protect lifelines and lanyards against being severed

FIGURE 1
COMPARISON OF WORKPLACE FATALITIES BETWEEN U.S. & U.K.

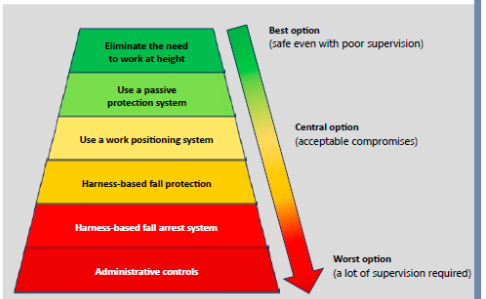
Average rate of workplace fatalities calculated over the past decade

U.S. average rate of workplace fatalities:	3.5/100,000	U.K. average rate of workplace fatalities:	< 1.0/100,000	First 15 members of EU average rate of workplace fatalities:	< 1.5/100,000

United States		United Kingdom		Comparison	
GDP[a]:	20.81 trillion USD	GDP[a]:	2.64 trillion USD	GDP[a]:	7.8x
Total fall fatalities[c]:	805	Total fall fatalities[b]:	34	Total fall fatalities:	23x
Total workplace fatalities[c]:	4,764	Total workplace fatalities[b]:	142	Total workplace fatalities:	33x

Note. Adapted from LJB Inc.
[a]"World Economic Outlook Database," by International Monetary Fund, 2022; [b]"Work-Related Fatal Injuries in Great Britain," by U.K. HSE, 2022; and [c]"Injuries, Illnesses and Fatalities," by U.S. Bureau of Labor Statistics, 2022.

FIGURE 2
REFINED HIERARCHY OF CONTROLS FOR WORK AT HEIGHT



Note. Adapted from ANSI/ASSP Z359.2-2023, Minimum Requirements for a Comprehensive Managed Fall Protection Program, 2023, p. 25; and "Hierarchy of Controls: Working at Height," by LJB Inc., 2023.

WORKER PROTECTION
Peer-Reviewed

A FALL PREVENTION & PROTECTION PARADIGM SHIFT

By Russell Duren, Peter Ferguson, Thomas Kramer and David Thomas

KEY TAKEAWAYS

- The American workforce has a disproportionate work-at-height fatality rate due to excessive reliance on ineffective control methods.
- Safety professionals must influence a paradigm shift—a fundamental change in approach—among those who only associate working at height with the use of harness-based methods.
- When harness-based fall protection systems are the only feasible choice, safety professionals must ensure that workers have the processes in place needed for protection, such as training, procedures and supervision.

IT IS TIME TO ESTABLISH NEW THINKING around the planning and execution of work at height. In the U.S. today, two protection methods lie at opposite ends of the control spectrum with too wide a chasm between them. At one end of the spectrum, the preferred method is to eliminate or engineer out the hazards during the design and construction phases to the extent that they simply do not exist or are dramatically reduced. At the other end, harness-based controls occupy a virtually unchallenged role in attempting to protect workers against the outcomes of fall incidents. The phrase "The worker wasn't wearing fall protection" assumes too much about the effectiveness of PPE controls for work at height exposures.

Safety professionals are in a unique position to lead the conversation toward a paradigm shift, especially for those who only associate fall protection with PPE. Two fundamental changes can drastically improve safety for work at height. First, organizations should focus on methods to control fall hazard risk without the use of harness-based systems. Second, when these systems are the only feasible option, organizations must provide for more comprehensive application of these tools.

Background

Falls are the second leading cause of occupational fatalities among American workers, behind only transportation incidents. Citations related to fall protection have held the number one spot on OSHA's top 10 list for the past 12 years (OSHA, 2022b). Despite significant updates to fall protection regulations and standards and continual advances in fall protection equipment, the number of fatalities continues to increase in the U.S. So, why do falls continue to occur at this rate and how can organizations better manage fall hazards?

First, a more successful way exists to control fall hazards. By embracing successful tactics from around the world, the lives of hundreds of American workers could be saved every year, not to mention reducing the number of workers affected by serious injuries and days away from work.

The U.K. has demonstrated the feasibility of achieving a decrease in fall fatalities. Figure 1 (p. 18) highlights differences in key statistics between the U.S. and the U.K. This is a comparison of two well-understood industrialized nations within the G7 intergovernmental political forum. While the economies are similar, the U.S. is roughly five times larger in population, and the gross domestic product figures show that while the U.S. produces more, the increase in production does not align with the dramatic difference in workplace fatalities. These numbers illustrate the urgent problem in the U.S. that needs attention.

While other countries such as Australia have also had enormous success, most have followed the U.K.'s lead, so it becomes a useful and simplified comparison point. The way the U.K. has developed and implemented these changes is well documented, and work at height regulations apply across the country and to all industries, rather than having different rules by location or industry.

A Paradigm Shift: A Refined Hierarchy of Controls

The improvements seen in the U.K. were not achieved as an overnight success or after one government directive, but rather after a determined drive across industry to reduce injuries and fatalities. In addition, the better workplace fatality figures were not achieved by simply using harnesses more effectively, but rather with PPE considered a last resort.

U.K. regulations specifically dictate that PPE should be the least preferred option for protecting workers at heights: "PPE should be regarded as the last resort to protect against risks to health and safety. Engineering controls and safe systems of work should be considered first" (U.K. HSE, 2022a).

In large part, the improved statistics are a result of a paradigm shift that included new construction methods, increased expectations and demands from owners, improved guidance and standards, targeted enforcement, increased fiscal penalties and implementation of the hierarchy of controls, with the development and acceptance of a different risk management culture across industry.

The elements of the U.K.'s paradigm shift share a common theme not yet prevalent in the U.S. workforce. At its core, U.K. risk management culture is less willing to assign workers to exposures with potentially catastrophic or fatal outcomes. When such exposure must occur, the investment made in preventing a harmful outcome more closely approaches the incalculable cost of the loss of human life. Because the cost of a workplace fatality is so horrible, U.K. risk management stakeholders are willing to spend more money, time or resources to prevent such an occurrence. The U.K. has put regulations in place to motivate industry to do better (Thomas, 2015). By comparison, the U.S. has few drivers of change.

U.S. regulatory agencies do not differentiate between the quality and reliability of the method of working at height (OSHA, 2016). When all options are considered acceptable, the industry has developed a culture that accepts whatever is the perceived cheapest method of working at height, rather than what is truly the safest. This culture of harness use has evolved, driven by cost effectiveness, simplicity, ease of use, a highly motivated equipment supply industry, and a lack of perceived need to change by designers, constructors and clients.

While OSHA regulations have yet to take a firm stance on an ordered hierarchy of controls for fall hazards, the safety profession's growing acceptance of the hierarchy of controls is illustrated in ANSI/ASSP Z359.2-2023. To build on the general hierarchy of controls provided in the ANSI/ASSP consensus standard, effectively managing hazards in any harness-based work at height task requires implementation of a more nuanced approach.

The control sequence shown in Figure 2 (p. 19) is adapted from the ANSI/ASSP Z359.2 hierarchy of controls and adds a work positioning element as the missing piece to help achieve more consistent worker protection in harness-based work at height. Rope access guidance provided by the ANSI/ASSP Z459 standard, the Society of Professional Rope Access Technicians and the International Rope Access Trade Association embraces this approach, which contributes to the high safety record that rope access enjoys.

This refined hierarchy of controls calls for improved hazard management, including more intentional management of personnel, equipment, work methods and incident responses. It also acknowledges that there is a role for the proper use of harness-based systems, including fall arrest, work restraint, rope access (as defined in ASSP Z359.0-2023) and positioning systems. However, these systems require significant supervision and cannot perform their crucial roles when called upon unless the user has configured them within the scope of the use, limitations and restrictions assigned by the components' manufacturer.

Required Changes

Acknowledging the drastic discrepancies between fall fatalities in the U.S. compared to the U.K., it is important to consider the possible reasons for the disparity between the outcomes. Imparting fundamental change requires cooperation at a systemic level from all stakeholders—regulators, industry influencers, employers and users—which takes time to establish. Still, the following three areas provide the greatest opportunity for safety professionals to influence improvements in the U.S. today.

1. Emphasize Prevention Through Design

While it is easier to see fall hazards in an existing structure, safety practitioners around the world have found that it is safer and more cost effective to implement fall protection solutions before structures or processes are built. This concept, referred to as prevention through design (ANSI/ASSP, 2021a) in the U.S., ensures that safety measures are evaluated and implemented during the programming and design phases of a project. In the U.K., this is achieved through construction (design and management) regulations (U.K. HSE, 2015).

Applying prevention through design has proven to decrease risk and reduce life cycle cost for both the builder and the building owner. Risk is minimized by eliminating hazards

Articles of Interest- Psychosocial Hazards

NORA

DOI: 10.1002/ajim.23583

COMMENTARY

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE WILEY

An urgent call to address work-related psychosocial hazards and improve worker well-being

Paul A. Schulte PhD[1] | Steven L. Sauter PhD[1] | Sudha P. Pandalai MD[2] | Hope M. Tiesman PhD[3] | Lewis C. Chosewood MD[4] | Thomas R. Cunningham PhD[2] | Steven J. Wurzelbacher PhD[5] | Rene Pana-Cryan PhD[6] | Naomi G. Swanson PhD[2] | Chia-Chia Chang MPH[4] | Jeannie A. S. Nigam MS[2] | Dori B. Reissman MD[6] | Tapas K. Ray PhD[7] | John Howard MD[6]

[1]Advanced Technologies and Laboratories International Inc., Gaithersburg, Maryland, USA

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Abstract

Work-related psychosocial hazards are on the verge of surpassing many other occupational hazards in their contribution to ill-health, injury, disability, direct and indirect costs, and impact on business and national productivity. The risks associated with exposure to psychosocial hazards at work are compounded by the increasing background prevalence of mental health disorders in the working-age population. The extensive and cumulative impacts of these exposures represent an alarming public health problem that merits immediate, increased attention. In this paper, we review the linkage between work-related psychosocial hazards and adverse effects, their economic burden, and interventions to prevent and control these hazards. We identify six crucial societal actions: (1) increase awareness of this critical issue through a comprehensive public campaign; (2) increase etiologic, intervention, and implementation research; (3) initiate or augment surveillance efforts; (4) increase translation of research findings into guidance for employers and workers; (5) increase the number and diversity of professionals skilled in preventing and addressing psychosocial hazards; and (6) develop a national regulatory or consensus standard to prevent and control work-related psychosocial hazards.

KEYWORDS
economics, mental health, occupational safety and health, psychological effects, work organization

TABLE 1 Psychosocial aspects of work and related hazards.

Psychosocial aspects of work	Associated psychosocial hazards
Job content	Lack of variety or short work cycles; fragmented or meaningless work; under-use of skills; high uncertainty; continuous exposure to difficult clients, patients, pupils, etc.
Workload and work pace	Work overload or too little work, machine pacing, high levels of time pressure, continually subject to tight deadlines
Work schedule	Shift work, night shifts, inflexible work schedules, unpredictable hours, long or unsociable hours
Control	Low participation in decision-making; lack of control over workload, pacing, shift working, etc.
Environment and equipment	Inadequate equipment availability, suitability, or maintenance; poor environmental conditions such as lack of space, poor lighting, excessive noise
Organizational culture and function	Poor communication; low levels of support for problem solving and personal development; poor managerial support; lack of definition of, or agreement on, organizational objectives
Interpersonal relationships at work	Social or physical isolation, poor relationships with superiors, interpersonal conflict, lack of social support, harassment, bullying, poor leadership style, third-party violence
Role in organization	Role ambiguity, role conflict, responsibility for people
Career development	Career stagnation and uncertainty, under-promotion or over-promotion, poor pa value of work
Home-work interface	Conflicting demands of work and home, low support at home, problems relating t labor force (dual career)

Source: Adapted from Mellor et al. (2011)[169], Leka and Jain (2014),[168] and Cox et al. (2005)[21].

TABLE 2 Selected scientific literature describing the association between occupation, psychosocial hazards, and adverse behavioral, mental health, and physical effects.

Effects	Representative references
Absenteeism	Dobson et al., 2020[15]; Sitarević et al., 2023[16]
Accidents	EU-OSHA, 2007[17]; Gomez-Ortiz et al., 2018[18]
Alcohol and drug use	Richter et al., 2021[19]; Virtanen et al., 2015[20]
Anxiety	Cox et al., 2005[21]; Niedhammer et al., 2021[11]; Harvey et al., 2017[22]
Behavioral disorders	Chamoux et al., 2018[23]; Harvey et al., 2017[22]
Burnout	Maslach and Leiter, 2016[24]; Schaufeli et al., 2009[25]; Ahola et al., 2007[26]; Kivimäki et al., 2012[27]; O'Connor et al., 2018[28]
Cardiovascular disease	Niedhammer et al., 2021[11]; Pega et al., 2021[29]; Kivimäki et al., 2006[30]; Belkic et al., 2004[31]; Kuper et al., 2002[32]; Schnall et al., 1998[33]
Cigarette smoking	Conway et al., 1981[34]; van den Berge et al., 2021[35]
Cognitive impairment	Grzywacz et al., 2016[36]; Elovainio et al., 2009[37]; Peterson et al., 2008[38]
Depression	Niedhammer et al., 2021[11]; Theorell et al., 2015[39]; Leka, 2010; Cox et al., 2005[21]; Mikkelson et al., 2021[40]; WHO, 2022[41]; Rugulies et al., 2023[42]; Madsen et al., 2017[43]; Rugulies et al., 2017[44]
Fatigue	Åkerstedt et al., 2004[45]; Tang et al., 2016[46]; Jallilian et al., 2019[47]
Health-related quality of life (HRQL)	Ray et al., 2021[48]; Bhattacharya and Ray, 2021[49]; Ray et al., 2014[50]
High blood pressure	Schnall et al., 1998[33]; Rosenthal and Alter, 2012[51]
Migraine headache	Wilkins and Beaudet, 1998[52]; Urhammer et al., 2020[53]; Magnavita, 2022[54]
Mood disorders	Lovelock, 2019[55]; Netterstrøm et al., 2008[55]; Woo and Postolache, 2008[56]
Negative emotional reactions	Jordan et al., 2002[57]; West et al., 2016[58]
Obesity	Ostry et al., 2006[59]; Kivimäki et al., 2003[60]; van den Berge et al., 2021[35]
Poor self-reported health	Stadin et al., 2019[61]; Niedhammer et al., 2022[62]
Posttraumatic stress disorder	Spence Laschinger and Nosko, 2015[63]; Nielsen et al., 2015[64]; Rudkjoebing et al., 2020[65]
Sickness Absence	Kivimäki et al., 2003[60]; Duchaine et al. 2020[66]; Goorts et al., 2020[67]
Sleep disturbance	Rugulies et al., 2009[68]; Peterson et al., 2008[38]; Åkerstedt, 1995[69]; Rudkjoebing et al., 2020[65]
Stress reaction	Nieuwenhuijsen et al., 2010[70]; WHO 2003[71]; van der Molen et al., 2020[72]
Subjective well-being decrease	Ray, 2021[73]; de Jonge et al., 2000[74]
Suicide and suicidal ideation	Niedhammer et al., 2021[11]; Woo and Postolache, 2008[56]; Milner et al., 2018[75]; Aronsson et al., 2017[76]
Work/family imbalance	Hämmig et al., 2011[77]; Jerg-Bretzke et al., 2020[78]

Construction Webinars

UF UNIVERSITY of FLORIDA NIOSH

An NSF-Funded Webinar on

Safe Human-Robot Interaction in Construction

December 1, 2023, 11:00 - 14:00 ET

Organized by

Rinker School of Construction Management at UF

National Institute for Occupational Safety and Health (NIOSH)

About this Webinar:

In an era marked by the rapid integration of robotics and automation into the construction industry, the paramount concern is ensuring the safety of human-robot interaction. As these cutting-edge technologies find their place alongside human workers on construction sites, there is an urgent need to prioritize safety above all else.

National Institute for Occupational Safety and Health

CDC NIOSH

The Role of Technology in the Future of Work

Gary A. Roth, M.S., PhD
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention
Department of Health and Human Services

NIOSH Future of Work Series
April 18, 2024

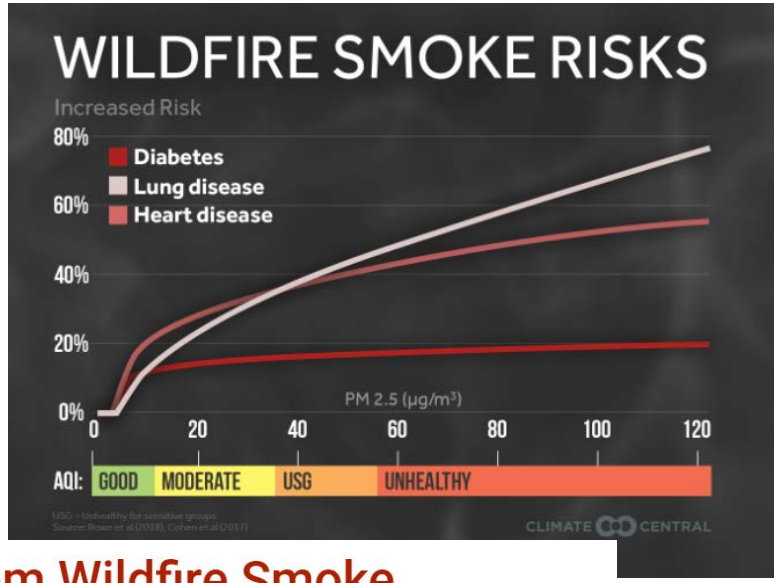
Disclaimer: The findings and conclusions presented here are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. Mention of any company or product does not constitute an endorsement by NIOSH, CDC.

Keynote Presentation: The NIOSH Construction Program and Robotics

G. Scott Earnest, Ph.D., P.E., C.S.P.
Associate Director for Construction, NIOSH

Scott Earnest is the Associate Director for Construction Safety and Health at NIOSH. Prior to joining the Office of Construction Safety and Health in 2015, Scott was Engineering Branch Chief in the NIOSH Division of Applied Research and Technology for ten years. Scott has over 70 peer-reviewed publications and technical reports. He began his career as an active-duty, commissioned officer in the U.S. Army, Corps of Engineers. He is a registered Professional Engineer (PE) and Certified Safety Professional (CSP) with M.S. and Ph.D. degrees in industrial and mechanical engineering.

NIOSH Wildland Fire Smoke & Outdoor Worker Report



Wildfires may present a major health hazard to outdoor workers from exposure to smoke. Image by NIOSH.

Worker Protection from Wildfire Smoke

[Outdoor Workers Exposed to Wildfire Smoke | NIOSH | CDC]

PREVENTION THROUGH DESIGN (PtD)

Series of workshops funded by NIOSH in collaboration with Arizona State University

- (2020-2024) 5th Workshop August 27, 2024
- ASU Barrett and O'Connor Ctr, Washington DC

Prevention through Design | (asu.edu)

Arizona State University

Questions?

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513-515-5053

https://www.cdc.gov/niosh/construction/

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

OSHA Updates

James Frederick

Deputy Assistant Secretary of Labor for Occupational Safety and Health

Research Session #1: Intervention Evaluation Outcomes

Moderator: **Scott P. Breloff, PhD**, Sr. Biomechanical Research Engineer, NIOSH

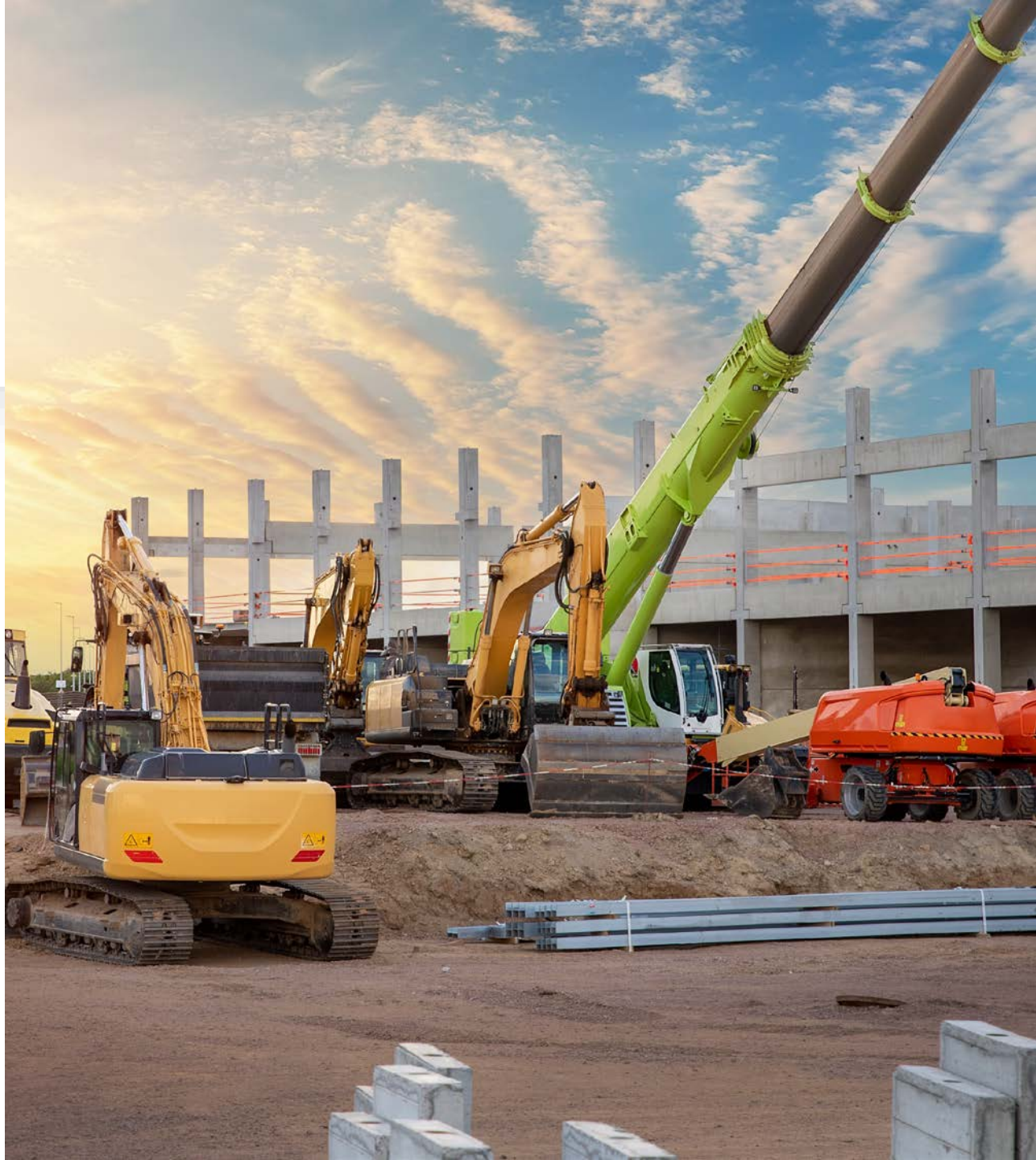
Evaluation of Trunk and Arm Support Exoskeletons for Construction

Alan Barr, MS, Senior Engineer, University of California Human Factors and Ergonomics Program

Promoting Safety and Well-Being Among Sheet Metal Worker Women Through Mentoring

Lily Monsey, Research Coordinator/MPH Student, Department of Environmental and Occupational Health Sciences, School of Public Health, University of Washington

Marissa Baker, PhD, Assistant Professor, Department of Environmental and Occupational Health Sciences, School of Public Health, University of Washington



Evaluation of Exoskeletons for Use in Construction

Carisa Harris, PhD
Alan Barr, MS
Nancy Gutierrez, MPH
Federico Arippa, PhD
Rieke Meyer, MS
Giulia Casu
Brandon Phillips, MS
Isaiah Barrajas-Smith, MPH
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Mohammad Sadra Rajabi

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"The findings and conclusions in this presentation are those of the author(s) and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Evaluation of Exoskeletons for Construction

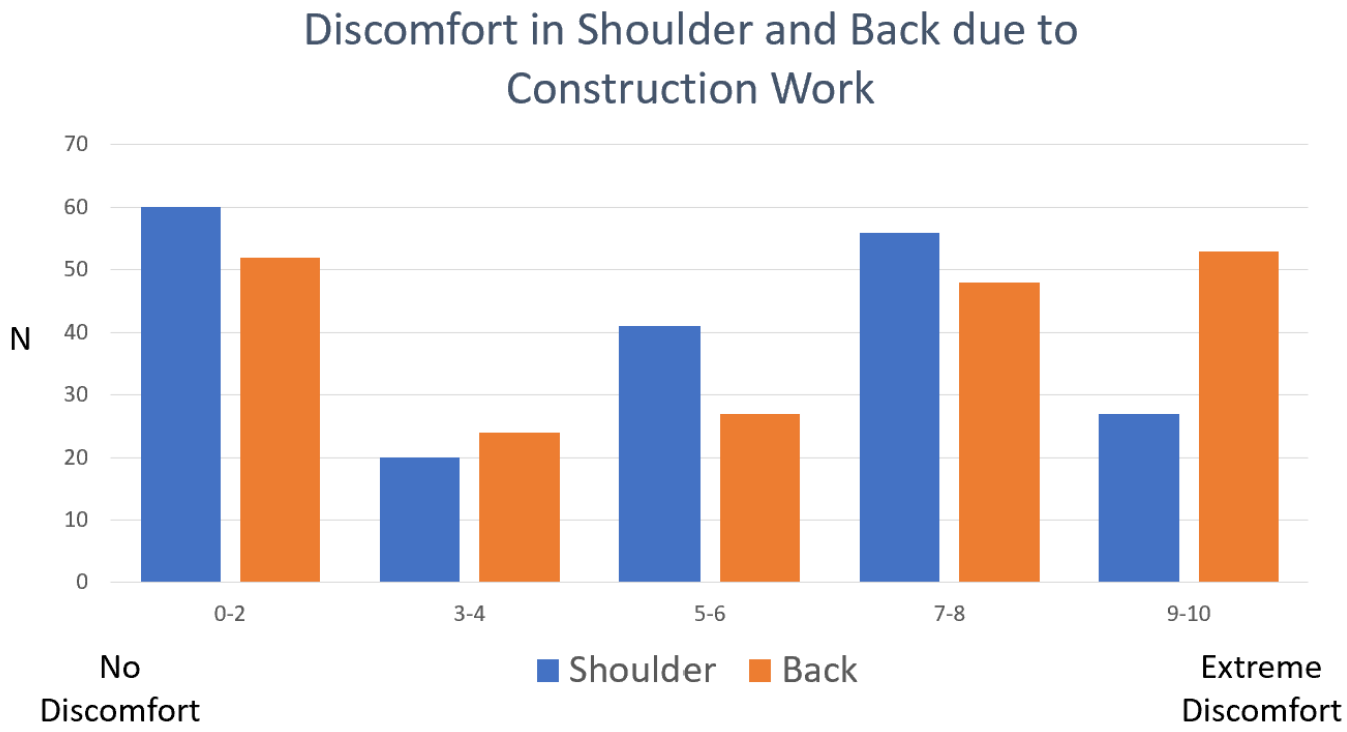
Aim 1	Obtain input from construction industry stakeholders
Aim 2	Determine the efficacy
Aim 3	Assess the perceived safety, effectiveness, and acceptability
Aim 4	Disseminate study findings nationwide

Aim 1

Understand relevant stakeholders' opinions on potential applications and promotors/barriers to the acceptance of exoskeleton technologies.

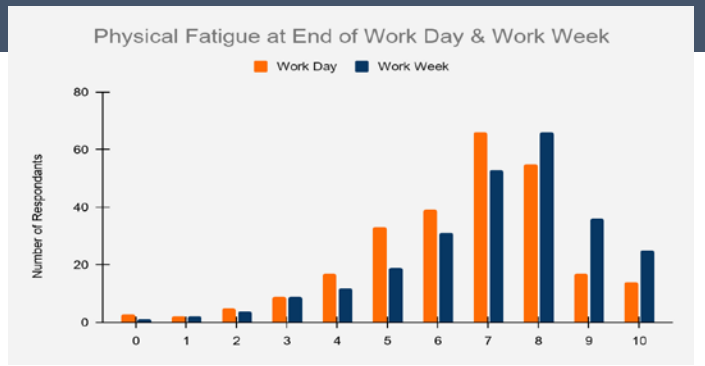
Aim 1: Input from Stakeholders

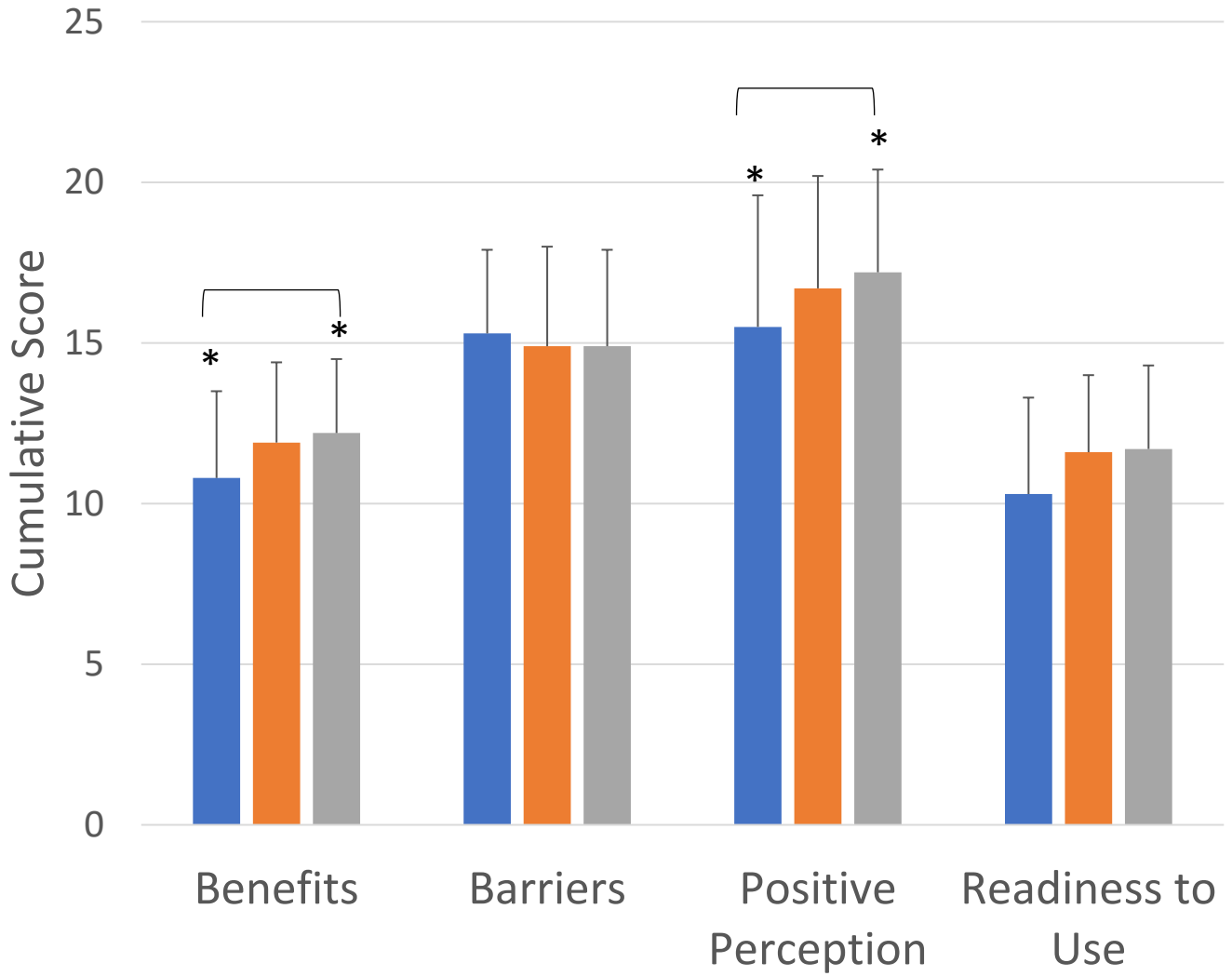
- 361 Respondents
  - 63% Caucasian
  - 24% Hispanic
  - 77% Male
  - 47 years median age
- Work Experience
  - 66% had >15 years of work experience in companies of various size
- Exoskeleton Knowledge
  - 36% have heard of workers using an exoskeleton
  - 35% had never heard of it



Gutierrez N, Ojelade A, Barr A, Kim S, Rempel D, Akanmu A, Nussbaum M, Harris-Adamson C. Perceived benefits, barriers, perceptions, and readiness to use exoskeletons in the construction industry: Differences by demographic characteristics. *Applied Ergonomics.* 2024: 116: 104199

Exoskeleton Receptivity by Fatigue





Lower Fatigue (0 to 5)

Moderate Fatigue (6-7)

Extreme Fatigue (8-10)

Gutierrez N, Ojelade A, Barr A, Kim S, Rempel D, Akanmu A, Nussbaum M, Harris-Adamson C. Perceived benefits, barriers, perceptions, and readiness to use exoskeletons in the construction industry: Differences by demographic characteristics. *Applied Ergonomics.* 2024: 116: 104199

Findings: Barriers

- Sharing & fitting the exoskeleton was a barrier
  - 97% agreed they would share an exoskeleton
  - 80% agreed that sharing would make it difficult to refit and/or use
  - There is no systematic information publicly available that can guide how to properly fit and select the support level

- Common safety concerns included:
  - Slips, trips & falls
  - Struck by/caught in/between
  - Scaffold/Trench Work

Gutierrez N, Ojelade A, Barr A, Kim S, Rempel D, Akanmu A, Nussbaum M, Harris-Adamson C. Perceived benefits, barriers, perceptions, and readiness to use exoskeletons in the construction industry: Differences by demographic characteristics. *Applied Ergonomics.* 2024: 116: 104199

Aim 2. Evaluate the efficacy of exoskeletons used in construction.

Evaluate usability and safety.

Identify optimal settings based on task-characteristics

Identify the usability and performance during common construction tasks.

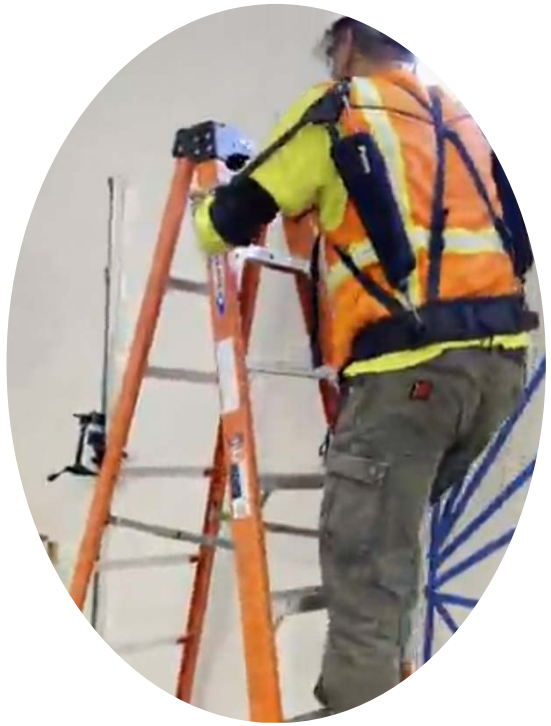
Fit Prediction

Optimize the fit and support level settings of a passive ASE based on a subject's height, weight, and sex to facilitate use across construction workers.

Conclusions

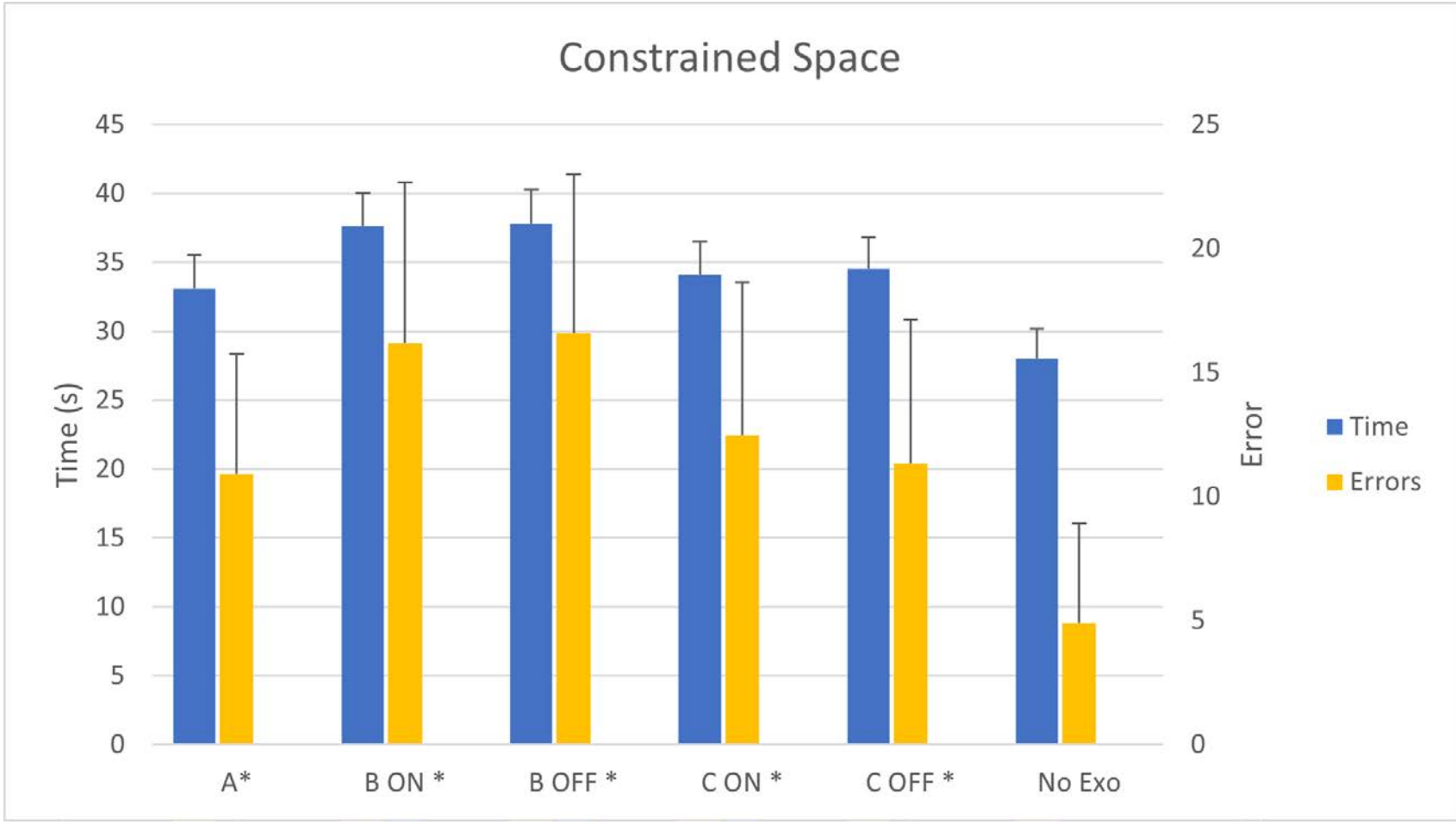
- Results demonstrate that the equations can predict support level fairly well (87%)
- Equations for anthropometric fit need to be refined
  - Particularly arm length
- Equations for anthropometric fit worked better for males than females (8% difference in good predictions)

	Fit Prediction %Correct	Support Prediction % Correct
All	85%	87%
EVO	90%	98%
SuitX	72%	74%
Otto	94%	88%



- Determine impact of EXO on maneuverability, balance, gait, shoveling & climbing.
- EXO (Diverse types with distinct characteristics)
- Support level fixed

Findings: Time and Errors



onditions

: Ottobock

: SuitX*

: EksoBionics*

Meyer, R., Barr, A., Kim, S., Rempel, D., Nussbaum M.A., and Harris-Adamson, C. Impacts of using arm-support exoskeletons on task performance, perceived safety, and usability during simulated construction-relevant tasks. *In progress.*

Findings: Time and Errors

Task 2: Balance Beam and Figure-eight

- No statistically significant differences in completion time across conditions ($p<0.60$)
- No significant effects of ASE use on errors during this task ($p<0.32$)

Task 3: Stairs and Ladder

- Wearing no ASE was faster than wearing any, though not quite statistically significant ($p<0.06$)

Conditions

A: Ottobock

B: SuitX*

C: EksoBionics*

A closer look at balance

- The study aimed to examine the effects of ASEs use on dynamic balance, focusing on sway and DPSI parameters

Arippa, F., Barr, A., Phillips, B., Kim, S., Rempel, D., Nussbaum M.A., and Harris-Adamson, C. Evaluation of balance and sway while performing a step-down maneuver while wearing an arm support exoskeleton. *International Journal of Industrial Ergonomics*. Under Review

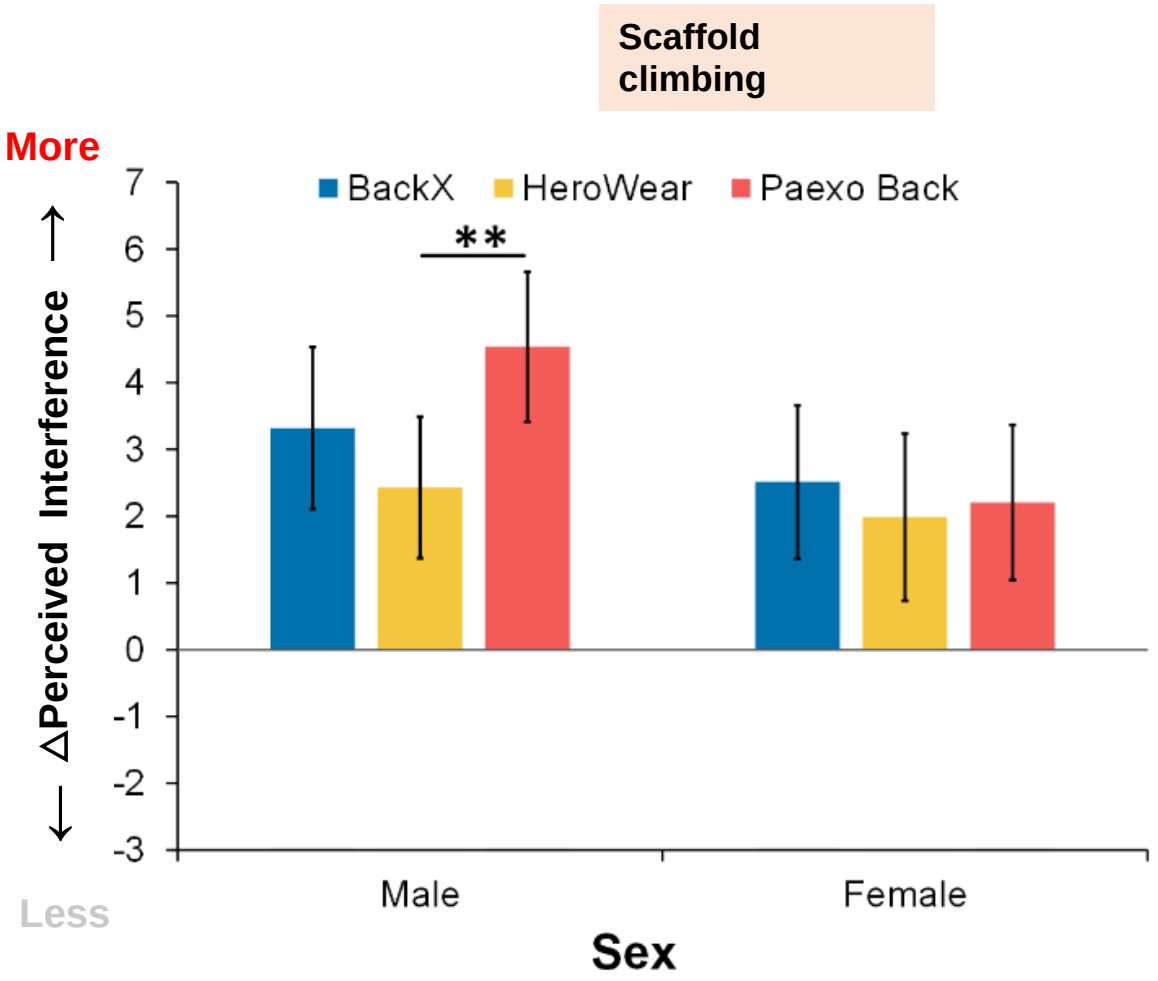
Conclusions- ASE Safety Evaluation

- Wearing an ASE versus no ASE:
  - Increased maneuvering time in constrained spaces and climbing
  - Increased errors in constrained spaces
  - Increased time when climbing ladders or stairs
- The differences in the ASEs between On-state and Off-state were minimal
- Guidelines
  - Caution should be used when wearing an ASE while in a constrained space or when climbing ladders or stairs
  - More time may be required to perform tasks when wearing an exoskeleton (on or off)
  - Little impact on ambulation on a narrow beam or figure-eight walking or on balance during a hop-down maneuver

Conclusions- BSE Safety Evaluation

BSE use increased perceived restriction and task interference for some tasks in confined space

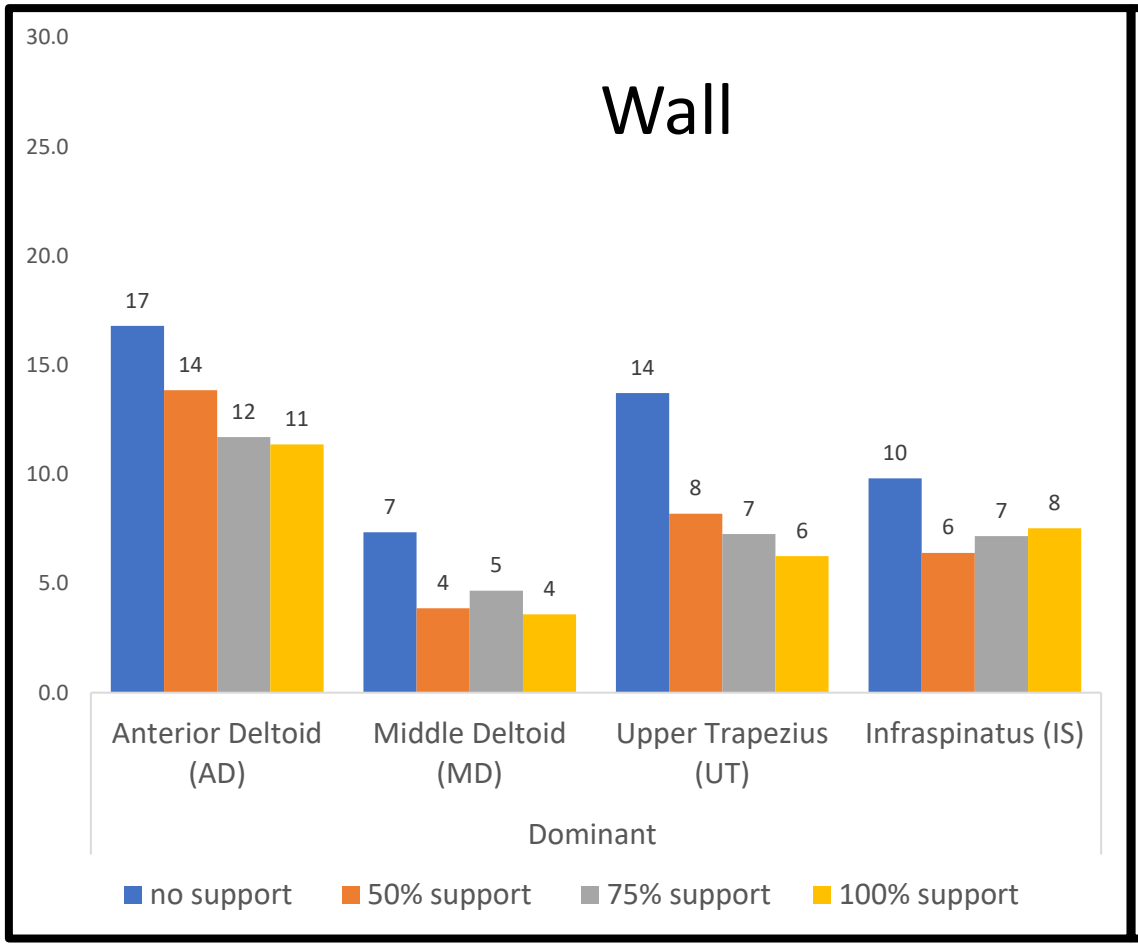
Magnitude of such increase depend on BSE types and sexes

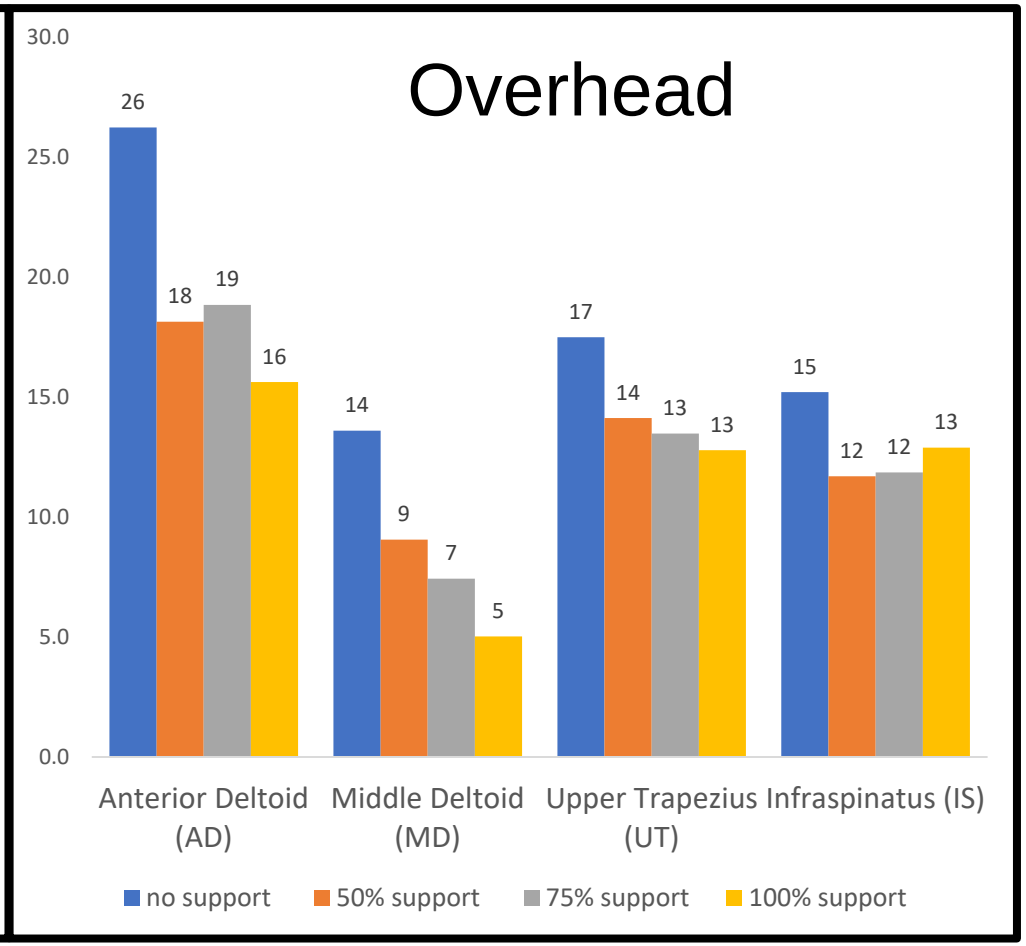


Aim 2: ASE Support Level Evaluation

- To evaluate the optimal and preferred support level by location and type of task
  - Location – Overhead versus Wall
  - Type of Task – Static versus Dynamic

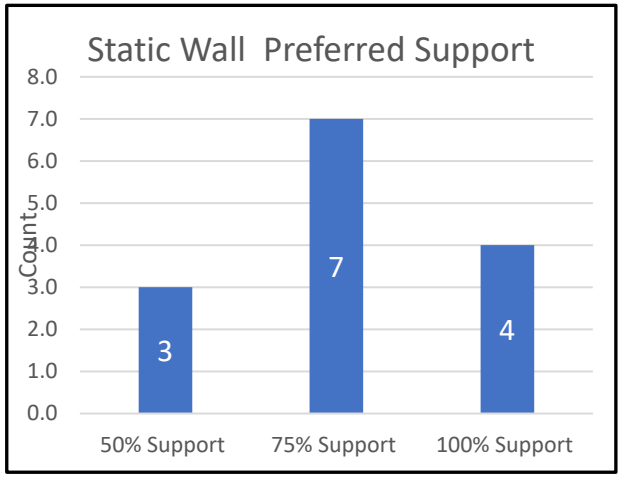
Findings: Static Wall vs Overhead

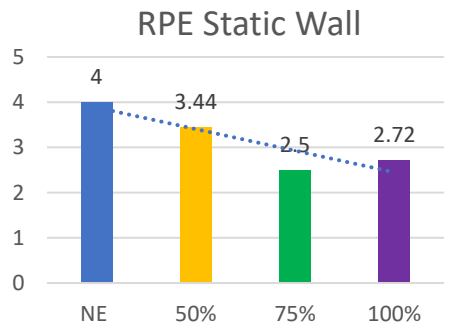


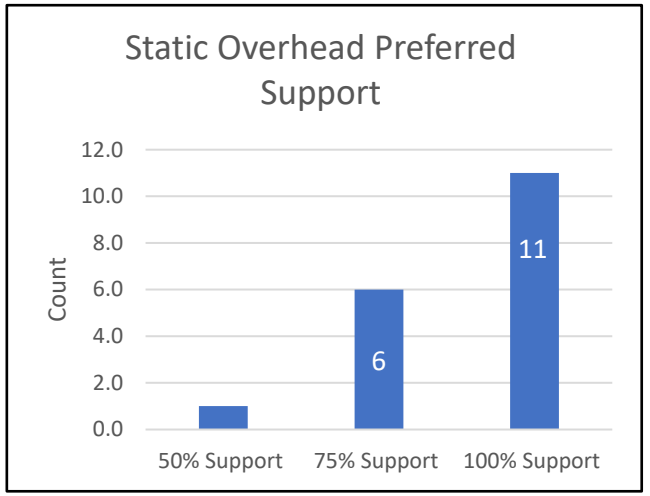


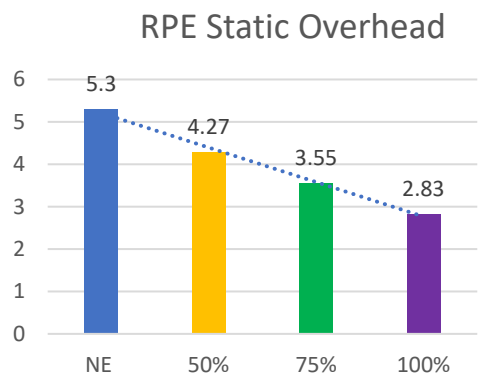
Barrajas-Smith, I., Casu, G., Phillips, B., Barr, A., Kim, S., Barr, A., Rempel, D., Nussbaum M.A., and Harris-Adamson, C. Evaluation of normalized support settings while performing static and dynamic drilling task overhead and on the wall. In progress.

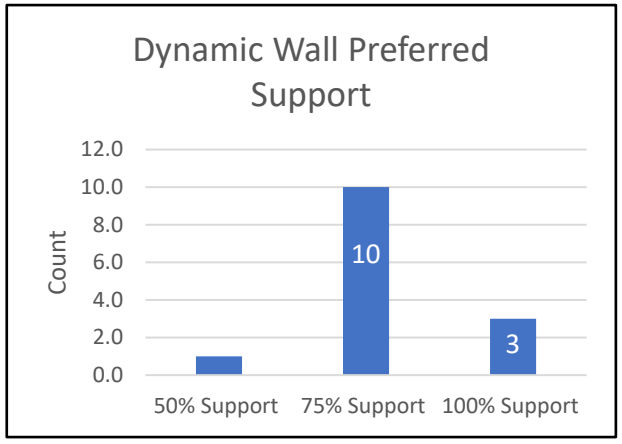
Findings: Support Level Preference vs. RPE

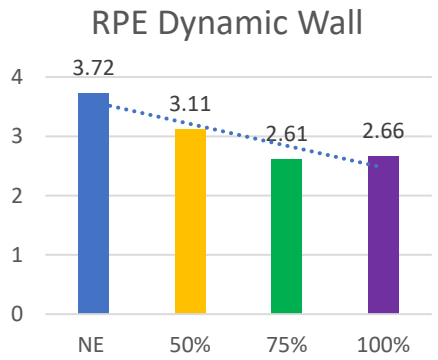


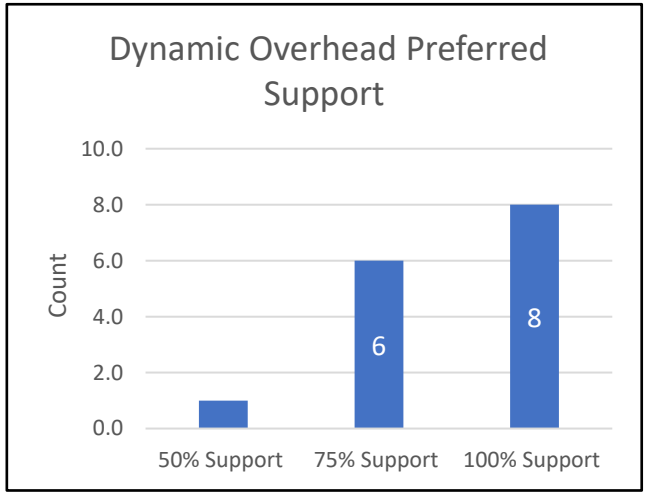


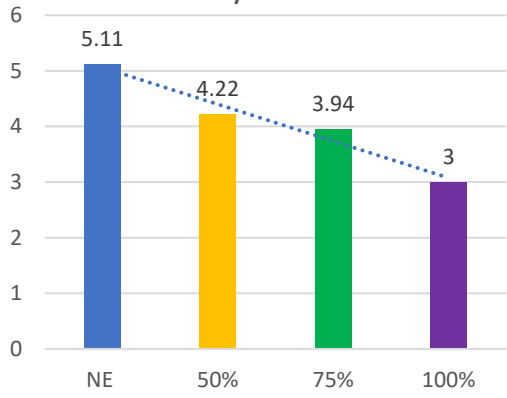












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Task-specific Simulations & Field Eval.

Surface Grinding

Cable Stapling

Drywall Installation

Roofing

Tiling

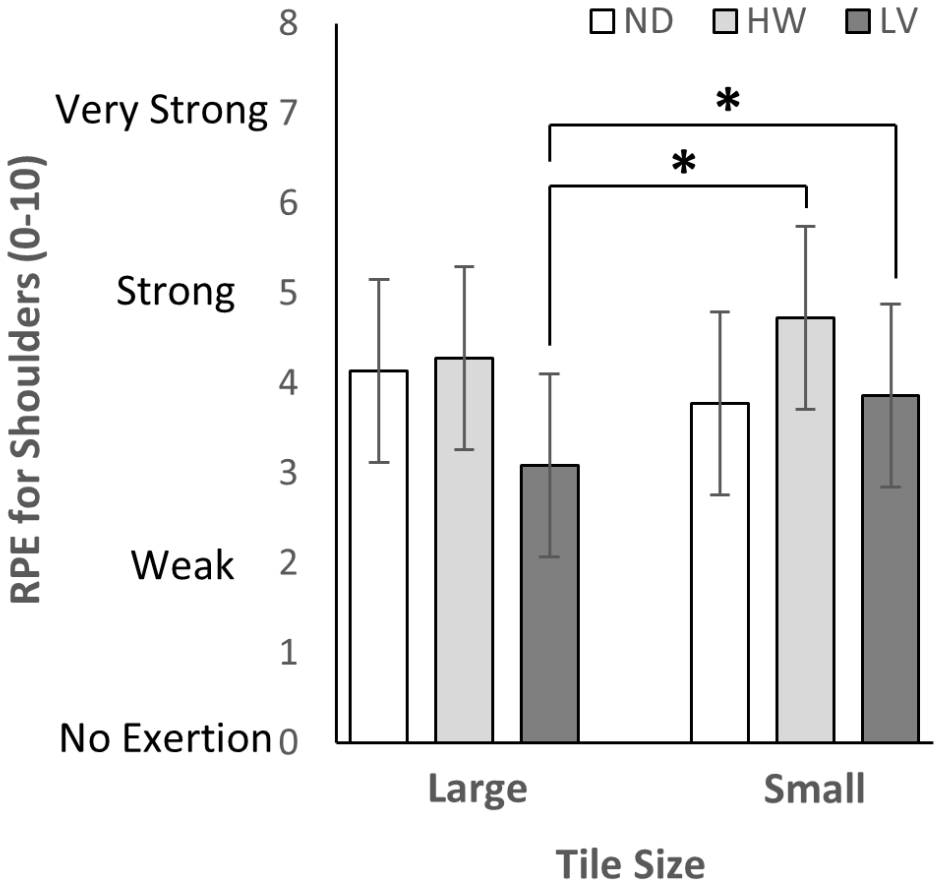
ASE results in progress…

- 75% support across ASEs was the goal for all three ASE tasks
  - Larger individuals and tasks with heavier tools could not get to 75%
  - Results are noisy given the differences in relative support
  - Further analysis is underway to evaluate results relative to actual support level
- Slight increases in perceived “unsafe” and “unbalanced” during tasks.
- Rated perceived exertion and usability varied across ASEs and by task.
  - Further analysis using normalized support values may provide more insight

BSE results in progress…

Tile Installation Simulation – Preliminary Findings

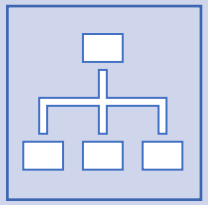
Using a BSE led to higher ratings of perceived exertion (RPEs) in the shoulders and legs, compared to no device



ND: No Device
LV: Laevo Flex
HW: HeroWear Apex

Aim 3. Assess the perceived safety, effectiveness, and acceptability of EXO use by construction workers in a realistic context.

Develop EXO Implementation Guidelines



Type-Benefit considering task characteristics and safety considerations

Field assessment of effectiveness on work performance, physical demand and usability

ASE Guidelines

Tips and tricks for using exoskeletons safely and effectively in construction.

In partnership with CPWR, researchers at the University of California and Virginia Tech have been studying the impact of exoskeletons on construction workers and have compiled resources for you and your team.

- the right fit
- the right task
- the right support
- safety cautions
- contraindications

MORE INFORMATION

Quick Tips

ARM SUPPORT EXOSKELETON
SET UP GUIDE FOR CONSTRUCTION

When performing **overhead tasks**, consider setting the exoskeleton to **100%** of your arm and tool weight (visit www.tiny.url/exofit).

When performing **forward reach tasks**, consider setting the exoskeleton to **75%** of your arm and tool weight (visit www.tiny.url/exofit).

You will need **extra clearance and time** to maneuver through scaffolds or other constrained spaces.

Balance is minimally impacted while walking, even on beams, whether the device is on or off.

Be CAUTIOUS when wearing an Exo while climbing as it can impact your sense of balance and safety when reaching overhead.

Visit www.tiny.url/exofit to generate your individualized support settings based on your sex, height, weight, type of exoskeleton, and task that you will be performing.

Guidelines for Construction Workers

- What is a back support exo?
- Benefits of use
- Choosing the right one
- Using it safely
- Caring for it

Guidelines for Construction Managers

- Implement exos in your workplace
- Training and Safety
- Maintenance and Storage

Guidelines for Construction Owners

- Benefits of investing in exos
- Selecting the right exos for your company
- Developing an exo program
- Staying informed on exo standards

Field Evaluation Results (to date)

- 22 participants aged 18-60 completed 33 field evals
- 77% reporting that they:
  - Fully exert themselves each day
  - Are exhausted at the end of their typical work shift.

- Reported improvements
  - 64% less physical effort
  - 55% less fatigue
  - 58% less discomfort
- 49% thought exos should be standard issue for their type of work
- On a “likely to use” scale 0-10 responses varied widely from 1 to 10 with an average of 6.9

Aim 4. Disseminate study findings nationwide

Construction contractors

Trades

Health and safety professionals

Let's figure out your optimal arm support setting

Exoskeleton Make:

Eksobionics EVO

Preferred Activity:

Overhead Work

Height (cm):

150

Weight (kg):

75

Sex:

Female

Tool Weight (kg):

0

Get Recommendation

Unit Converter

Inches: Convert to cm

Pounds: Convert to kg

Based on your inputs, the recommended support setting for Eksobionics EVO during overhead is 10.

Let's figure out your optimal arm support setting

Exoskeleton Make:

SuitX ShoulderX

Preferred Activity:

Overhead Work

Height (cm):

150

Weight (kg):

75

Sex:

Male

Tool Weight (kg):

0

Get Recommendation

Unit Converter

Inches: Convert to cm

Pounds: Convert to kg

Based on your inputs, the recommended support setting for SuitX ShoulderX during overhead is 10.


J.F.SHEA
KING
J.F.SHEA
SHEA
ELKIN TOOLS


IS YOUR UNION'S
CREDIT UNION
BERKELEY
Cal

THANK YOU!

We would like to acknowledge CPWR, The Center for Construction Research and Training, for their support of this project (U60-OH009762-11).

www.ergo.berkeley.edu
carisaharris@berkeley.edu

https://oshrc.centers.vt.edu/
nussbaum@vt.edu

https://www.ergo.berkeley.edu/research-projects
https://bit.ly.cpwrexo
https://www.facebook.com/UCErgoResearch/posts/3766397566725967

Mentoring SMART Women:

A coordinated approach to supporting safety, health, and wellbeing

Dr. Marissa Baker, PI

Lily Monsey, Research Coordinator

Department of Environmental and Occupational Health Sciences, University of Washington

CPWR Annual r2p Conference

June 10-11, 2024

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ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON | SCHOOL OF PUBLIC HEALTH

Agenda for Today

- Refresher of study aims, background
- Study activity update
- Plans for Dissemination

Study Background

- Tradeswomen are at higher risk for a variety of psychosocial and physical risk factors on the job than their male counterparts
- Pilot research with Washington Women in the Trades identified mentorship as an intervention strategy to offer empowerment and skills to apprentice tradeswomen through targeted support from experienced journeywomen
- Partnership with SMART International, support from CPWR
- Part of NABTU's efforts to improve working conditions for female construction workers
- Mentorship as an intervention strategy offers empowerment and skills to tradeswomen through targeted support from experienced journeywomen

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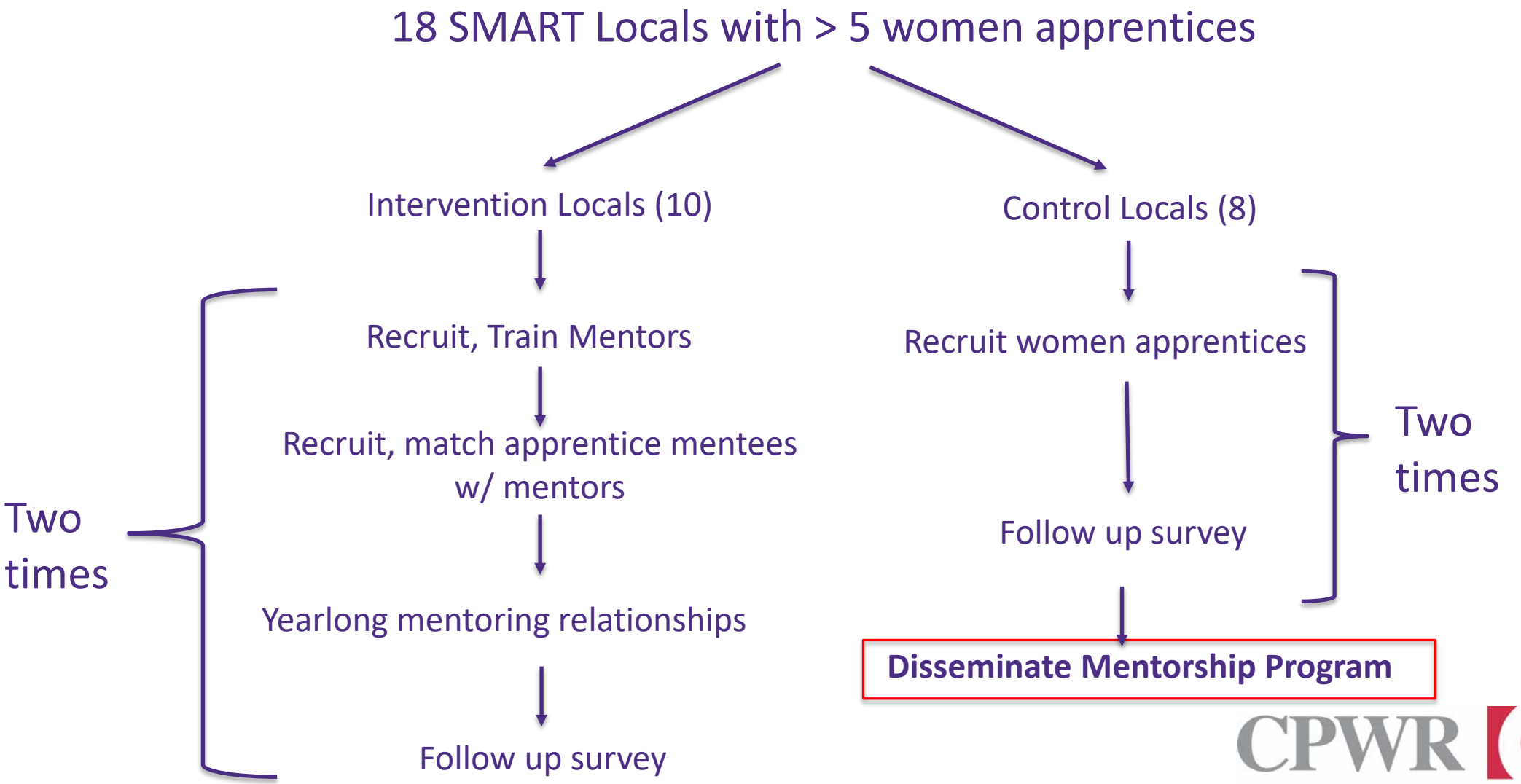
Study Design



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Current Activity

- Round 2 of mentorship dyads complete as of April 2024
- Qualitative interviews with mentors, mentees underway
- Integrating skill-specific videos to add to asynchronous training
- **Analyzing:**
  - Survey data from rounds 1 and 2

Photo courtesy of SMART International

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Mentee, Control Study Retention

	Round 1		Round 2	
	Mentees	Controls	Mentees	Controls
Baseline	38	25	13	15
Midyear Survey	21 (55%)	15 (60%)	12 (92%)	12 (80%)
Follow up (1 yr) Survey	14 (37%)	8 (32%)	10 (77%)	11 (73%)

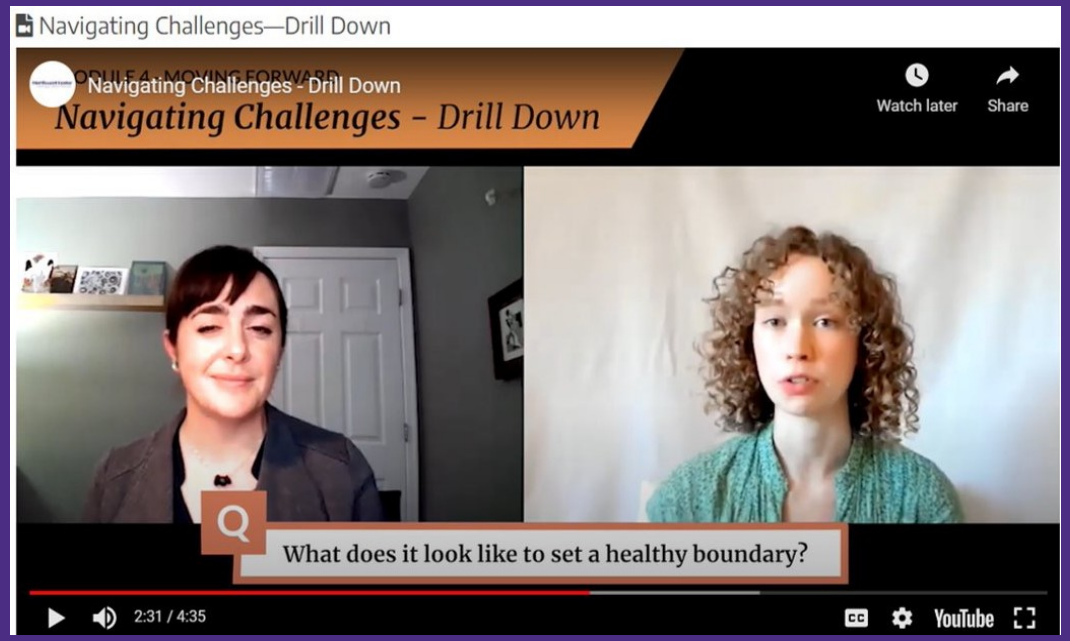
r2p outputs from our project

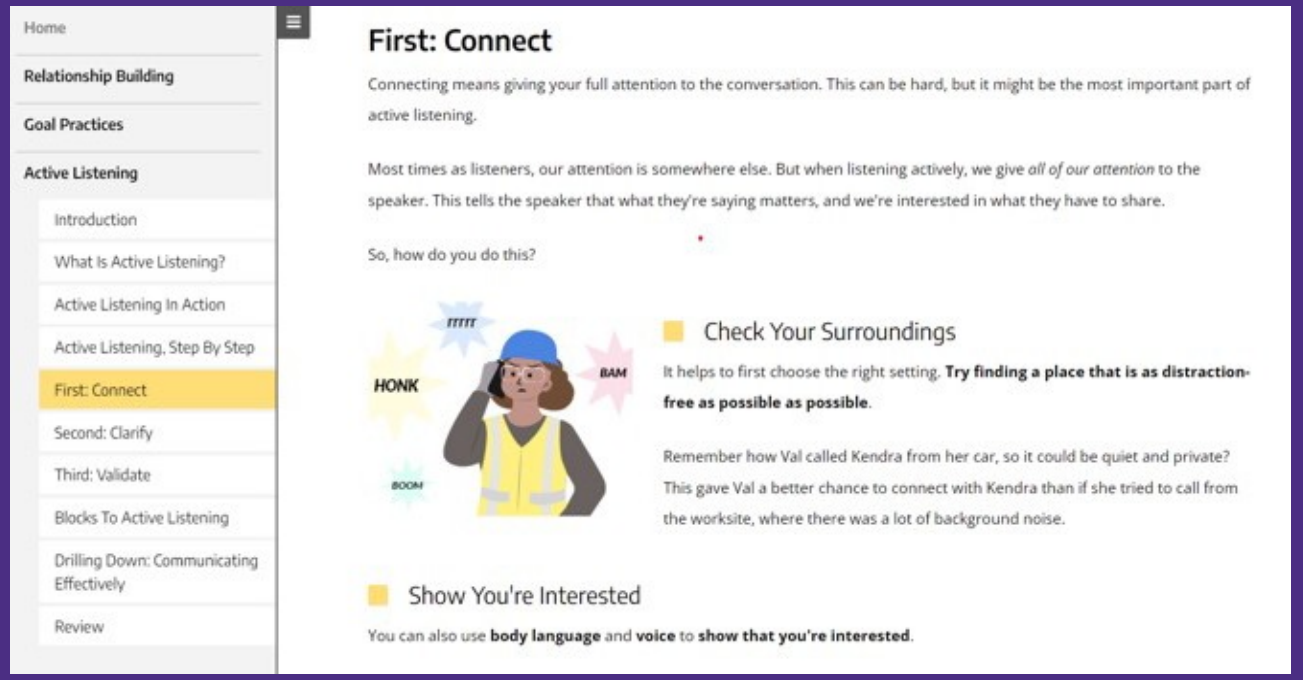
We will show examples of some of these products

- **Asynchronous online mentorship training**
- **Mentor workbook**
- **Synchronous facilitation guides**
- **Skill-based videos**
- **Program evaluation guide**
- **Best practices guide for implementing a mentorship training**

Asynchronous Mentor Training

Video, text, and audio elements
15-25 minute sections





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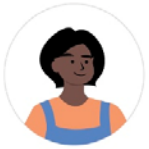
Best Practices Guide



3. What Makes a Good Mentor

Overview:

While is no single combination of qualities that makes an excellent mentor, there are certain qualities for incoming mentors. This section is intended to be a resource in supporting mentor recruitment; particularly for mentors who are new or have not held other mentor-adjacent roles in the trades or other areas of life, these qualities can be helpful to keep in mind as you recruit, and help interested tradeswomen determine if they would be a good fit for the role. The following list is by no means exhaustive; this is intended only to give a sample of potential qualities to consider for potential new mentors.

Mentor Qualities:

1. *Desire to support future tradeswomen*

   In articulating their desire to step into a mentorship role, many mentors talk about their motivation to support incoming tradeswomen in ways they themselves did not feel supported themselves as apprentices. Given the "survivor" mentality among many women in the trades, who had to overcome steep social and political hurdles to succeed in the profession—wanting to reduce these barriers for new tradeswomen and making the trades a more welcoming and supportive space for new tradeswomen.

2. *Strong Communication*

   While communication skills can be learned and built over time a mentor's tenure, successful mentors often come in with solid communication skills and ability to reach out and readily connect with mentees. This quality is particularly important mentor/mentee relationships where most of the communication does not take place in person—ability to build connection and support mentees via phone, text, or video chat can require an extra layer of communication skills to fill in the gaps of body language, tone, and expression that are harder to read over the phone.

1. Overview Section

2. Recommendations for implementation

Reflections from our mentorship study:

With our cohort of mentors, the common denominator across fully engaged mentors was a desire to make the trades a more welcoming space for new tradeswomen. Every mentor had stories that illustrated their own journey toward "making it" in the trades as successful journeywomen: this involved strategies to overcome discrimination, harassment, and tokenism that comes with being a woman in the trades. While mentors often shared that there is a mentality in the trades of putting up with harassment or aggression on the job as a kind of rite of passage, many mentors expressed desire to break this cycle through more supportive programs for tradeswomen, like mentorship.

While we did not require all mentors to be women, our cohort was majority women (one male mentor participated.) Having your mentors share the gendered experience of your mentees creates a sense of camaraderie and shared experience among dyads; however, trust is often the biggest factor in determining the success of a pairing: men can be excellent mentors for the right tradeswoman mentee. If you do decide to open up the mentor role to all genders, we would recommend having mentees preference whether they would like at tradeswoman mentor, or if they are open to working with a tradesman. This ensures that all participants feel comfortable with their matches.

3. Lessons learned from mentorship study

Aim 4: Dissemination of Mentorship Program

- Make training modules publicly available: these will be linked on CPWR's website
  - Share training guide, best practices guide
- This summer: reaching out to control locals to deliver mentorship materials and offer support
- Working with Chicago Women in Trades to disseminate more widely

Support and Acknowledgement

- CPWR
- SMART International
- Study team members: Dr. Noah Seixas, Dr. Hendrika Meischke
- Trainer: M Miller
- SMART mentor extraordinaire: Lisa Davis

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Thank you!

Questions? Want to see more?

Marissa Baker (PI) :
bakermg@uw.edu

Lily Monsey (Research Coordinator):
lilymm04@uw.edu

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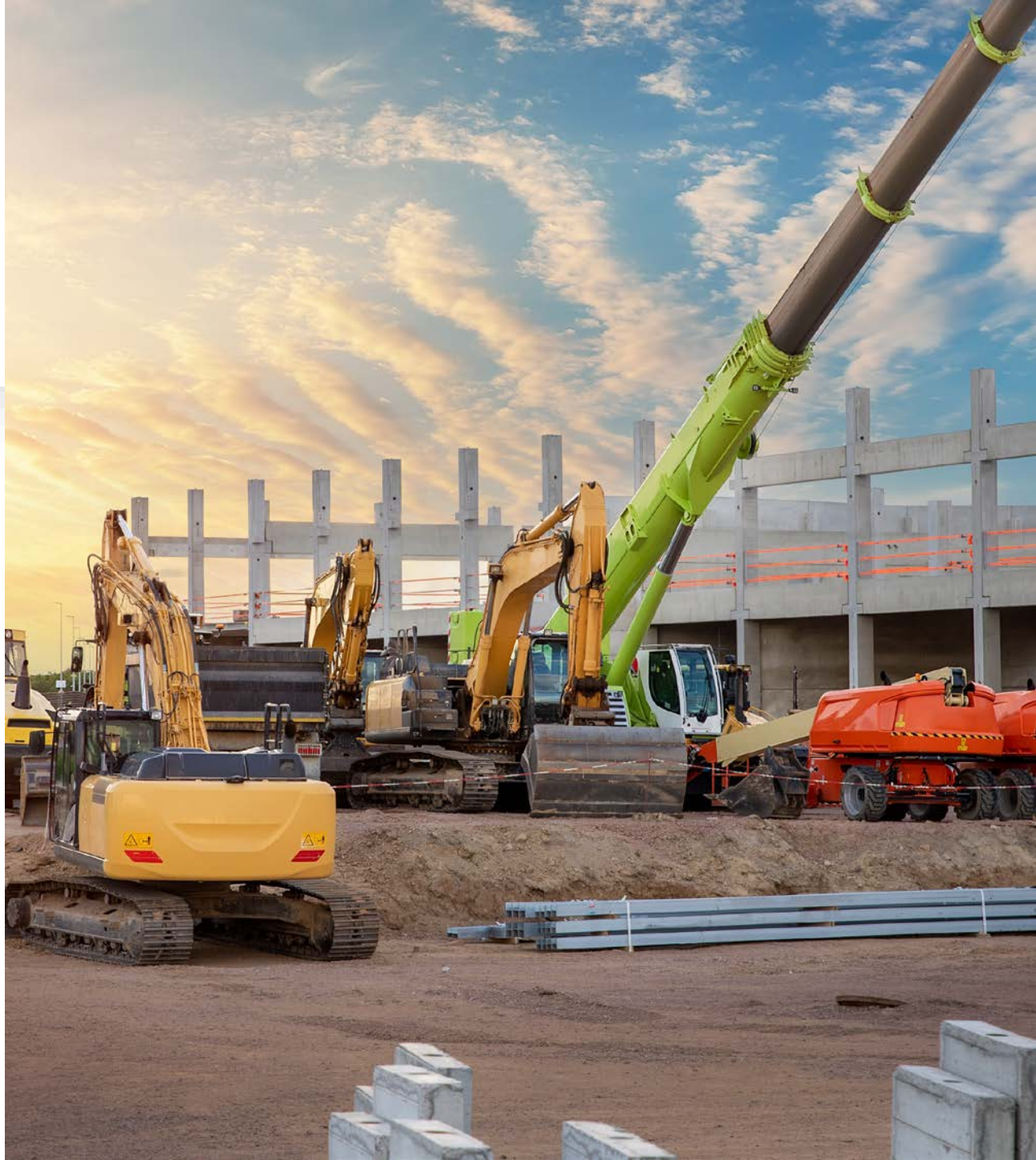
Research Session #2: Lessons Learned from Research & Implementation

Moderator: **Doug Trout, MD, MHS**, Medical Officer, Office of Construction Safety and Health, NIOSH

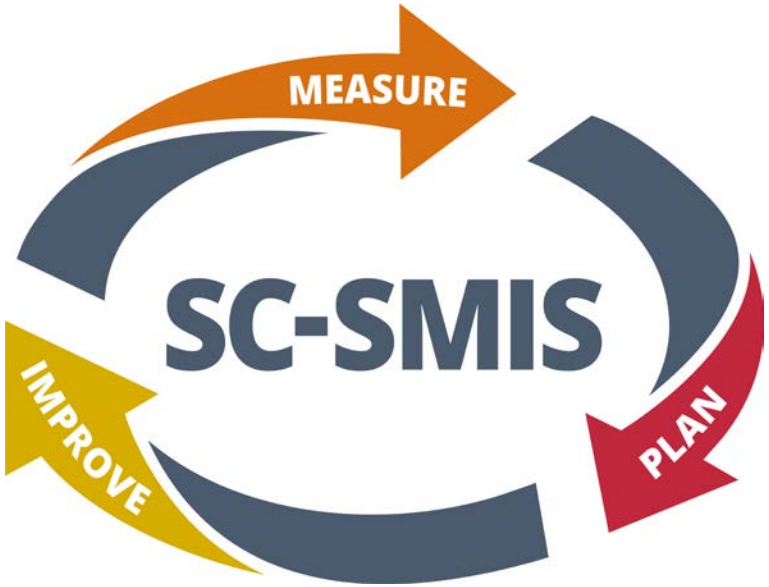
Safety Climate-Safety Management Information System (SC-SMIS) Update & Hear Safety Directors Share How They Strengthen the Safety Climate Indicators
Linda M. Goldenhar, PhD, Director, Evaluation and Research, CPWR (retired)

Prevention Through Augmented Pre-Task Planning
Babak Memarian, PhD, CSP, CHST, Director, Safety Research, CPWR

Health Hazard Controls Industry Diffusion: Evidence-Based Intervention Strategy (PTD Diffusion)
Deborah E. Dickerson, PhD, CIH, CSP, Associate Professor, Grado Department of Industrial and Systems Engineering; and Director, Healthy Work Design Laboratory, Virginia Tech



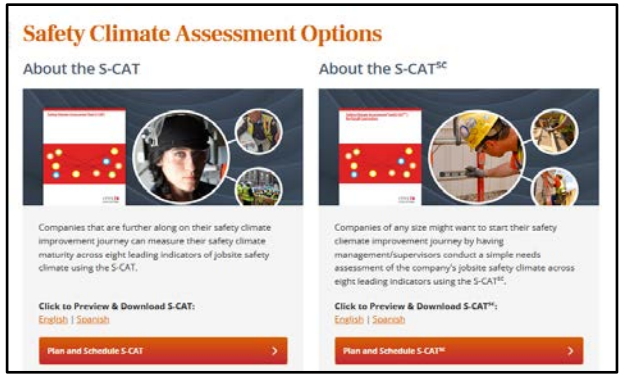
SC-SMIS update + safety directors share how they strengthen safety climate indicators



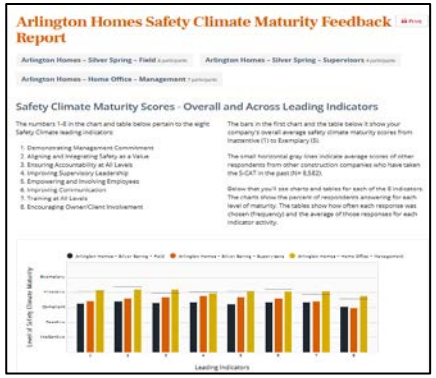
CPWR r2p meeting
June 11-12, 2024

Continuous safety climate and safety management improvement

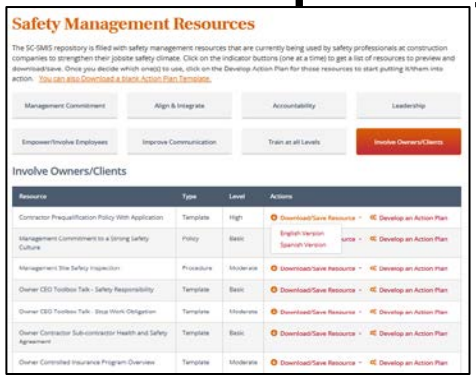
Conduct safety climate assessments



Run reports



Safety management resource repository



Download/tailor resources

CONTRACTOR PREQUALIFICATION POLICY AND APPLICATION

PURPOSE

This policy ensures we hire only those contractors committed to working safely and who offer minimal risk from a financial and business operations standpoint.

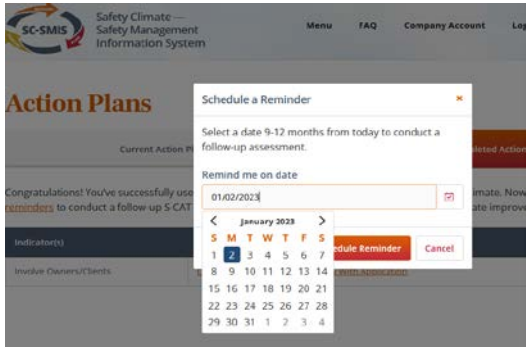
A. Prequalification is based upon:
   a. The contractor's demonstrated safety performance
   b. The contractor's ability to manage an effective safety program
B. The Prequalification application asks for supporting information on the following:
   a. Safety statistics
   b. Safety program and training content

PRE-QUALIFICATION REQUIREMENTS

- All contractors with a contract amount of $$XXX or greater to provide labor must complete a pre-qualification application that will be used by **[COMPANY NAME]** to determine hiring.
- A "Letter of Exception" (LOE) process is intended to be a last resort option considered for those not meeting our basic criteria. This process is explained later in this document.
- Contractors with contract amounts of $$XXX or greater that do not meet our safety criteria would also require a LOE.
- All contractors are required to pre-qualify on an annual, rolling calendar year basis. Pre-qualification date will be the date all information in the pre-qualification package is complete and the contractor is fully qualified through the pre-qualification package review or LOE.

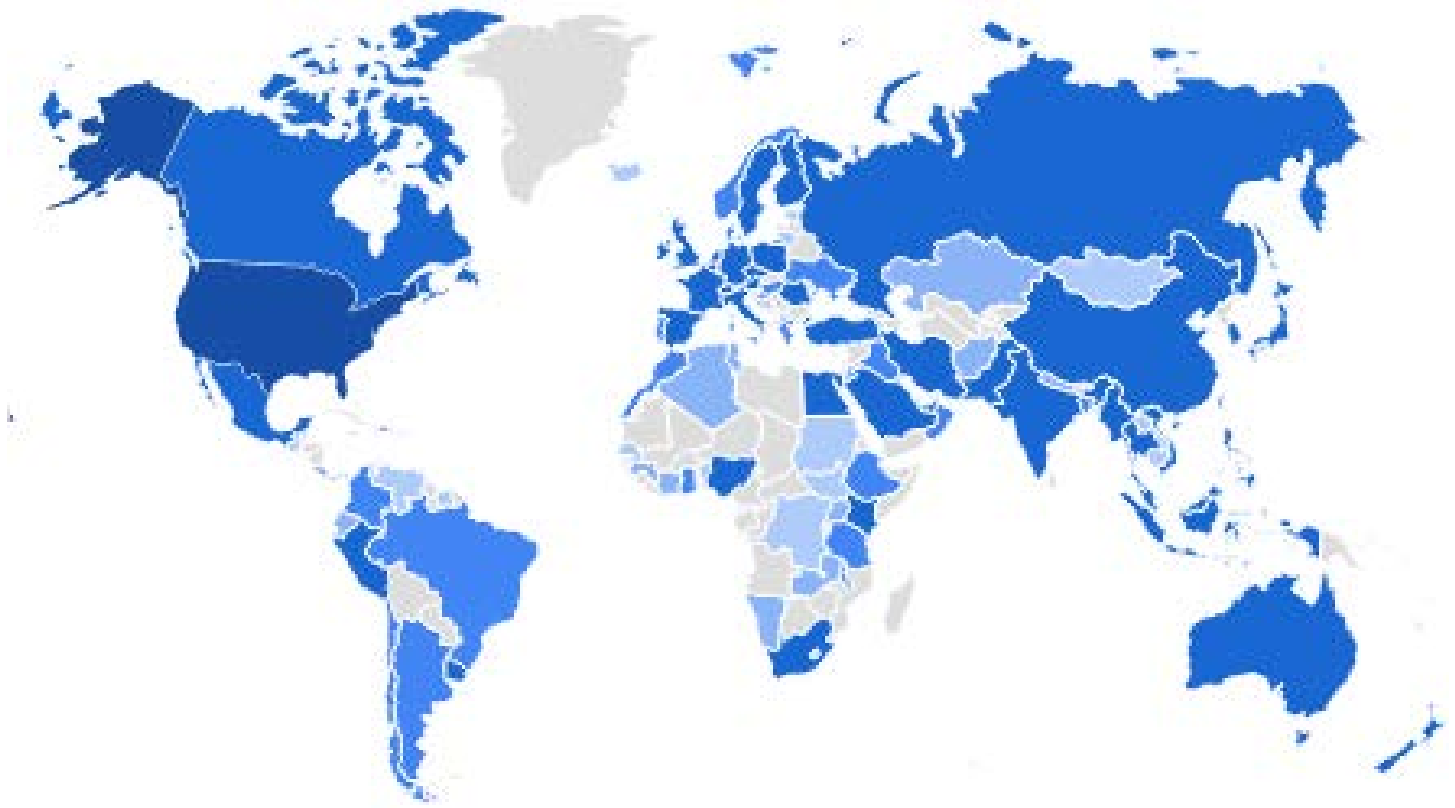
Plan implementation

Schedule annual assessments



SC-SMIS Visits and Use

Cumulative January 1, 2021 – June 6, 2024



Top 10

28,041

new visits

US (78.9%)

Canada (8.3%)

China

UK

Germany

Netherlands

Australia

Indonesia

France

India

# of accounts created	510 Construction 372 Non-Construction **882 Total**
# of guests	515
# of companies conducting S-CAT or S-CAT^{SC}	237 (27%)
# of S-CAT & S-CAT^{SC} completed	8,354 (plus 7,495 S-CATs from original site)
# of times resources have been downloaded	135,968

Top 15 downloads

(Range of downloads across all resources 1,313 - 3,604)

Accountability	Good Catch-Near Miss Reporting Program with sample templates
Align & Integrate	Site Safety Audit
Management Commitment	Management Site Safety Inspection
Leadership	Foundations for Safety Leadership (FSL) Handbook
Improve Communication	Owner CEO Toolbox Talk - Safety Responsibility
Accountability	Safety Recognition Program Guidelines
Improve Communication	Owner CEO Toolbox Talk - Stop Work Obligation
Management Commitment	Management Commitment to a Strong Safety Culture
Leadership	Foundations for Safety Leadership (FSL) Course Description
Accountability	Near Miss - Good Catch Program with sample reporting templates
Improve Communication	New Hire Identification
Empower/Involve Employees	Report Unsafe Condition - Stand Up Moment
Management Commitment	Zero Tolerance Poster Bundle, Anti-Harassment and Bias Policy Communication Protocols, Graffiti Policy

Safety directors talk about what they do to strengthen the eight safety climate indicators

Thank you!

It’s been a pleasure

Prevention through Augmented Pre-Task Planning

Babak Memarian, Ph.D., CSP, CHST
Director of Safety Research

Sara Brooks, MPH
Industrial Hygienist

Chris Le, MPH
Solutions Database Program Manager

CPWR- The Center for Construction Research and Training

June 11, 2024
Silver Spring, MD

CPWR's Project Team

Sara Brooks, MPH
Industrial Hygienist

Chris Le, MPH
Solutions Program Manager

Daniel Mehrabi, Ph.D.
Intern/Arizona State University

Babak Memarian, Ph.D., CSP, CHST
Director of Safety Research

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Problem Statement

- Work-related incidents can be prevented if hazards are proactively recognized and addressed.
- Pre-task planning (PTP) is intended to serve this goal.
- Challenges and shortcomings:
  - Mainly from a compliance perspective
  - Lack of opportunity for workers' input
  - Lack of task-specific content based on actual site conditions
  - Inconsistent design, language, and implementation
  - Lack of workers' engagement and "buy-in"

Project AIMS

“Learn and incorporate what workers say about the task.”

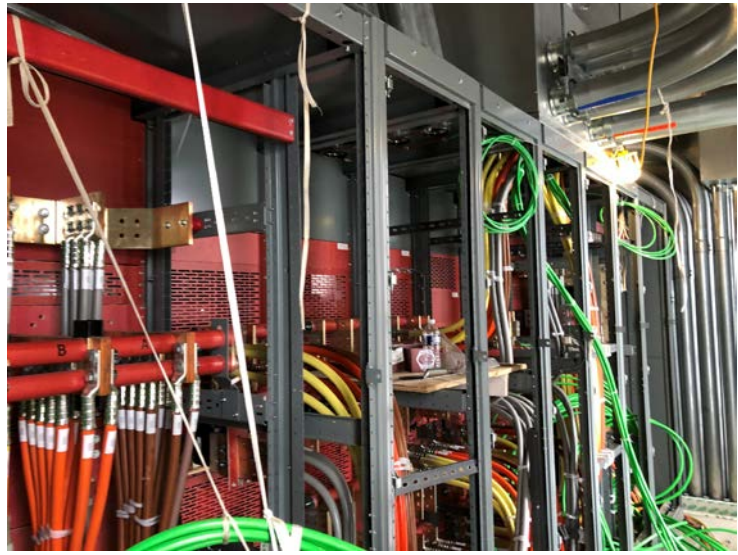
- **Aim 1:** Establish partnership with electrical contractors, unions, and associations
- **Aim 2:** Develop a repository for high-risk electrical tasks
- **Aim 3:** Develop enhanced Pre-Task Planning resources
- **Aim 4:** Evaluate the impact and effectiveness
- **Aim 5:** Dissemination

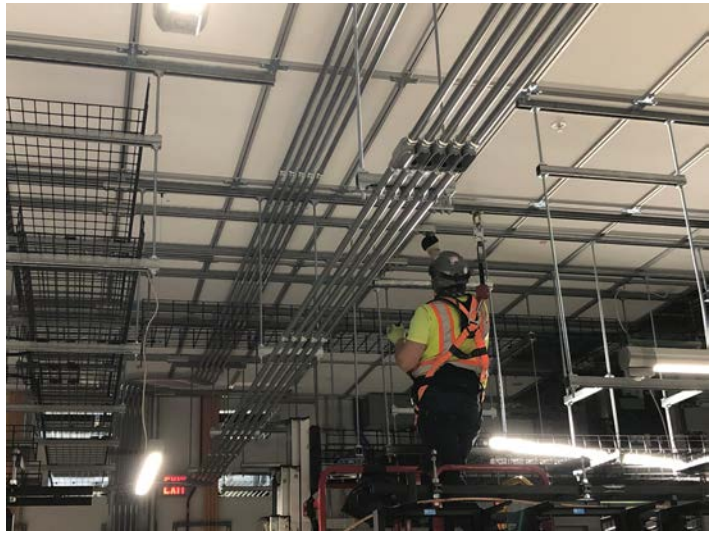
Partnership & Industry Advisory Group

Electrical Tasks Studied to Date

13 electrical tasks studied to date:

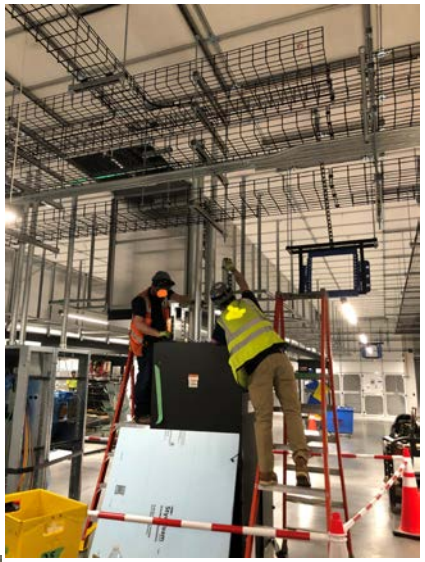
- Overhead Conduit Installation
- Installing Lighting Tracks & Supports
- Site Preparation and Layout
- Pulling Wire
- Terminating Junction Boxes
- Electrical Demolition
- Cable Tray Installation
- Grounding
- Busway Installation
- Terminating Cables/Wires
- Material Handling/Logistics
- Wiring AC Units
- QA/QC





Electrical Task Analysis

- Interviews to assess workers' challenges and explore contributing work factors:
  - Physical
  - Mental
  - Time
  - Frustration
  - Other
- 10 site visits to date including a commercial warehouse, a data center, a museum, a substation, and multiple office buildings
- 195 interviews with electrical workers and management



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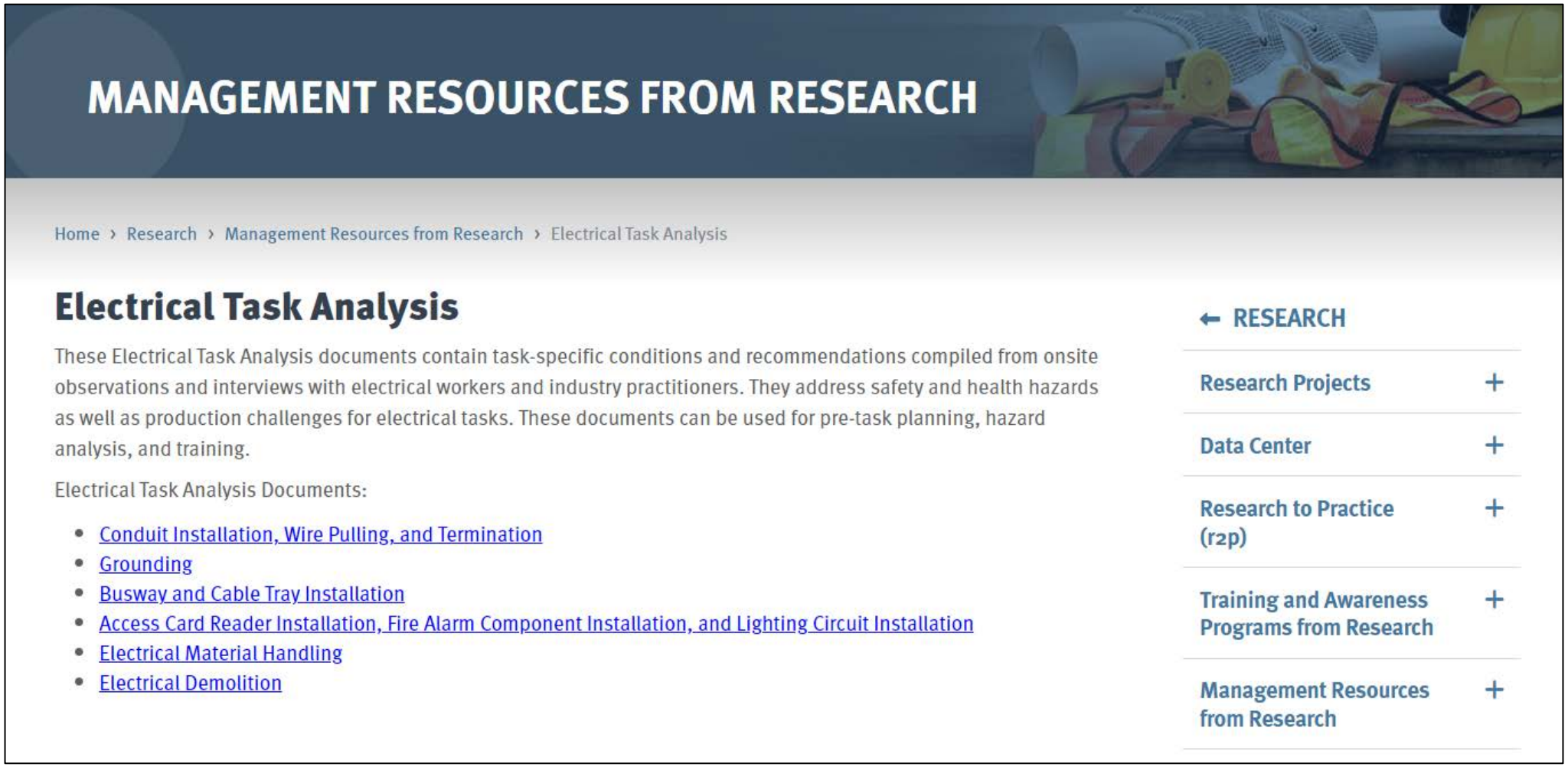
Electrical Task Analysis Page



www.cpwr.com/electrical-tasks

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Sample Electrical Task Analysis Document

Electrical Task Analysis Document

Conduit Installation, Wire Pulling, and Termination

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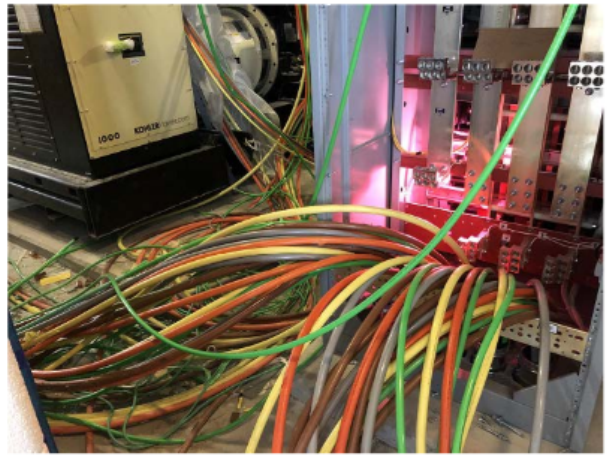
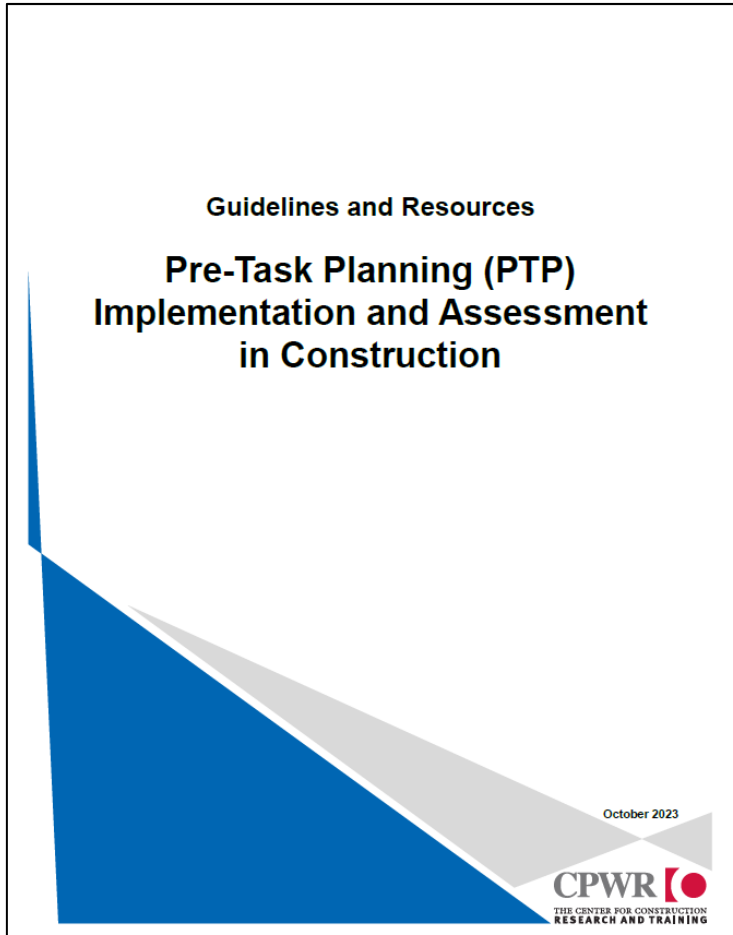
CONDITIONS	RECOMMENDATIONS
Handling cables and wires in tight spaces in awkward positions: • Installing cables and wires at ground level in awkward positions can increase the risk of ergonomic injuries and lacerations during wire stripping. Additionally, the inherent bend in wires when taken directly off the reel can make handling and pulling them through conduit more difficult. • The restricted space around switchgear may require manual bending and shaping of heavy cables if mechanical benders will not fit, further elevating the risk of ergonomic injuries. 	• Don appropriate hand and arm PPE • Increase the frequency of breaks • Rotate workers if feasible • Stretch and flex • Unbend the wire using available hard surfaces and tools • Hand-held cable strippers • Mechanical wire and cable feeder • Powered wire-stripping machine • Wire dispensing cart

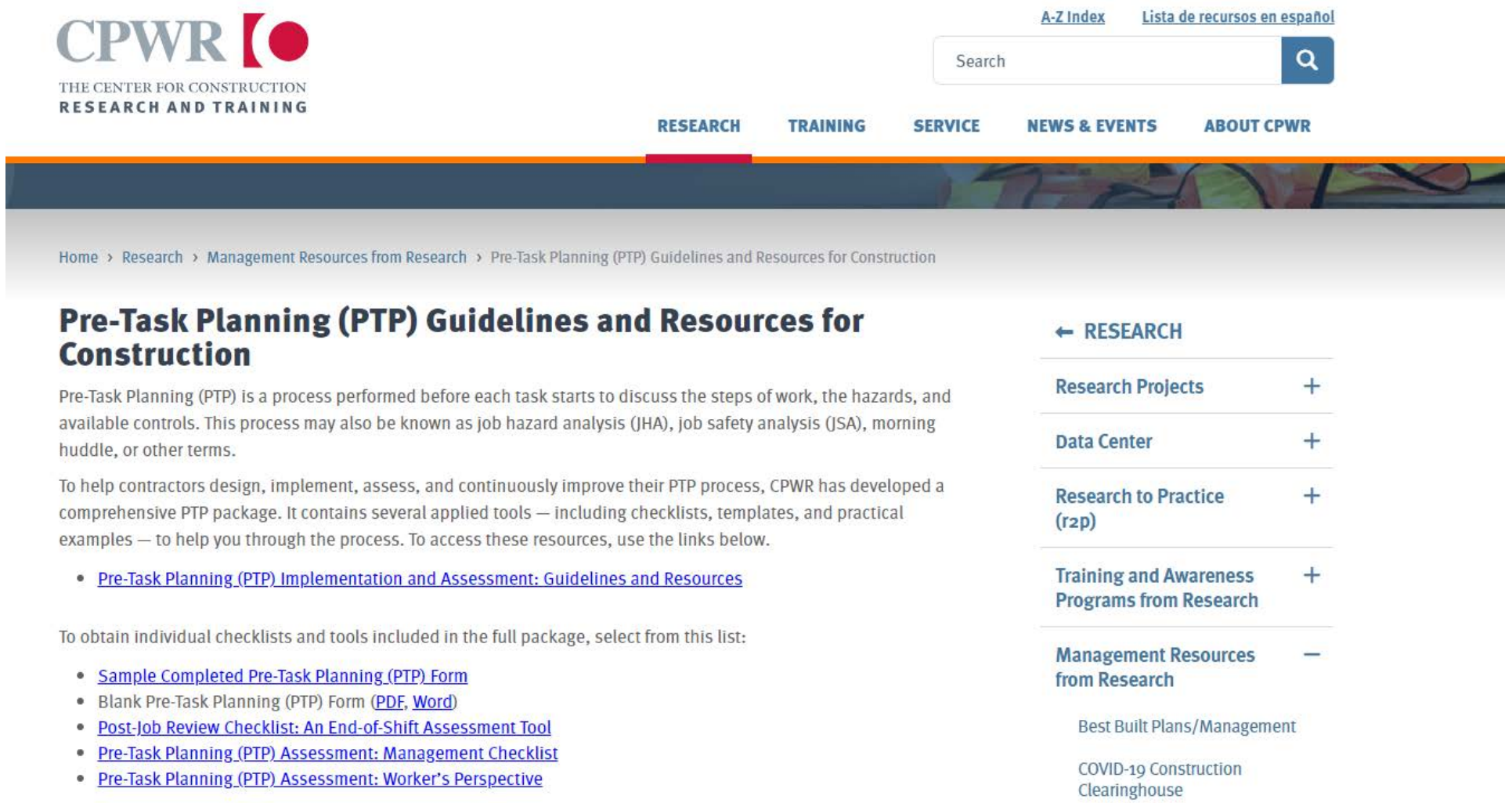
A Comprehensive PTP Guidelines & Resources Package

- Translated research findings into an easy-to-use, comprehensive PTP package (www.cpwr.com/ptp)
- Helps contractors design, implement, assess, and continuously improve their PTP
- Contains:
  - Implementation and Assessment Guidelines
  - Sample Completed PTP Form
  - Blank PTP Template (PDF and Word)
  - Post-Job Review Checklist
  - Management PTP Assessment Checklist
  - Workers' Perspective Questionnaire

Pre-Task Planning (PTP) Implementation and Assessment: Guidelines and Resources



Pre-Task Planning (PTP) Guidelines and Resources Page

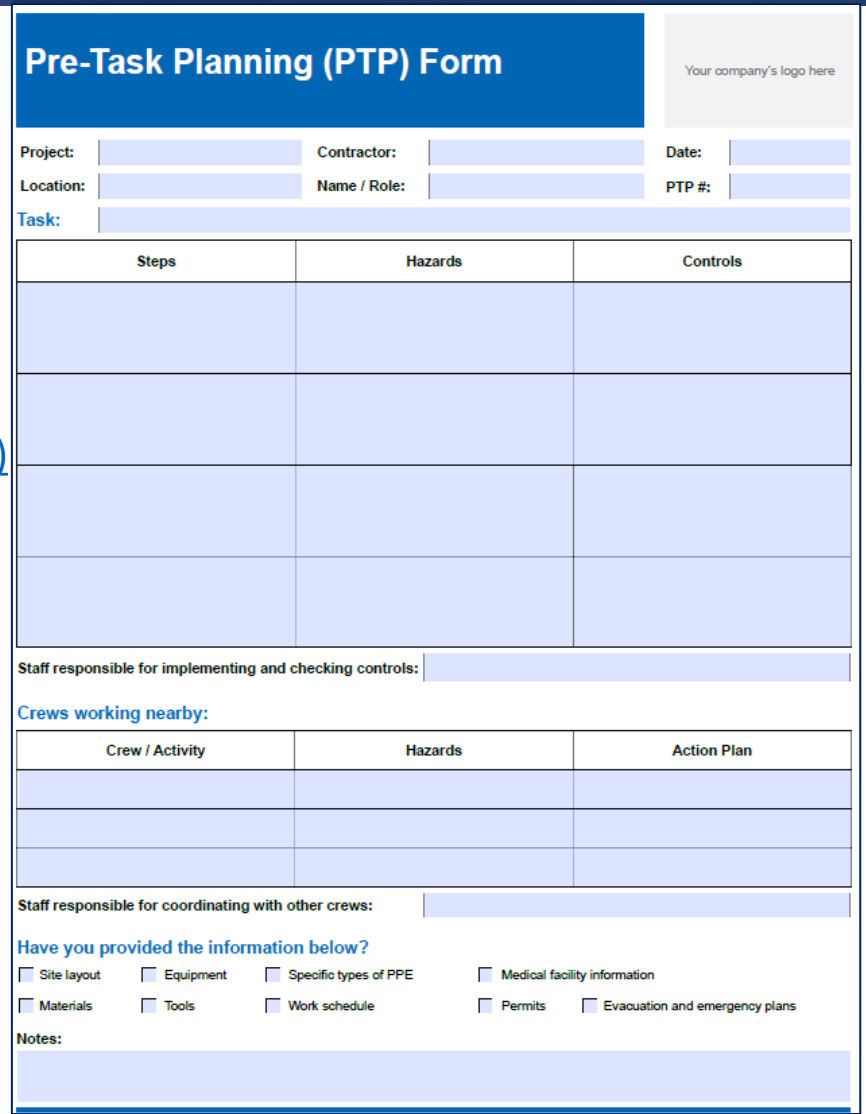


www.cpwr.com/ptp

Blank PTP Template

- Ready to develop your own PTP?
- Follow the example provided in CPWR's package
- Download:
  - Sample Completed PTP: Sample-Completed-Pre-Task-Plan-PTP-Form.pdf (cpwr.com)
  - Blank PTP form: Blank-Pre-Task-Plan-PTP-Form-PDF.pdf (cpwr.com)

Note: Web-based version of this form under development – Coming Soon!



Pre-Task Planning (PTP) Form

Your company's logo here

Project: | Contractor: | Date:

Location: | Name / Role: | PTP #:

Task:

Steps	Hazards	Controls

Staff responsible for implementing and checking controls:

Crews working nearby:

Crew / Activity	Hazards	Action Plan

Staff responsible for coordinating with other crews:

Have you provided the information below?

☐ Site layout ☐ Equipment ☐ Specific types of PPE ☐ Medical facility information

☐ Materials ☐ Tools ☐ Work schedule ☐ Permits ☐ Evacuation and emergency plans

Notes:

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How to Develop PTP

- Conduct PTP before each task starts
- Conduct daily walkthroughs and involve workers
- Update and communicate PTP content when condition changes
- Break the task into manageable steps
- Specify hazards associated with each step
- Identify ways to control each hazard
- Identify who is responsible for implementing the controls
- Discuss permit requirements
- Use photos or other visual aids instead of text where possible
- Use educational aids like a whiteboard or live demo

Task: Conduit Installation

Steps	Hazards	Controls
Pre-job set up	• Injury from hand tools and power tools • Slips, trips, and falls	• Inspect all tools prior to use. • Secure the work area and clear bystanders. • Use site-specific PPE. • Maintain good housekeeping. • Complete hands-on training prior to using power tools. • Evaluate materials to be drilled for potential hazards (e.g., lead based paint).
Bend conduit using conduit bender tool 	• Injury to hands, including pinching fingers • Strain/sprain from awkward position	• Use site-specific PPE. • Keep hands away from bender head. • Use proper body positioning when bending conduit.
Cut conduit with reciprocating saw 	• Lacerations • Metal debris in eyes • Strain/sprain from awkward position	• Use site-specific PPE. • Secure conduit with a vise prior to cutting. • Keep hands away from saw blade. • Use proper body positioning.
Drill holes with power drill and install conduit supports 	• Debris in eyes • Lacerations • Strain/sprain from awkward position • Breathing hazardous dust • Noise • Burns	• Use site-specific PPE. • In addition to site-specific PPE, use an N95 mask and hearing protection. • Make sure drill bits are sharp and not cracked before use so they don't break off and cause injury. • Do not wear loose fitting clothing that can get caught in moving parts. • Keep hair and jewelry out of the drill path. • Keep hands away from rotating drill bit. • Use proper body positioning. • After drilling, do not touch the drill bit, it is often extremely hot.
Drill hole in junction box with power drill	• Debris in eyes • Lacerations • Strain/sprain from awkward position • Breathing hazardous dust • Noise • Burns	• Use site-specific PPE. • In addition to site-specific PPE, use an N95 mask and hearing protection. • Do not wear loose fitting clothing that can get caught in moving parts. • Keep hair and jewelry out of the drill path. • Keep hands away from rotating drill bit. • Secure junction box with a vise prior to drilling to prevent rotation. • Use proper body positioning. • After drilling, do not to touch the drill bit, it is often extremely hot.
Place conduit 	• Falls • Strain/sprain from awkward position • Debris in eyes	• Use site-specific PPE. • If using a ladder, select one of appropriate height. • Position the ladder directly beneath work area to avoid over-reaching as this can result in falls.

Staff responsible for implementing and checking controls: R. Garcia

How to Develop PTP

- Discuss hazards posed by other crews working nearby
- Include supplemental information
- Give workers the opportunity to lead the PTP meeting
- Provide PTP training – how to complete and how to conduct it
- Gather and incorporate workers' feedback on the PTP process

Crews working nearby:

Crew / Activity	Hazards	Action Plan
Ironworkers / Overhead work	• Falling objects	• Use safety nets. • Establish a clearly marked safety perimeter.
Drywallers / Sanding	• Silica exposure	• Wear a dust mask or N95.
Laborers / Excavation	• Cave-ins • Falling into excavation	• Install barriers or fence off excavation site. • Use a spotter when workers are in or near excavation site.
Operating Engineers / Heavy equipment traffic	• Struck by	• Designate marked pedestrian walkways.

Staff responsible for coordinating with other crews: L. Smith

Have you provided the information below?

☑ Site layout ☑ Equipment ☑ Specific types of PPE ☑ Medical facility information

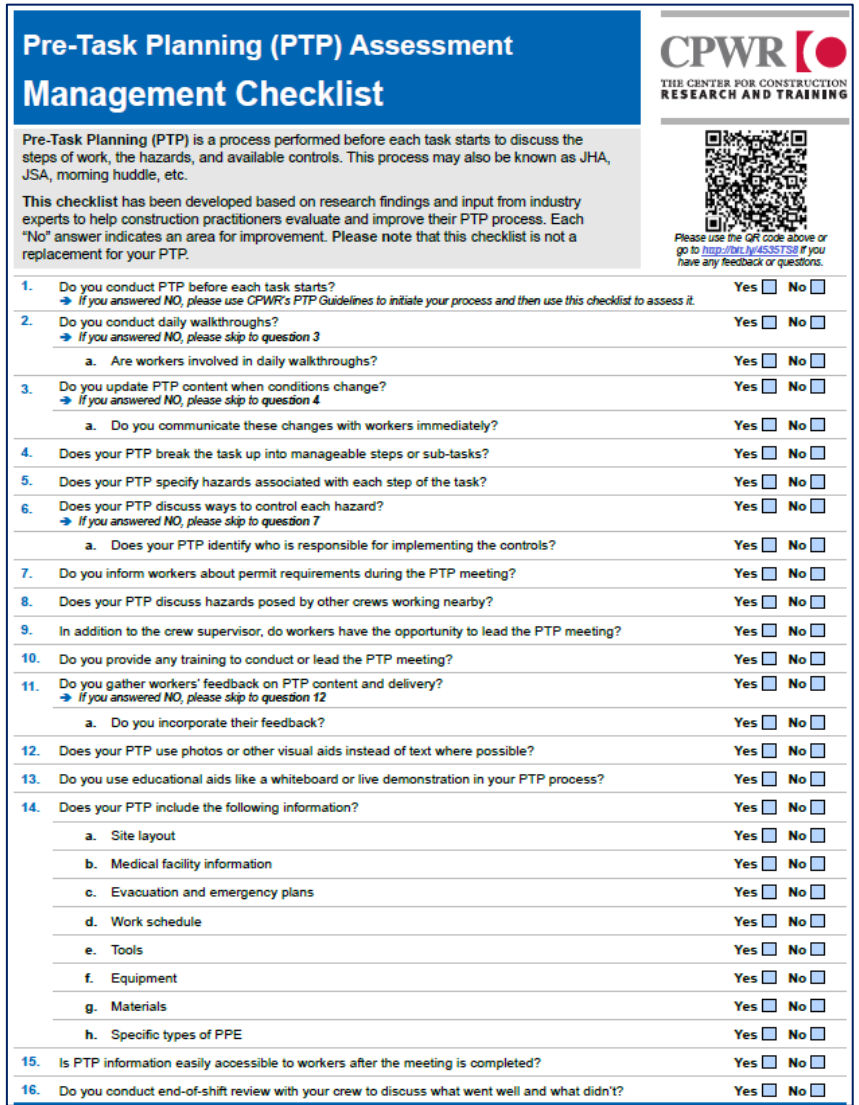
☑ Materials ☑ Tools ☑ Work schedule ☑ Permits ☑ Evacuation and emergency plans

PTP Assessment Management Checklist

- Use the Management Checklist to assess your PTP process
- Each “No” answer indicates an area for improvement
- Use guidelines presented in the PTP package to improve each component

[Pre-Task-Planning-PTP-Assessment-Management-Checklist.pdf (cpwr.com)]

Note: Web-based version of this form under development – Coming Soon!



Pre-Task Planning (PTP) Assessment Management Checklist

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Pre-Task Planning (PTP) is a process performed before each task starts to discuss the steps of work, the hazards, and available controls. This process may also be known as JHA, JSA, morning huddle, etc.

This checklist has been developed based on research findings and input from industry experts to help construction practitioners evaluate and improve their PTP process. Each “No” answer indicates an area for improvement. **Please note** that this checklist is not a replacement for your PTP.

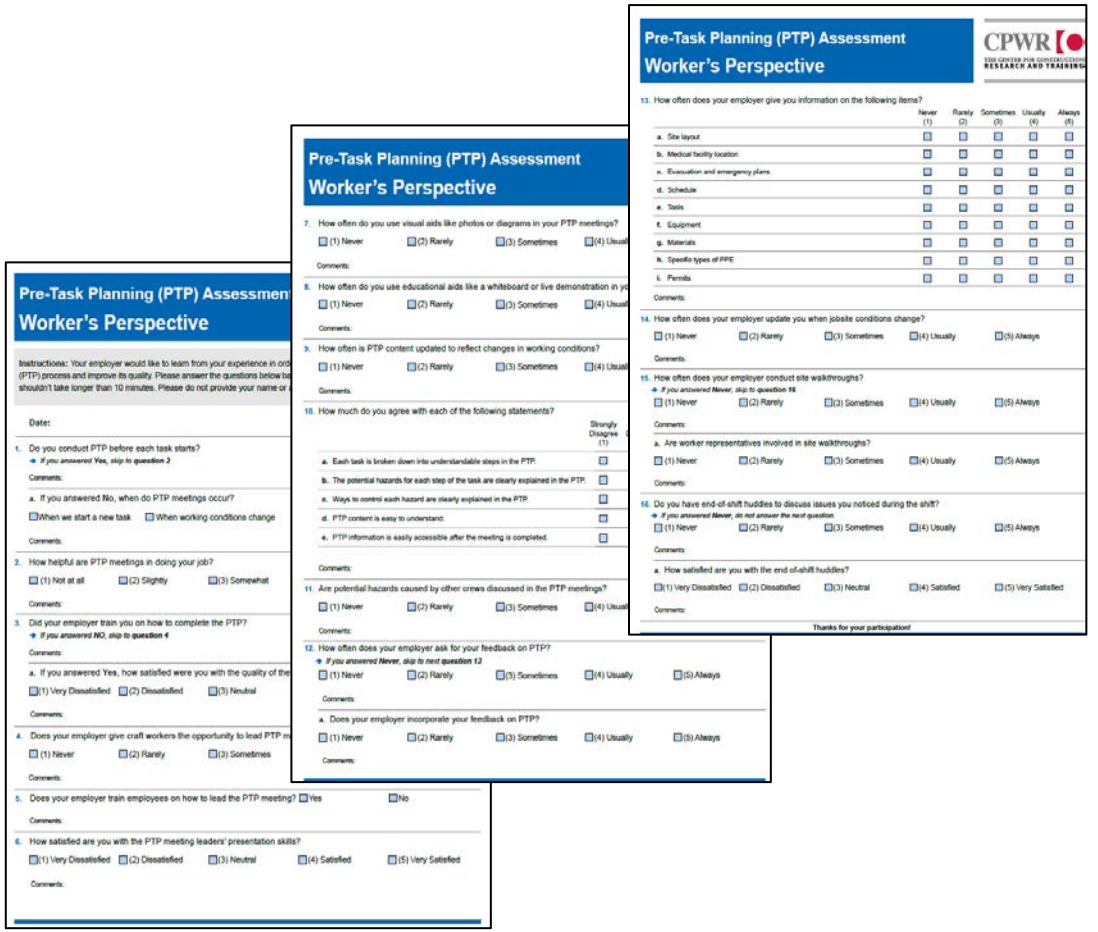
Please use the QR code above or go to http://bit.ly/4535TS8 if you have any feedback or questions.

1.	Do you conduct PTP before each task starts? → *If you answered NO, please use CPWR's PTP Guidelines to initiate your process and then use this checklist to assess it.*	Yes ☐ No ☐
2.	Do you conduct daily walkthroughs? → *If you answered NO, please skip to question 3*	Yes ☐ No ☐
	a. Are workers involved in daily walkthroughs?	Yes ☐ No ☐
3.	Do you update PTP content when conditions change? → *If you answered NO, please skip to question 4*	Yes ☐ No ☐
	a. Do you communicate these changes with workers immediately?	Yes ☐ No ☐
4.	Does your PTP break the task up into manageable steps or sub-tasks?	Yes ☐ No ☐
5.	Does your PTP specify hazards associated with each step of the task?	Yes ☐ No ☐
6.	Does your PTP discuss ways to control each hazard? → *If you answered NO, please skip to question 7*	Yes ☐ No ☐
	a. Does your PTP identify who is responsible for implementing the controls?	Yes ☐ No ☐
7.	Do you inform workers about permit requirements during the PTP meeting?	Yes ☐ No ☐
8.	Does your PTP discuss hazards posed by other crews working nearby?	Yes ☐ No ☐
9.	In addition to the crew supervisor, do workers have the opportunity to lead the PTP meeting?	Yes ☐ No ☐
10.	Do you provide any training to conduct or lead the PTP meeting?	Yes ☐ No ☐
11.	Do you gather workers' feedback on PTP content and delivery? → *If you answered NO, please skip to question 12*	Yes ☐ No ☐
	a. Do you incorporate their feedback?	Yes ☐ No ☐
12.	Does your PTP use photos or other visual aids instead of text where possible?	Yes ☐ No ☐
13.	Do you use educational aids like a whiteboard or live demonstration in your PTP process?	Yes ☐ No ☐
14.	Does your PTP include the following information?	Yes ☐ No ☐
	a. Site layout	Yes ☐ No ☐
	b. Medical facility information	Yes ☐ No ☐
	c. Evacuation and emergency plans	Yes ☐ No ☐
	d. Work schedule	Yes ☐ No ☐
	e. Tools	Yes ☐ No ☐
	f. Equipment	Yes ☐ No ☐
	g. Materials	Yes ☐ No ☐
	h. Specific types of PPE	Yes ☐ No ☐
15.	Is PTP information easily accessible to workers after the meeting is completed?	Yes ☐ No ☐
16.	Do you conduct end-of-shift review with your crew to discuss what went well and what didn't?	Yes ☐ No ☐

Assess Your PTP Process: Workers' Perspectives

- Actively gather firsthand information from workers and continuously incorporate it to reach an optimum outcome
- Identify areas for improvement
- Use guidelines presented in the PTP package to improve each component

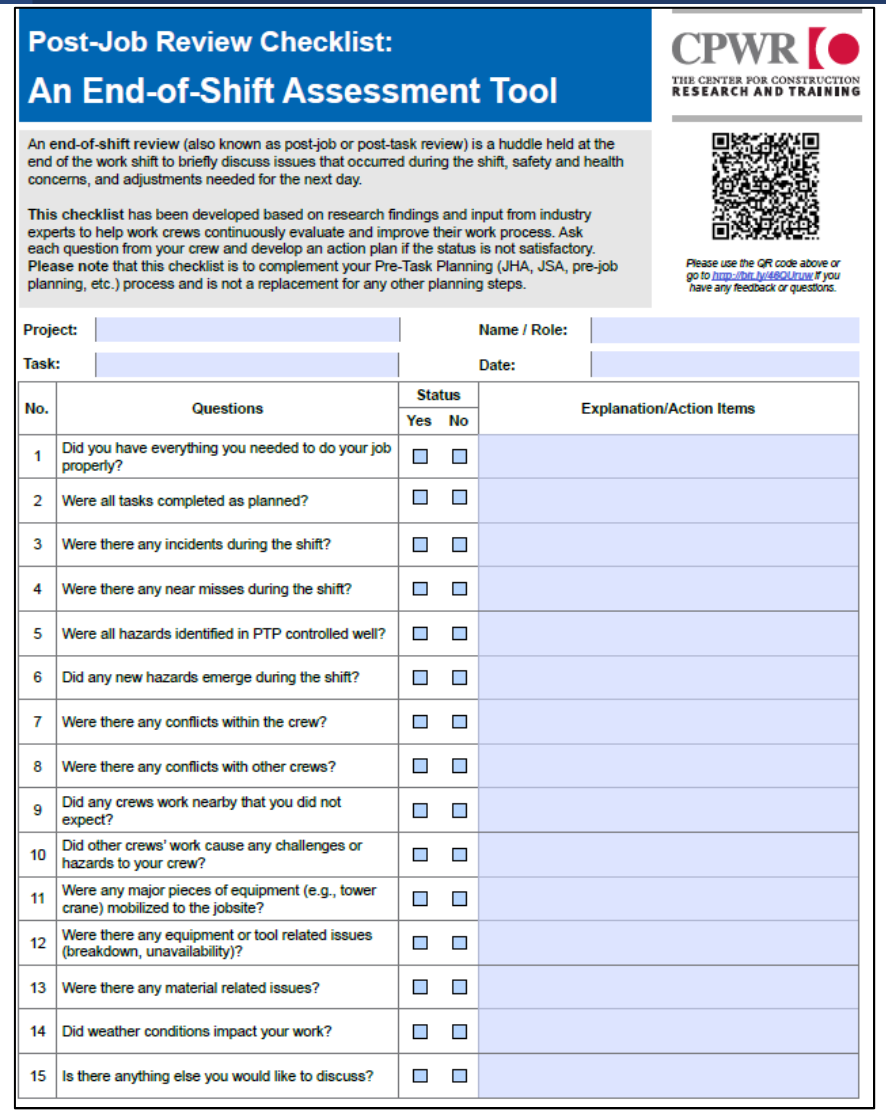
Pre-Task-Planning-PTP-Assessment-Workers-Perspective.pdf (cpwr.com)



Post-Task or End-of-Shift Review

- Huddle at the end of the work shift or completion of the task
- Briefly discuss safety, health, and issues that occurred during the shift
- Plan adjustments and improvements for the next day
- Keep track of issues during the project lifecycle
- 14 interviews held with construction professionals to assess the reliability, functionality, and accessibility of the tool

[Post-Job-Review-Checklist-An-End-of-Shift-Assessment-Tool.pdf (cpwr.com)]



Post-Job Review Checklist:
An End-of-Shift Assessment Tool

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An **end-of-shift review** (also known as post-job or post-task review) is a huddle held at the end of the work shift to briefly discuss issues that occurred during the shift, safety and health concerns, and adjustments needed for the next day.

This checklist has been developed based on research findings and input from industry experts to help work crews continuously evaluate and improve their work process. Ask each question from your crew and develop an action plan if the status is not satisfactory. **Please note** that this checklist is to complement your Pre-Task Planning (JHA, JSA, pre-job planning, etc.) process and is not a replacement for any other planning steps.

Please use the QR code above or go to [illegible] if you have any feedback or questions.

Project: **Name / Role:**
Task: **Date:**

No.	Questions	Status Yes	Status No	Explanation/Action Items
1	Did you have everything you needed to do your job properly?	☐	☐	
2	Were all tasks completed as planned?	☐	☐	
3	Were there any incidents during the shift?	☐	☐	
4	Were there any near misses during the shift?	☐	☐	
5	Were all hazards identified in PTP controlled well?	☐	☐	
6	Did any new hazards emerge during the shift?	☐	☐	
7	Were there any conflicts within the crew?	☐	☐	
8	Were there any conflicts with other crews?	☐	☐	
9	Did any crews work nearby that you did not expect?	☐	☐	
10	Did other crews' work cause any challenges or hazards to your crew?	☐	☐	
11	Were any major pieces of equipment (e.g., tower crane) mobilized to the jobsite?	☐	☐	
12	Were there any equipment or tool related issues (breakdown, unavailability)?	☐	☐	
13	Were there any material related issues?	☐	☐	
14	Did weather conditions impact your work?	☐	☐	
15	Is there anything else you would like to discuss?	☐	☐	

CPWR, NECA, and IBEW Joint Workshop

- Conducted an interactive workshop on Pre-Task Planning and Electrical Task Analysis Documents in collaboration with NECA-DC and IBEW Local 26.
- A total of 43 participants from various companies.
- Participant evaluation
  - Level of satisfaction with resources: 4.7/5.0
  - Popularity: (1) Management Checklist, (2) Post-Task Review, (3) Worker's Perspective Questionnaire

Testimonial

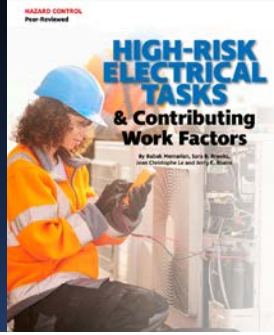
“We are using the PTP Assessment Checklist in our Safe Start meetings with the trade partner foremen. The checklist allows us to engage in specific conversations around planning their work. We see a large number of pre-task plans that are generic or non-specific which leads to unsafe work practices in the field. The guidance provided in the CPWR Checklist assists the crew supervisor in improving their plans and including the level of detail necessary to both ensure the work will be performed in a safe manner and provide enough detail to the craft performing the work. We are using and sharing this resource with our GC counterparts through the CEA Safety Council and AGC Safety & Health Council as a best practice to improve the planning of work.”

-Mike Holland, Clark Construction West Coast Safety Director

Positive Events

- A request for a workshop from NECA DC and IBEW Local 26
- Rosendin Electric learned about the project through CPWR Highlights
  - Adopted the ORM approach based on our findings to replace their current PTP process
- Requests from universities for guest lectures
  - Georgia Tech, University of Alabama, Lawrence Tech
- Requests for publications, research findings, and other outputs
  - Several construction contractors – e.g., NJM Construction and Clark Construction decided to include the checklist in their safety planning program
  - Some major insurance companies (e.g., Liberty Mutual, WTW, Oregon Workers' Comp, and NY State Fund)
- Three well-attended webinars
  - 2178 registrants in total

Publications



Published:

- Memarian, B., Brooks, S., Le, J & Rivera, J. (August 2022). High-risk Electrical Tasks and Contributing Work Factors. *Professional Safety Journal*, p.15-20.

- Memarian, B., Brooks, S. & Le, J. (2023). Obstacles and Solutions to Implementing Job Hazard Analysis in Construction: A Case Study. *International Journal of Construction Education and Research*, 19(2), 187-198.

In review:

- Memarian, B., Brooks, S. & Le, J. (in review). Pre-Task Planning for Construction Worker Safety and Health: Implementation and Assessment, *American Journal of Industrial Medicine*.

In preparation:

- Memarian, B., Brooks, S., Le, J. & Mehrabi, D. (in preparation). Post-Task Review: Benefits and Applied Resources.

Project at a Glance

Progress Summary

- Partnership with 21 electrical contractors of various sizes, unions, and associations
- 195 interviews with electrical workers and management teams
- Guidelines and Resources for Pre-Task Planning (PTP) Implementation and Assessment in Construction
- PTP Assessment Checklist
- Post-Task Review Checklist
- Worker's Perspective Questionnaire
- Two peer-reviewed journal articles
- One manuscript in review, another in preparation
- Studied 13 electrical tasks and released Electrical Task Analysis Documents
- One workshop in collaboration with NECA and IBEW
- 25 presentations – 3 more accepted
- Three well-attended webinars (2178 registrants)

Thanks!

Babak Memarian, Ph.D., CSP, CHST
Director, Safety Research, CPWR
bmemarian@cpwr.com
(301) 495-8523

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Prevention through Design (PtD)

Industry Diffusion

Deborah Dickerson, PhD CIH CSP
Associate Professor
Director Product and System Safety Lab
Virginia Tech

PtD Industry Diffusion

Project Background

Prevention through Design (PtD), **eliminating hazards at the design-stage of tools, equipment, materials, buildings, processes, and systems**, is the optimal method of mitigating occupational health and safety risks.

PtD Industry Diffusion

Project Aims

To design, implement, and evaluate intervention strategies to improve adoption of hazard controls among small firms, large firms, and workers in the following trades:

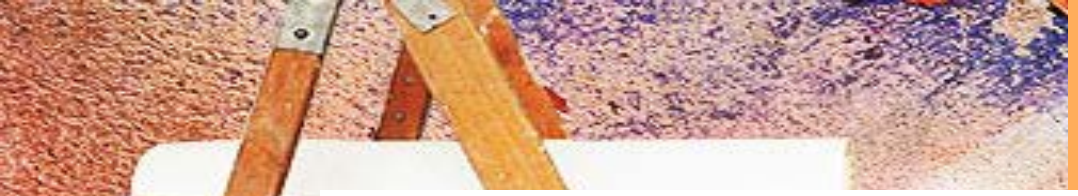
- **Concrete**
- **Masonry**
- **Asphalt Roofing**

PtD Industry Diffusion

Project Aims

Table I: PtD Innovations of Interest by Trade Sector

Trade Sector	PtD Innovation
Concrete/Masonry	Ventilated tools
Concrete/Masonry	Wet-method systems
Concrete/Masonry	Isolation systems
Concrete/Masonry	Sweeping compound
Concrete/Masonry	Material substitution
Asphalt Roofing	Tanker delivery systems
Asphalt Roofing	Hot luggers, mechanical spreaders, felt-laying machines
Asphalt Roofing	Insulated kettles, insulated hot luggers
Asphalt Roofing	Fume-suppressing asphalt
Asphalt Roofing	Local-exhaust ventilation
Welding	Local-exhaust ventilation: high-vacuum low-volume, high-volume low-vacuum, and fume-extracting nozzle
Welding	Low-smoke wire



Target Constructs

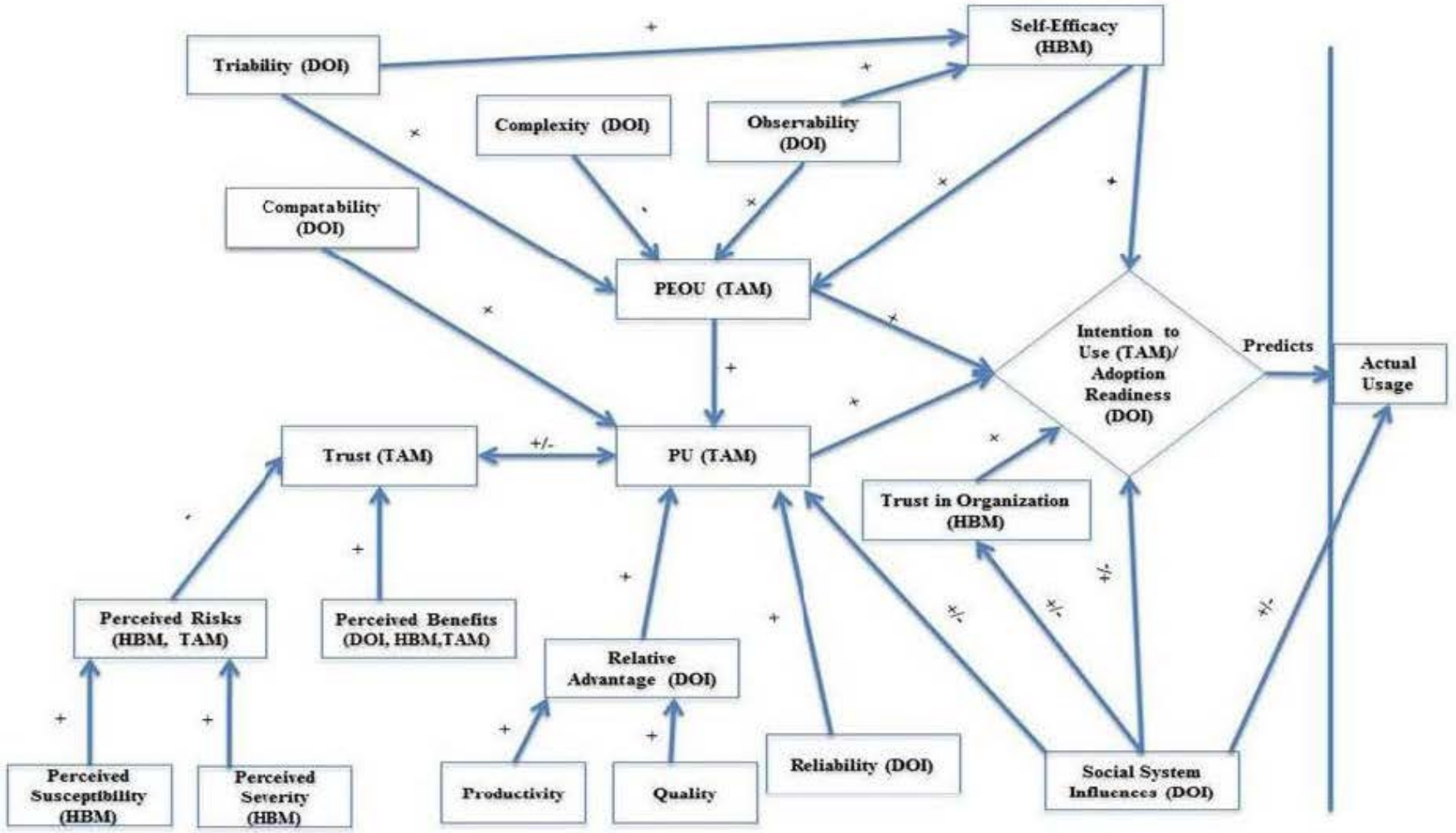


Figure 1: Prevention through Design Adoption Readiness Model (PtDAR)

Weidman et al, 2015

PtD Industry Diffusion

Project Findings:

Best Practices for Intervention Design:

To have the greatest impact on willingness to use a new method or tool, target the following constructs:

- **Ease of Use**
- **Usefulness**
- **Perceived Risk (Severity and Susceptibility)**

PtD Industry Diffusion

Intervention Design:

Purchasing Decision Makers

Barriers To Address:

- Productivity
- Cost/Benefit
- Perception of Health Risks

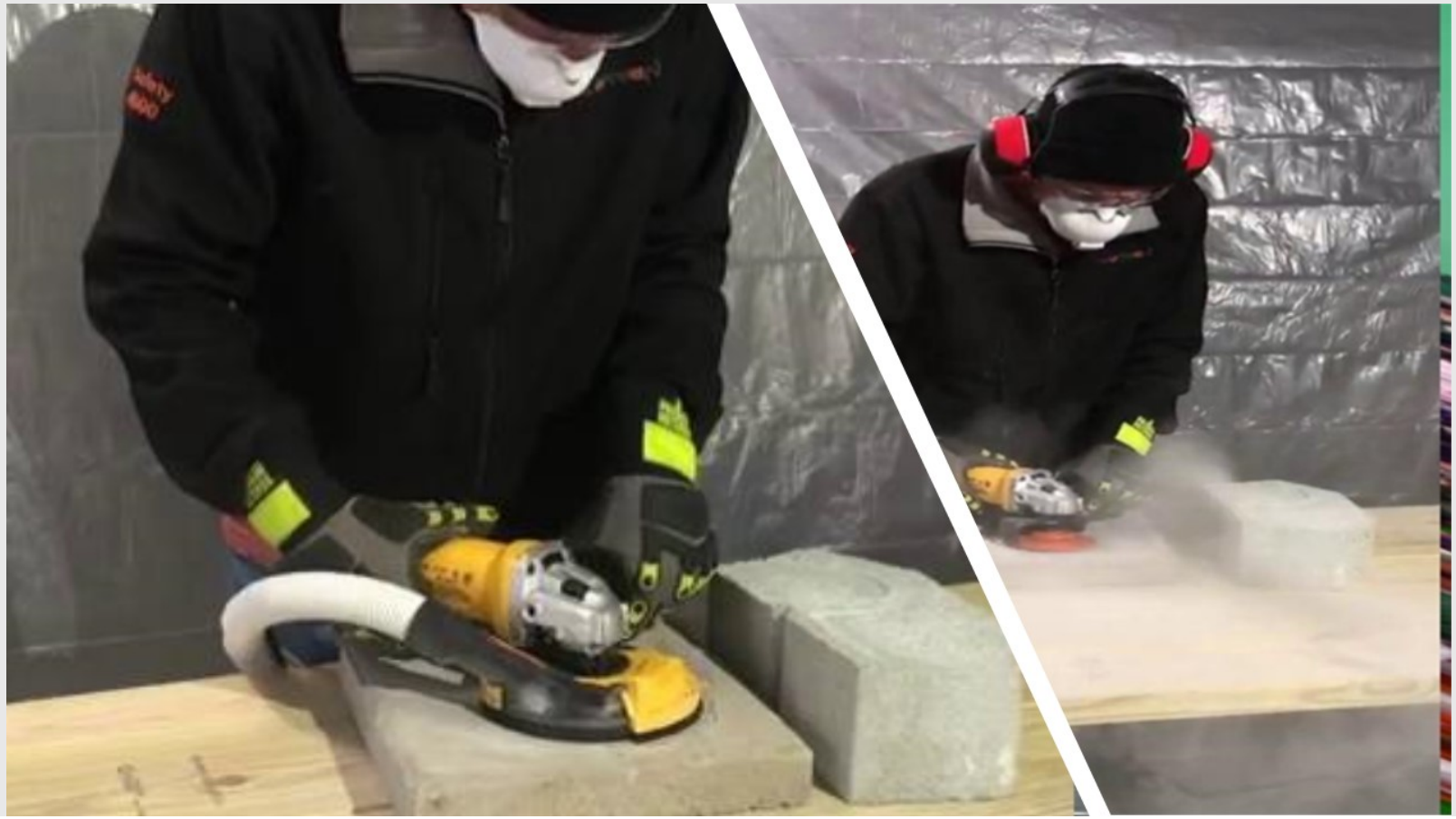
Intervention Strategies:

- Demonstration of productivity (side-by-side videos)
- Return on investment calculations
- Information about health risks

PtD Industry Diffusion

Intervention Design: Purchasing Decision Makers

Side-by-side video to demonstrate Usefulness



PtD Industry Diffusion

Intervention Design: Purchasing Decision Makers

Return on Investment (ROI) Information Provided

- A study of masonry work with and without dust collection systems found a labor-time savings of 65% when using dust collection
- Initial investment in a dust shroud and shop vac per grinder tool = $144
- An annual return on investment (ROI) was calculated to be over 483%

$$ROI = \frac{Current\ Value\ of\ Tool - Cost\ of\ Tool}{Cost\ of\ Tool}$$

Calculation of ROI for each type of tool

Current value is measured by the money saved on each job due to clean-up, time on job, etc.

PtD Industry Diffusion

Intervention Design: Small Firm Owners

Barriers To Address:

- Trust in Technology
- Cost/Benefit
- Perception of Health Risks

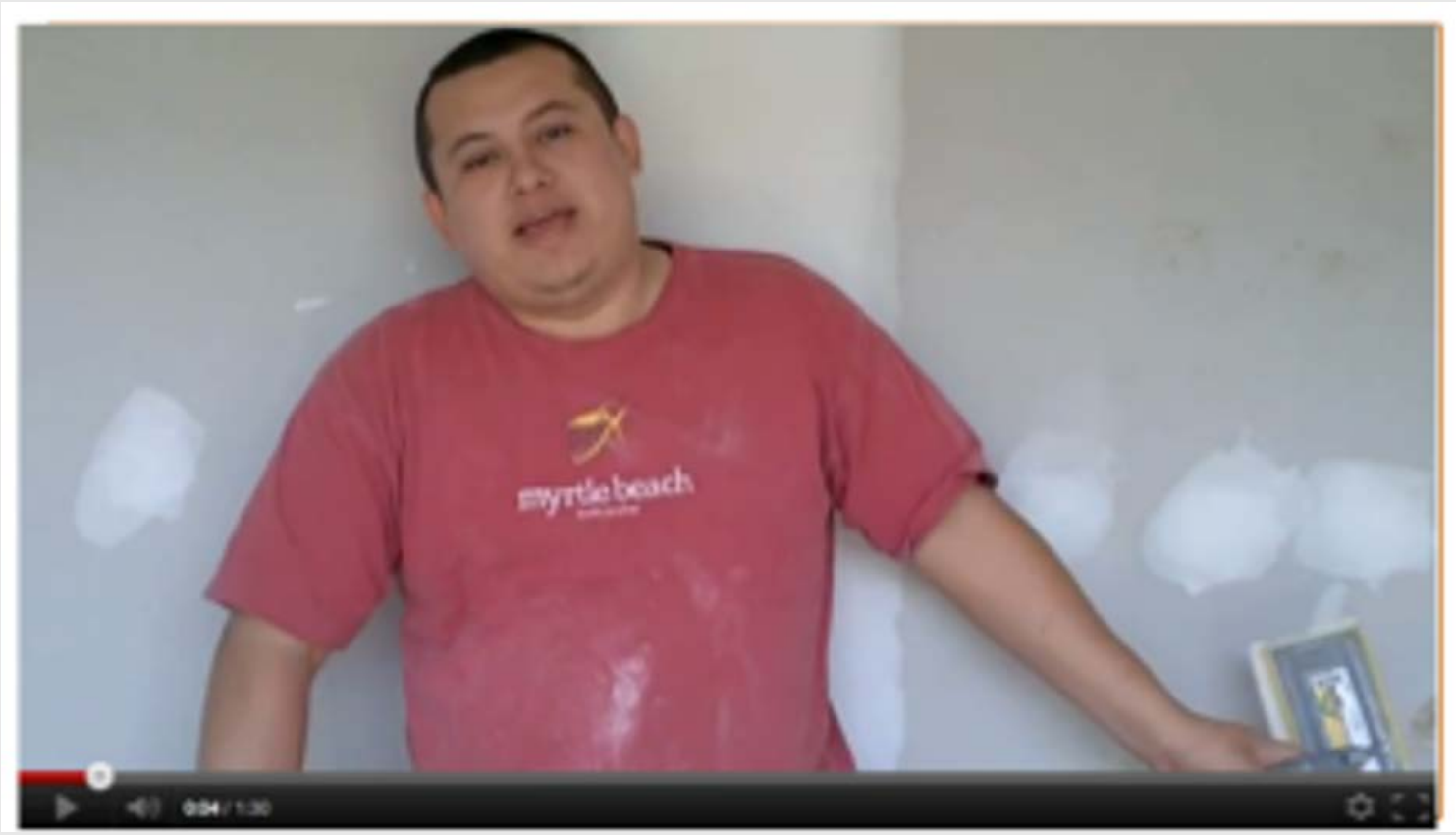
Intervention Strategies:

- Technology Champion
- Return on investment calculations
- Information about health risks

PtD Industry Diffusion

Intervention Design: Small Firm Owners

Technology Champion Testimonials



PtD Industry Diffusion

Intervention Design: Workers

Barriers To Address:

- Trust in Technology
- Perception of Health Risks

Intervention Strategies:

- Hands-on use
- Information about health risks

Hazards of Concrete and Masonry Dust

- Concrete and masonry dust contains crystalline silica
- Silica causes
  - Silicosis
  - Lung cancer
  - Chronic obstructive pulmonary disease (COPD)
  - Kidney diseases
  - Autoimmune diseases

Dissemination and R2P

Proposed Research Activities

- Concrete Trade Intervention
- Masonry Trade Intervention
- Asphalt Roofing Trade Intervention
- Welding Trade Intervention

Outputs

- Dissemination of Successful Intervention Strategies
- Trade Journal Articles
- Trade Show Presentations
- Scientific Journal Articles
- IH and Safety Conference Presentations

Outcomes

- Increased Use of PtD Solutions for Health Hazard Control
- Reduced Exposure to Silica
- Reduced Exposure to Asphalt Fumes/Vapors
- Reduced Exposure to Welding Fumes

Dissemination and R2P

- Dissemination of Successful Strategies:
  - **Creation of Best-Practices Guide**
  - **Guide to be disseminated:**
    - CPWR website and communication channels
    - Trade shows and journals
    - EHS trade shows and conferences

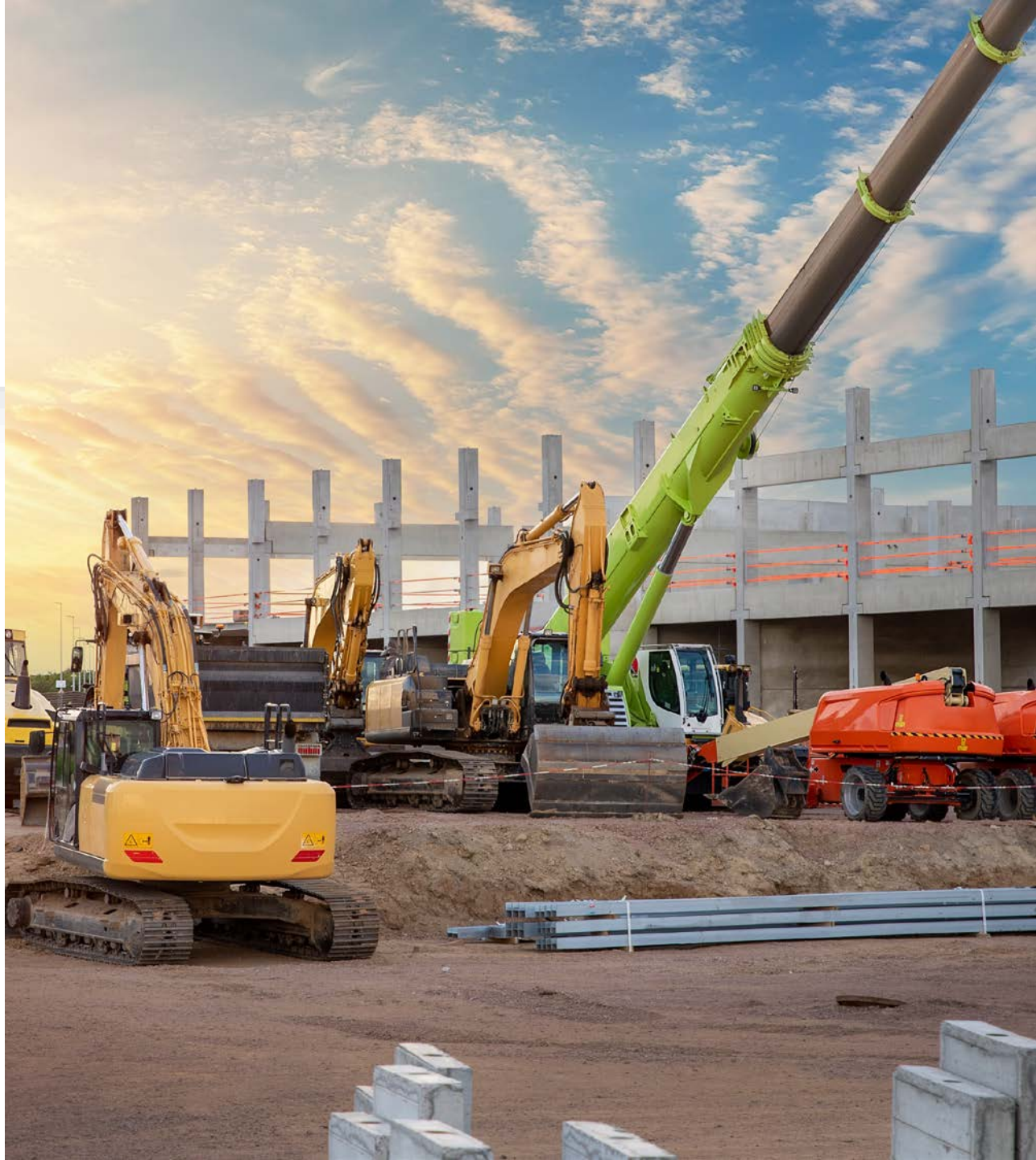
Research Session #3: Research to Practice Projects

Moderator: **Christina Socias-Morales, DrPH**, Research Epidemiologist, on detail with the Office of Construction Safety and Health, NIOSH

Communications, Education, and Outreach Core
Bill Wright, Director, Communications, CPWR

Research to Practice (r2p) Core
Jessica Bunting, MPH, Director, Research to Practice, CPWR

Evaluation of the Best Built Plans Manual Material Handling Tool for Construction
Ann Marie Dale, PHD, OTR/L, Professor of Medicine and Occupational Therapy, Washington University School of Medicine in St. Louis



COMMUNICATIONS CORE

Bill Wright

Sharretta Benjamin

Daniela Caceres

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RESEARCH AND TRAINING

r2p Seminar

Washington, DC

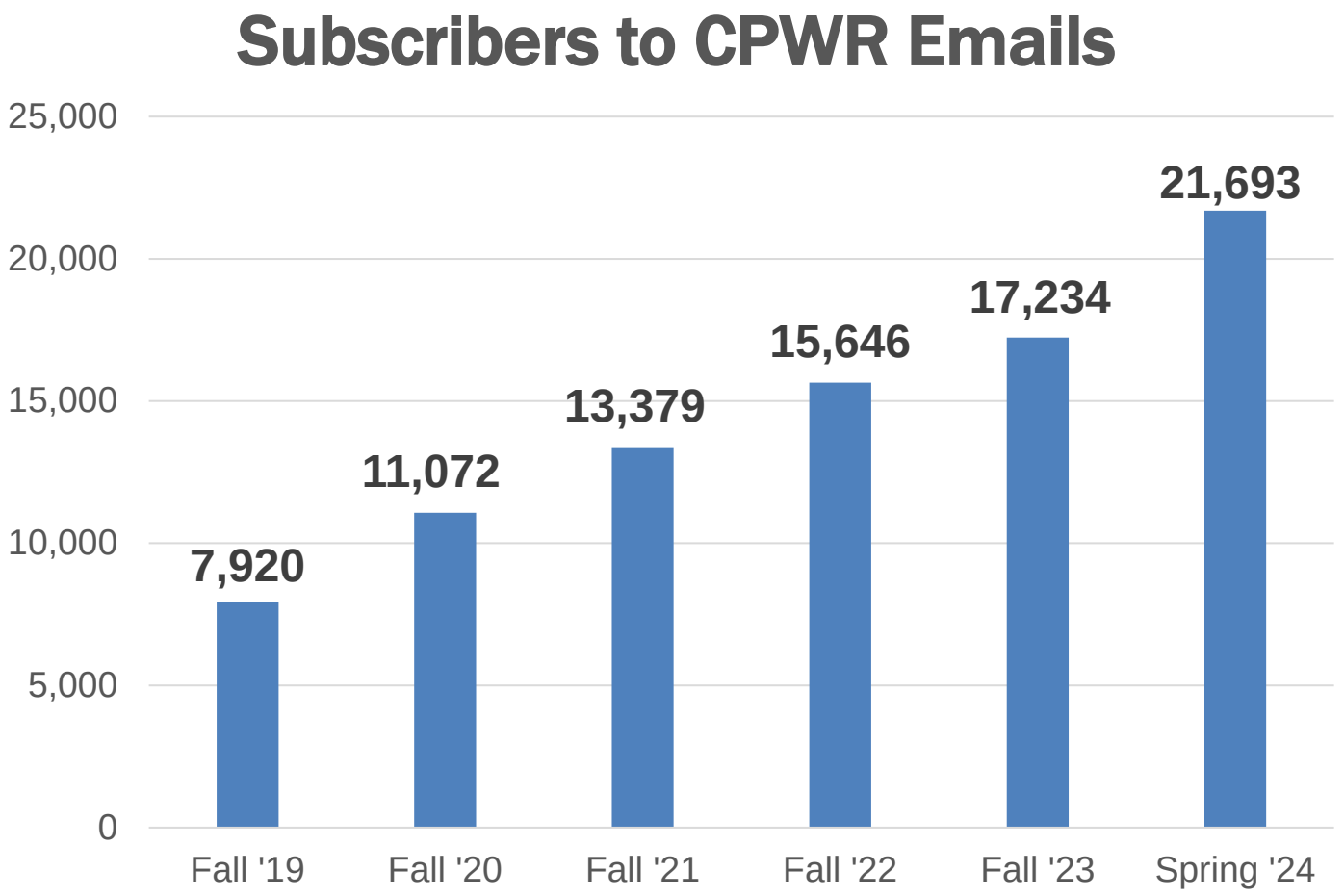
6/11/2024

Overview

1. Update on Outreach

2. Improvement Projects
   - Websites Audit
   - Data Quality
   - Prevention through Design (part 2)

Email



List Growth

9/19-8/20 +40%
9/20-8/21 +21%
9/21-8/22 +17%
9/22-8/23 +10%
9/23-6/24 +26%

Bounce Rate

Recent messages 6%
Industry Avg. 10%

Spanish

Total: 2,695

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Email – Reason newsletter

Social Media

Fall 2023	Spring 2024	Change
33,646	33,820	+1%
4,540	5,143	+13%
3,283	3,427	+4%
730	830	+14%

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Websites

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Website

Page(s)

Page	Unique users	Views	Sessions ▼	Average engagament time	Engagement rate
/	13,606	19,656	17,914	00:00:19	54.6%
/research/research-to-practice-r2p/r2p-library/toolbox-talks/	6,177	16,072	12,222	00:01:48	71.67%
/research/research-to-practice-r2p/r2p-library/other-resources-for-stakeholders/struck-by-hazards/	5,812	9,886	8,485	00:01:01	58.24%
/search-results/	3,268	10,636	5,065	00:01:15	88.37%
/training/	2,606	4,169	3,277	00:00:36	91.3%
/research/training-and-awareness-programs-from-research/foundations-for-safety-leadership/	2,041	3,459	2,904	00:00:48	74.72%
/research/data-center/data-dashboards/construction-fatality-map-dashboard/	1,625	2,553	2,391	00:00:34	57.97%
/research/data-center/data-reports/	1,366	2,166	1,985	00:00:29	67.2%
Grand total	**49,725**	**149,633**	**78,530**	**00:01:20**	**53.74%**

1 - 10 / 2291

Website

GA4 - CPWR - Main website - Google Analytics Data Visualization

Searches (Page 3 of 5)

Reset | Share | Edit

Internal Search terms

	Search term	Total searches
1.	toolbox talks	323
2.	toolbox	93
3.	tool box talks	85
4.	toolbox talk	77
5.	heat	65
6.	mental health	51
7.	silica	51
8.	Toolbox talks	47
9.	fall protection	44
10.	falls	41
11.	struck by	39
12.	fall	38
13.	hazard alert	30
14.	FSL	29
15.	head protection	28
16.	ppe	28
17.	infographics	27
18.	ladder	27
19.	ergonomics	25
	Grand total	**6,253**

1 - 100 / 3018

Google Search terms

	Query	Clicks	Impressions	Click-Through Rate	Average Position
1.	cpwr	2,429	26,553	9.15%	1.02
2.	cpwr toolbox talks	828	5,714	14.49%	8.12
3.	toolbox talks	299	15,768	1.9%	13.5
4.	cpwr toolbox talk	214	1,777	12.04%	12.43
5.	icra training	206	1,126	18.29%	5.9
6.	center for construction research and training	182	1,540	11.82%	1.02
7.	descontaminacion	173	6,553	2.64%	1.74
8.	construction site safety checklist	172	2,508	6.86%	4.05
9.	construction site safety checklist pdf	166	749	22.16%	3.58
10.	free toolbox talks	165	2,049	8.05%	4.69
11.	cwpr	140	1,457	9.61%	2.34
12.	the center for construction research and training	115	941	12.22%	1.01
13.	descontaminación	99	3,173	3.12%	1.63
14.	protección para la cabeza pdf	93	363	25.62%	2.29
15.	construction safety checklist	89	968	9.19%	4.48
16.	protección auditiva charla pdf	86	224	38.39%	1.04
	Grand total	**46,382**	**2,220,011**	**2.09%**	**23.95**

1 - 20 / 38882

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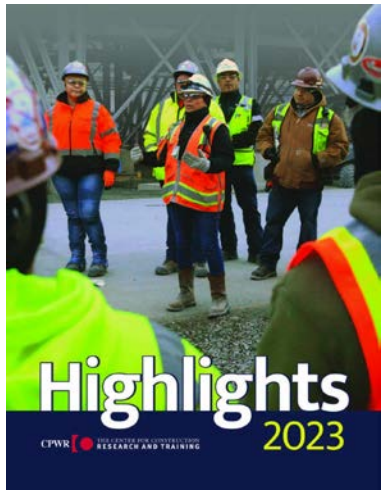
Database -- Mailing

Annual Report

Distribution: 12,365

Return rate:
2023: 8.6%
2024: 1.3%



Annual mailing

- Safety consultants/trainers
- Apprenticeship trainers
- Academics/Researchers

Distribution:
2024: 6,298

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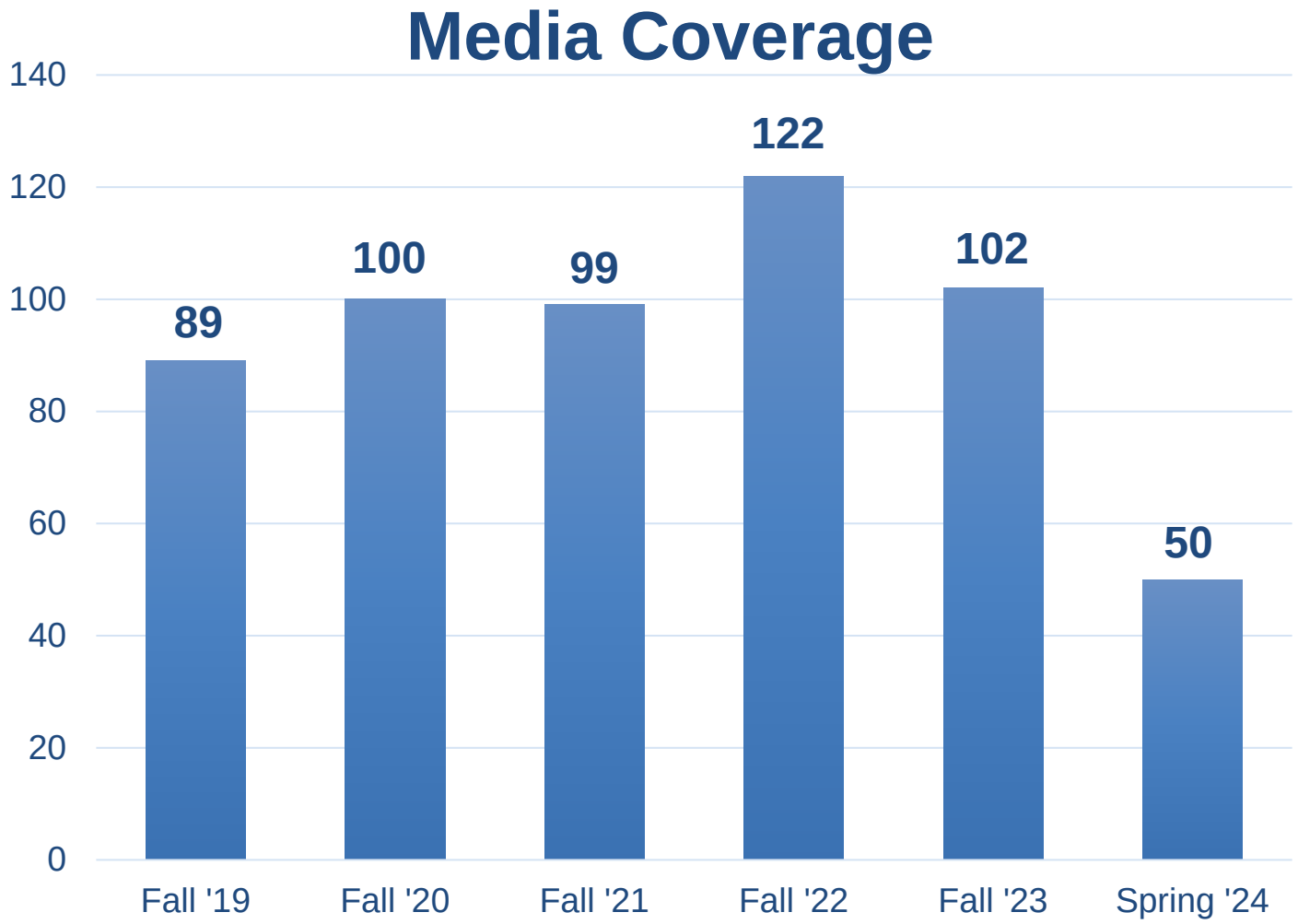
Media



Most Popular Topics

- Falls
- Mental Health
- Struck-By

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Current Projects: Website Audit

- https://www.cpwr.com/
- https://choosehandsafety.org/
- https://cpwrconstructionsolutions.org/
- https://elcosh.org/
- https://covid.elcosh.org/
- https://covidcpwr.org/
- https://ecd.cpwrconstructionsolutions.org/
- https://nano.elcosh.org/
- https://nanosds.elcosh.org/
- https://scsmis.com/
- https://stopconstructionfalls.com/
- https://safeconstructionnetwork.org/
- https://safecalc.org/
- https://silica-safe.org/
- https://plan.silica-safe.org/

Three main concerns:

- Staff need to know four different technologies
- Higher costs from hosting on multiple platforms
- Harder for visitors to find relevant content

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Current Projects: Website Audit

Questions they're considering include:

What technology (technologies) to use?

What should we do about each individual site?

- Close
- Combine
- Redesign
- Leave Alone

How do we work across sites?

Current Project: Data Quality

Current Project: Research on Attitudes on PtD

First stage of research:

- 10 Interviews
- Quantitative survey with 210 architects, 122 engineers – done with Dodge Data and Analytics

Focused on three main topics:

- Understanding of PtD – Do they know about it? How do they define it?
- PtD in current practice – what counts as a PtD technique? What are barriers?
- What's needed for broader adoption – What messages? What resources, like case studies? Who should we target?

Current Project: Research on Attitudes on PtD

Second stage of research:

Will get 40 responses apiece from four types of owners:

- **Private**: Corporations or businesses that are developing new facilities, expanding existing ones, or renovating structures to meet their own operational needs. (Banks, retail, hospitality, manufacturing, etc.)
- **Institutional** (not including government): Universities, schools, healthcare facilities, and other institutions that require new construction or renovation
- **Government**: Federal, state, or local government entities that undertake public buildings or infrastructure projects like roads, bridges, and utilities.
- **Developer**: Corporations or businesses that are developing new facilities, expanding existing ones, or renovating structures that they will not occupy but either sell or lease to others

Communications

Thank You

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Research to Practice Program Updates

Jessica Bunting, MPH
Director, Research to Practice (r2p)
CPWR – The Center for Construction Research and Training

R2p Team

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- Rosa Greenberg, MPH
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- Grace Barlet, MPH
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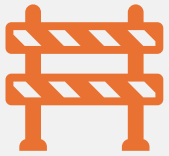
- Daniela Caceres
  dcaceres@cpwr.com

2023-2024 Highlights

Live Spanish Webinar Interpretation

Focus on Employer Planning

Expert Panel on Head Protection



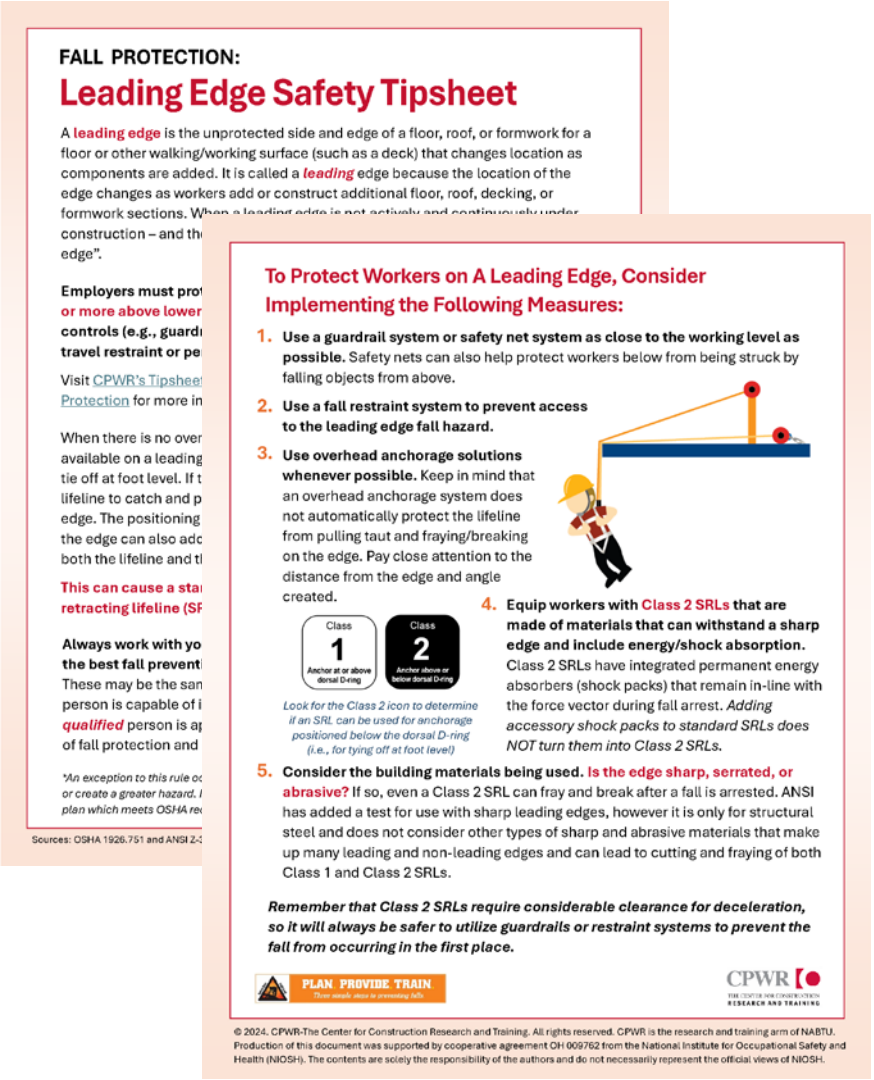
Improved Annual Safety Stand-Down Events

R2p Research Projects

Live Spanish Webinar Interpretation

- Launched July 2023 on ***Outdoor and Indoor Heat-Related Hazards in Construction***
  - 158 Spanish YouTube views (393 English)
- Regular Spanish interpretation since February 2024
  - 4 Webinars
  - 219 Spanish YouTube views total (880 English)
- Spanish webinar, ***Evento de la Campaña Nacional de Prevención de Caídas 2024***
  - 300 live attendees, 90 YouTube views
  - Live English interpretation: 32 English YouTube views

Focus on Employer Planning



FALL PROTECTION:

Leading Edge Safety Tipsheet

A **leading edge** is the unprotected side and edge of a floor, roof, or formwork for a floor or other walking/working surface (such as a deck) that changes location as components are added. It is called a ***leading*** edge because the location of the edge changes as workers add or construct additional floor, roof, decking, or formwork sections. When a leading edge is not actively and continuously under construction – and th edge".

Employers must pro or more above lower controls (e.g., guard travel restraint or pe

Visit CPWR's Tipshee Protection for more in

When there is no over available on a leading tie off at foot level. If t lifeline to catch and p edge. The positioning the edge can also adc both the lifeline and t

This can cause a sta retracting lifeline (SF

Always work with yo the best fall preventi These may be the san person is capable of i ***qualified*** person is ap of fall protection and

**An exception to this rule oc or create a greater hazard. I plan which meets OSHA re*

Sources: OSHA 1926.751 and ANSI Z-

To Protect Workers on A Leading Edge, Consider Implementing the Following Measures:

1. **Use a guardrail system or safety net system as close to the working level as possible.** Safety nets can also help protect workers below from being struck by falling objects from above.
2. **Use a fall restraint system to prevent access to the leading edge fall hazard.**
3. **Use overhead anchorage solutions whenever possible.** Keep in mind that an overhead anchorage system does not automatically protect the lifeline from pulling taut and fraying/breaking on the edge. Pay close attention to the distance from the edge and angle created.

Class 1 — Anchor at or above dorsal D-ring

Class 2 — Anchor above or below dorsal D-ring

Look for the Class 2 icon to determine if an SRL can be used for anchorage positioned below the dorsal D-ring (i.e., for tying off at foot level)

4. **Equip workers with Class 2 SRLs that are made of materials that can withstand a sharp edge and include energy/shock absorption.** Class 2 SRLs have integrated permanent energy absorbers (shock packs) that remain in-line with the force vector during fall arrest. *Adding accessory shock packs to standard SRLs does NOT turn them into Class 2 SRLs.*
5. **Consider the building materials being used. Is the edge sharp, serrated, or abrasive?** If so, even a Class 2 SRL can fray and break after a fall is arrested. ANSI has added a test for use with sharp leading edges, however it is only for structural steel and does not consider other types of sharp and abrasive materials that make up many leading and non-leading edges and can lead to cutting and fraying of both Class 1 and Class 2 SRLs.

Remember that Class 2 SRLs require considerable clearance for deceleration, so it will always be safer to utilize guardrails or restraint systems to prevent the fall from occurring in the first place.

PLAN. PROVIDE. TRAIN.

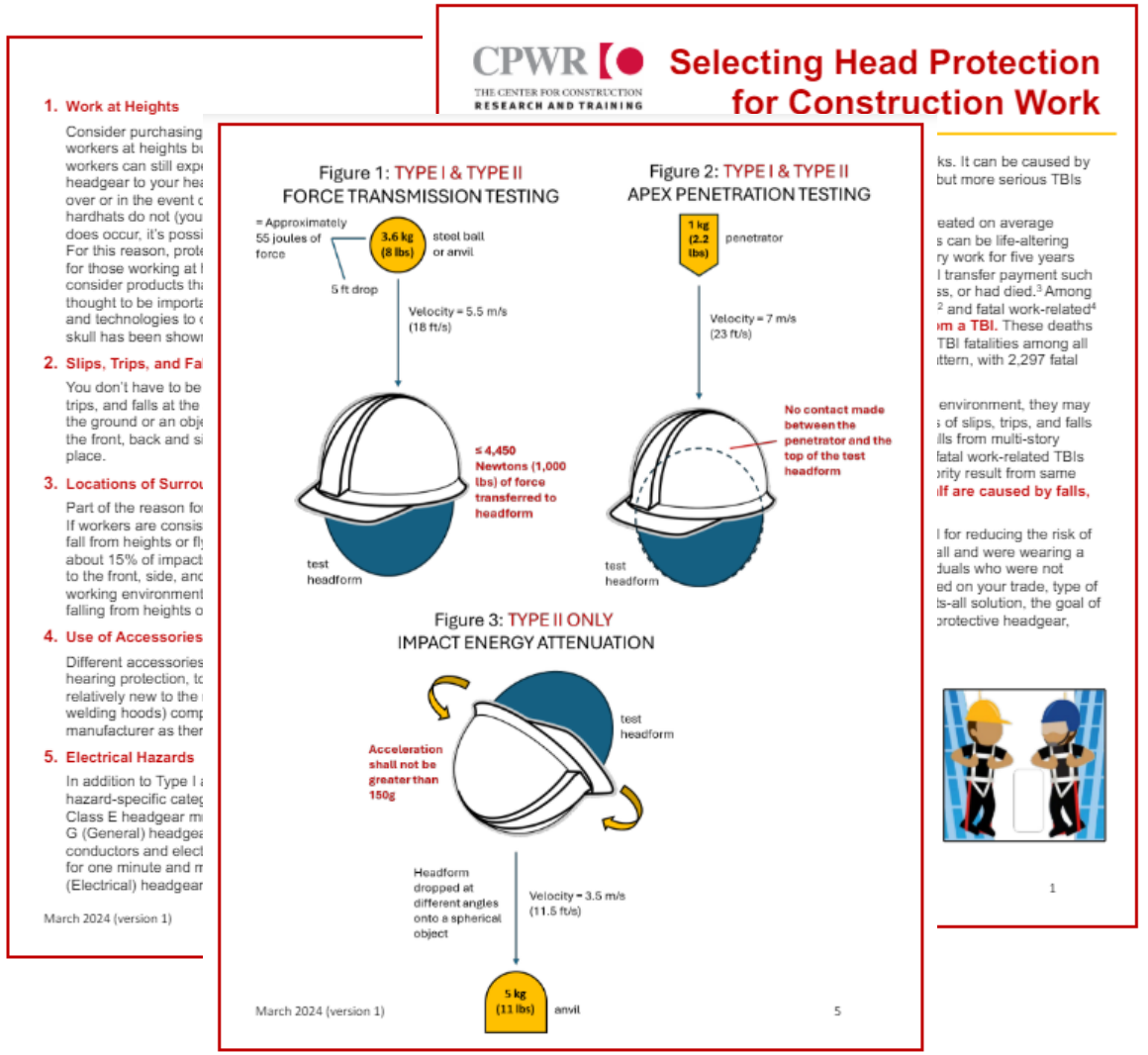
CPWR

Production of this document was supported by cooperative agreement OH 009762 from the National Institute for Occupational Safety and Health (NIOSH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.

- **Webinars**
  - October 27th *Pre-Task Planning (PTP) through Post-Job Review*
  - April 18th *Developing and Enforcing Internal Traffic Control Plans*
  - May 8th *Beyond Fall Prevention Planning: Being Prepared for Fall Rescue*
  - June 26th *Developing a Heat Illness Prevention Program in Construction*
- **Resource Development**
  - HIP Checklists now in Spanish
  - Guide on Selecting Head Protection in Construction
  - Leading Edge Tipsheet

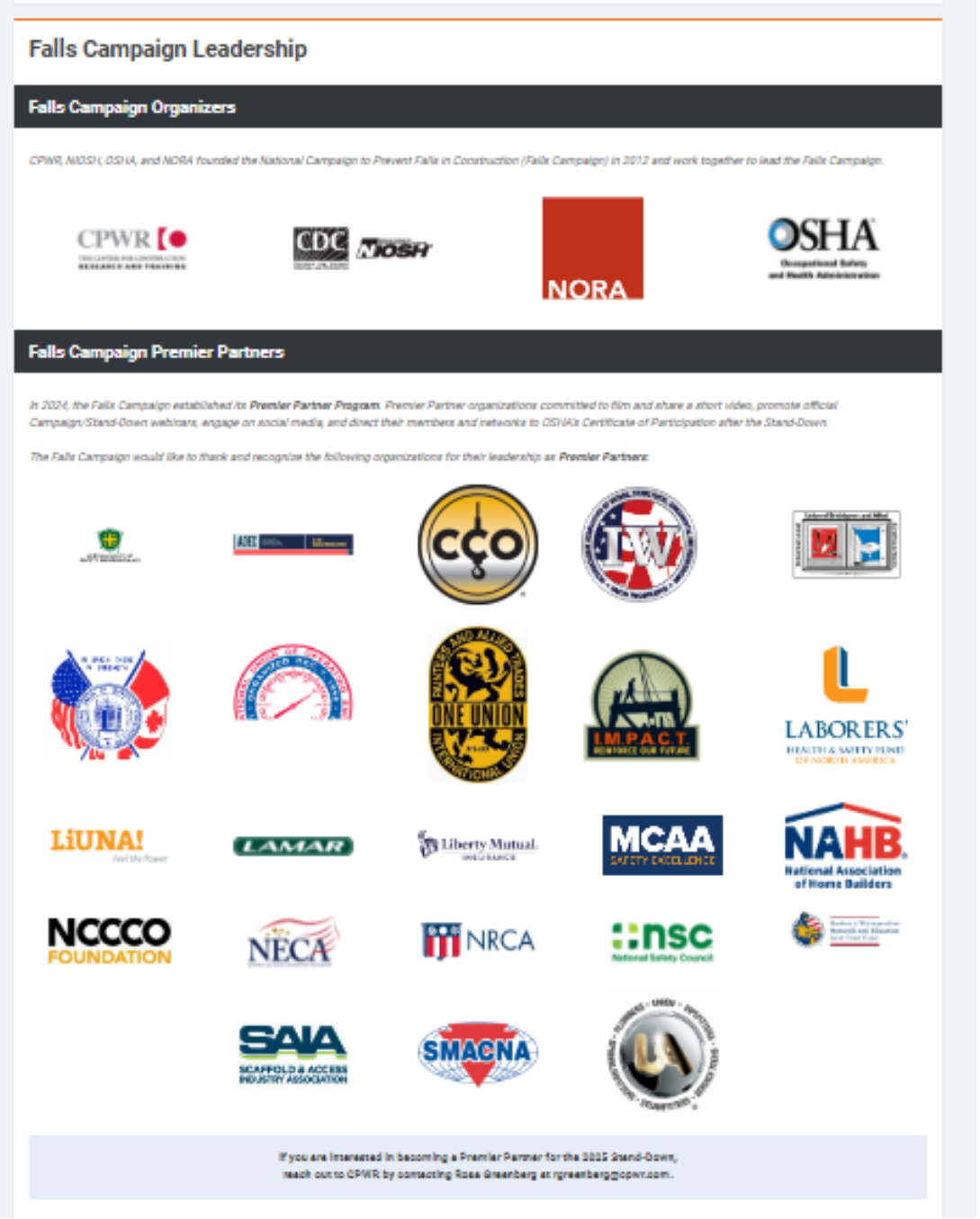
Expert Evaluation Panel on Head Protection

- Based on the Delphi Method
- 25 Experts
- 5 meetings since June 2023
- 4 surveys
- Outputs
  - Selecting Head Protection for Construction (version 2 in progress)
  - Updated Infographic
  - Regulatory Memo (in progress)



Improved Annual Safety Stand-Downs

- First *IN-PERSON* Struck-by Stand-Down (April 2024)
  - Live Spanish webinar interpretation
- Falls Stand-Down (May 2024)
  - Updated & Relaunched Stopconstructionfalls.com
  - New Premier Partners
  - Live Spanish webinar interpretation
  - Additional Spanish resources available



R2p Research Catch-Up/Wrap-Up

- R2p Roadmap Evaluation & Research on Factors that Lead to Implementation
- Struck-by Planning Program Pilot Study (Nudges)
- Communicating Risk & Uncertainty
- CPWR Noise & Hearing Loss Training Program Evaluation
- Developmental Evaluation

Best Built Plans: Research and Developmental Evaluation Projects

Washington University:

Ann Marie Dale and Brad Evanoff

CPWR r2p:

Jess Bunting and Grace Barlet

BEST BUILT PLANS
BUILD SAFETY INTO EVERY JOB

- http://bestbuiltplans.org/

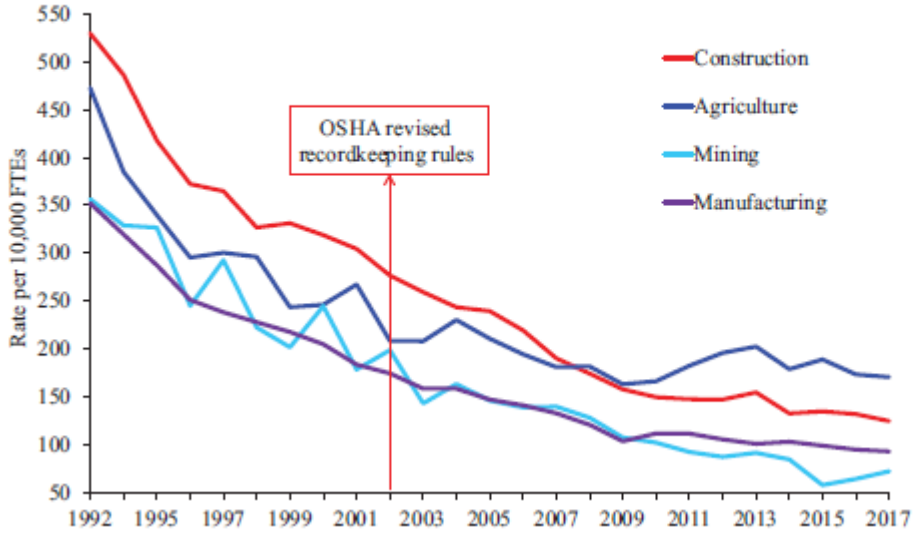
CPWR
THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Washington University in St. Louis
SCHOOL OF MEDICINE

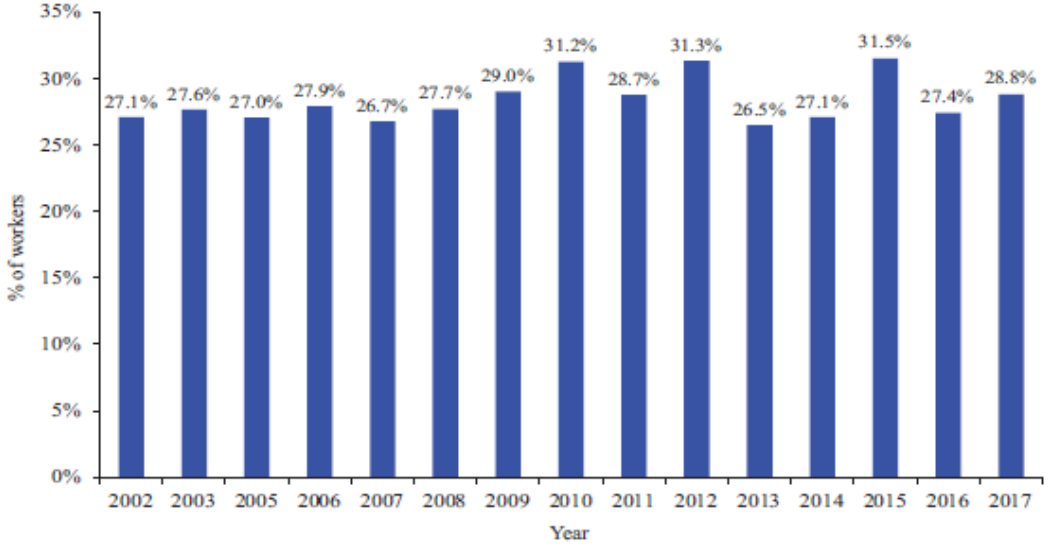
Background

- Chronic musculoskeletal non-fatal injuries remain high in construction
- Over 20% of nonfatal injuries in construction are musculoskeletal disorders (MSDs)
- Manual material handling (MMH) is the most common risk for MSDs (Low Back Pain)
- Solutions available but not often used

1. Rate of nonfatal injuries resulting in days away from work, selected industries, 1992-2017

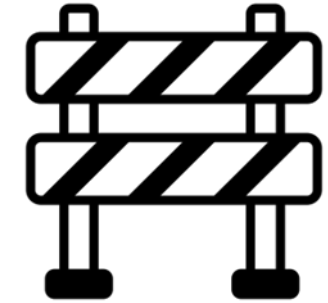


14. Rate of self-reported low back pain (in the past three months) among construction workers, 2002-2017



CPWR Quarterly Data Report, Third Quarter 2019

What are the barriers?



Created by Brickclay
from Noun Project

Investigation by Ergonomics Community of Practice (ECOP) and CPWR r2p

- ✓ Gaps in awareness of the risks, solutions, and benefits of safer practices for MMH
- ✓ Lack of access to or time to find material weights, lifting and storage options
- ✓ Lack of planning for MMH experience

Background

- Best Built Plans (BBP) program guides contractor planning in projects to reduce MMH injuries, focused on small- and medium-sized contractors

- ✓Site Planning Tool
- ✓Training and coaching resources
- ✓Downloadable forms and infographics

…Is free and easy to access

Background

- BBP program had limited evaluation
- *Wash U team research goals*
  - Aim 1: Measure uptake and adoption of BBP program
    - Over a 6-month period
  - Aims 2/3: Evaluate intervention effectiveness
    - Pre-Post knowledge/behavior changes using worker surveys and observations
- *CPWR r2p project*
  - Aim 4: Conduct a Developmental Evaluation
    - Modify BBP program using contractor feedback from Wash U project

Project Challenges and Results

Recruitment of contractors

(Goal: Total of 45 contractors in 2 waves; 23/22 Waves 1/2)

- Pandemic: no access to jobsites, no time, competing priorities
- Post-pandemic (2023-2024): had not returned to pre-pandemic operations

Results:

- 2019-2022: Wave 1= 10 contractors with 6-month follow-up (Aim 1)
- 2022: ECOP meetings for modifications to BBP program (Aim 4)
- 2023-2024: Wave 2=12 contractors with 6-month follow-up (Aim 1)
  - *Low recruitment, can't assess intervention effectiveness (Aims 2/3)*

Aim 1: Wave 1
Contractor MMH program and BBP assessment

- Contractors: 10 (8 large, *1 medium, 1 small*)
- Little awareness of need for or have a program to plan for MMH
- Most contractor MMH programs consisted of toolbox talks on proper lifting

BBP program evaluation results: generally favorable

Liked

- Lots of useful information
- Liked the downloadable forms/documents

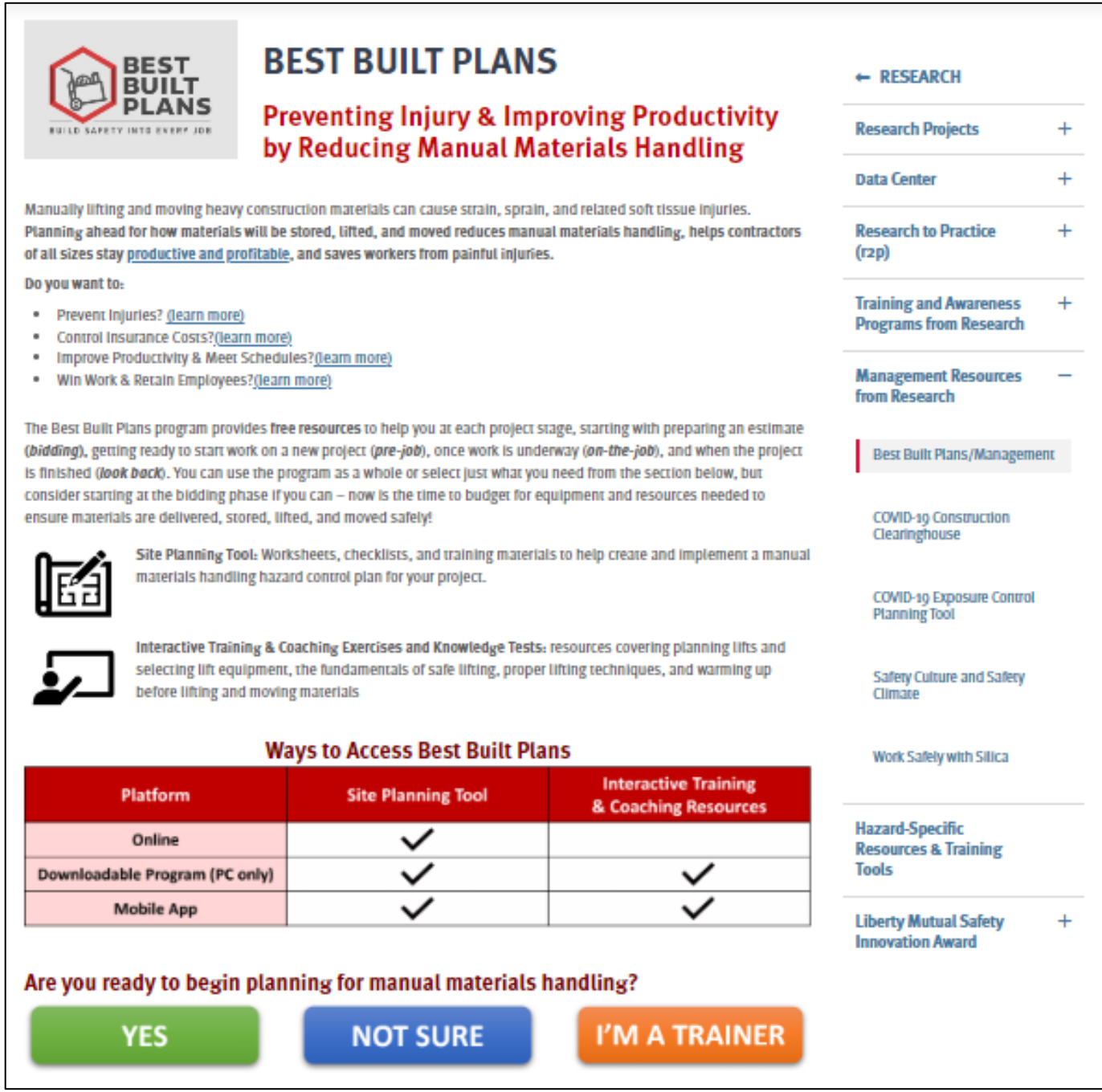
Didn't like

- Hard to navigate and find "favorites"
- Hard to digest the large amount of information
- Too few sample documents and trainings

Aim 4:
BBP program changes with ECOP

Overall Improvements:

- More graphics/less text
- Simplified navigation menus
- Selections funneled users toward relevant information
- More checklists, toolbox talks, infographics, short informational videos for contractors



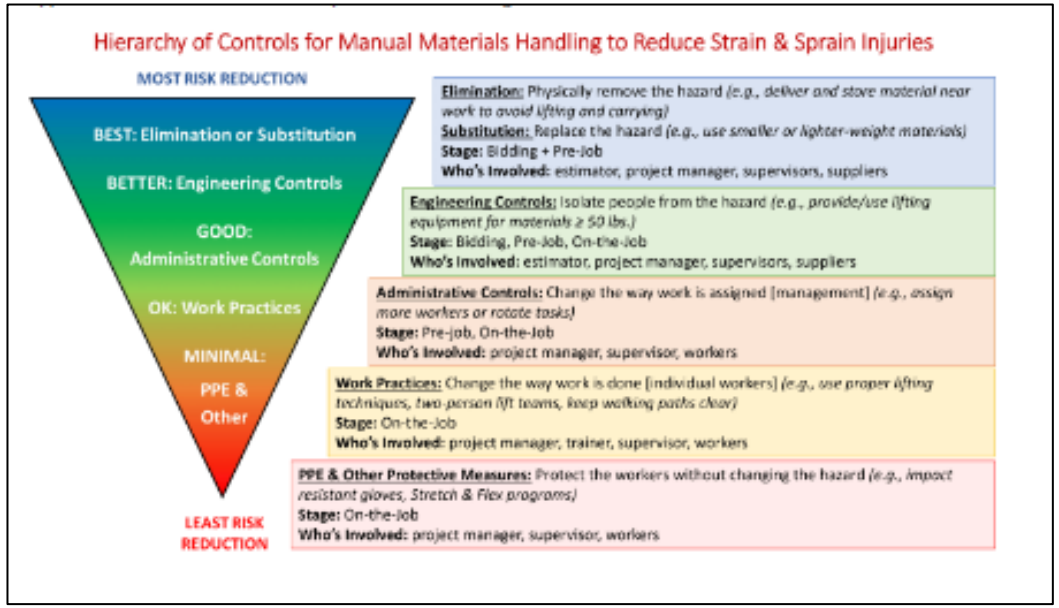
Are you ready to begin planning for manual material handling?

YES

BEST BUILT PLANS
BUILD SAFETY INTO EVERY JOB

Contractor Planning Tool

Get Started



1 Bidding | 2 Pre-Job | 3 On-the-Job | 4 Look Back

BEST BUILT PLANS
BUILD SAFETY INTO EVERY JOB

Contractor Planning Tool

Bidding

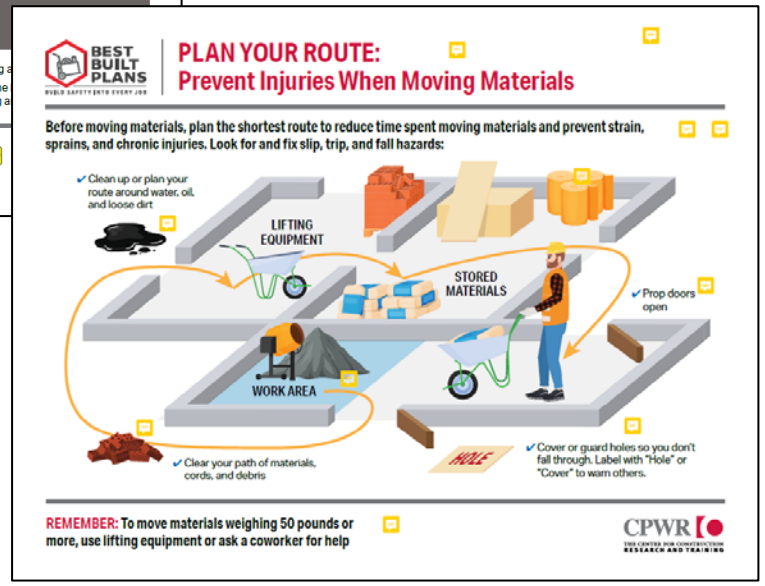
WHO TO INVOLVE: Bidding on a new project may involve the estimator, project manager, safety director, and, if needed, the supplier/delivery driver, owner/general contractor.

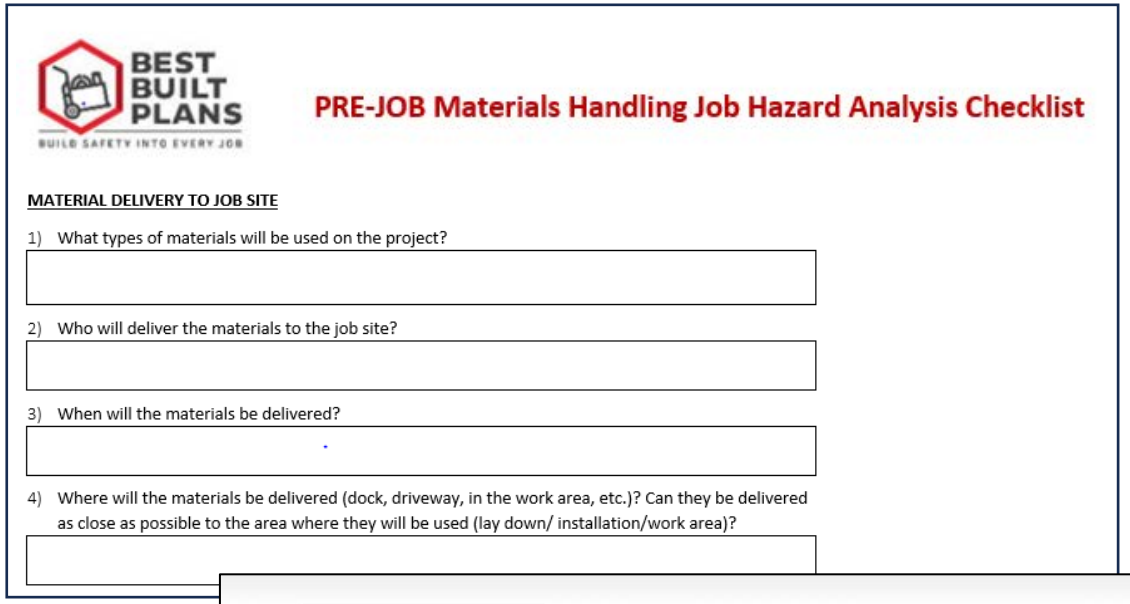
PURPOSE & GOAL: Ensure resources are included in the estimate to cover the cost of the equipment and labor that will be needed to deliver, store, lift, and move materials without injury on the project.

KEY QUESTIONS	RESOURCES TO HELP
1. What materials do you plan to use on the project? 2. What quantity of each material will you need? 3. How heavy are the units (bundles, bags, etc.) of each material that workers will need to lift and move? Which weigh more than 50 pounds? Are their light weight or lighter weight options (e.g., 40 lb bags instead of 80 lb bags)? 4. How will the materials be delivered and stored? Will you need storage equipment to ensure the materials are stored off the ground (at least 24" off the ground) to minimize bending and lifting? 5. What lifting equipment will be used to eliminate worker lifts of more than 50 pounds? 6. How will you keep track of the quantities and costs of the materials, weights, storage options, lifting equipment and assistance you need to prepare your bid?	• Weights of common building materials • Storage options for materials • Lifting equipment options • Manual Materials Handling Workbook – **Worksheet #1** to help calculate and keep track of the cost of different material lifting and moving options

TIP: Ask your employees for their ideas on how to improve manual materials handling to avoid injuries and improve productivity.

New Resources: infographics, checklists, videos





Aim 1: Wave 2 (n=12) and "Roadmap" Contractor Eval (n=10) Contractor MMH program and BBP assessment

- Contractors:
  - Wave 2:10 (8 large, *1 medium, 1 small*)
  - Roadmap contractors: 10 (8 large, *1 medium, 1 small*)
- Generally little planning for MMH but greater awareness of the need

BBP program evaluation results: very favorable

Liked

- Lots of useful information
- Positive comments about the new materials (HOC, infographics, checklists, key questions)

Didn't like

- Information takes too much time and effort to digest
- Not sure how to get started without more help
- Want more trade specific, off-the-shelf training
- Many small contractors have informal operations so don't use checklists

Aim 4: Remaining gaps

- Inadequate changes
  - Navigation doesn’t guide the user to **create an MMH program**
  - The presentation of information is difficult to digest quickly
  - Worker training materials are meant for a trainer to use
  - New toolbox talks were not available on the BBP webpages
- Audience shortfalls
  - Smaller/less formal contractors didn’t know how to get started
  - Many contractors lacked basic knowledge about safe MMH concepts

Important lessons

- Smaller/ less formal contractors need VERY short, easily digestible and usable information
- Informal contractors do not use checklists/posters but transfer information through regular communication
- Contractors and supervisors not familiar with computers/apps are not able to use web-based programs

Proposed modifications for Aim 4

- Create a brief, simple version of the BBP program to help contractors gain knowledge (hard copy, downloadable)
- Create an index of all tools and resources for easy reference
- Create series of short training videos for workers
- Create an interactive tool to make a basic MMH plan

- And many smaller edits to the current webpages

Questions?

Ann Marie Dale PhD, OTR/L
e-mail: amdale@wustl.edu

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http://bestbuiltplans.org/

Workshop #2: Preventing Suicide and Overdose Fatalities

Moderator: **Chris Trahan Cain, CIH**, Executive Director, CPWR

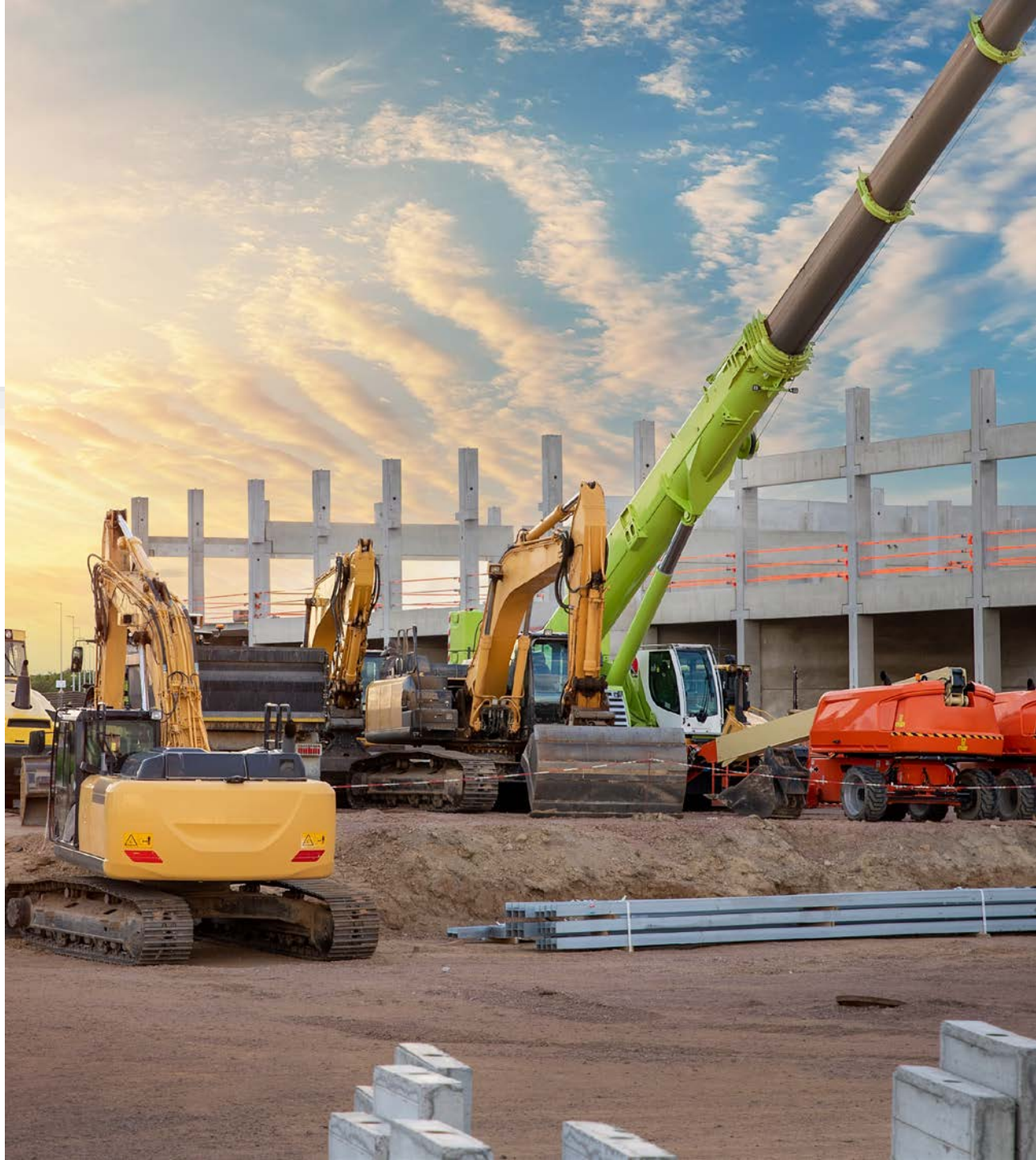
Jon Davis, PhD, Assistant Professor, University of Iowa, College of Public Health, Department of Occupational and Environmental Health

Allison Weingarten, LMSW, Senior Analyst, MDB, Inc.

Jeffrey Bradley, Program Administrator, Sheet Metal Occupational Health Institute Trust (SMOHIT)

Bradley Evanoff, MD, MPH, Professor of Medicine; Director, Division of General Medicine and Geriatrics; Assistant Vice Provost for Public Health, Washington University in St. Louis

Behzad Esmaeili, PhD, MS, MS, Associate Professor, Purdue University School of Industrial Engineering



HEALTHIER WORKFORCE
CENTER of the MIDWEST

Impact of Employment Laws on Construction Worker Suicide

Jon Davis, PhD

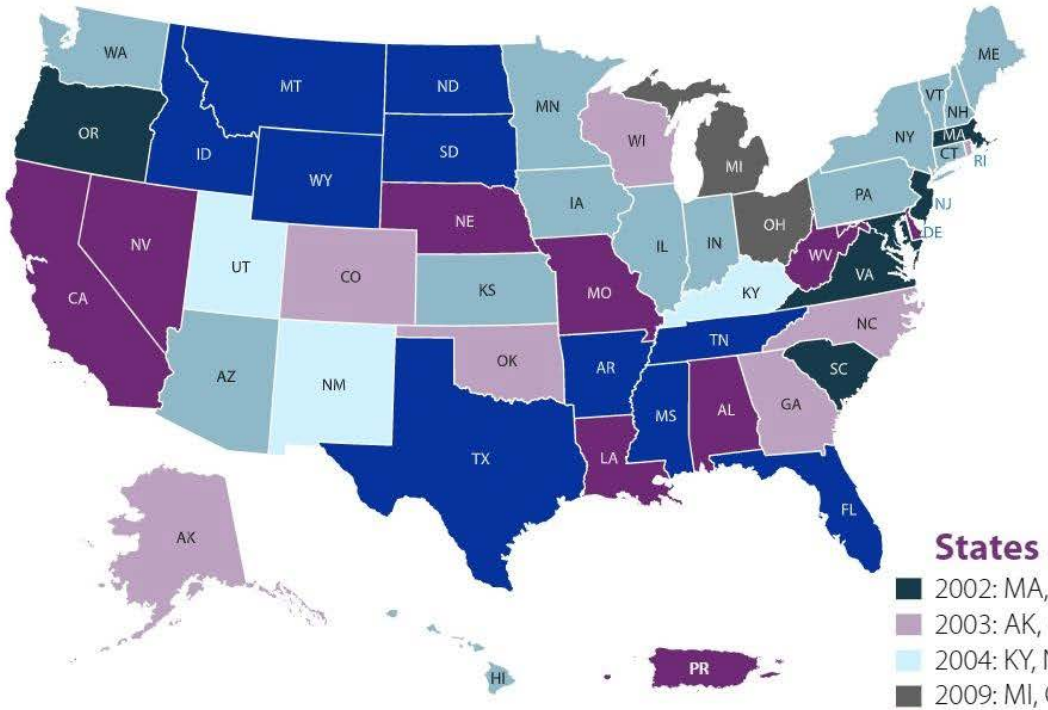
Assistant Professor, University of Iowa, College of Public Health, Department of Occupational and Environmental Health

Research Questions

- What makes construction worker suicide different?
- Are there state level laws that are protective?

This work was supported by CPWR: The Center for Construction Research and Training through a grant from PhRMA. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CPWR or PhRMA.

How do we study worker suicide?



The Reach of NVDRS

NVDRS began collecting data on violent deaths from six states in 2002, followed by progressive additions to the system over several years. **In 2018, NVDRS was expanded to include data collection from all 50 states, Puerto Rico, and the District of Columbia.** This expansion brings NVDRS closer to the goal of providing a complete picture of violent deaths across the nation

States added by year:

- 2002: MA, MD, NJ, OR, SC, VA
- 2003: AK, CO, GA, NC, OK, RI, WI
- 2004: KY, NM, UT
- 2009: MI, OH
- 2014: AZ, CT, HI, IA, IL, IN, KS, ME, MN, NH, NY, PA, VT, WA
- 2016: AL, CA, DE, DC, LA, MO, NE, NV, Puerto Rico, WV
- 2018: AR, FL, ID, MS, MT, ND, SD, TN, TX, WY

Study Design

Years: 2013 – 2020

160,939 Deaths from Suicide

45,000 Excluded: Current Military (1.7%), Not in workforce (11.0%), Inadequate info (9.6%)

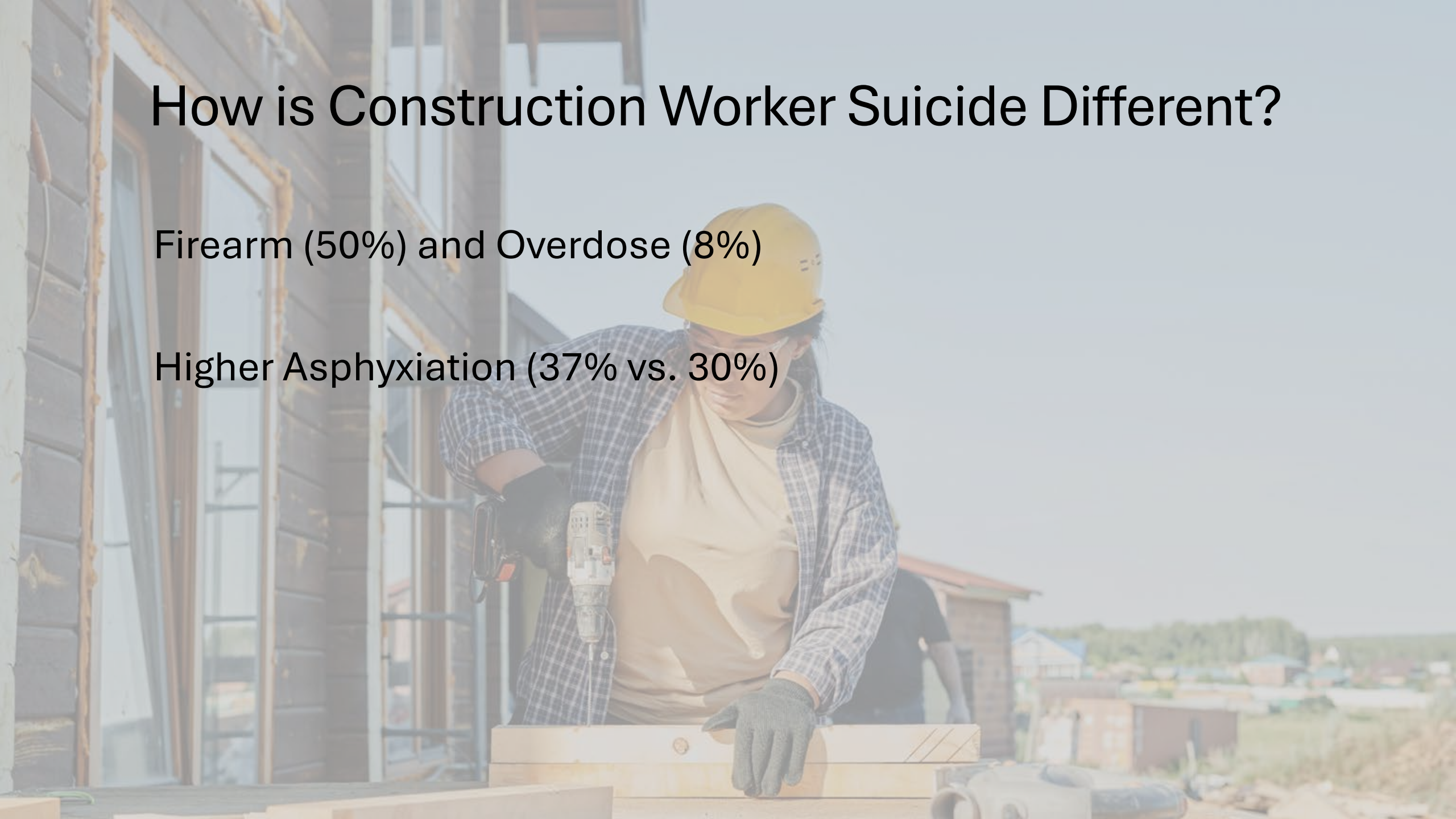
128,450 aged 16 to 64

19,602 Construction (15.3%)

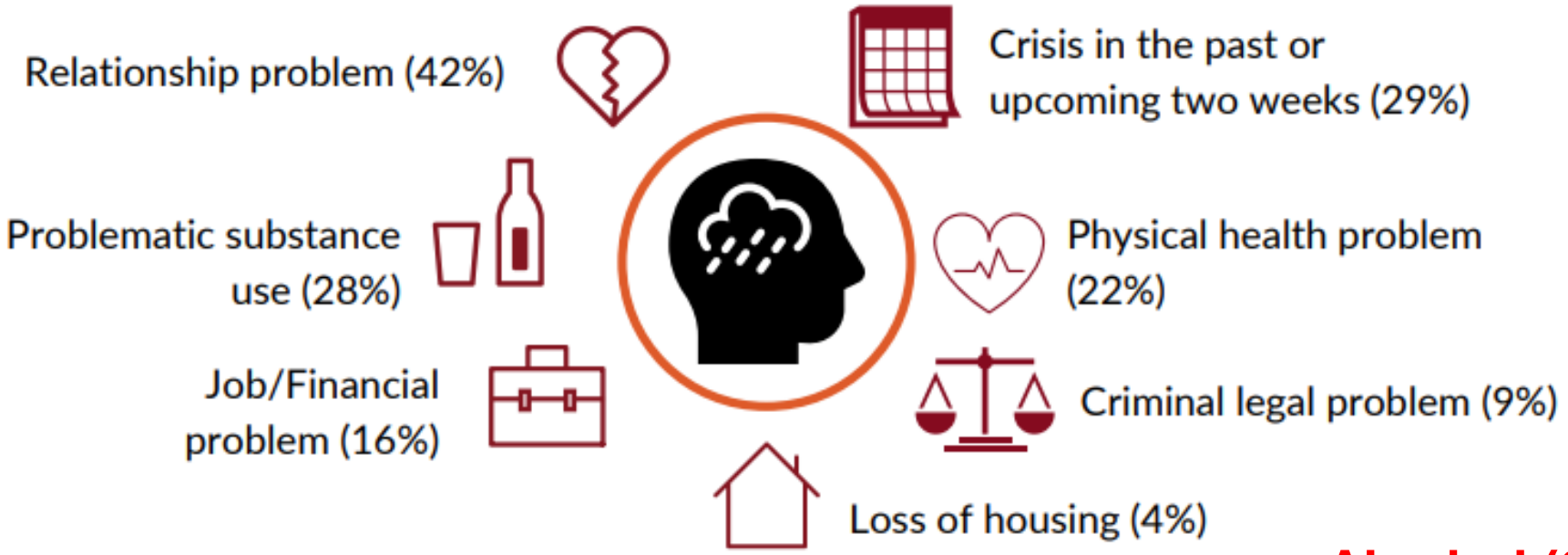
How is Construction Worker Suicide Different?

Firearm (50%) and Overdose (8%)

Higher Asphyxiation (37% vs. 30%)



Circumstances



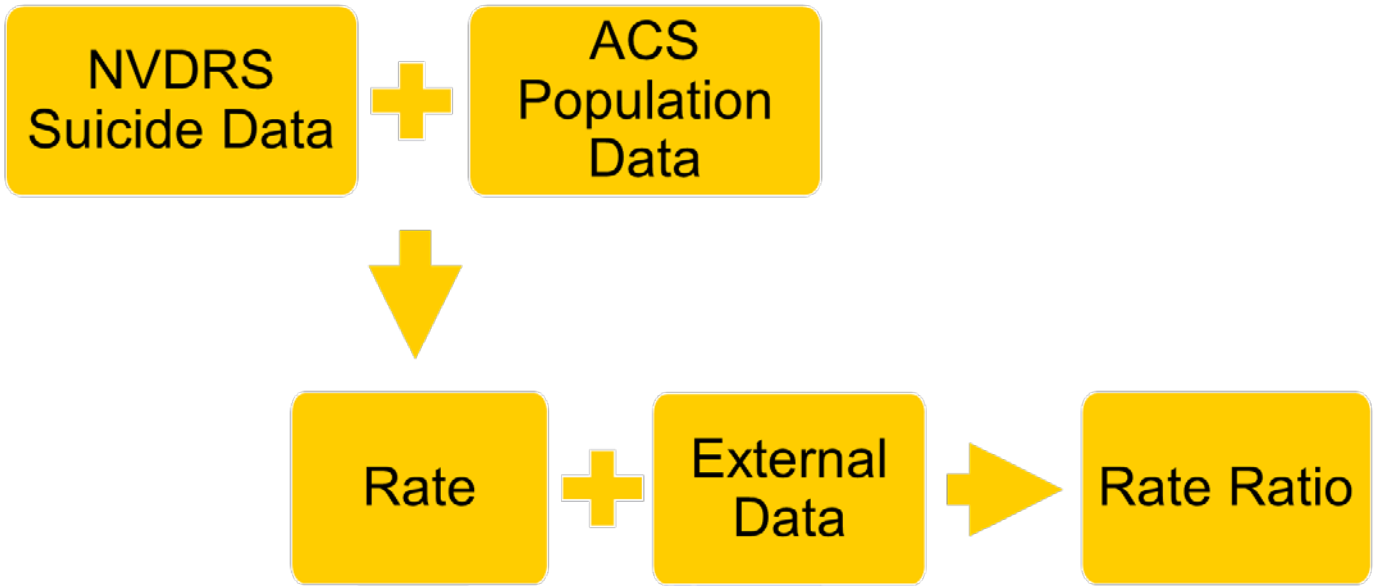
Alcohol (21% increase)

Substance Use (61% increase)

Labor Law and Policy Impact

Preventing Construction Worker Suicide, 2013 to 2020

Laws
Paid sick leave
Family leave
Union Restrictive



Rate Ratio Calculation

Number of Suicides (μ)

Ref Population (n)

$$\log(\mu_{ij}/n_{ij}) = \beta_0 + \beta_1 \cdot LAW_{ij} + \beta_2 \cdot YEAR_{ij}$$

i population group in *j* state

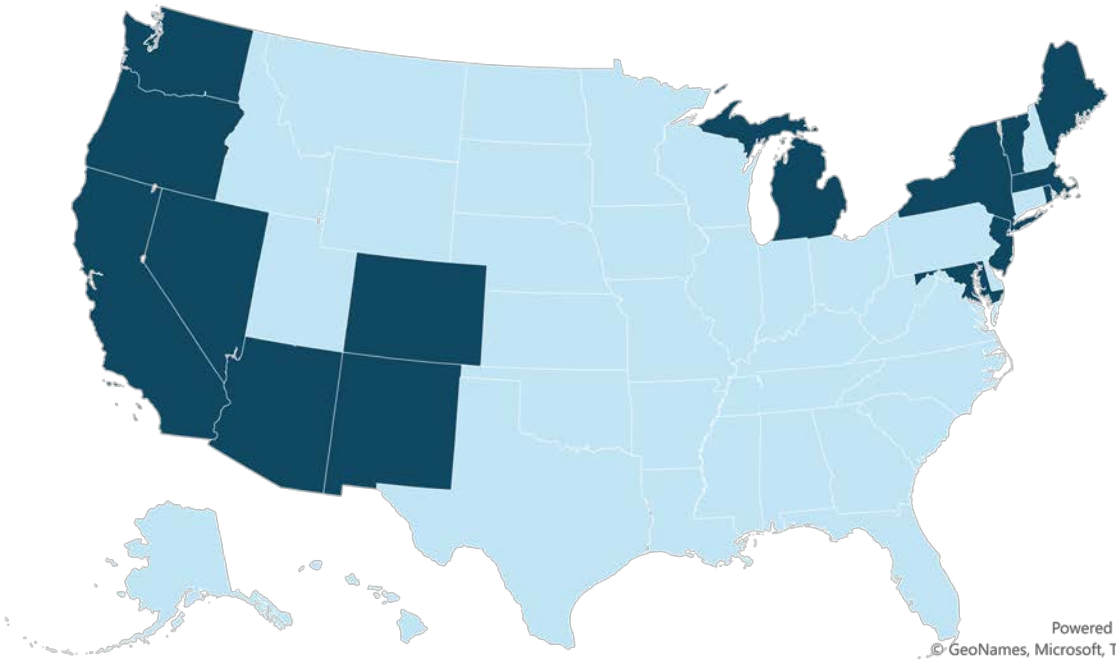
Paid Leave

15 States that cover construction

Reduction

18% Male

33% Female



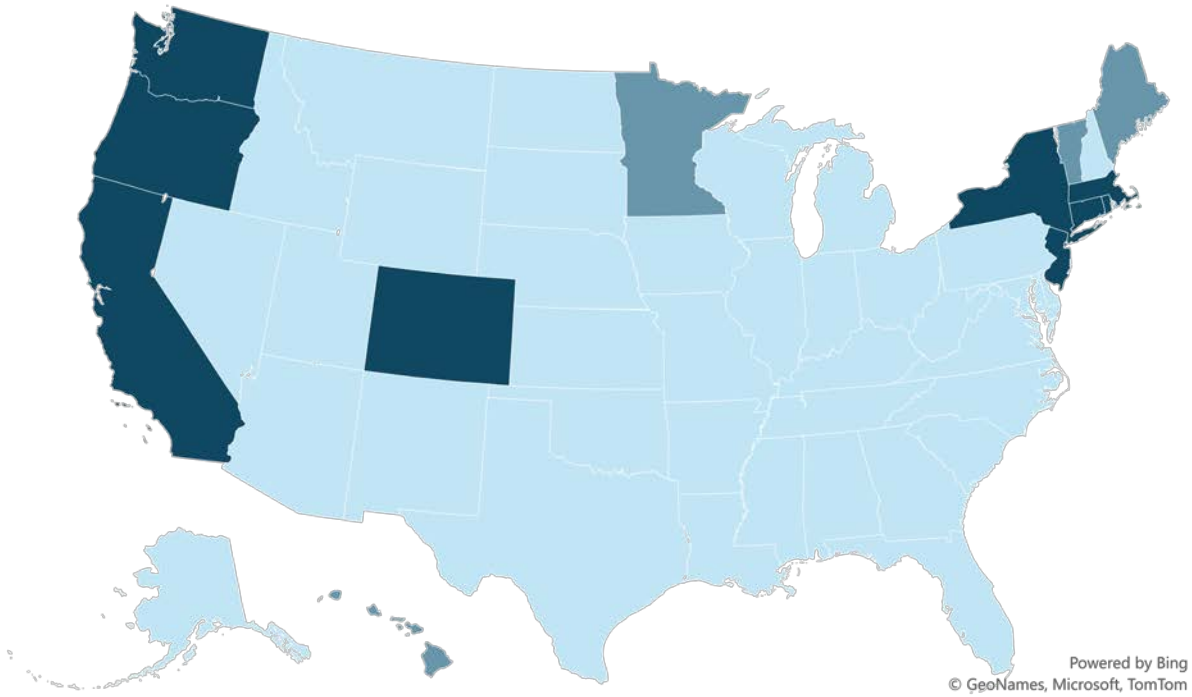
Family Medical Leave

13 States with benefits greater than federal

Reduction

28% Paid, 11% Unpaid / Male

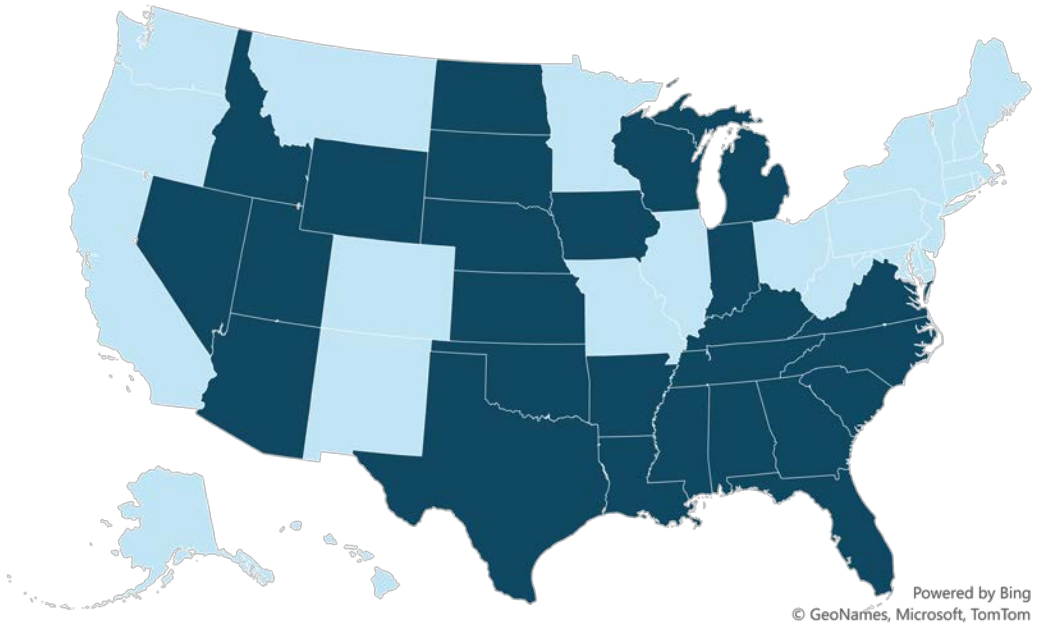
62% Paid, 50% Unpaid / Female



Union Restrictive

27 States
(Michigan repeal after study period)

20% Increase for Male and Female



Takeaways

Policies at state level could translate to workplace best practices

Protection across policy different for women working in construction

A case study examining the development and impact of the International Union of Elevator Constructors (IUEC) Local 1 Member Assistance Education Program (MAEP).

MDB, Inc. and IUEC Local 1

Project Leads

- Allison Weingarten, LMSW
- Brendan Loftus, LAP-C, Director of Member Assistance Educational Program
- Deborah Weinstock, MS
- Jonathan Rosen, MS CIH FAIHA

Overview

Participatory Action Research

- Forming advisory committee of key IUEC stakeholders and from the Training and Education Fund

About IUEC Local 1

- 3,200 members in the elevator construction industry in NYC, Westchester, Rockland, Long Island and New Jersey.
- Specialize in installing, servicing, repairing, and modernizing elevators, escalators, and other conveyances.

Construction work and impact

- Elevator construction workers are exposed to electrical, struck by, caught in hazards and falls.
- The work is physical and fatiguing. Injuries and occupational stress related to these exposures may lead to opioid misuse and addiction as well as to depression, anxiety, and other mental health effects.
- Construction workers experience the highest mortality rates from suicide and overdose of any industry. Effective peer programs are a key component to addressing this dilemma.

Formation of MAEP

- Series of 5 deaths from drug overdoses in 11-month period.

About the MAEP

- Led by Brendan Loftus, Executive Board member and Safety & Health Trainer, person in long term recovery who is open about his lived experience
- Two-hour drug and alcohol class
- MAEP includes:
  - vetting treatment facilities
  - making referrals for treatment
  - facilitating group recovery meetings
  - training members and apprentices, and
  - providing support to members and their families.

MAEP Success

- Prior to 2016, only about 10% of members who went for treatment maintained their recovery.
- After the IUEC established the MAEP program, 78% maintained recovery.
  - Determined by reviewing data from the treatment providers on the status of members who had gone through their treatment programs.

Goal of Case Study

- Yield useful insights into the construction union-based member assistance program.
- CPWR previously conducted qualitative research conducting focused telephone interviews with members of the NABTU Opioids Taskforce and published a report highlighting construction industry peer advocacy networks. That was the first qualitative research of its kind in construction.
- The proposed research with IUEC Local 1 will further this work by doing an in-depth case study of a specific program.

Specific Aims

1. Document key action steps that led to the establishment of the IUEC Local 1 MAEP.
2. Document activities and methods employed by the MAEP to provide support to members.
    1. Qualitative research methods – key informant interviews, focus groups, and a survey.
3. Develop lessons learned from the case study.


Project Advisory Group
Key Informant Interviews
Participant Focus Group
Membership Survey
Final Report

Results and Analysis

Project Advisory Group (PAG)

- Included the research team, eight leaders from IUEC Local 1, and a member who went through the MAEP Program.
- Several of the participants identified themselves as people in recovery or as having a family member impacted by drugs and alcohol.
- Participants included: the local president, organizers, vice-president/business agent, day secretary, safety director, and recording secretary.

Brendan Loftus' Toolbox Talk on Suicide Prevention

Comments about MAEP from the PAG included:
Huge advantage to have a full-time person, funded by Training and Education Fund with full support of the union leadership
Established sober support network of coworkers
Peer recovery program – not clinicians, a new social network of coworkers
Aftercare and sober living support increased successful recovery rate from 10 to 78%.
Treatment geared to individual needs: some outpatient, some 30-day inpatient
One-year post-treatment monitoring/support
MAEP is currently about 50% mental health and 50% substance use disorder. Twenty to 30 are in rehab at any given time.
Large number of veterans in workforce. PTSD is a big issue.
Lots of behind-the-scenes work, don't always get a pat on the back
Open-door policy and privacy are "number one"
Impact of SUD: dozing off, absent, late for work, not returning after lunch
Recently added 8 hours of training in psychological first aid for peer network – sticker on hard hat to promote the program
MAEP has helped family members and management get into treatment
Toolbox talks on substance use, mental health, suicide prevention
MAEP has improved labor/management relations as it provides concrete support to the workforce
Day secretary places members in treatment on paid disability leave and provides return to work

Key Informant Interviews

Brendan Loftus, director of MAEP, conducting a toolbox talk on suicide prevention.

Local 1 President/Business Manager Lenny Legotte

New York District Metropolitan Manager of Kone U.S.A. Justin Tomasino

Lee Pirone, Local 1 day secretary

Key Informant Interviews

- Key themes included:
  - Before MAEP, signs of misuse and addiction were being ignored.
  - Mental health issues are as prominent as SUD.
  - Many PAG members reported about their own recovery or that of family members and close friends.
  - There is heavy reliance on Brendan Loftus, MAEP program director.
  - Members often deny. They have many enablers. Having Brendan and peers helps overcome the denials.

Focus Group of MAEP Participants

- The focus group included IUEC Local 1 members who have been through the program.
- Purpose – To document experiences and satisfaction with the program, and to learn about ideas for expanding and improving it.
- Six members participated in the focus group.
  - All but one were 35 years of age or younger. One was an apprentice.

Focus group of MAEP program participants with research team.

Highlighted Quotes

Quote from mother of a IUEC Local 1 member who went through the MAEP program:
“He hasn’t just changed in being sober. He has changed in being a righteous man. He is trustworthy. He is honest. He is hard working, dedicated, devoted, loyal. He doesn’t make a commitment that he cannot fulfill.”

Lenny Legotte, IUEC President: “After losing several apprentices, we were standing over a casket and I started getting mad, what is going on? There is something we can do and we are not doing it.”

Justin Tomasino, Management: “I had no idea. I worked with this person every day. Not this guy who comes to work every day and does his job. Looking back, in this situation, I was willing to support him because I love him, he is a friend, I recruited him. I know his family; I know his kids. But if I am being truthful, when we pull a mechanic off a job because he is a drunk, I am probably less in the helpful frame of mind, more like, ‘let him go deal with this on his own, not on my dime.’”-

Highlighted Quotes

Brendan Loftus: “I believe the best way is peer based, people with lived experience, on-the-job, within the industry, and people in recovery. It was inspirational to me to hear a person within the industry, Bobby Stack, who was a volunteer when we had the bare bones of program.”

Jonathan Anderson (Peer): “Brendan calls on me because he knows I am a good, sober man and I want to help. I will pick up or drop off members going to treatment at the airport when needed.”

Focus Group: “The thing I never lost was my job. Never got kicked out of the union.”

"Theres a lot of sober people in this union now. It’s not like it used to be. Now half my coworkers are sober."

Survey Results

Survey Population

- Aim – Evaluate the reach and reputation of the program.
- Survey population was 600 apprentices.
- Not all Local 1 instructors distributed the survey.
- The 317 apprentices who received the survey completed it – approximately 100% completion rate.
- *Note that Local 1 apprentices join the union after completing one year in their apprenticeship. They also work as helpers with a journeyman mechanic as part of their apprenticeship.

Key Results

- Years in the IUEC Local 1 Apprenticeship Program:
  - 10% (n=31) had 0-1 years
  - 85% (n=269) had 1-5 years
  - 5% (n=17) did not answer the question.
- 6% (n=19) noted a culture of misuse of drugs and alcohol among union members.
- 23% (n=74) noted a problem with stress, anxiety, and depression among union members.
- 54% (n=171) knew about the Member Assistance and Education Program (MAEP).
- 3% (n=10) of survey respondents indicated that they have utilized the MAEP.
- 80% (n=254) would seek out the MAEP if they were to experience a drug, alcohol, or mental health problem.
- Of the largest barriers to getting help for SUDs or mental health concerns, apprentices ranked:
  - #1, fear of losing the apprenticeship
  - #2, financial loss
  - #3, stigma
  - #4, other reasons
- **Survey results show a favorable impact of the MAEP program.**

- **What stressful or hazardous conditions in the industry would you change?**

What stressful or hazardous condition in the industry would you change?	Percentage	Number
Paid sick leave	43%	136
Prevention of strains and sprains	25%	79
8-hour workday	10%	32
Other	10%	30
No response	13%	42

Summary

Key Findings

- Case study provides first-person testimony about the impact of MAEP on workers, families, and employers.
- Illustrates a site-specific strategy for developing an effective program that addresses mental health and substance use among a population of construction workers.
- MAEP and related training/recovery resources have significant impact on program members
- Benefits to workers' families and employers incentivize replication and implementation through the industry
- MAEP programs can help overcome stigma and the "deadly silence" in traditional drug -free -workplace programs.
- There is a need to develop resources to address gaps in:
  - Systematic record keeping
  - Ability to address leadership training
  - Establish family support networks

Strengths and Limitations

Strengths

- Multiple streams of data
- Strong relationships between participants and researchers
- High survey response rate
- Study uniqueness
- Many opportunities revealed to improve the program

Limitations

- No control group to compare MAEP with traditional employee assistance programs
- Limited program data
- Adaptation to different settings – MAEP was established in an urban setting that had access to significant resources

Recommendations

For Local 1

1. Build peer network
2. Instructor training for peers
3. Frequent and regular peer meetings
4. Documentation
5. Employ an administrative assistant

6. Routine meetings with leadership/MAEP firector
7. Training for union leaders
8. Peer family program

For IUEC International

1. Brainstorm how to help smaller locals adapt the IUEC Local 1 program where they do not have a training and education fund.
2. Find champions within the locals and support their efforts to become LAP certified.
3. Help the local unions evaluate their member support programs and develop a strategy for improving them using local LAP, IUEC, and regional resources.

For the Construction Industry

1. Conduct leadership training to educate and build commitment among key stakeholders.
2. Begin a dialogue between key stakeholders to assess the steps necessary to initiate or strengthen support programs.
3. Consider which elements of the IUEC Local 1 MAEP apply and which do not to local and industry conditions.

Recommended dissemination

- CPWR: The Center for Construction Research and Training, the National Institute for Occupational Safety & Health, and the National Institute of Environmental Health Sciences National Clearinghouse for Worker Safety and Health Training websites.
- North America's Building Trades Unions and affiliates.
- National Safety Council.
- The White House Office of National Drug Control Policy to share with federal workgroup and consider posting on U.S. Department of Labor Employment and Training Administration’s Recovery-Ready Workplace Resource Hub.
- Substance Abuse and Mental Health Services Administration.

Potential Publications

- New Solutions Journal of Environmental and Occupational Health Policy
- American Journal of Industrial Medicine
- National Institute for Occupational Safety and Health Total Worker Health Newsletter or Blog
- American Public Health Association, The Nations Health
- Potential posting of CPWR report: National Clearinghouse for Worker Safety & Health Training, Substance Abuse and Mental Health Services Administration website, U.S. Department of Labor Recovery Ready Workplace Resource HUB

Future Research and Funding

Research on member assistance programs in the construction industry is needed to identify key elements in establishing them, data sources, peer programs, program effectiveness, training strategies, and access to resources. Funding sources may include but are not limited to:

- The National Institute for Occupational Safety and Health
- The Substance Abuse and Mental Health Services Administration
- U.S. Department of Labor Employment and Training Administration
- CPWR
- Private foundations

Thank you

Naloxone Administration Training and Distribution

Jeff Bradley

Program Administrator

Overview

- The overdose reversal drug Naloxone (Narcan) has saved countless lives that otherwise would have been lost to opioid overdose.
- Naloxone is not readily available throughout local unions or apprenticeship schools.
- Many leaders and members are not aware that the medication exists.

Overview

- This project, led by representatives from the Sheet Metal Occupational Health Institute Trust (SMOHIT) Sheet Metal, Air, Rail and Transportation (SMART) workers Member Assistance Program (MAP), will pilot widescale training and distribution of naloxone nasal spray in three local union areas across the U.S.

Three locations across the United States

- West - SMART Local 104-San Francisco, CA
- Active membership of approximately 7000 building trade sheet metal workers representing 4 separate JATC training centers.
- Approximately 100 people will be trained at this local.

Three locations across the United States

- Midwest - SMART local unions in Illinois
- Active membership of approximately 5000 building trade sheet metal workers representing 8 separate JATC training centers.
- Approximately 75 people will be trained at this local.

Three locations across the United States

- East - SMART Locals 28 and 137-New York City
- Active membership of approximately 4000 building trade sheet metal workers representing 4 separate JATC training centers.
- Approximately 50 people will be trained at this local.

Aim 1

- Naloxone administration training will be delivered at each of the locals.
- The naloxone training will be facilitated for audiences in the three areas to increase awareness of opioids; decrease the stigma associated with opioids and naloxone and will teach trainees to administer naloxone.

Aim 2

- Distribute naloxone nasal spray at no or reduced cost to apprenticeship schools and provide each trainee with two doses of naloxone for future emergency use on or off jobsites.

- Each training center will receive the remaining doses in proportion to their size, to redistribute as needed. This aim includes creating a simple and reliable system under which additional naloxone nasal spray can be requested.

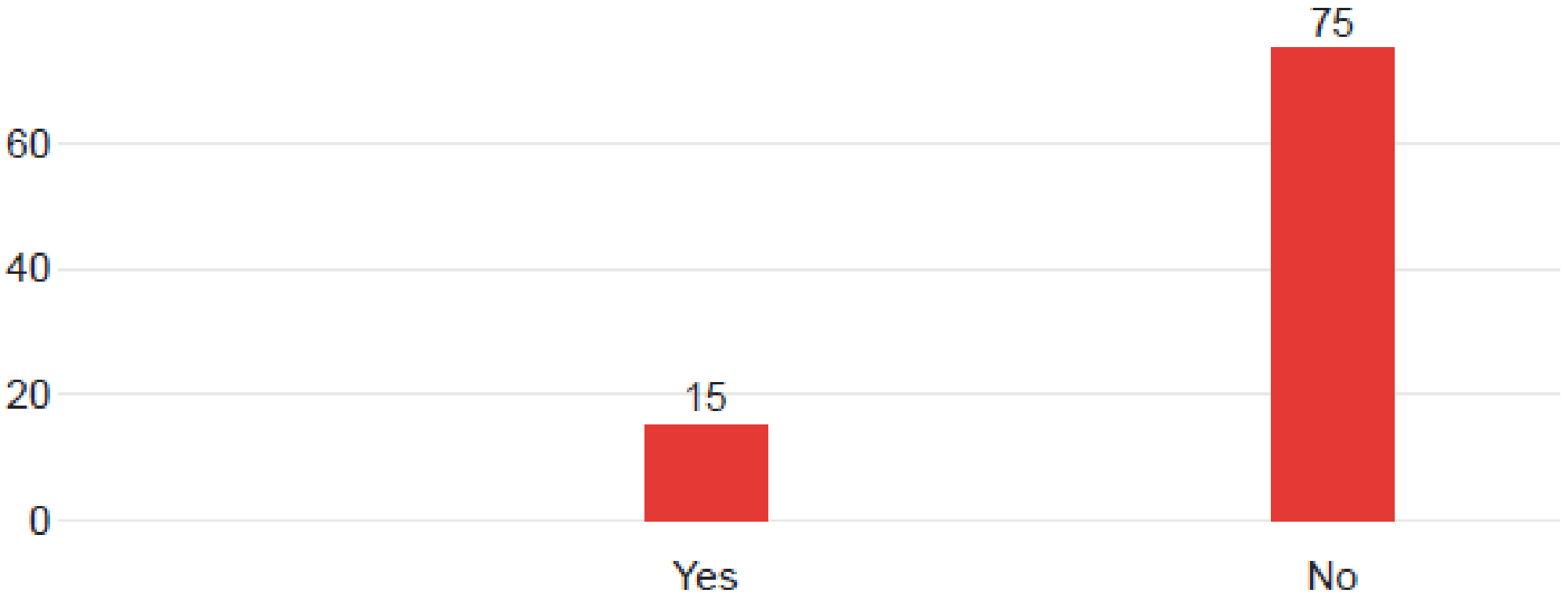
- These trainings are open to all members who are in a position of leadership throughout our union and training centers including managers, agents, organizers, coordinators, instructors, superintendents, forepersons, etc.

- Trainings will include the signs and symptoms of an opioid overdose, proper administration of naloxone nasal spray, what to expect when administering naloxone, as well as providing 2 doses of Naloxone for each person trained.

- Our goal is to have this life saving medication everywhere and that Naloxone be stored and available in the first aid station in all training centers as well as all major jobsites (that we have supplies for).

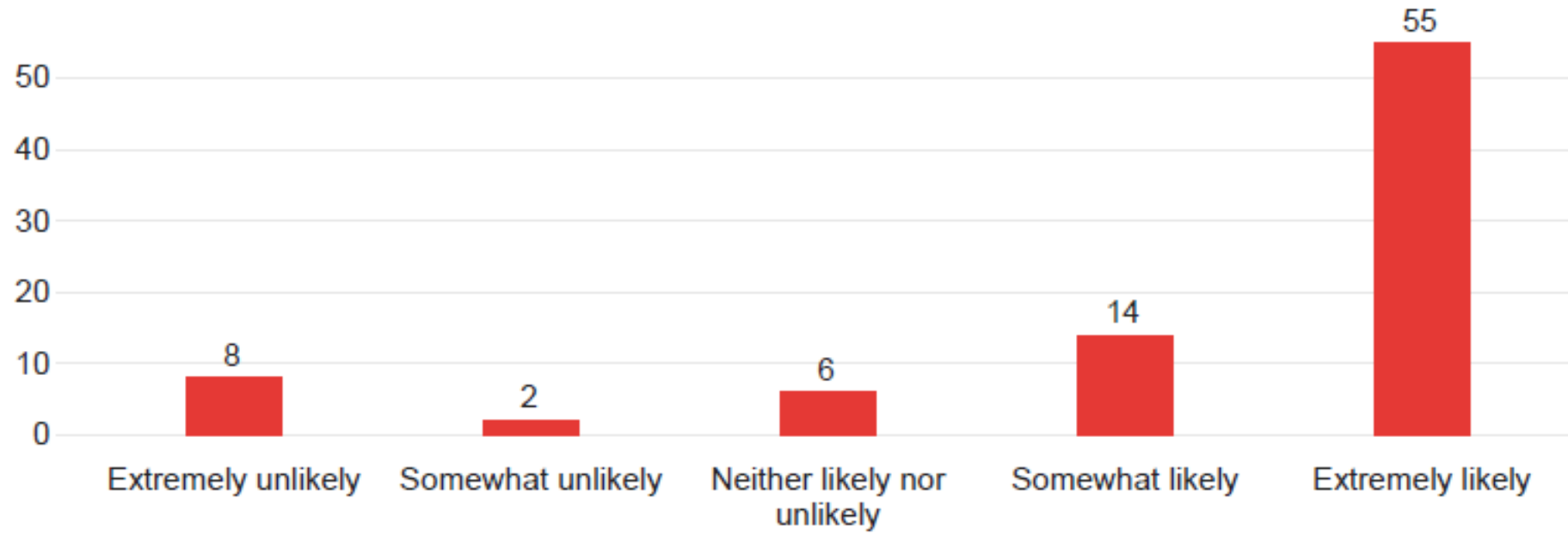
Pre-Training Survey

Q2 - Do you currently carry naloxone?



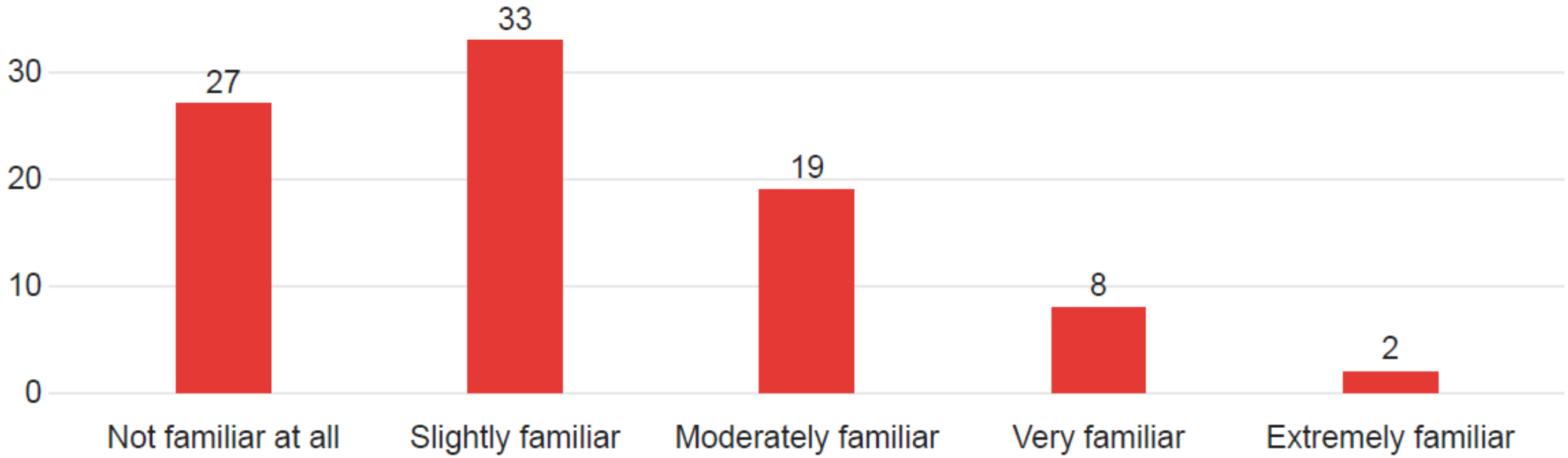
Post-Training Survey

Q13 - After completing this training, how likely are you to carry your naloxone with you?

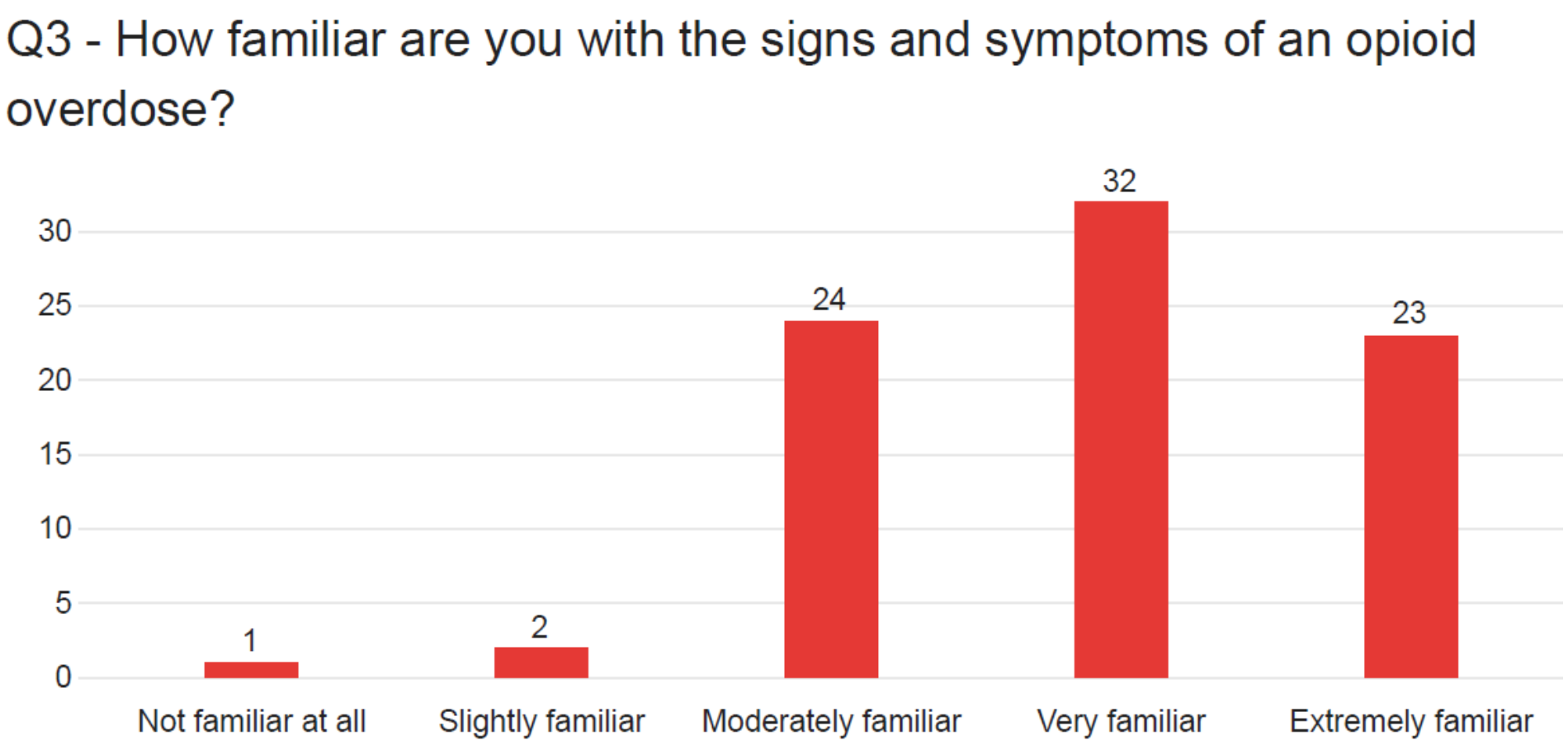


Pre-Training Survey

Q3 - 2. How familiar are you with the signs and symptoms of an opioid overdose?



Post-Training Survey



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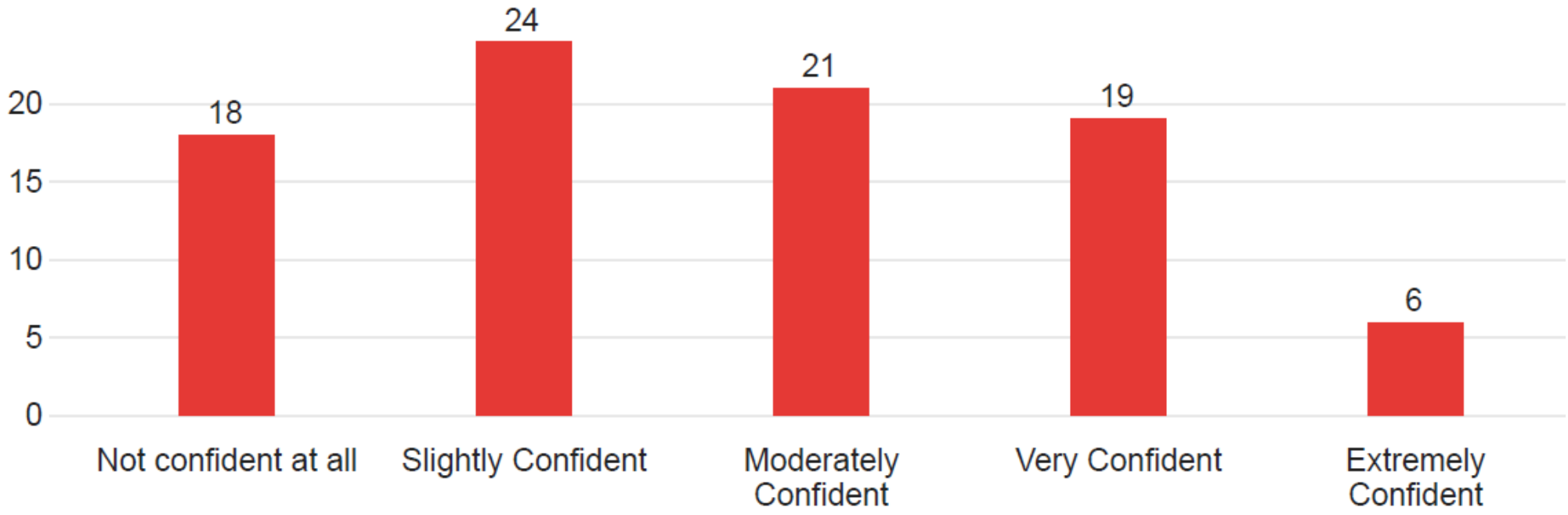
Pre-Training Survey

Q4 - How confident are you in your ability to respond to an opioid overdose emergency?



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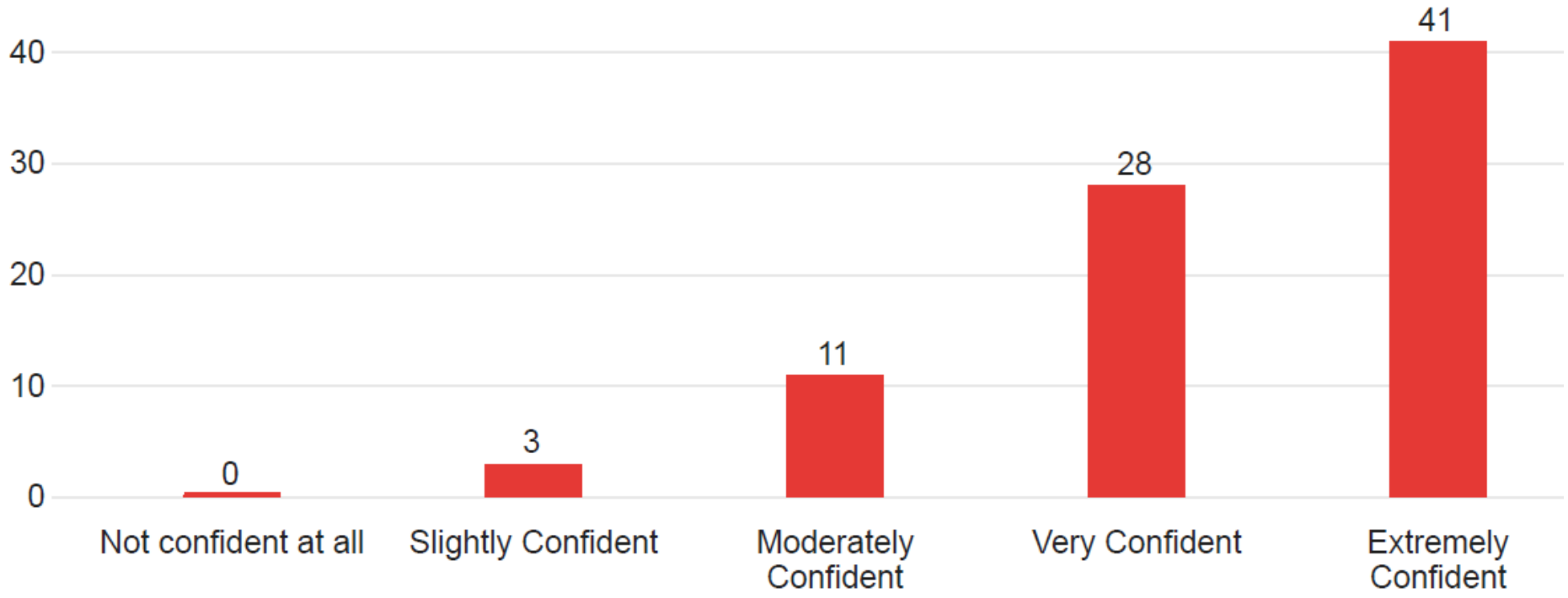
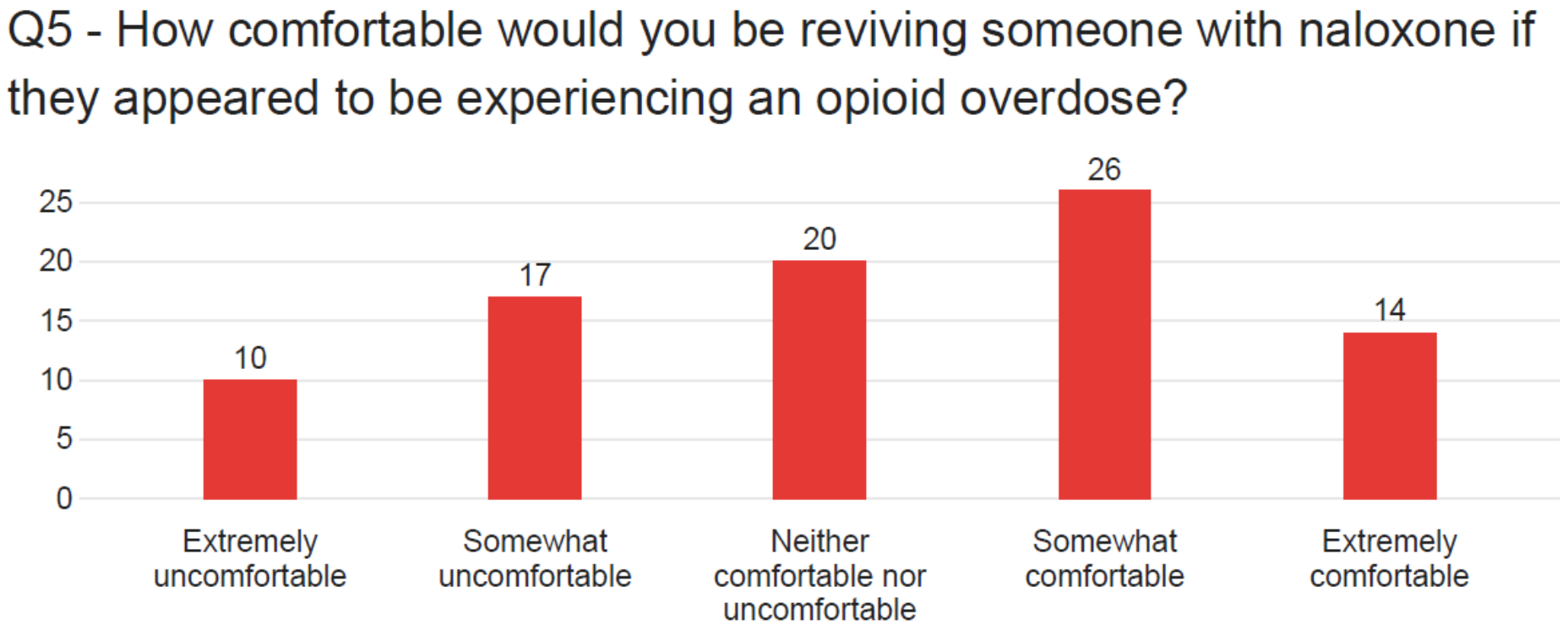
Post-Training Survey

Q4 - How confident are you in your ability to respond to an opioid overdose emergency?

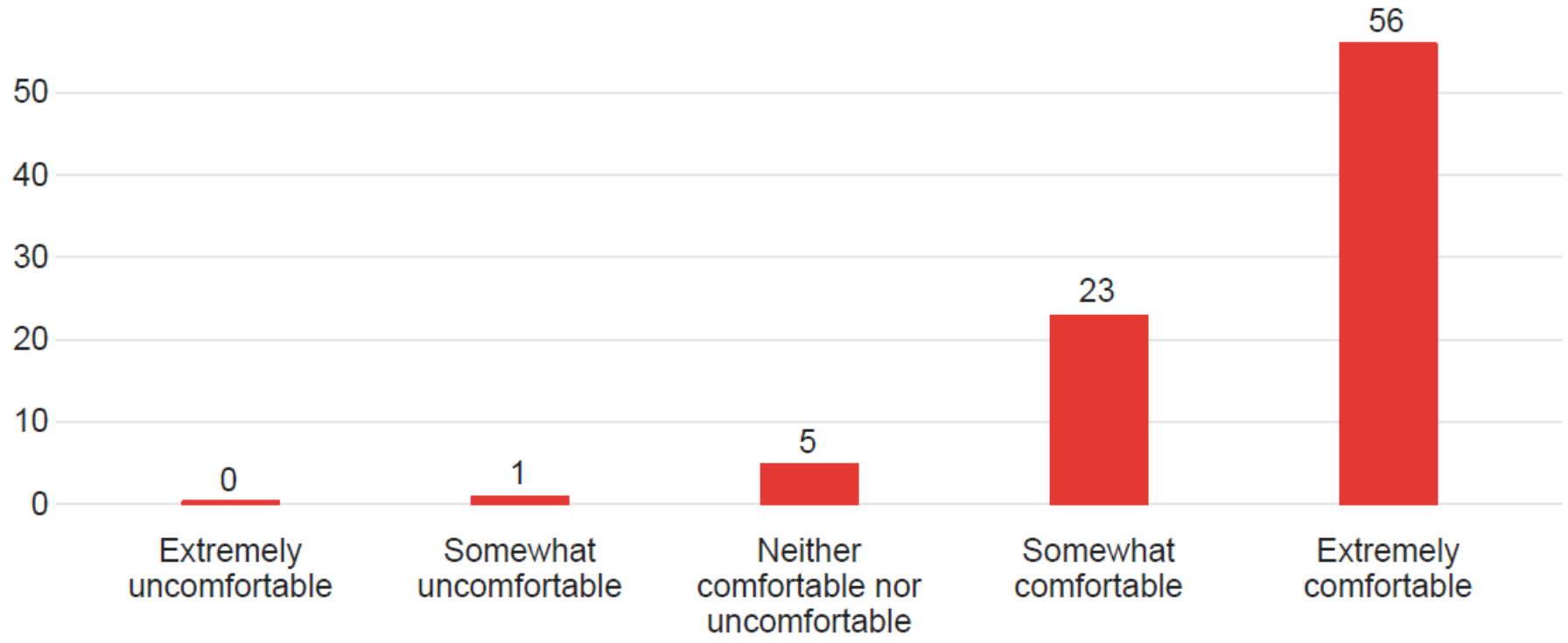


Pre-Training Survey

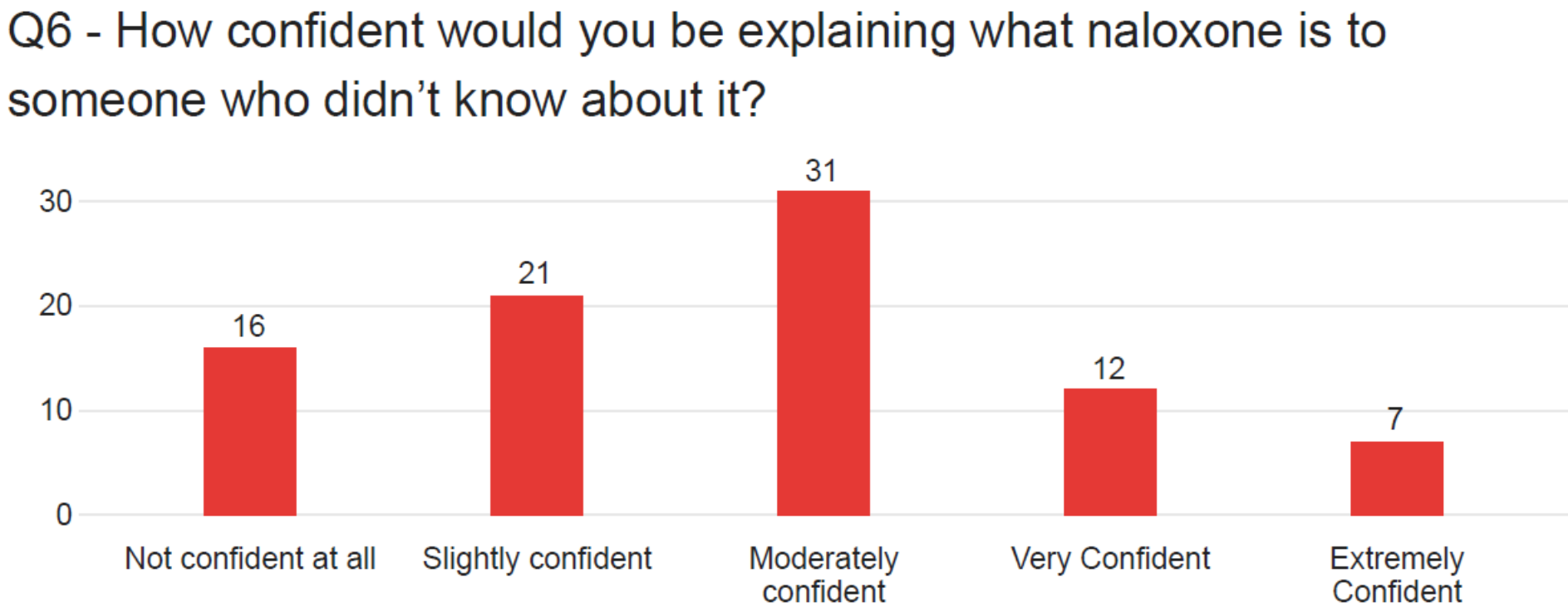


Post-Training Survey

Q5 - How comfortable would you be reviving someone with naloxone if they appeared to be experiencing an opioid overdose?



Pre-Training Survey



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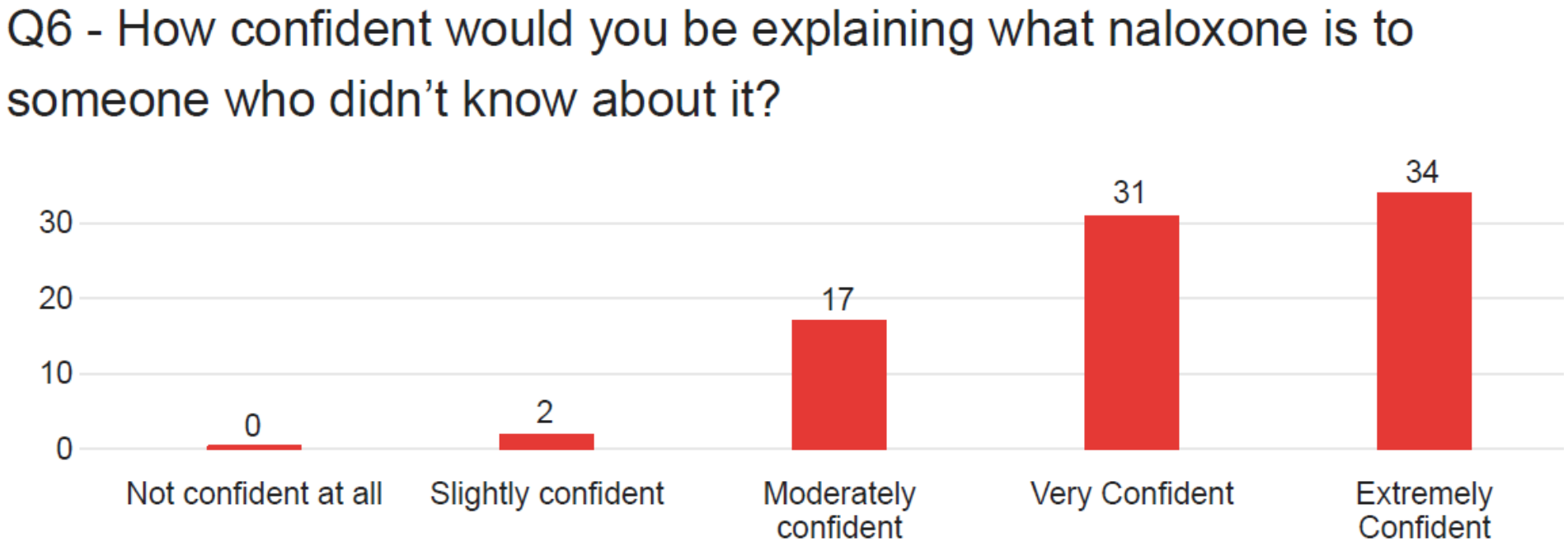
Post-Training Survey



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SMOHIT.ORG

Evaluating the Implementation and Effectiveness of New Peer-Support Programs

Healthy Work Center

Brad Evanoff
Anna Kinghorn

Intro / Goals:

- Many trade unions and contractors are implementing *peer support programs* to better prevent and treat opioid dependency and mental health issues
- Little practical information about the barriers and facilitators of implementing peer support programs
- We are evaluating 2 recently started programs
- Evaluate implementation, organizational effects, and effectiveness

Greater St. Louis Construction Laborers Health and Welfare fund

- Serves Locals 110 and 42 (~4200 active members and ~7000 retired members and dependents)
- “LEAN StL” program based on the “Laborers Escaping Addiction Now” program pioneered in Boston, includes an expanded focus to address suicide prevention and other mental health topics
- Two peer counselors hired March 2023, completed >200 hours of training, including MO certification for Peer Support Specialist and Community Health Worker, additional training in Behavioral Health and Substance Use counseling; joined the National Peer Recovery Alliance

Key Activities of LEAN StL Peer Counselors

- Provide advice and referral to individual workers and dependents
- Jobsite talks
- Apprentice classes on mental health and SUD
- Serve as interface between the union members and their MAP
- Help members to get access to union-sponsored benefits and community resources
- Reaching out to contractor associations
- Working to create a network of support

Semi-structured Interviews

- 15 to date: Union leaders, trustees, business agents
- **Adoption and Buy-In**: relatively smooth, initial concerns about cost
- **Satisfaction and Impact**: meeting or exceeding expectations, personal stories are key to perceived impact
- **Awareness and Utilization**: continuous communication is key; lived experience of the peer connectors seen as helpful to reducing stigma and encouraging utilization
- **Program fit and relevance**: peer support approach seen as particularly effective, good acceptance by leaders and workers

Semi-structured Interviews (cont’d)

- **Sustainability:** ongoing need for mental health and substance use support is expected to maintain the program's relevance; program will need to evolve over time to meet the needs of members
- **Cost and Feasibility:** stakeholders believe the benefits far outweigh the costs
- **Challenges and Areas for Improvement:** need for additional staff as program grows
- **NEXT STEPS:** Continue interviews with leaders, interview members who have sought assistance through the peer counselors

Other evaluation metrics

- Increased utilization of health plan and Member Assistance Program
- Health plan claims for mental health / addiction:
  - 3/22 – 2/23: 648 claims / $69,960 payment (per month)
  - 3/23 – 2/24 : 783 claims / $87,058 payment (per month)
- NEXT STEPS: Analyze individual level claims data
- Analyze MAP data to compare utilization pre-and post-intervention (changes in #contacts, utilization, reasons for utilization)

Second site – Tarlton Corporation

- St. Louis General Contractor, ~250 employees; 20-25 job sites
- Employs Union carpenters, cement masons, laborers, iron workers
- Participant in Suicide Prevention Stand-Downs since 2019

Implemented pilot of a MATES adaptation

- Two day ASIST training for HR, safety managers August ‘23
- General Awareness Training for all workers: Five days of TBTs Sept ‘23
- Half-day SafeTalk Training for Peer Connectors: October ’23
- Hard Hat Stickers, resource cards
- Final TBT promoting the program: Jan 2024
- Interviews with trained personnel: March-May 202

Semi-structured Interviews

- 11 to date: HR, Workforce management, Superintendants, Safety Manager
- **Value of training**: SafeTALK and ASIST valuable and useful; increased confidence; recurring theme was that real life practice needed. Some had already used skills
- **Awareness/Observation/Empathy**: increased
- **Support Systems and Resources**: make it easier to connect individuals to the right resources based on their trust and comfort

Semi-structured Interviews (cont'd)

- **Challenges and Suggestions:** share success stories, continuous education and refreshers, address specific needs of diverse populations
- **Overall Reception**: Worker reactions perceived as neutral to positive. Stigma about discussing mental health seems to be decreasing. Peer connectors seen as beneficial in making support more beneficial and creating culture of openness and support.

Baseline Questionnaire Data: 93 respondents

Proportion responding "Agree" or "Strongly Agree"	**%**
Suicide is a serious problem in the construction industry	71
If I was struggling with mental health issues, I would be willing to ask for help	60
If I was struggling with mental health issues I would know who I would talk to, in order to get help	76
If I knew a coworker was struggling then I would be willing to offer help	94
I believe my workplace tries to look after worker mental health	69
Poor mental health is a workplace health and safety issue	86
An employee would be treated poorly in the workplace if they were to disclose that they had been diagnosed with a mental illness	17
I would feel embarrassed if others knew I was seeking professional help for depression or a substance use problem	17

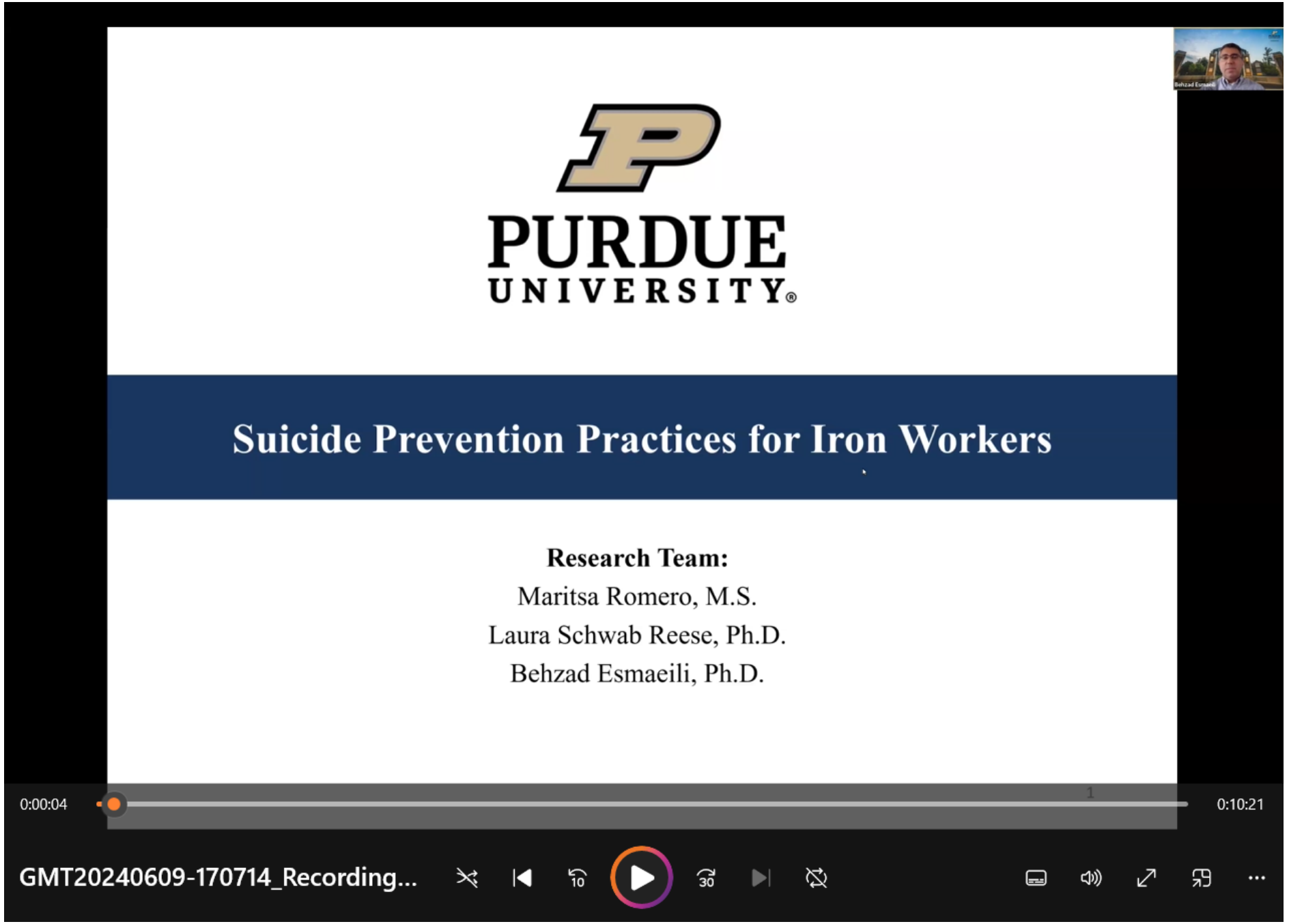
Washington University in St. Louis
School of Medicine

Healthy Work Center

https://oshr.wustl.edu

healthyworkcenter@wustl.edu

Many thanks to:
Greater St. Louis Construction Laborers Health and Welfare Fund
Tarleton Corporation – Ryan Wehrle
AGCMO – Brandon Anderson
Washington University – Ann Marie Dale
Healthier Workforce Center of the Midwest – Diane Rohlman
United Erectors in Des Moines – Brad Churchill


PURDUE
UNIVERSITY
Suicide Prevention Practices for Iron Workers
Research Team:
Maritsa Romero, M.S.
Laura Schwab Reese, Ph.D.
Behzad Esmaeili, Ph.D.
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CPWR

THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

2024 R2P SEMINAR & PARTNERSHIP WORKSHOP

r2p

WEDNESDAY, JUNE 12TH

8:00 – 9:00	Breakfast
9:00 – 9:15	Welcome Back
9:15 – 10:15	Research Session #4: Improving Safety and Health Through Training
10:15 – 10:30	Break
10:30 – 11:30	Research Session #5: Tracking and Evaluating Hazardous Exposures
11:30 – 11:55	Final Discussion: How can we work together to ensure that outputs from consortium research continue to be disseminated and implemented?
11:55 – 12:00	Closing Remarks

Research Session #4: Improving Safety and Health Through Training

Moderator: **Rick Rinehart, ScD**, Deputy Director, CPWR

Evaluation and Improvement of OSHA 10-Hour Construction Safety Training

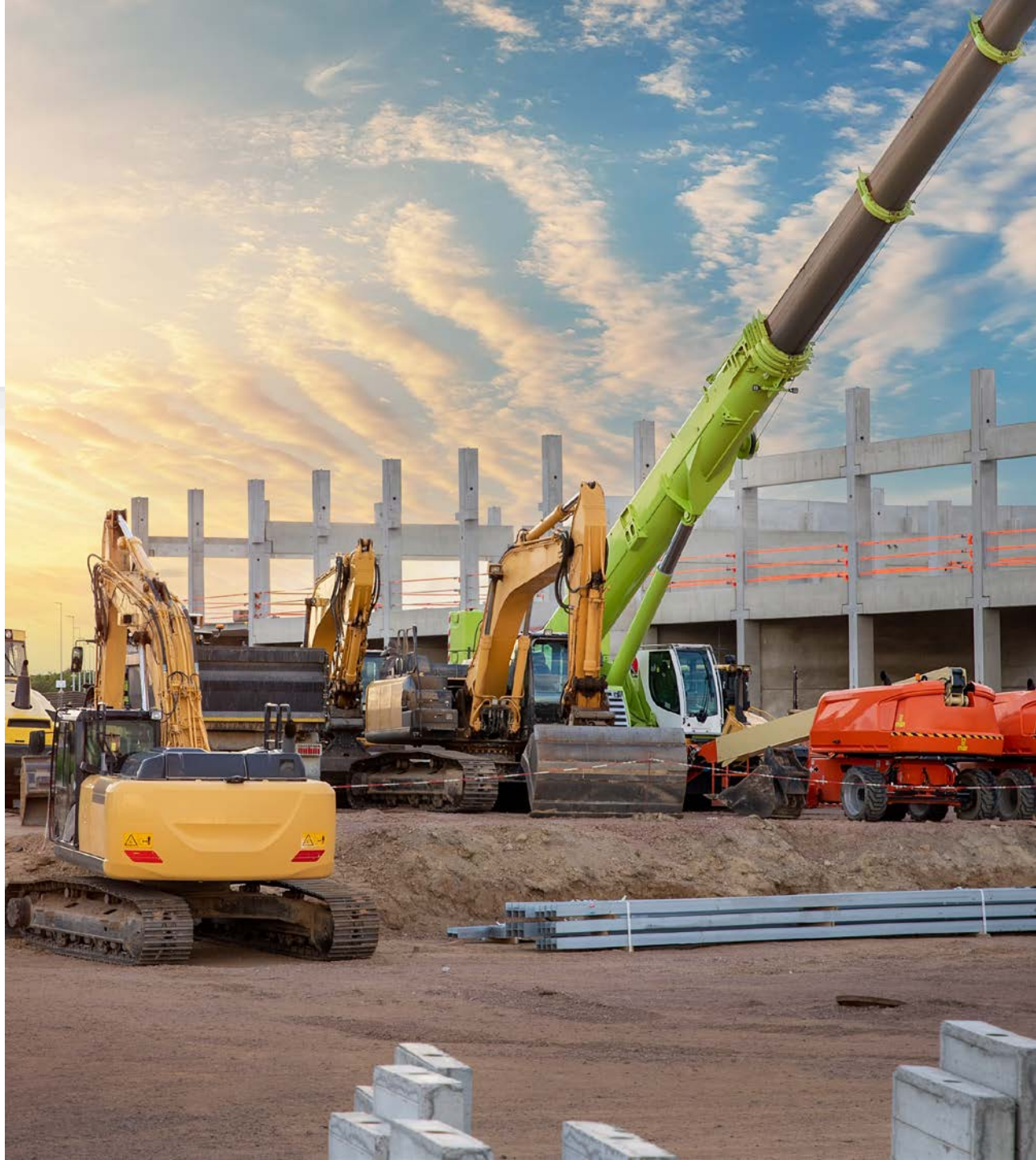
Mark Fullen, EdD, CSP, Professor and Director, Safety and Health Extension, West Virginia University

Improving Safety Leadership and Fall Prevention Training in Residential Construction

Bradley Evanoff, MD, MPH, Professor of Medicine; Director, Division of General Medicine and Geriatrics; Assistant Vice Provost for Public Health, Washington University in St. Louis

Using Community-Based Organizations and Partnerships to Enhance Reach and Engagement of Small Construction Establishments

Sue Ann Sarpy, PhD, MS, Sarpy and Associates, LLC



Evaluation and Improvement of OSHA 10-Hour Construction Safety Training

2024 R2P SEMINAR &

PARTNERSHIP WORKSHOP

June 11-12, 2024, Silver Spring, MD

Mark Fullen - West Virginia University – Safety & Health Extension
Kimberly Rauscher - Boise State University - Department of Community and Environmental Health
Wayne Lundstrom - West Virginia University – Safety & Health Extension
Douglas Myers - Boise State University - Department of Community and Environmental Health
Brandon Takacs – Formerly West Virginia University – Safety & Health Extension,

WV EXTENSION

Safety and Health

Refresher on the Project

- Study Objectives
  - To understand the current approaches used by Outreach Trainers when teaching the OSHA 10
  - Evaluate the quality of these approaches and identify areas in need of improvement
  - Develop an enhanced OSHA 10 training approach that addresses current areas of weakness
  - Translate the new approach into practice among Outreach Trainers.

Refresher

- Methods
  - 5-year, mixed-methods study in four phases
  - Interviews, surveys of trainers, training evaluations, and student knowledge assessments
  - Planned to recruit 200 affiliated OSHA 10 authorized outreach trainers and 6000 OSHA 10 trainees.

Evaluation Tools that resulted from Developmental Stage work

- Trainer Questionnaire (Completed by Trainer)
- Training Questionnaire (Completed by Trainer)
- Pre and Post Knowledge Assessment (Completed by Student)
- Training Evaluation (Completed by Student)

Current Status of Project

- Completed the data collection portion of the Evaluation Phase of the Project
- Survey responses:
  - 57 Authorized Trainer Questionnaires total
  - 281 Students Completed the Pre Safety Questionnaire
  - 178 Students have completed the Post Safety Questionnaire
  - 73 Students completed the Training Satisfaction Survey

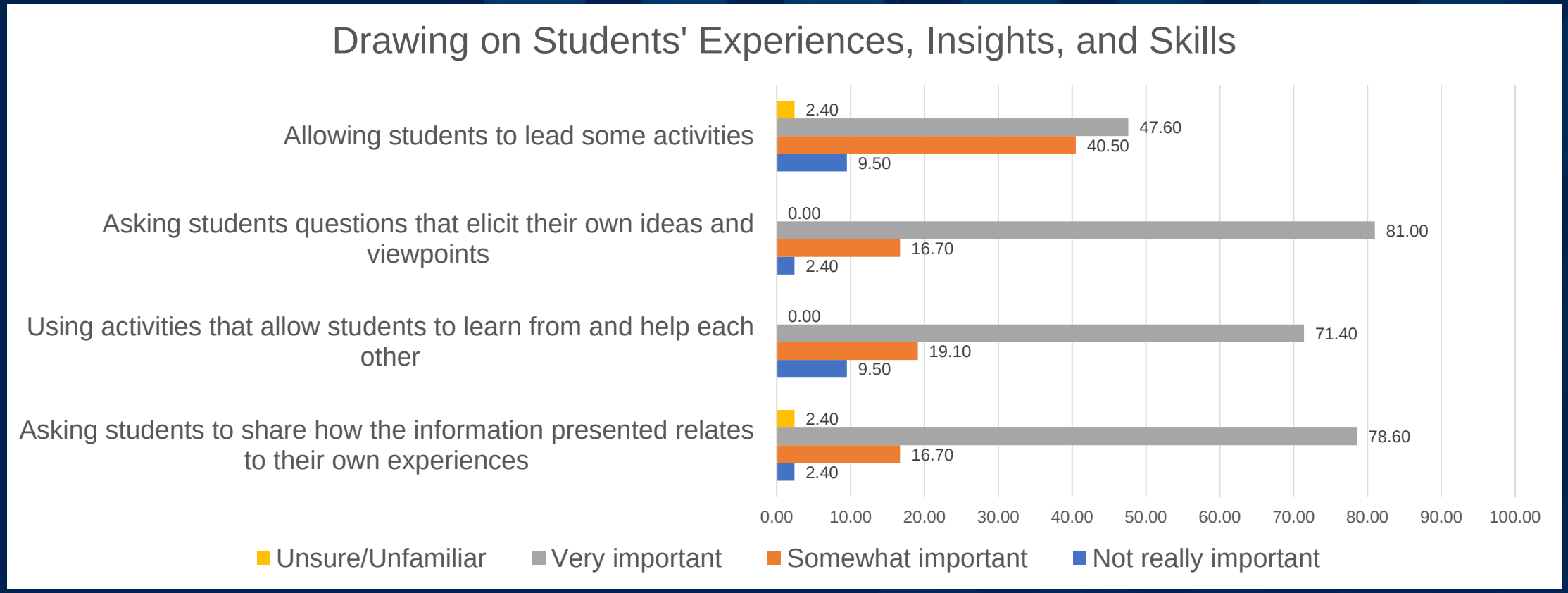
Current Status of Project (Cont).

- Ended recruitment of trainers April 1, 2024
- Ended data collection from training courses June 1, 2024
- Initial Data Analysis has been conducted on the Trainer Questionnaire and the Student Satisfaction Survey
- Development of an enhanced OSHA 10 training approach is underway

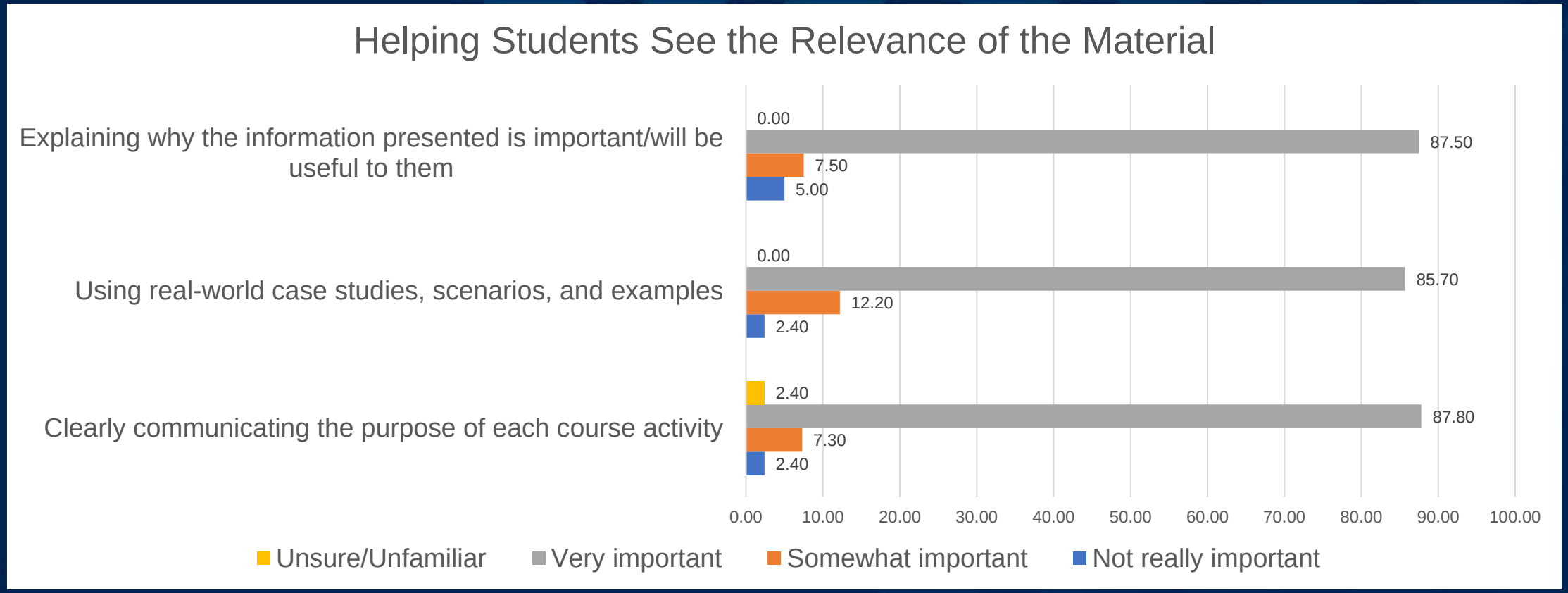
Trainer Questionnaire

- Demographics
- Professional Background
- Construction Background
- Safety and Health Background
- Perspectives on importance of different teaching approaches (Importance of and confidence in doing
- Teaching Methods and Activities (Importance of and confidence/comfort in doing)

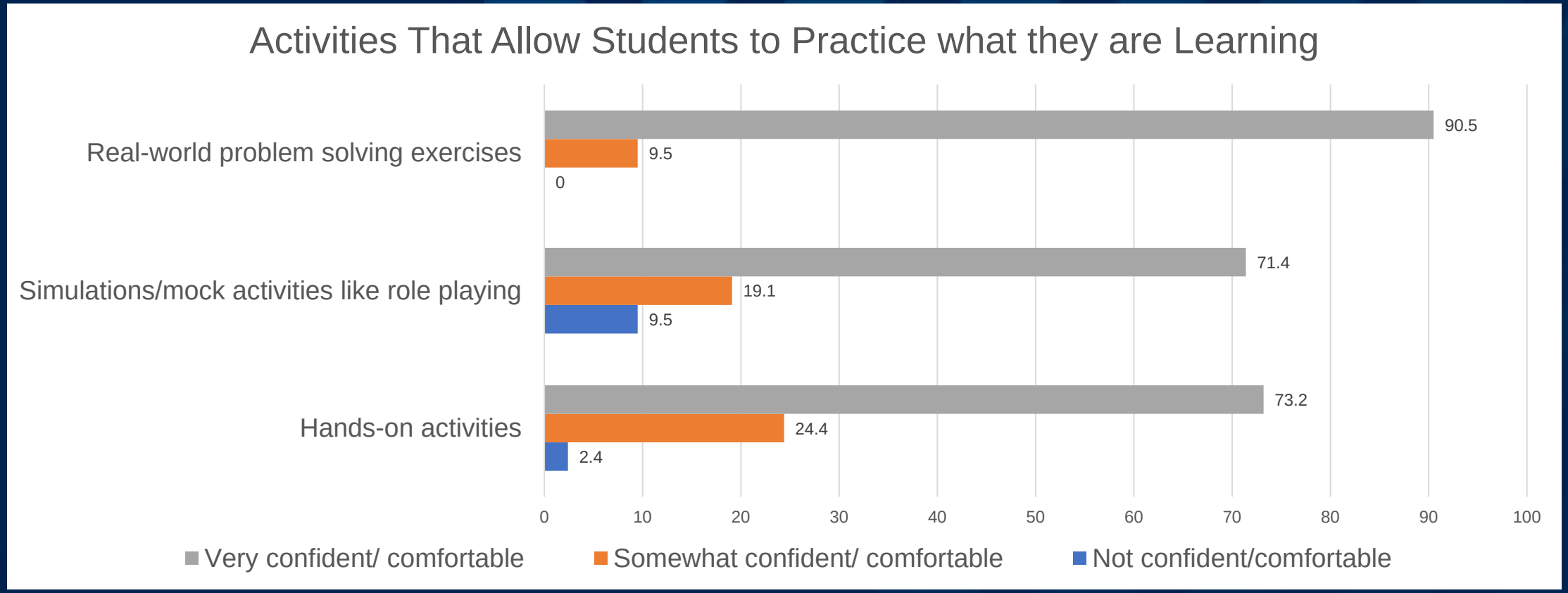
Selected Trainer Questionnaire Results



Selected Trainer Questionnaire Results



Selected Trainer Questionnaire Results



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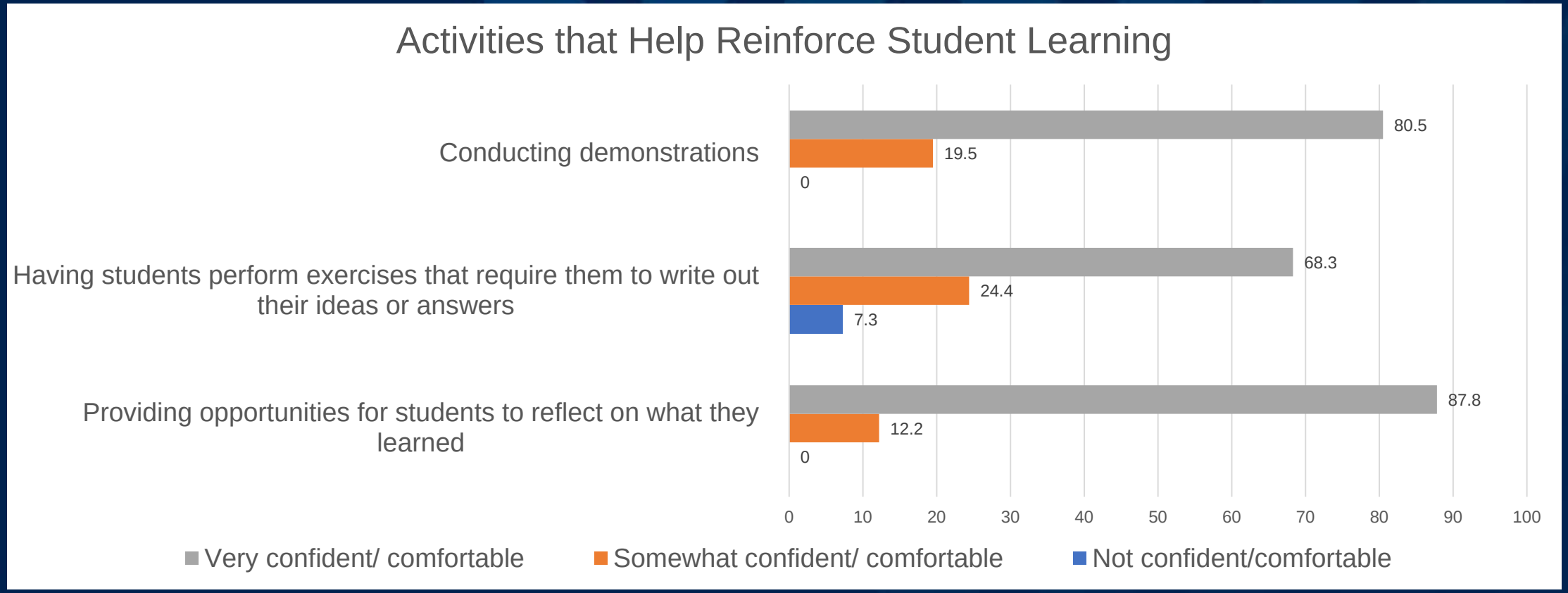
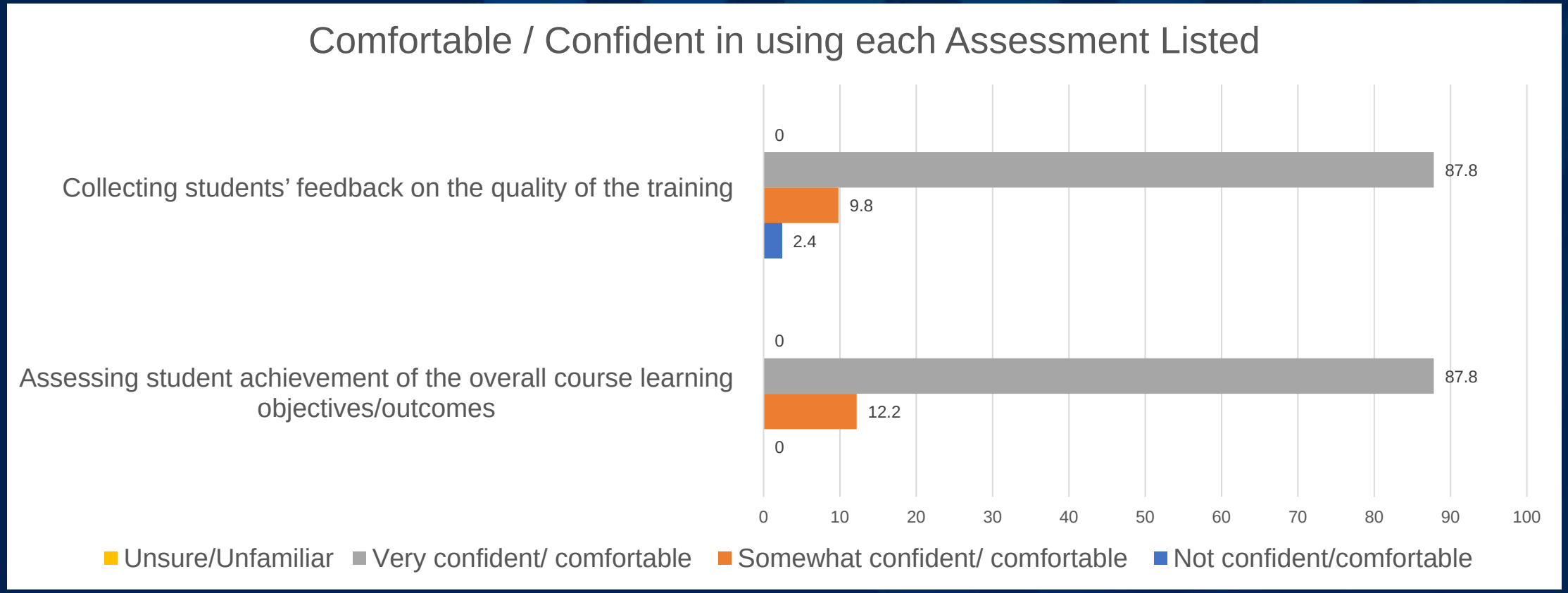


Selected Trainer Questionnaire Results



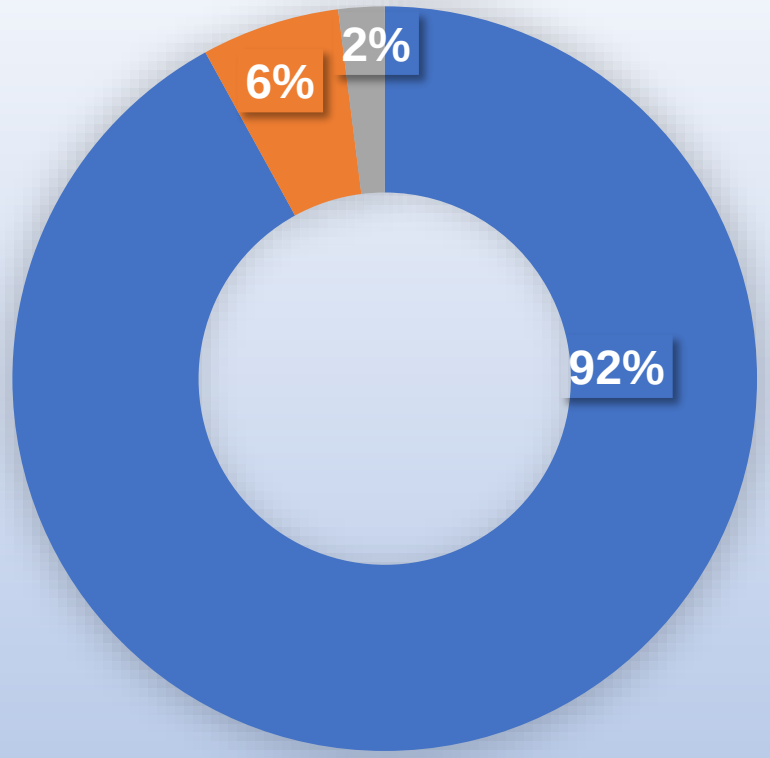
Emerging Themes from Trainer Questionnaire and Exploratory Data

- The trainers are confident and comfortable and the see value in conducting engaging activities with their students.
- The reality of OSHA 10 training and trainers:
  - Classes are often delivered with a minimal amount of preparation time and customization.
  - Delivered in training facilities that do not provide the ability to conduct hands on activities.
- Trainers are more likely to utilize pre-developed curriculum versus developing customized curriculum for their audience.

Training and Trainer Evaluation – Satisfaction Survey

- Tailored to Students Needs
- Environment is Comfortable and Positive
- Draws on Students' Experiences
- Demonstrates Relevancy of What is Being Taught
- Provides Feedback to Students
- Provides Route Maps Throughout Training
- Activities Encourage Student Engagement/Active Participation
- Includes Opportunities to Practice Skills and/or Apply Concepts Being Taught
- Presentation Methods Vary

Which one of the following responses best represents how you feel about the training?

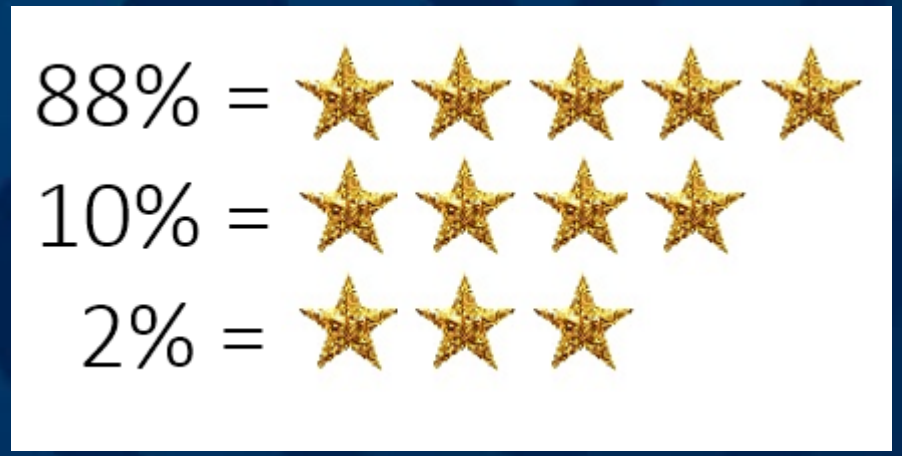


- The training gave me a lot of relevant information and skills that I will use on the job
- Overall, the training was good but some of it was not relevant to me
- This training was not very relevant to me and my needs

WV EXTENSION

How good was the instructor at creating a comfortable learning environment?

Out of 5 stars…



WV EXTENSION

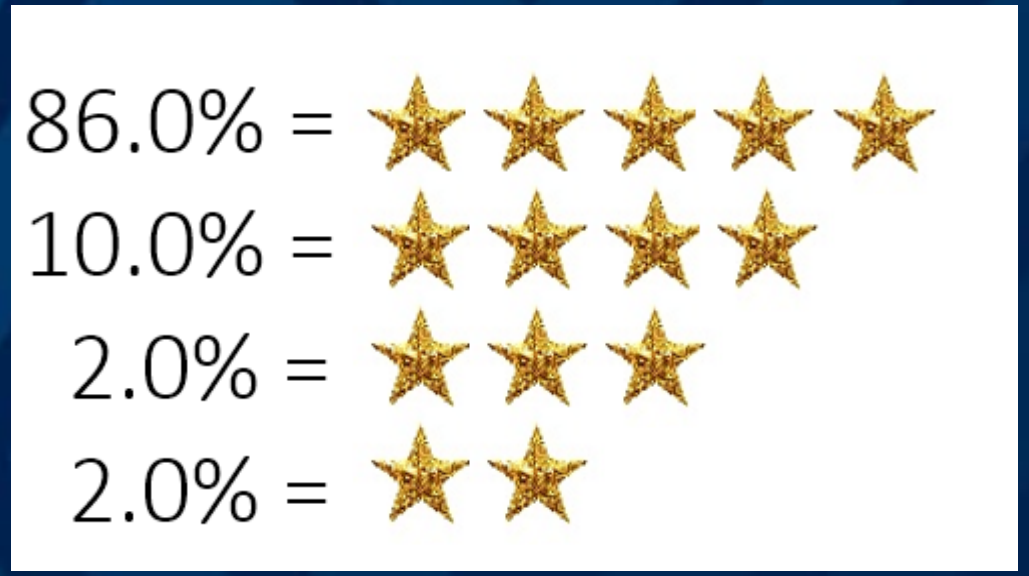
How good was the instructor at creating positive relationships with students?

WV EXTENSION

How good was the instructor at bringing out students' experiences, insights, and skills?

WV EXTENSION

How good was the instructor at connecting the course material to students' jobs in construction?



WV EXTENSION

How good was the instructor at providing feedback to students?

WV EXTENSION

How good was the instructor at **making sure students did not get lost during** the course?

WV EXTENSION

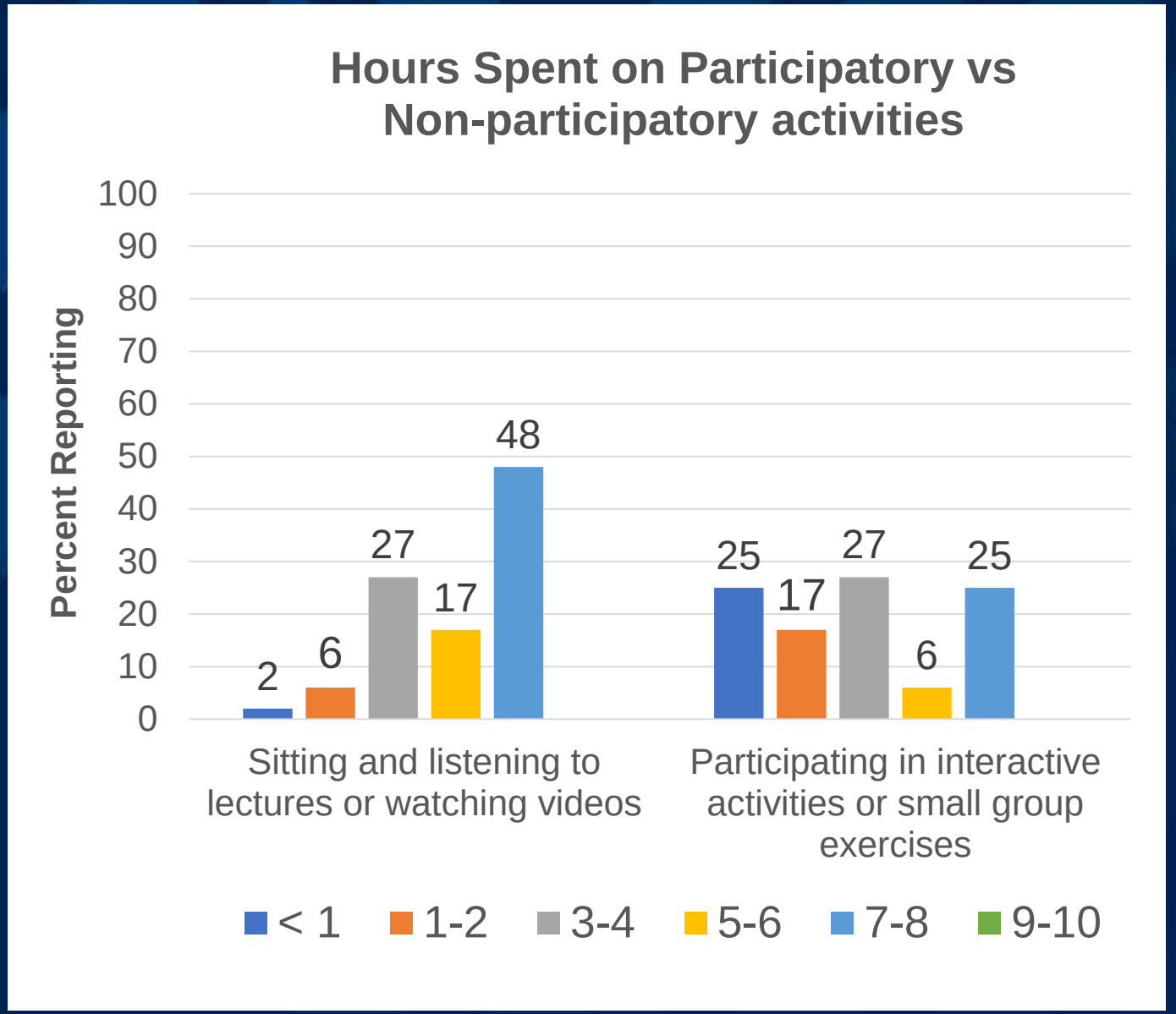
How good was the instructor at encouraging active participation among students?

WV EXTENSION

How good was the instructor at allowing students to practice what they were learning?

WV EXTENSION

During the 10 hours of this training, about how much time did students spend on each of the following activities?



WV EXTENSION

Student Satisfaction Survey Results

- Students on a 5-point ratings scale overwhelmingly reported satisfaction with their training at all levels.
- Contradicting the 5-point ratings, 48% students reported sitting and listening to lectures and/or watching videos for 7 to 8 hours out of the 10 hours of class.
- 25% of students reported that less than 1 hour was spent in interactive activities or small group exercises and 17% reported only1 to 2 hours.
- Students' expectations of the OSHA 10 seem to be to receive lectures and watch videos even though that is not their preference (based on our exploratory data).

Trainer Requirements for Activity Based Learning

- OSHA requirements include:
  - OSHA expects Outreach Training Program training to meet adult learning needs and include interactive activities.
  - Training must include workshops, case studies, exercises, and demonstrations that involve student participation and interaction
  - Videos cannot comprise more than 25% of the instructional time spent on OSHA Outreach Training Program."
- OSHA's publication "Resource for Development and Delivery of Training to Workers" states that:
  - Activity-based learning should fill at least two-thirds of training hours (no more than one-third is lecture).

The reality of training content available from OSHA

- Nearly all trainers interviewed use OSHA 10 training material from osha.gov
- The content available from the OSHA website includes trainer's guides, PowerPoints and handouts.
- Much of the material provided does not meet the learning objectives set forth by OSHA.
- For a trainer to ensure that they meet the learning objectives and deliver engaging training they must spend time and effort prior to training and make decisions about what and how they will embed hands on activities into the training material.
- Trainers don’t tend to have the time or desire to do this, and even if they do, the material is not easy to find and sift through.

Development of a Better Approach

- We are revising existing OSHA 10 curriculum and developing new content to ensure:
  - The curriculum meets the OSHA learning objectives
  - Revising “Introduction to OSHA” presentation and embedding the required hands-on activities to make it seamless for the trainer
  - Embedding hands on activities into the existing PPE and Health Hazard modules.
  - Developing new Focus Four training material and hands on activities.
  - Embedding within each curriculum section a hands-on activity or several hands-on activities that guides both the trainer and the student in the hands-on activity.

Development of a Better Approach

- Once completed and reviewed we will make the new material available through a publicly available Learning Management System.
- We will include developed evaluation tools, pre and posttests, training and trainer surveys and evaluations.
- Once live, we will market the new training approach to OSHA 10 trainers, collect the data and evaluate.

Next Steps

- Complete analysis of data collected:
  - compare what the trainer reported that their training preferences are with what they actually do while training across multiple classes
  - compare what the trainers reported they did with what the students reported was done
  - determine if the learning objectives were met with the analysis of the pre and post knowledge assessment
- Once the new training approach is evaluated, we plan to meet with OSHA about adopting.
- As an OTIEC we will provide this new material to our existing and new OSHA 500 students. We will encourage the other OTIEC's to do so as well.

Questions

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Safety Leadership Training to Improve Fall Prevention in Residential Construction: FSL4Res

Healthy Work Center

Bradley Evanoff, Anna Kinghorn, Ann Marie Dale, Barry Steltzer[1], Linda Goldenhar[2]

[1]Carpenters Joint Apprenticeship Program, St. Louis

[2] Center for Construction Research and Training (CPWR)

The Problem

- Residential construction lags behind commercial construction in safety practice
- Foremen and other supervisors may lack the skills to effectively lead their teams to safer behaviors
- Fall prevention and other safety practices not fully implemented at many sites, particularly smaller contractors

Foundations for Safety Leadership (FSL)

- Training program created by CPWR in 2016
- 2.5 hr training, teaches 6 essential safety leadership skills
- Video scenarios with interactive discussion of effective and less effective leadership behaviors
- Approved as an OSHA 30 elective 2017 – widely disseminated (over 500,000 trained in OSHA 30 or free-standing training)

FSL for Residential Construction (FSL4Res)

- Uptake much lower in residential sector
- Smaller contractors, fewer resources, higher injury and fatality rates (particularly falls)
- Residential workers harder to reach than commercial
- Few foremen have OSHA 30 training
- FSL could be highly effective in this high-risk sector

Project goals: Develop, Disseminate, and Evaluate a version of the FSL to address the unique needs of residential construction, including an emphasis on fall prevention.

- Formal Needs assessment with 47 construction stakeholders
- Project Advisory Committee and Curriculum Development Committee developed changes in Content, Context, Organization of the training

Adaptations

- Keep all the good didactic material, integrate with existing FSL
- Even better if……
  - Develop real-world scenarios emphasizing use of FSL leadership skills to reduce falls
  - Alter the delivery format to allow multiple shorter sessions
  - Modify materials to facilitate jobsite training, expanded pool of trainers

FSL **Leadership** Skills

Skill	Practice
Lead by Example	"Walk the talk." Make Safety a core value and make sure everyone owns safety.
Engage and Empower Team Members	Encourage and empower crew members to identify, report, and remove hazards – and to come up with solutions.
Actively Listen	Listen to hear and understand what crew members are telling you.
Practice 3-way Communication	Make sure crew members understand what is being said or asked.
Develop Team Members by Teaching, Coaching, & Feedback	Act as a teacher and coach and provide constructive feedback using the FIST principle: Facts, Impact, Solutions, and Timely.
Recognize Team Members for a Job Well Done	This can be done in private or public if the employee is comfortable with it.

Scenarios retained from original FSL

Title	Situation
Cover Up!	Foreman asks a trainee to cover a large hole in the floor, without communicating any other directions.*
It's Too Hot	Foreman suspects that a worker may have heat exhaustion.
Fritz's Shortcut	Foreman ignores worker's warning that the rigging equipment is damaged, and pushes the crew to proceed with a dangerous lift.
Stormy Weather	Trying complete a task before a storm moves in, a foreman cuts safety corners to save time.*
Oh Solar Mio	Foreman pressured to stay on schedule and proceeds with a crane that is too small.

*= Scenario content focuses on fall hazards

New Scenarios in FSL4Res

Title	Situation
Derailing the Job	A trainee removes a guardrail to finish a taping job and forgets to replace it, creating a safety hazard for the crew.*
Reality Check	An experienced worker suspects trainees have not properly inspected their fall protection.*
Don’t Shortcut Safety	The foreman of a framing crew sends a trainee to install shutters without communicating safety expectations.*

*= Scenario content focuses on fall hazards

Reality Check

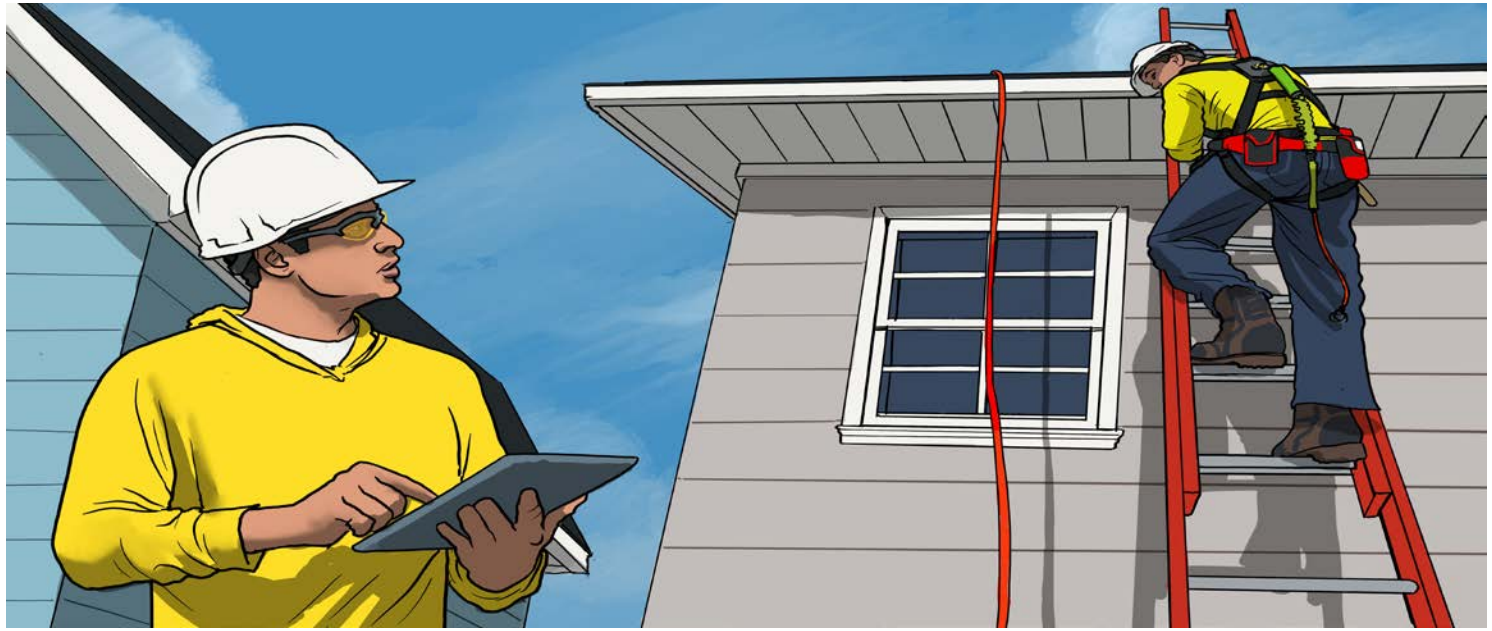
Situation – Key Points

- As Eduardo, an experienced roofer, arrives at the worksite, he sees trainees Troy and Tara start to climb onto the roof to begin their work. Eduardo asks if they've secured the ladder and inspected all of the fall protection harnesses, anchor points, and lines they'll be using.

Reality Check

Situation – Key Points

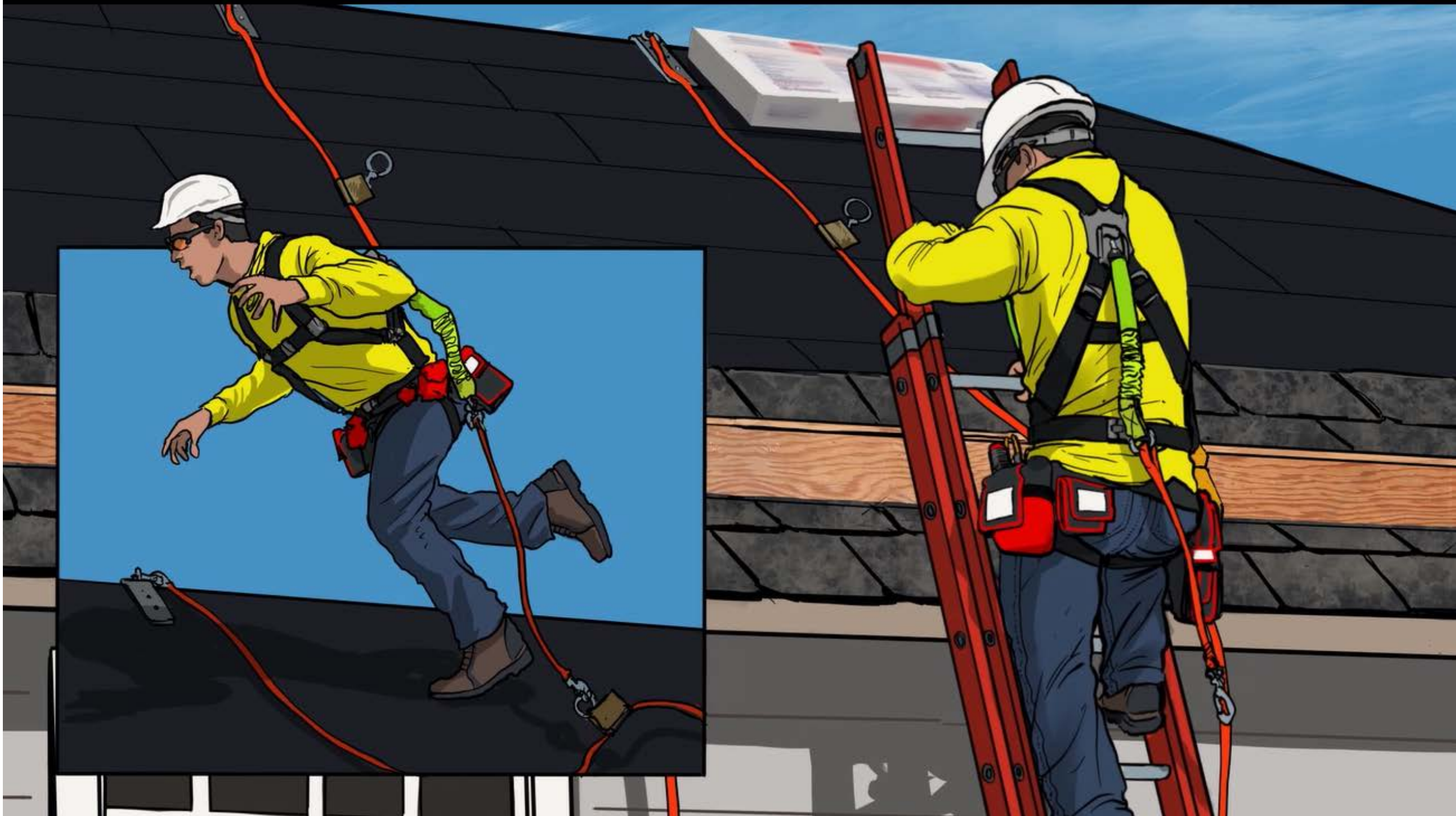
- Troy snaps back, saying they'd just put the ladder up and the rest of the equipment was checked yesterday. Tara chimes in, saying she's sure it's all fine.



Reality Check

Discussion Questions: Situation

1. Keeping in mind the 6 leaderships skills, what can Eduardo do to demonstrate safety leadership?
2. What are your thoughts on Troy & Tara's responses to Eduardo?



Outcome B – Key Points

- Troy and Tara's reaction makes Eduardo wonder if they actually know how to inspect the fall protection equipment or think it's okay to cut corners. Even though they were ok the day before, the equipment must be checked! Eduardo tells Foster, the foreman, his concerns.
- Foster calls the group together so they can all check the equipment. Admitting they they're not sure what to look for, Foster thanks them for being honest and carefully goes over how to check the equipment…

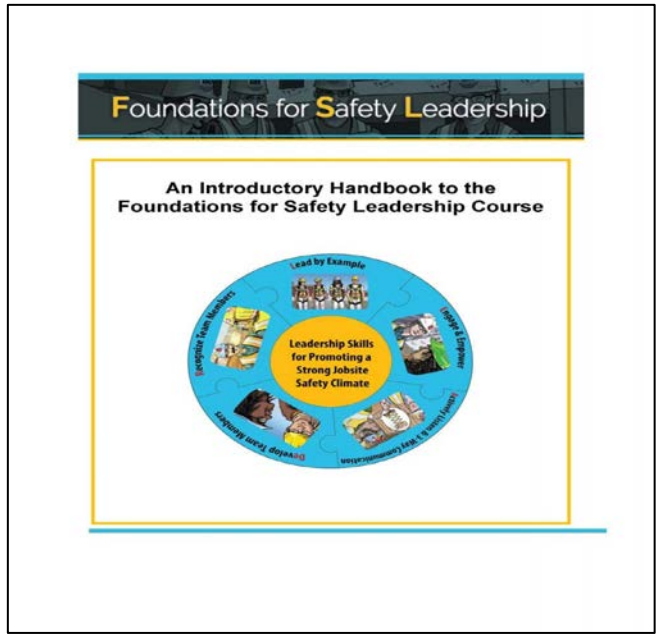
Discussion Questions: Outcome B

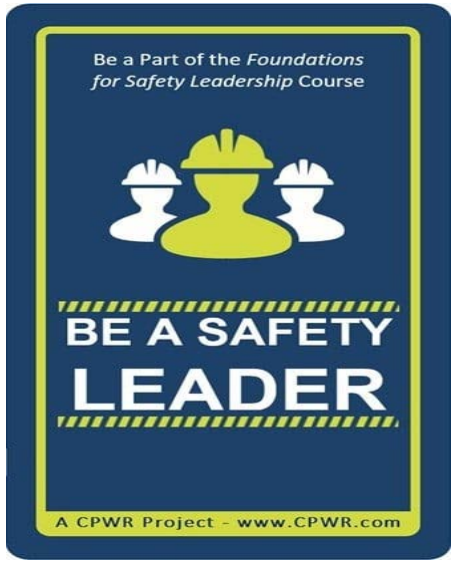
1. What do you think of the way Eduardo handled the situation this time?
2. Which of the leadership skills did he demonstrate?

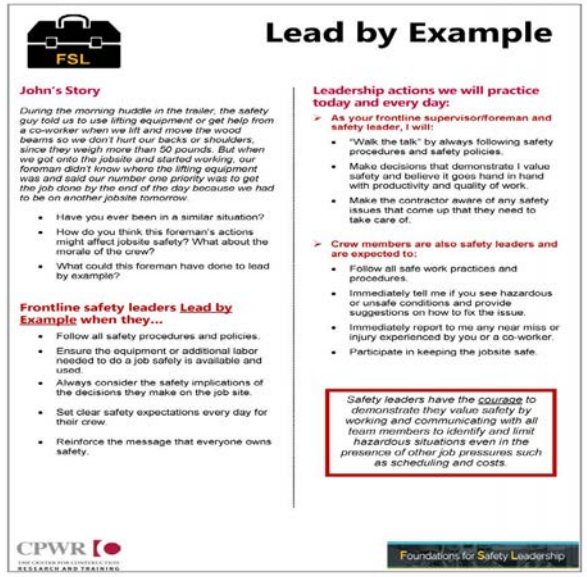
Schedule for Multi-session FSL4Res Training

Session 1 (30 min)
• Welcome, introductions, goals & learning objectives
• Characteristics of ineffective and effective leaders
• Importance and benefits of effective safety leadership
• Introduction of safety leadership skills and self-assessment
Session 2 (30 min)
• Safety leadership skill review
• *"Derailing the Job"* and discussion
Session 3 (30 min)
• Brief skill review
• *"Reality Check"* and discussion
• Discussion of recent experiences/opportunities for using skills

Session 4 (30 min)
• Brief skill review
• "*Cover Up*" and discussion
• Discussion of recent experiences/opportunities for using skills
Session 5 (30 min)
• Brief skill review
• "*Don't Shortcut Safety*" and discussion
• Setting up for success







Lead by Example

FSL

John's Story

During the morning huddle in the trailer, the safety guy told us to use lifting equipment or get help from a co-worker when we lift and move the wood beams so we don't hurt our backs or shoulders, since they weigh more than 50 pounds. But when we got onto the jobsite and started working, our foreman didn't know where the lifting equipment was and said our number one priority was to get the job done by the end of the day because we had to be on another jobsite tomorrow.

- Have you ever been in a similar situation?
- How do you think this foreman's actions might affect jobsite safety? What about the morale of the crew?
- What could this foreman have done to lead by example?

Frontline safety leaders Lead by Example when they...

- Follow all safety procedures and policies.
- Ensure the equipment or additional labor needed to do a job safely is available and used.
- Always consider the safety implications of the decisions they make on the job site.
- Set clear safety expectations every day for their crew.
- Reinforce the message that everyone owns safety.

Leadership actions we will practice today and every day:

➢ **As your frontline supervisor/foreman and safety leader, I will:**

- "Walk the talk" by always following safety procedures and safety policies.
- Make decisions that demonstrate I value safety and believe it goes hand in hand with productivity and quality of work.
- Make the contractor aware of any safety issues that come up that they need to take care of.

➢ **Crew members are also safety leaders and are expected to:**

- Follow all safe work practices and procedures.
- Immediately tell me if you see hazardous or unsafe conditions and provide suggestions on how to fix the issue.
- Immediately report to me any near miss or injury experienced by you or a co-worker.
- Participate in keeping the jobsite safe.

Safety leaders have the courage to demonstrate they value safety by working and communicating with all team members to identify and limit hazardous situations even in the presence of other job pressures such as scheduling and costs.

CPWR

Foundations for Safety Leadership

FSL4Res Foundations for Safety Leadership for Residential Construction

EMOTIONAL WASTE

Skill	Practice	Emotional waste if not practiced
Lead by Example	"Walk the talk." Make Safety a core value and make sure everyone owns safety.	**Uncertainty** due to be being told what to do and how to act, but watching others, particularly their leaderships are not following the rules.
Engage and Empower Team Members	Encourage and empower crew members to identify, report, and remove hazards – and to come up with solutions.	**Frustration** at not being asked for ideas on how to do task even though they may know a safer and more efficient way to do it.
Actively Listen	Listen to hear and understand what crew members are telling you.	**Annoyance** at not being listened to when raising an issue.
Practice 3-way Communication	Make sure crew members understand what is being said or asked.	**Anxiety** due to not understanding the desired outcome of the request being made.
Develop Team Members by Teaching, Coaching, & Feedback	Act as a teacher and coach and provide constructive feedback using the FIST principle: Facts, Impact, Solutions, and Timely.	**Apprehension** and fear of being ignored or ridiculed when they ask for more direction on how to complete a task.
Recognize Team Members for a Job Well Done	This can be done in private or public if the employee is comfortable with it.	**Resentment** from never being recognized for going above and beyond what's expected.

Three Aims: Develop, Disseminate, Evaluate

- **Disseminate**:
  - CPWR website: Have documented 2007 unique page views, with 920 material downloads since September 2023.
  - 280 mailings to local residential contractors with initial and follow up contact
  - Two Webinars: NRCA & CPWR
  - Newsletters: National HBA, NRCA
  - Presented to local HBA leadership group to showcase training and discuss dissemination plans; scheduling presentation for general membership
  - Mid-America Carpenters Regional Council integrated FSL4Res into their pre-apprentice curriculum
  - Safety+Health published article on the FSL4Res
  - In talks with the Laborers Training Center in High Hill, MO to include training in curriculum

Evaluate

- **Evaluate**: email surveys and short interviews
  - Measure Reach (did you hear about this?)
  - Uptake (did you use it?)
  - Assess determinants of reach and uptake

For Additional Info: bevanoff@wustl.edu

Washington University in St. Louis
SCHOOL OF MEDICINE

Healthy Work Center

https://oshr.wustl.edu
healthyworkcenter@wustl.edu

cpwr.com/fsl

Using Community-based Organizations and Partnerships to Enhance Reach and Engagement of Small Construction Establishments

(CPWR Small Study No. 21-6-PS)

Sue Ann Sarpy, MS,PhD

Sarpy and Associates, LLC

June 12, 2024

Study Background

Small Construction Establishments (employ fewer than 20 employees) have a disproportionate share of fatal work injuries and increasing rates of non-fatal work injuries

Health and safety researchers face Significant Challenges in reaching and providing evidence-based solutions

Reaching and Engaging Small Construction Establishments

More Active and Direct Methods

Advisory Boards more successful for recruiting and engaging small construction contractors

Outreach and Engagement Efforts Small Construction Establishments

Use trusted relationships through **local** organizational and community-based networks

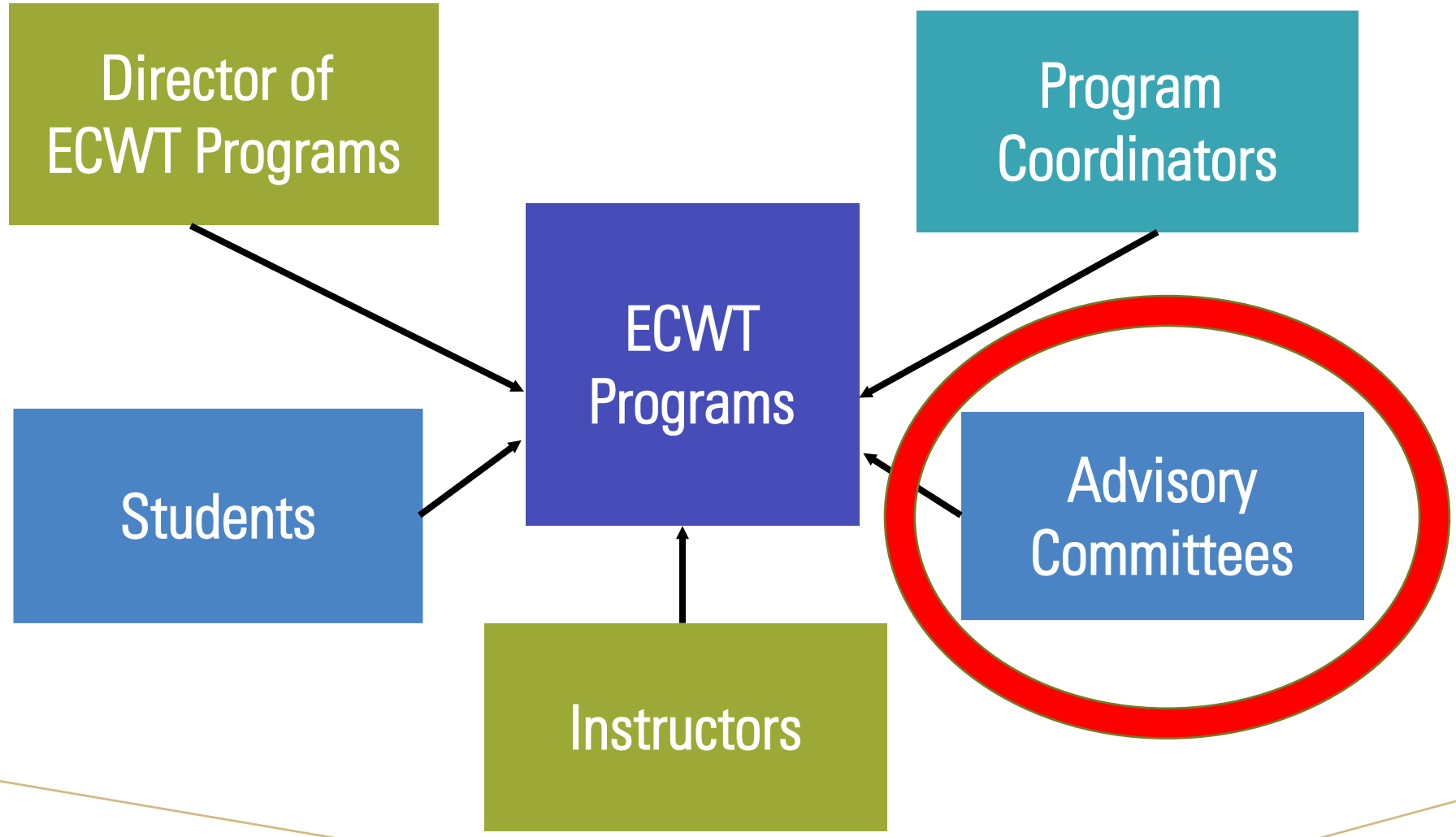
Environmental Career Worker Training Program (ECWTP)

- CPWR ECWTPs, funded by NIEHS, in four communities: **Boston, East Palo Alto, Flint, New Orleans**
- ECWTPs train, certify, and secure jobs for **economically disadvantaged workers** living in or around Brownfields or EPA Superfund sites
- ECWTPs have extensive **Community Advisory Committees and partnerships** in each community

ECWTP Partnership and Advisory Committees

- **Extensive network of partners:** government, workforce investment boards, community-based and faith-based organizations, academics, labor unions, potential employers, transportation departments
- **ECWTP Community Advisory Committees:** 8 to 10 representatives per program
- **Assist in recruiting Small Construction Establishment Owners**

ECWTP Stakeholders



ECWTP Advisory Committees

ECWTPs Advisory Committee members will provide contacts of Small Construction Establishments

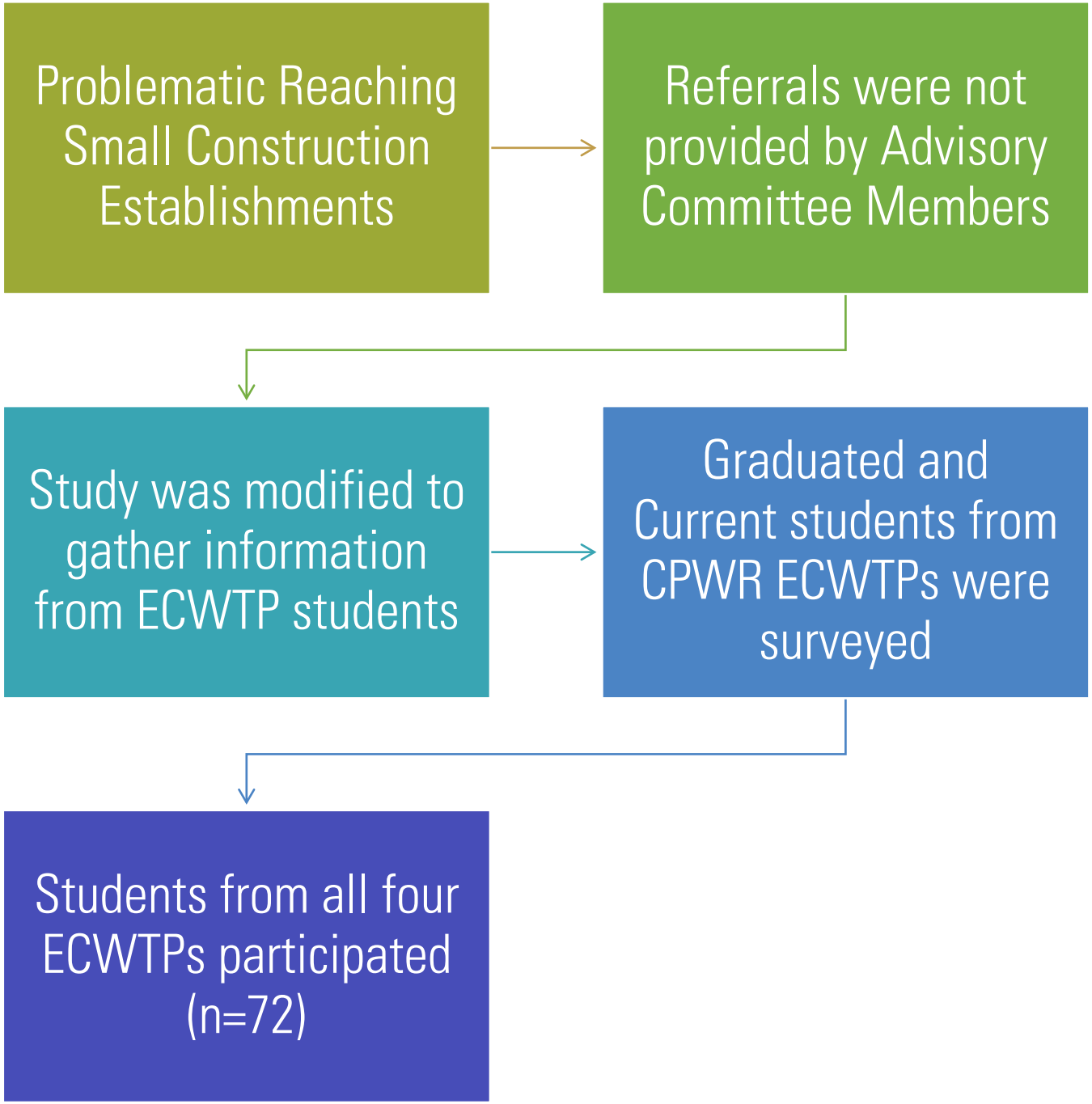
20 Small Construction Establishment Owners will be interviewed

- 30-minute semi-structured interview

100 Small Construction Establishment Employees will be surveyed

- 5-minute online questionnaire

Initial Study Findings

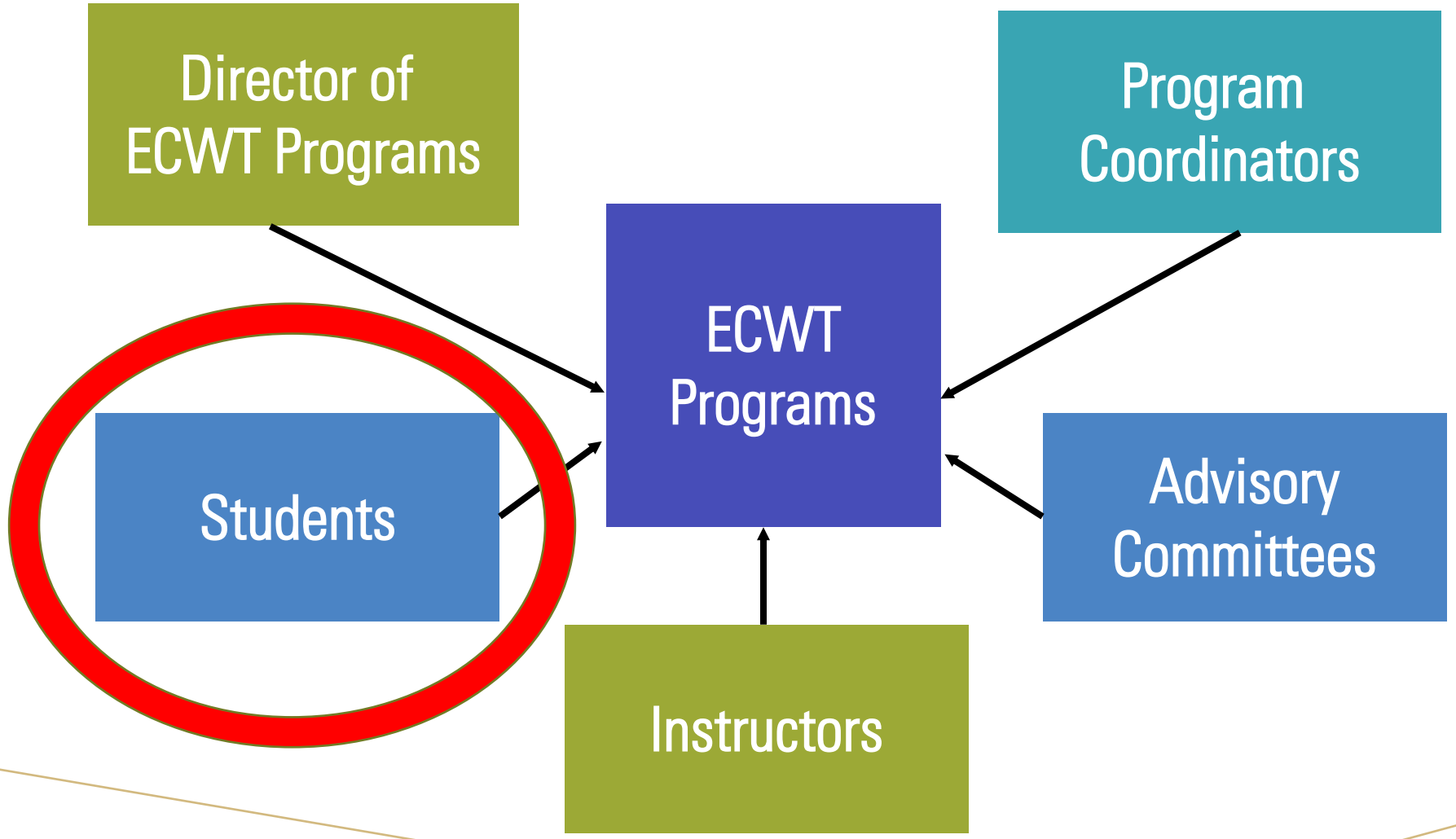


Survey ECWTP Students: Current and Graduated

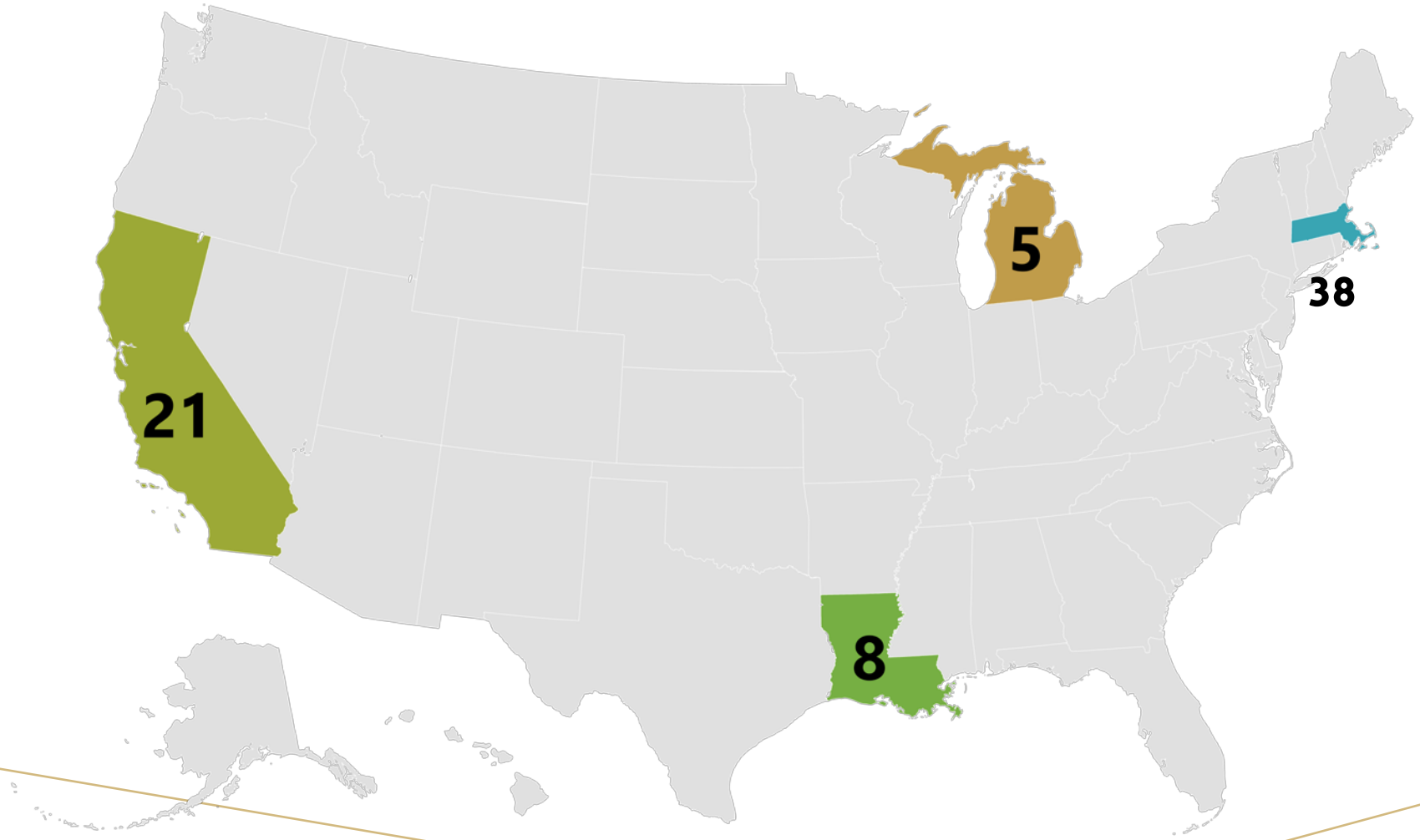
BRIEF (3- to 5-minute) online survey of safety-related information

- **Work experience** in construction (in years)
- **Size of construction companies** they have worked in (small, medium, large)
- **Importance of Safety/Factors that Support Worker Safety in their community**
- **Greatest Safety Challenges** for the **average construction worker in their community**

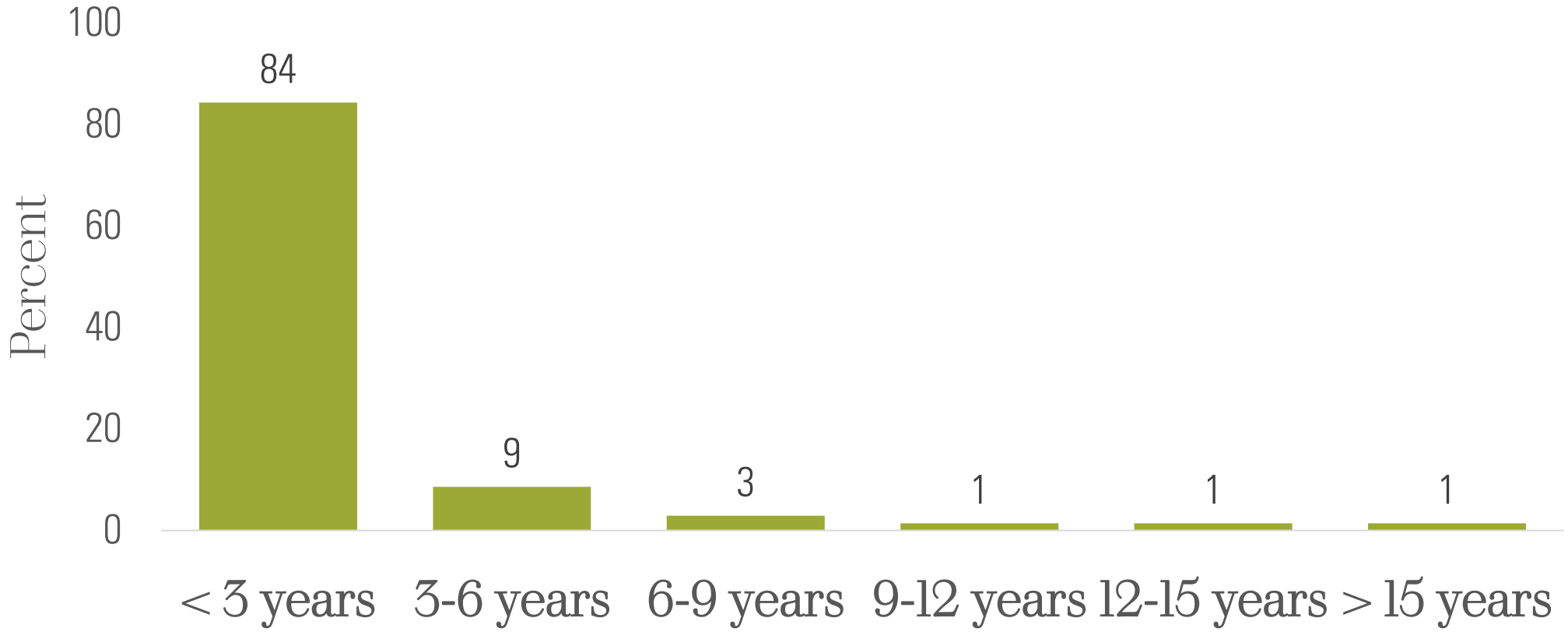
ECWTP Stakeholders



ECWTP Students Participating by State

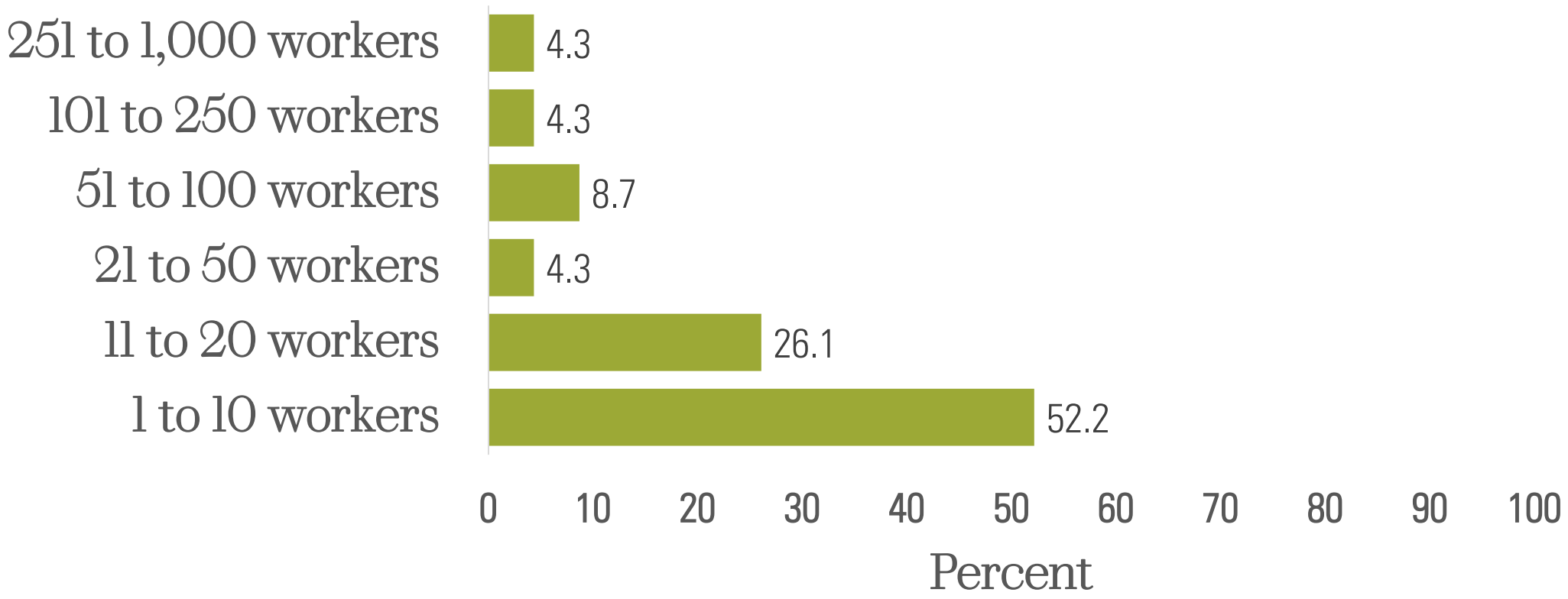


Years Worked In Construction



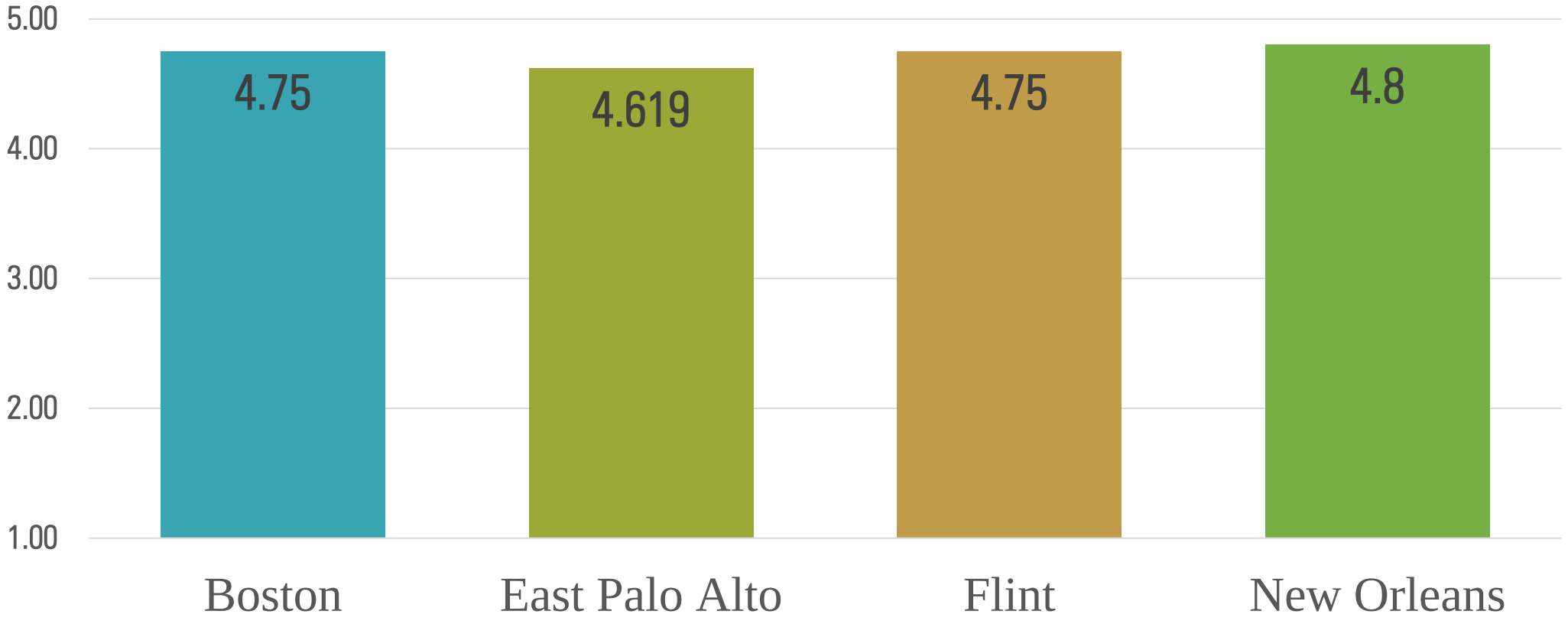
N=70

Number of Employees on Worksite



N=23

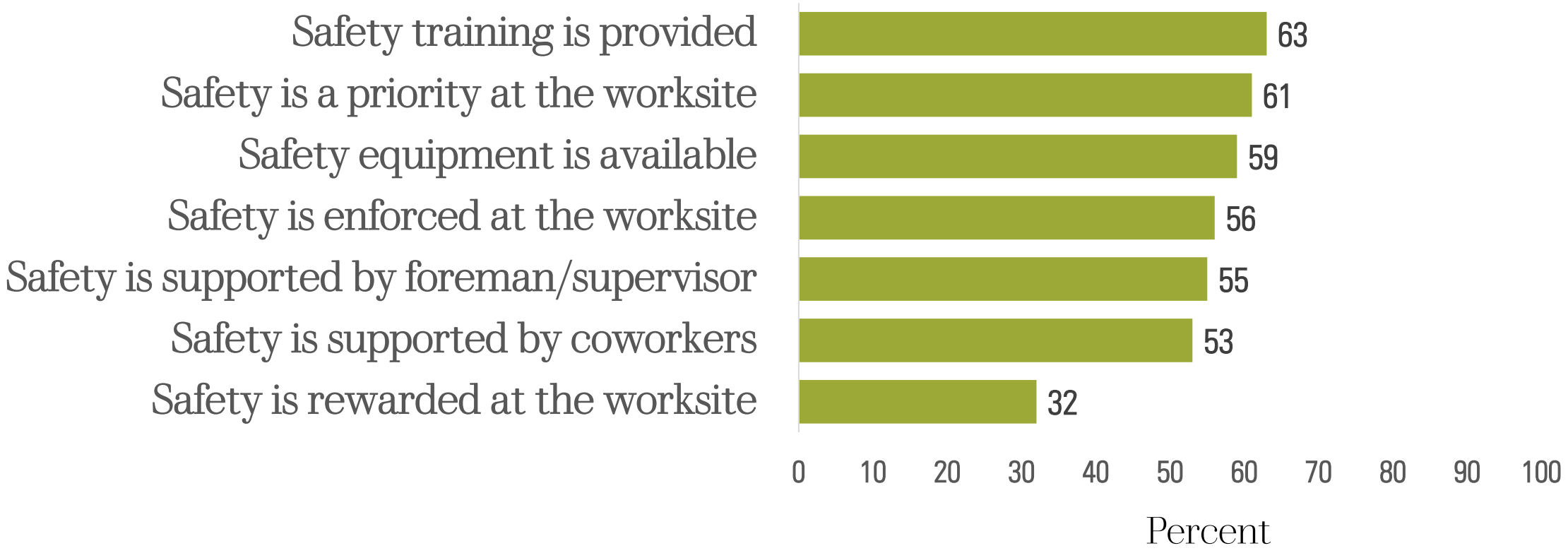
How important is SAFETY to the Average Construction Worker in your community?



1 – Not At All Important to 5 – Extremely Important

N=70

Most Important Factors Supporting Safety in Construction in My Community



Greatest Challenges to Worksite Safety in Construction in My Community

Additional Comments: Safety in Construction in My Community

Challenges

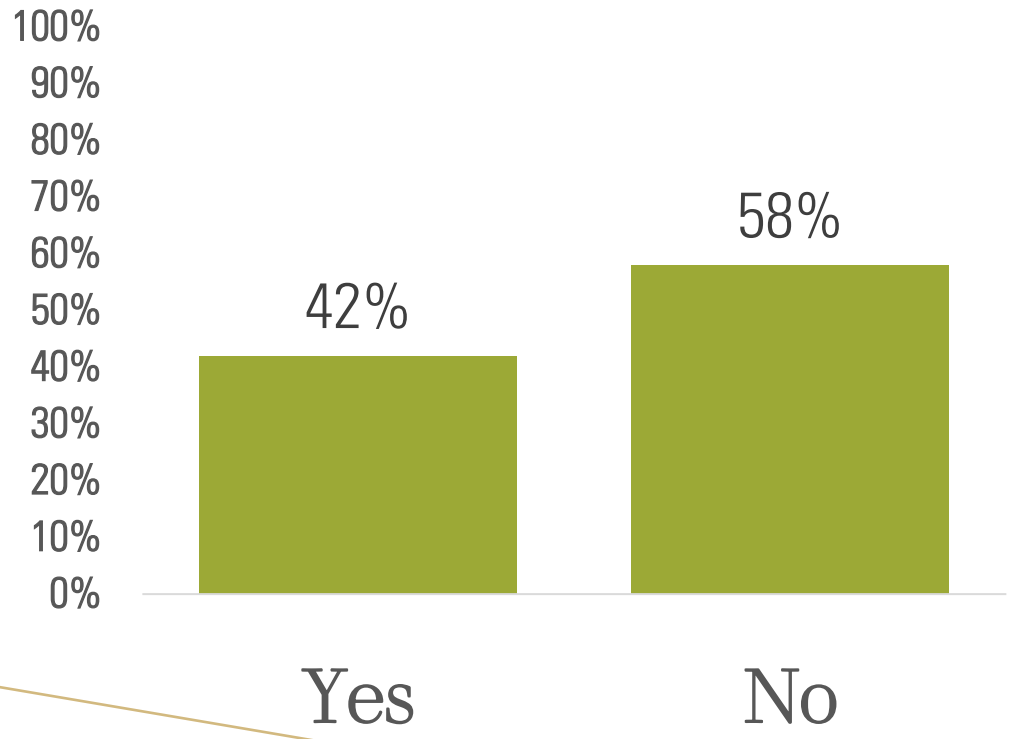
- Lack of **Safety Knowledge and Safety Training** for many workers
- **Lack of Safety Communication** among workers and supervisors
- **Priority is Given to Production** ("getting the job done") over Safety
- **Safety is often <u>not</u> Enforced** on worksites

Supporting Factors

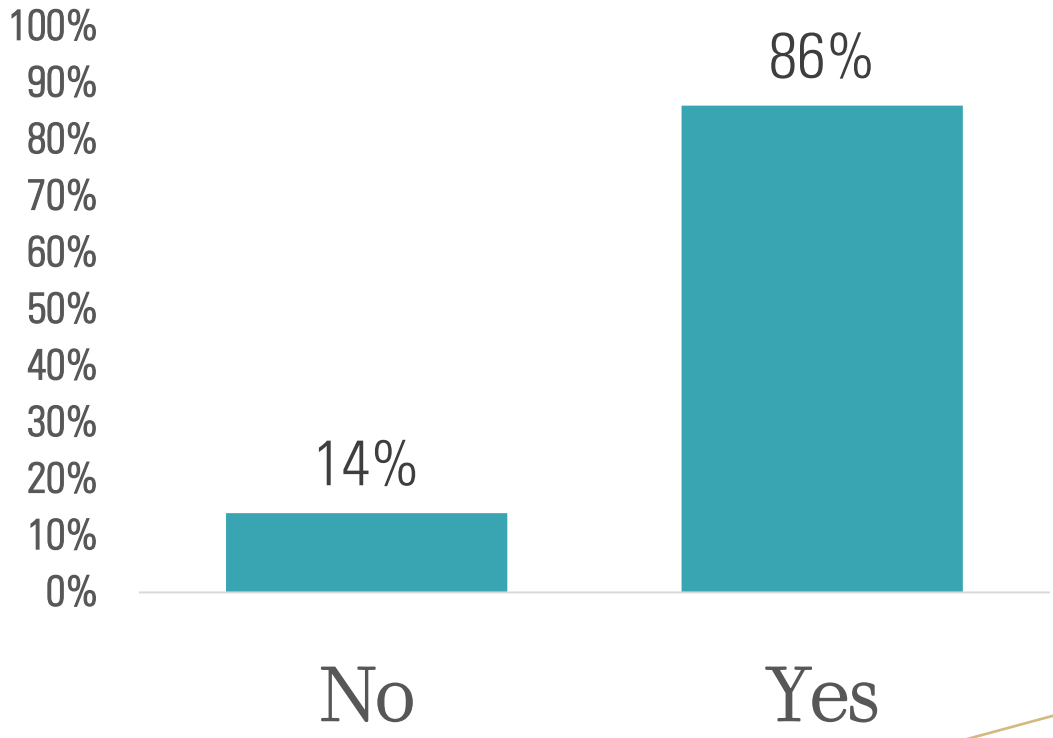
- **Appreciation to ECWTPs** for focusing on the **Importance of Safety**

CPWR Resources for Workers

Familiarity with CPWR



Interest in Learning More



Key Findings

- Process effective at reaching **at-risk individuals** in **underserved communities**
- **Safety** reported as **Extremely Important** for average construction workers
- **Safety Facilitators:** safety training, safety is a priority, safety equipment
- **Safety Challenges**: emphasis on production; lack of training
- 86% reported **interest in learning more** about **CPWR and related safety solutions**
- Recommended: **Strengthen connections** between ECWTP **graduates and CPWR**

More Information

- Overview and Key Findings available at:
  - https://www.cpwr.com/wp-content/uploads/KF2023-Community-based-Organizations-Partnerships.pdf
- Full report available at:
  - https://www.cpwr.com/wp-content/uploads/SS2023-Community-based-Organizations-Partnerships.pdf

Questions?

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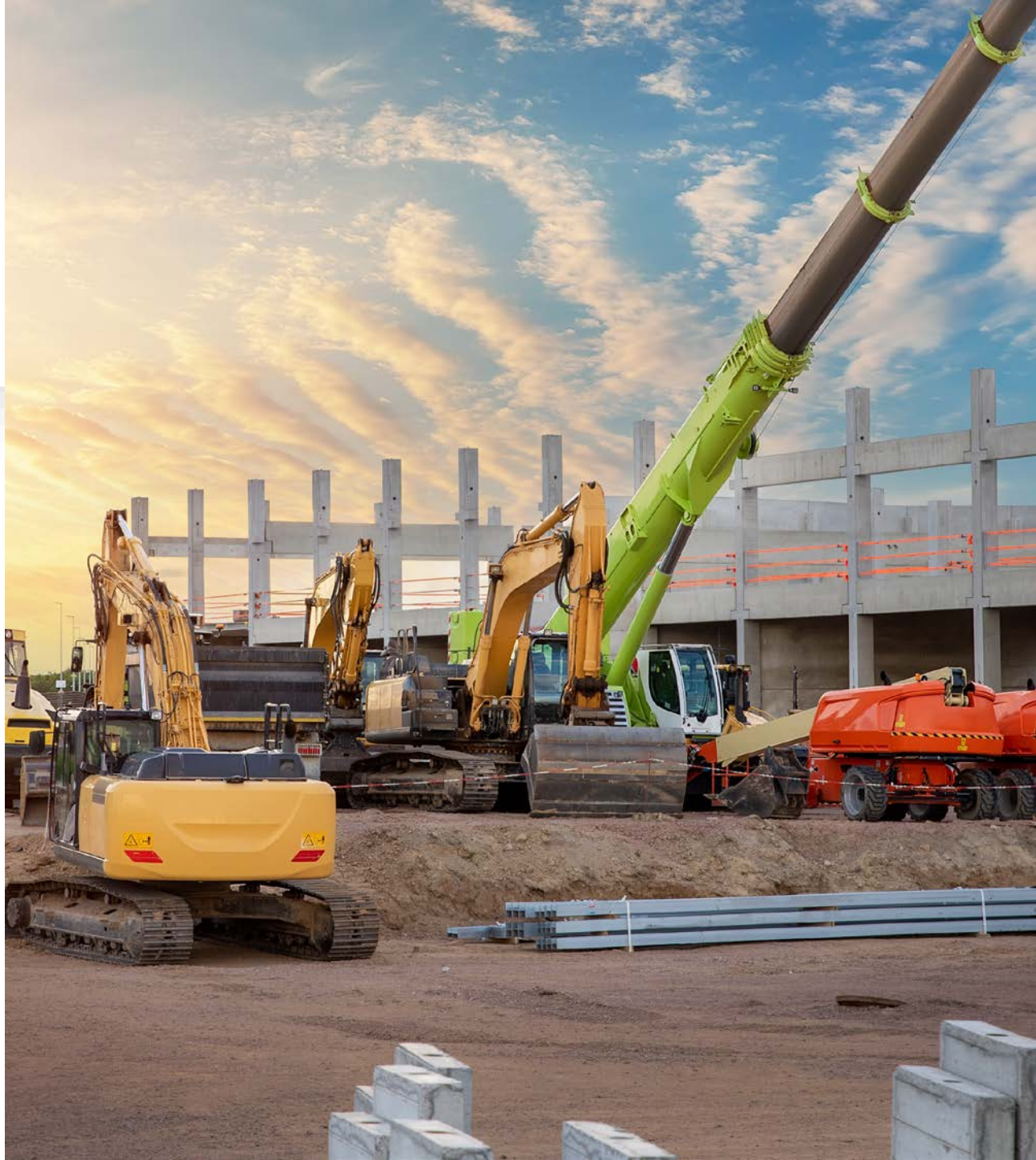
Research Session #5: Tracking and Evaluating Hazardous Exposures

Moderator: **G. Scot Earnest, PhD, PE, CSP**, Associate Director for Construction, Office of Construction Safety and Health, NIOSH

Construction Industry Data and Statistical Core
Amber Trueblood, DrPH, Director, Data Center, CPWR
William Harris, MS, Research Analyst, Data Center
Thomas Yohannes, MPH, Research Assistant, Data Center

Manufactured Nanomaterials in Construction: Evaluating Exposures, Controls and Worker Training
Gavin West, MPH, Director, Health Research, CPWR

Reactive Chemical Systems: Part B – Developing Data-Driven Interventions
Dhimiter Bello, ScD, MSc, Professor of Exposure Biology; Associate Dean of Research and Graduate Studies, Zuckerberg College of Health Sciences, University of Massachusetts Lowell



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Construction Industry Data and Statistical Core

Amber Trueblood, DrPH, Director, Data Center, CPWR
William Harris, MS, Research Analyst, Data Center, CPWR
Thomas Yohannes, MPH, Research Assistant, Data Center, CPWR

Outline

New Outputs

- Data Bulletins
- Data Dashboards
- Manuscripts

Recent Findings

- Injuries
- Employment

Upcoming Outputs

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New Outputs

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Data Bulletins

- Employment Costs in Construction
- Labor Force Characteristics in Construction and All Industries, 2011-2022
- Safety Practices Reported Among Construction Contractors
- Trends of Apprenticeships in the Construction Trades
- Fatal and Nonfatal Falls in the U.S Construction Industry, 2011-2022
- Trenching Injuries, Citations, and Penalties in Construction

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Data Dashboards

New

- Retirement Plans
- Nanomaterials
- Aging Workers

Updates

- Income and Benefits
- Employment Trends
- Employment Projections
- Falls, Slips, and Trips
- Fatality Map
- Focus Four
- MSDs
- OSHA Citations
- OSHA Inspections
- Severe Injury
- Women in Construction

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Manuscripts

- Harris W., Trueblood A.B., Yohannes T., Rodman CP, Rinehart R. (Submitted R&R). Suicides among construction workers in the United States, 2021. American Journal of Industrial Medicine.
  - Special Issue: Safety and Health in the Construction Industry.
- Trueblood A.B., Rinehart R., Harris W., Yohannes, T. Cain, C. (To be Submitted). Fatal Falls in Construction: Establishment Size Matters. TBD.

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Recent Findings

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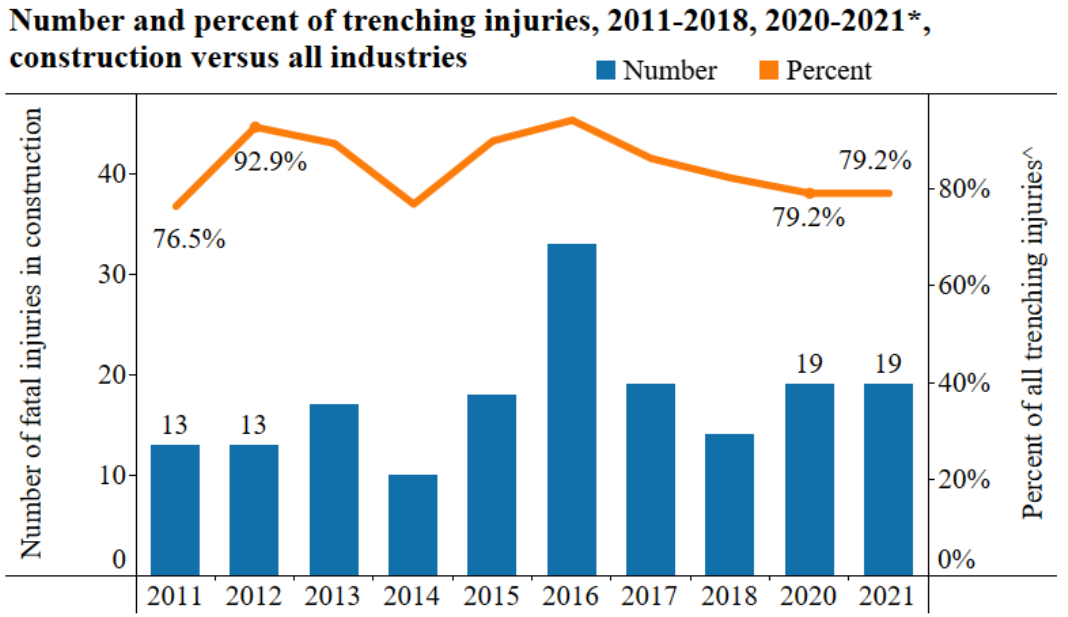
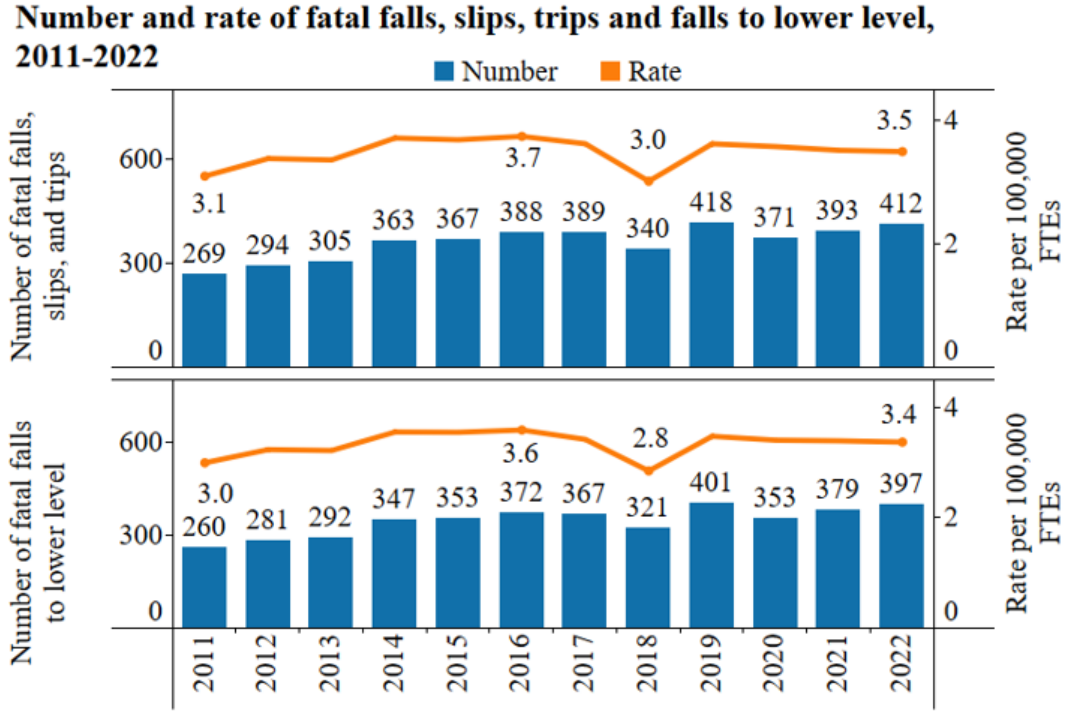
Fatal Injury Trends

- **62%** of fatal injuries in construction were from a Focus Four injury in 2022
- **5%** increase in falls, slips, or trips from 2021 to 2022
- **85%** of fatal trenching injuries were in construction from 2011 to 2021
  - Over a third (**35%**) of all fatal trenching injuries occurred among Hispanic workers





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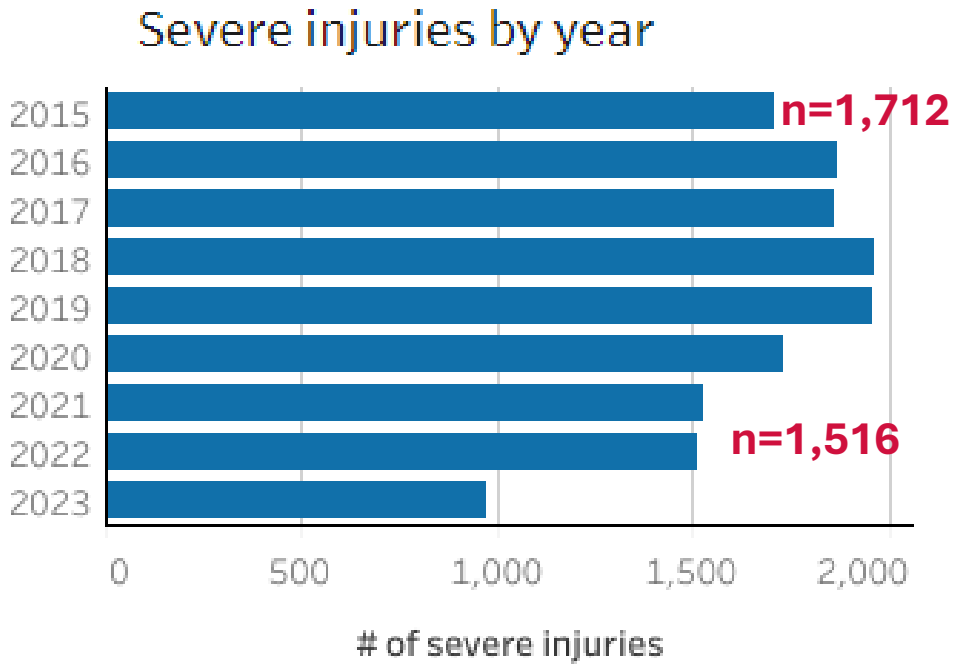
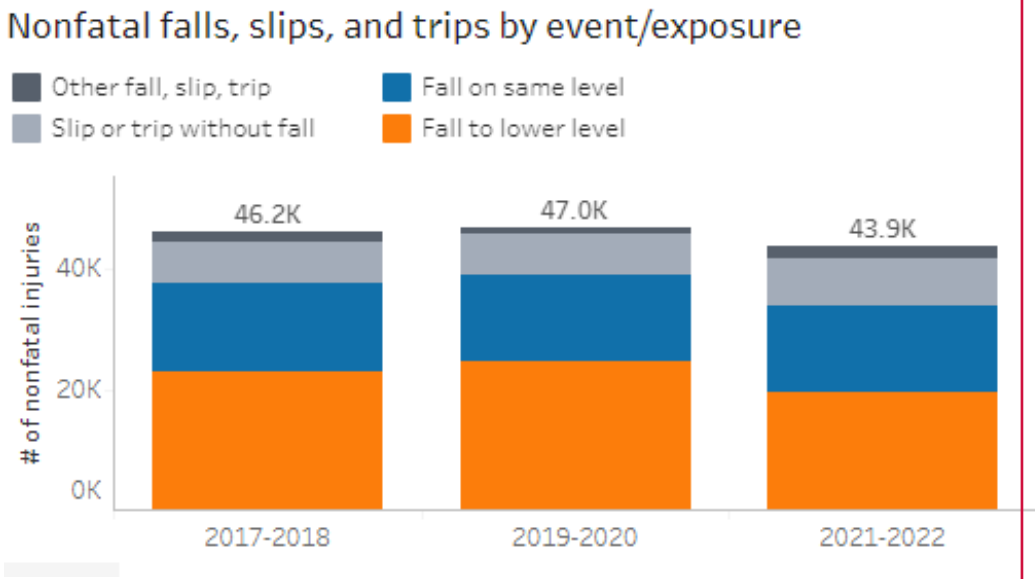
Nonfatal Injury Trends

- **1,516** severe injuries in 2022
  - **11%** decrease compared to 2015
- **44 thousand (K)** nonfatal falls, slips, or trips from 2021-2022
- **7%** decrease since 2019-2020
- **83%** of nonfatal trenching injuries from 2021-2022 were in construction





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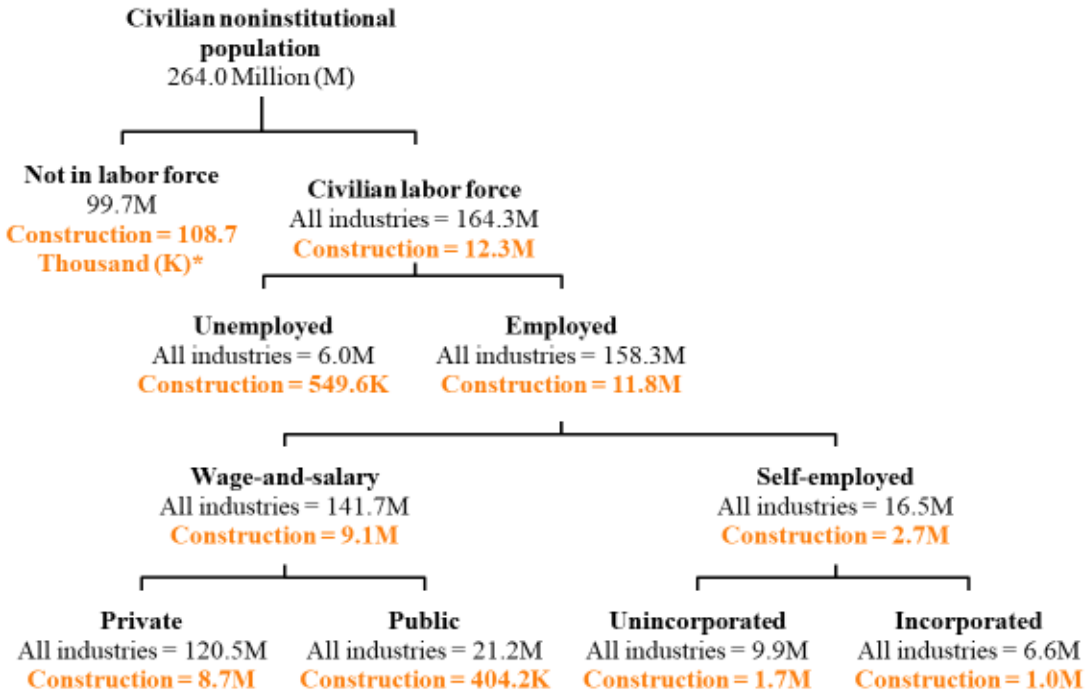
Construction Employment Trends

- Employment Trends (Sep. 2023)
  - **11.8 million** workers employed in construction in 2022 surpassing 2019 pre-pandemic numbers
- Labor Force Characteristics (Sep. 2023)
  - From 2021 to 2022,
    - **5%** increase in employment
    - **28%** decrease in unemployment
- Apprenticeships in Construction (January 2024)
  - **742K** new apprenticeship registrations in the construction trade from 2015 to 2021
    - **4%** of new apprentice registration were women
- Employment Costs (July 2023)
  - Wages and salaries accounted for **70%** of compensation costs in construction in Q4 of 2022

1. Type of labor force and class of workers, construction and all industries, 2022



Source: Integrated Public Use Microdata Series (IPUMS), 2022 Current Population Survey. Calculations by the CPWR Data Center.

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Upcoming Outputs

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Chart Book

Women in Construction

Women are underrepresented in many infrastructure-related industries, including construction, manufacturing, and clean energy (Shaw, 2023). All of these industries have a high demand for workers to meet federally funded projects. This need highlights the need for a diverse workforce and understanding trends of growing workforce populations to have timely and accurate data that can guide safety and health interventions, as well as recruitment and retainment efforts.

The number of women in construction have been increasing over the last 40 years. There were 614,100 women workers in 1985 which doubled to 1.3 Million women in 2023. This interactive dashboard highlights data trends for women in construction, including temporal trends and information on women workers by industry, occupation, and characteristic. The **year** filter updates the charts and the **bold underlined** key findings.

Beneath the interactive dashboard, you will find more information on the data source, definitions, chart notes, a downloadable data file, and recommended citation. This interactive data dashboard corresponds to the Women in Construction Chart Book Chapter. Data will be updated annually as available. If you have questions or comments, please email datacenter@cpwr.com.

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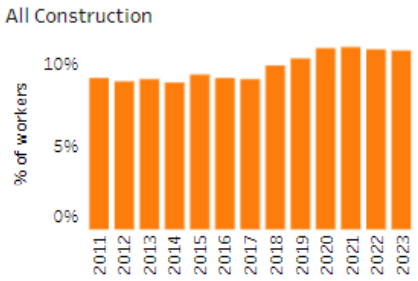
Women in Construction

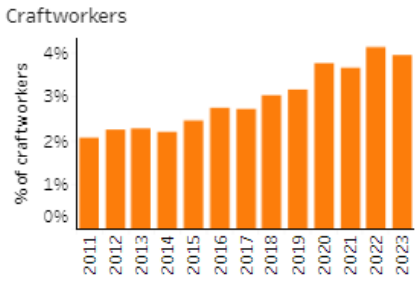
Year: (All)

Total women workers construction:	Total women craftworkers construction:
1.0 Million	226.0 Thousand

Women Construction Workers

- On average annually from 2011 to 2023, **9.9%** of all construction workers were women.
- On average annually from 2011 to 2023, **3.0%** of all construction craftworkers were women.
- All women in construction increased 57.1% and women craftworkers increased 139.9% from 2011 to 2023.





Women in Construction

Women are underrepresented in many infrastructure-related industries which have a high demand for additional workers to meet federally funded projects, such as workers in construction, manufacturing, and clean energy (Shaw, 2023). The Associated Builders and Contractors (ABC) estimates that the workforce shortage in construction is over half a million workers in 2024 (Associated Builders and Contractors, 2024). Highlighting the need for a diverse workforce and for understanding trends of growing workforce populations, including women, Hispanic, and workers 55 years or older (Harris et al., 2022).

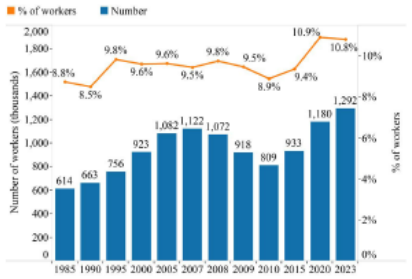
Looking at overall distribution of the workforce, women workers accounted for 10.8% of the workforce in 2023 which increased 2.4 percentage points since 1985 (8.4%; chart 1a). The number of women in construction have been increasing over the last 40 years. There were 614,100 women workers in 1985 which doubled to 1.3 Million women in 2023.

Looking at overall distribution of the workforce, women workers accounted for 10.8% of the workforce in 2023 which increased 2.4 percentage points since 1985 (8.4%; chart 1a). The number of women in construction have been increasing over the last 40 years. There were 614,100 women workers in 1985 which doubled to 1.3 Million women in 2023.

FINDINGS

Construction employment for all workers declined 23.5% during the Great Recession from 2007 to 2010 (11.9 Million to 9.1 Million) with additional smaller declines throughout 2012 (McAnaw Gallagher, 2022). Women in construction declined 27.9% during the same time period (1.1 Million to 808,600). By 2019, the number of women in construction surpassed pre-Great Recession numbers, reaching 1.2 Million. Women in construction were consistent from 2019 to 2020 with a 0.5% increase, but employment continued to grow 4.0% from 2021 to 2023.

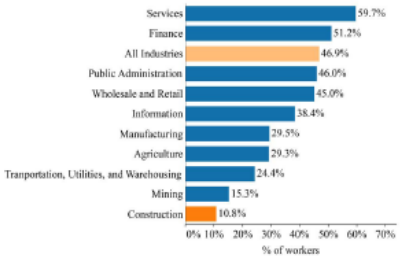
1a. Women workers in construction, selected years, 2000-2023



Source: IPUMS, 1985-2023 Current Population Survey.

Despite overall growth women continue to be underrepresented in construction, accounting for 10.8% of the construction workforce in 2023. In comparison, 46.9% off all workers across all industries were women (Chart 1b). Women working in services industries had the highest percentage of women workers at 59.7% in 2023. Women working in services industries had the highest percentage of women workers at 59.7% in 2023.

1b. Women as a percentage of all workers by industry, 2023



Source: IPUMS, 2023 Current Population Survey.

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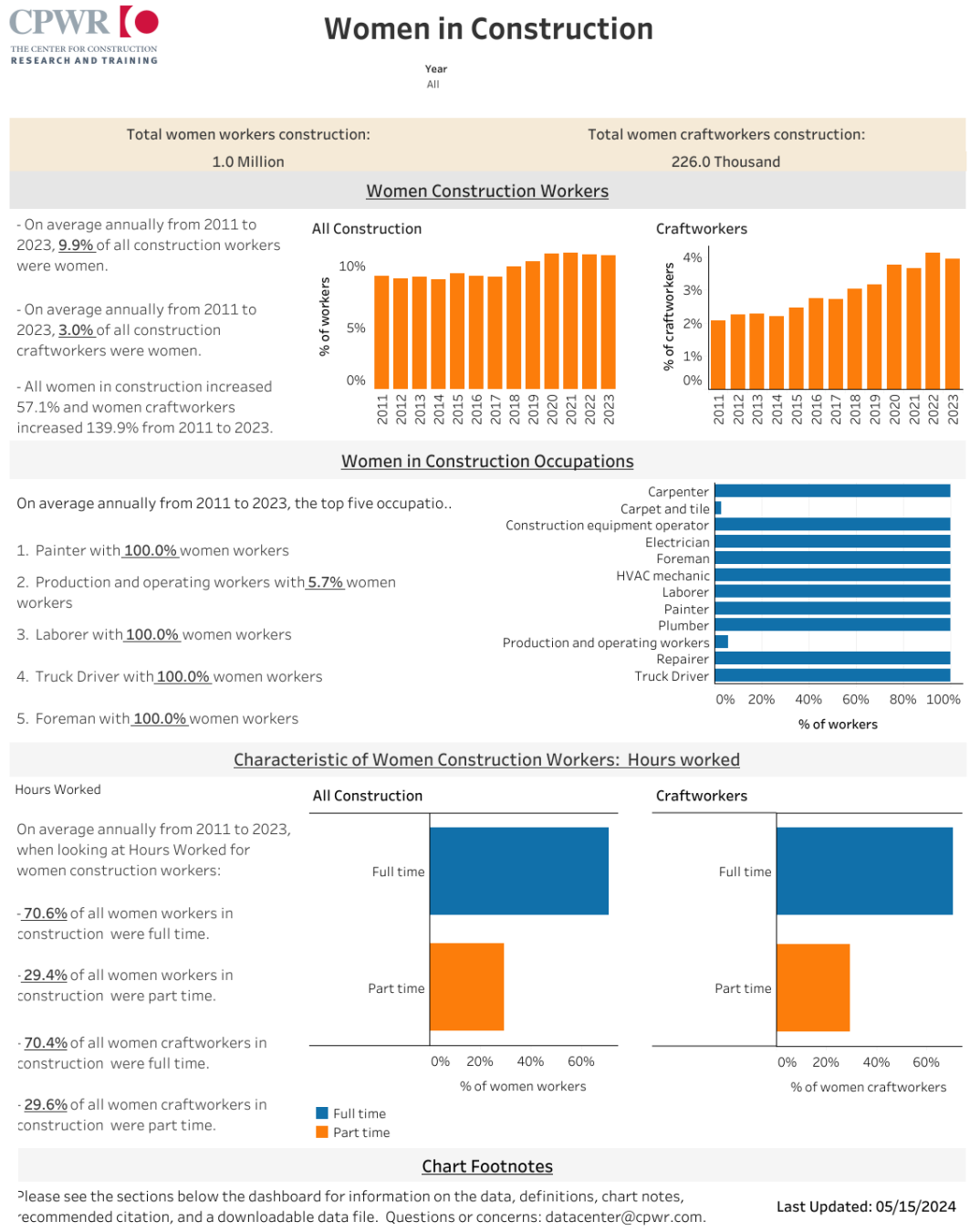
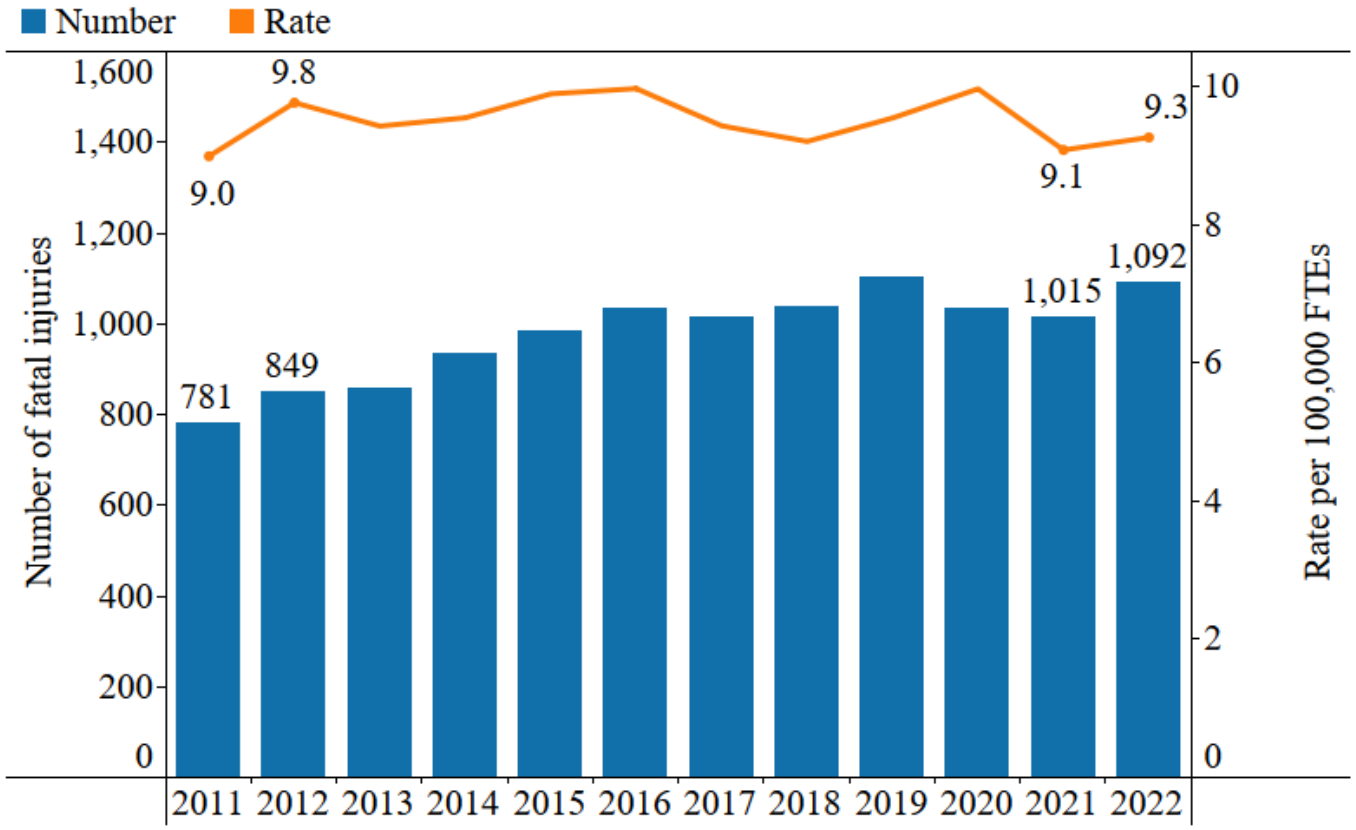
Interactive Chart Book

- Key findings change with filter selection
- Contents:
  - High Level Overview/Introduction
  - Dashboard
  - Technical Information
    - About the Data
    - Definitions and Chart Notes
    - Recommended Citation and Data File



Other Upcoming Outputs

1. Fatal injuries by year, 2011-2022



Source: U.S. Bureau of Labor Statistics, 2011-2022 Census of Fatal Occupational Injuries and 2011-2022 IPUMS Current Population Survey.

- Fatal Injury Data Bulletin
- Updated Construction FACE Database

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CPWR Data Center aims to produce easily accessible and user-friendly products, please email datacenter@cpwr.com if you have suggestions or questions.

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Nanomaterials in Construction: Exposures, Control Methods, and Training

CPWR's Research to Practice (r2p) Seminar and Partnership Workshop

June 12, 2024 | Silver Spring, MD

Gavin H. West, MPH
Director, Health Research
gwest@cpwr.com | (301) 495-8522

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I am fortunate to work with this truly terrific team

Bruce Lippy, PhD, CIH, CSP, FAIHA

Sara Brooks, MPH

Leonard Burrelli, MS

Andreas Saldivar, MS

Mark Nealley MS, CIH

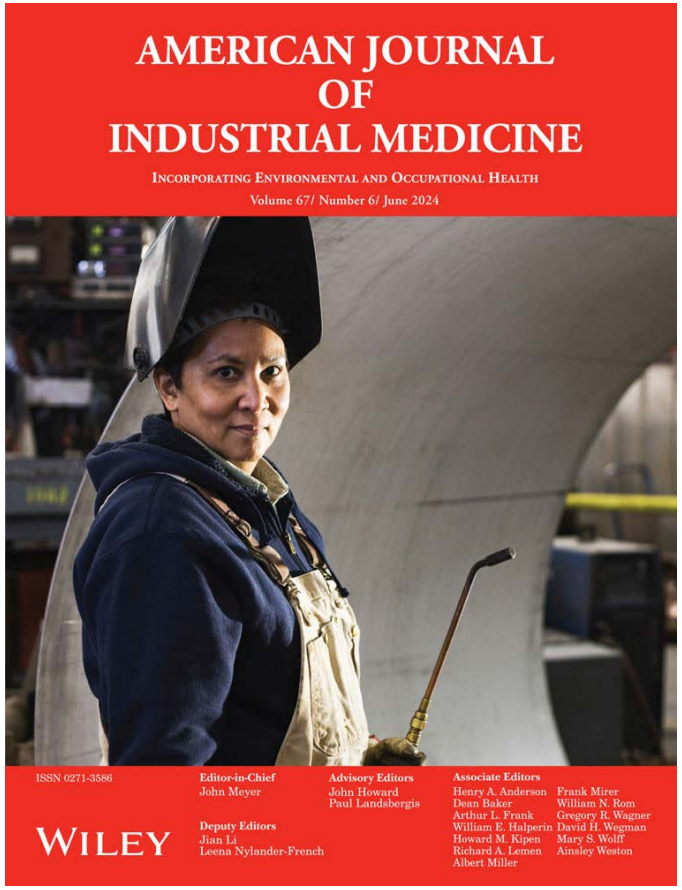
Bill Kojola, MS

Mike Cooper, MPH, CIH, CSP

This presentation will briefly highlight a few notable activities and resources since last year's R2P meeting in June:

1. New study published last week
2. Initial findings from NIOSH collaborators
3. Dissemination strategies and products

We just published a new study last week in the American Journal of Industrial Medicine (AJIM)



Lippy BE, Brooks SB, Cooper MR, Burrelli LG, Saldivar A, West GH. **Characterizing applications, exposure risks, and hazard communication for engineered nanomaterials in construction**.

Am J Ind Med. 2024;1-15. doi:10.1002/ajim.23618

Scan the QR code to access the free full-text!

Objectives were to:

1. Characterize applications of nanomaterials in construction
2. Identify potential exposure scenarios
3. Evaluate the quality of safety data sheets (SDSs) for nano-enabled construction products

The primary data source for the first objective was CPWR's construction nanomaterial inventory

https://nano.elcosh.org/

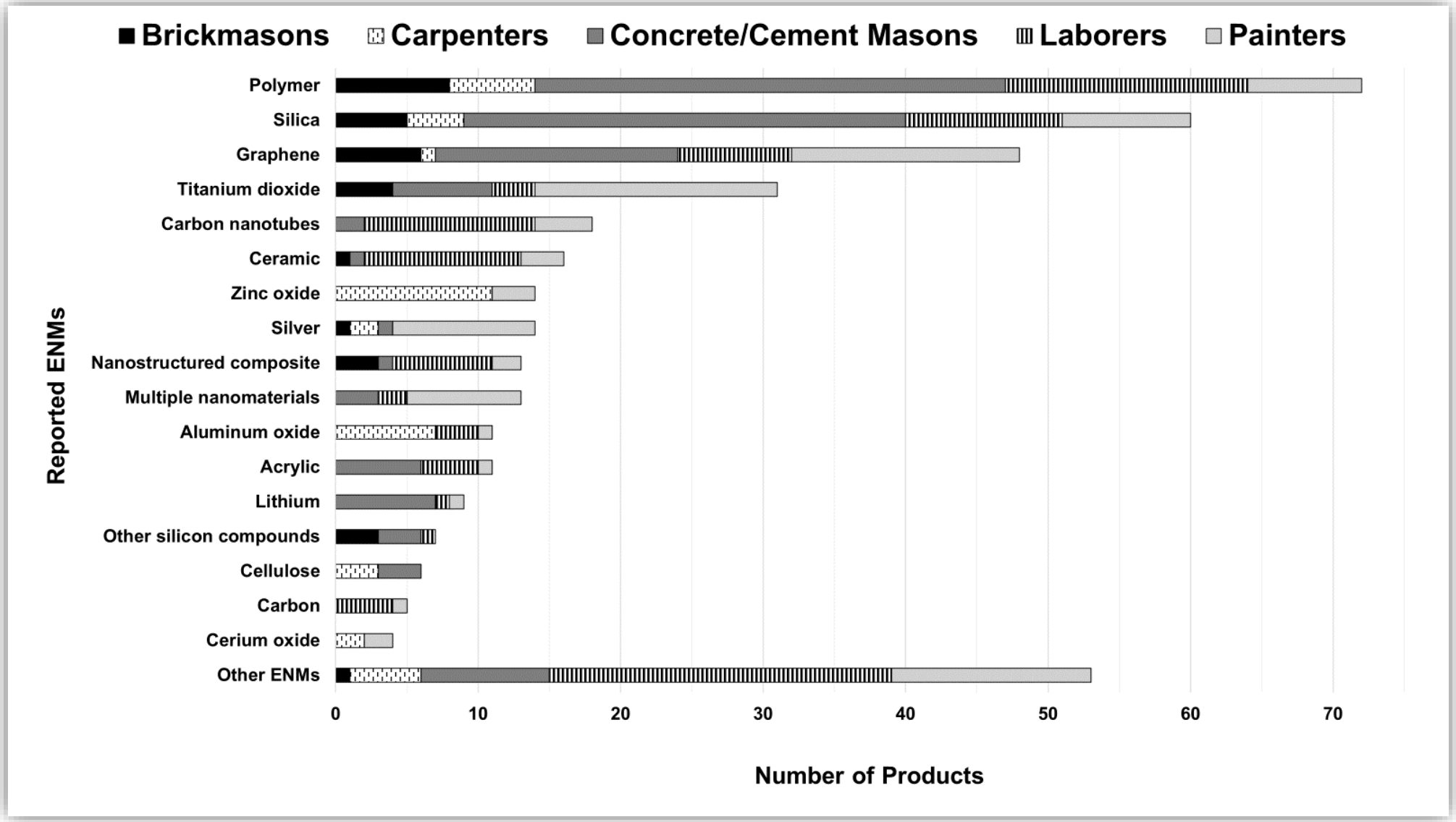
The study identified construction products that are frequently reported to be nano-enabled…

Product Category	Number of Products (n=907 total)	Percent
Paints & Coatings	483	53.3%
Pre-market additives	108	11.9%
Cementitious	68	7.5%
Thermal insulation	38	4.2%
Lubricants	23	2.5%
Flooring	20	2.2%
Glass and solar panels	17	1.9%
Adhesives	16	1.8%
Surface preparation	16	1.8%
HVAC	15	1.7%
Other	103	11.4%

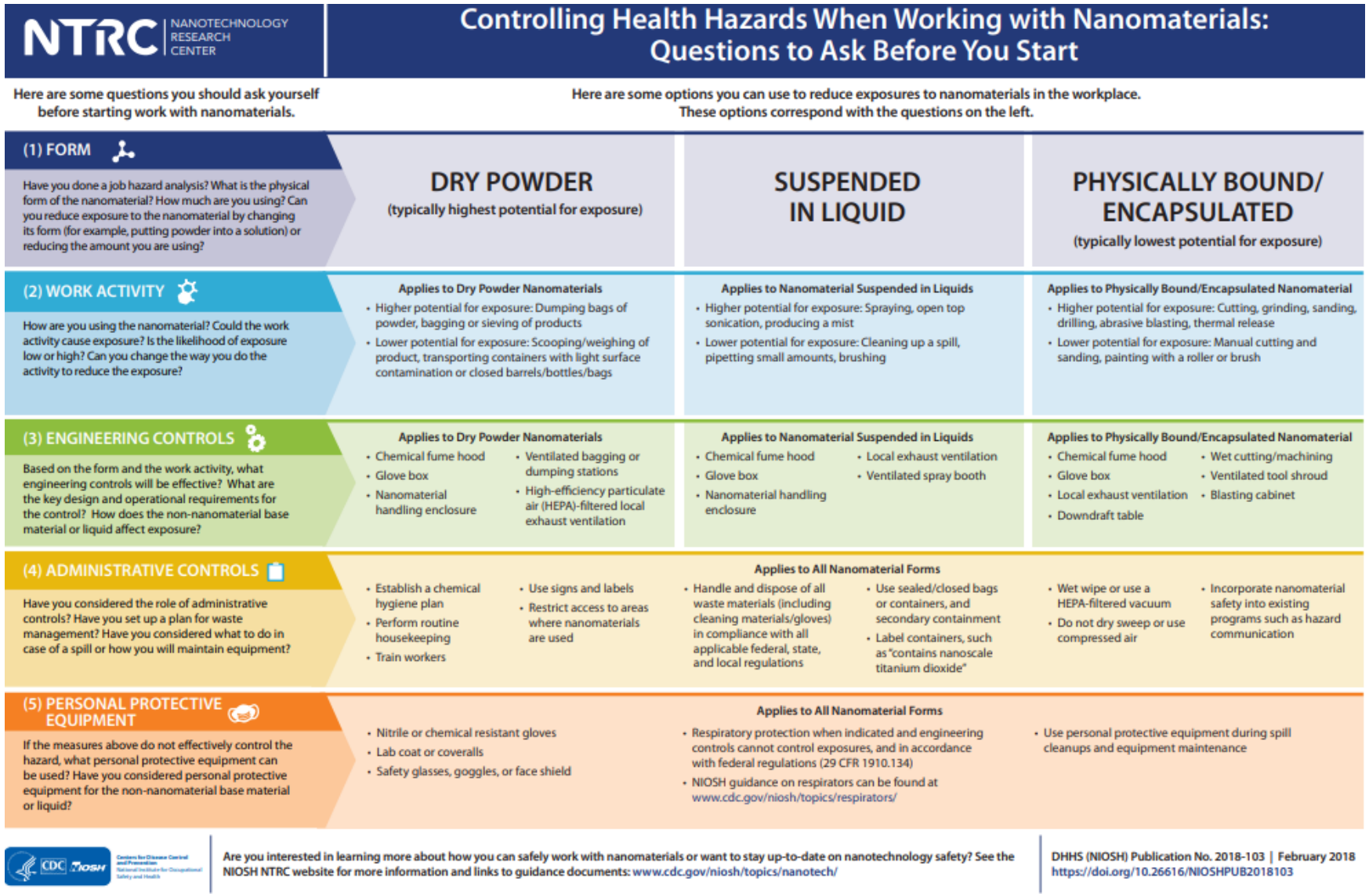
Trades most likely to handle these products…

Primary Trade	Number of Products (n=907 total)	Percent
Concrete/Cement Masons	201	22.2%
Painters	156	17.2%
Laborers	153	16.9%
Carpenters	66	7.3%
Brick masons	53	5.8%
Glaziers	46	5.1%
Insulators	36	4.0%
Carpet & Tile Installers	24	2.6%
Roofers	24	2.6%
Operating Engineers	23	2.5%
Other	125	13.8%

And the types of nanomaterials to which these trades could be exposed



We used this practical workplace guidance from NIOSH to classify exposure potential for each product category



NTRC NANOTECHNOLOGY RESEARCH CENTER

Controlling Health Hazards When Working with Nanomaterials: Questions to Ask Before You Start

Here are some questions you should ask yourself before starting work with nanomaterials.

Here are some options you can use to reduce exposures to nanomaterials in the workplace. These options correspond with the questions on the left.

	DRY POWDER (typically highest potential for exposure)	SUSPENDED IN LIQUID	PHYSICALLY BOUND/ ENCAPSULATED (typically lowest potential for exposure)
(1) FORM Have you done a job hazard analysis? What is the physical form of the nanomaterial? How much are you using? Can you reduce exposure to the nanomaterial by changing its form (for example, putting powder into a solution) or reducing the amount you are using?			
(2) WORK ACTIVITY How are you using the nanomaterial? Could the work activity cause exposure? Is the likelihood of exposure low or high? Can you change the way you do the activity to reduce the exposure?	**Applies to Dry Powder Nanomaterials** • Higher potential for exposure: Dumping bags of powder, bagging or sieving of products • Lower potential for exposure: Scooping/weighing of product, transporting containers with light surface contamination or closed barrels/bottles/bags	**Applies to Nanomaterial Suspended in Liquids** • Higher potential for exposure: Spraying, open top sonication, producing a mist • Lower potential for exposure: Cleaning up a spill, pipetting small amounts, brushing	**Applies to Physically Bound/Encapsulated Nanomaterial** • Higher potential for exposure: Cutting, grinding, sanding, drilling, abrasive blasting, thermal release • Lower potential for exposure: Manual cutting and sanding, painting with a roller or brush
(3) ENGINEERING CONTROLS Based on the form and the work activity, what engineering controls will be effective? What are the key design and operational requirements for the control? How does the non-nanomaterial base material or liquid affect exposure?	**Applies to Dry Powder Nanomaterials** • Chemical fume hood • Glove box • Nanomaterial handling enclosure • Ventilated bagging or dumping stations • High-efficiency particulate air (HEPA)-filtered local exhaust ventilation	**Applies to Nanomaterial Suspended in Liquids** • Chemical fume hood • Glove box • Nanomaterial handling enclosure • Local exhaust ventilation • Ventilated spray booth	**Applies to Physically Bound/Encapsulated Nanomaterial** • Chemical fume hood • Glove box • Local exhaust ventilation • Downdraft table • Wet cutting/machining • Ventilated tool shroud • Blasting cabinet
(4) ADMINISTRATIVE CONTROLS Have you considered the role of administrative controls? Have you set up a plan for waste management? Have you considered what to do in case of a spill or how you will maintain equipment?	• Establish a chemical hygiene plan • Perform routine housekeeping • Train workers • Use signs and labels • Restrict access to areas where nanomaterials are used	**Applies to All Nanomaterial Forms** • Handle and dispose of all waste materials (including cleaning materials/gloves) in compliance with all applicable federal, state, and local regulations • Use sealed/closed bags or containers, and secondary containment • Label containers, such as "contains nanoscale titanium dioxide"	• Wet wipe or use a HEPA-filtered vacuum • Do not dry sweep or use compressed air • Incorporate nanomaterial safety into existing programs such as hazard communication
(5) PERSONAL PROTECTIVE EQUIPMENT If the measures above do not effectively control the hazard, what personal protective equipment can be used? Have you considered personal protective equipment for the non-nanomaterial base material or liquid?	• Nitrile or chemical resistant gloves • Lab coat or coveralls • Safety glasses, goggles, or face shield	**Applies to All Nanomaterial Forms** • Respiratory protection when indicated and engineering controls cannot control exposures, and in accordance with federal regulations (29 CFR 1910.134) • NIOSH guidance on respirators can be found at www.cdc.gov/niosh/topics/respirators/	• Use personal protective equipment during spill cleanups and equipment maintenance

CDC NIOSH Centers for Disease Control and Prevention National Institute for Occupational Safety and Health

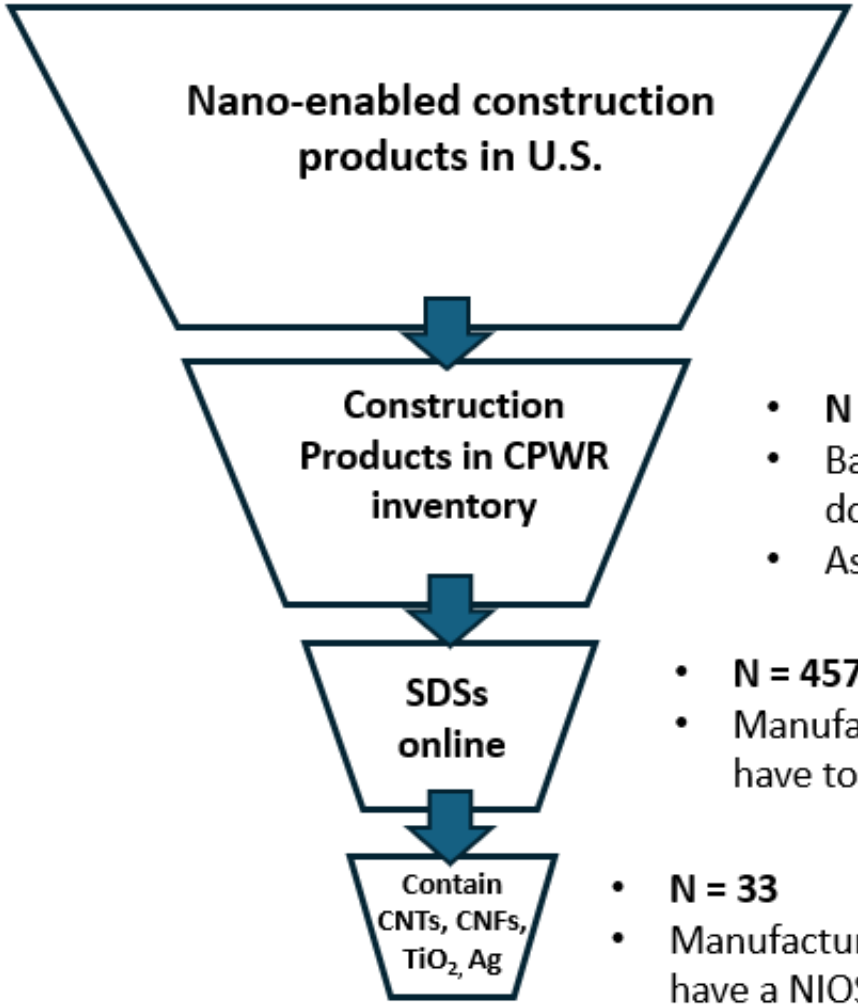
Are you interested in learning more about how you can safely work with nanomaterials or want to stay up-to-date on nanotechnology safety? See the NIOSH NTRC website for more information and links to guidance documents: www.cdc.gov/niosh/topics/nanotech/

DHHS (NIOSH) Publication No. 2018-103 | February 2018
https://doi.org/10.26616/NIOSHPUB2018103

TABLE 2 Identifying the potential for occupational exposure based on product availability, use, and physical form.

Product Category	N	Form	Examples of Work Activities with Potential for Exposure	Exposure Potential
Coatings - mineral surfaces	158	Suspended in liquid	Spray application, polishing after application	Higher
			Application with roller or brush	Lower
Coatings - multi-surface	146	Suspended in liquid	Spray application, polishing after application	Higher
			Application with roller or brush	Lower
Coatings – metal	53	Suspended in liquid	Spray application, sanding after application	Higher
			Application with roller or brush	Lower
Coatings – wood	46	Suspended in liquid	Spray application, sanding after application	Higher
			Application with roller or brush	Lower
Coatings – paints	41	Dry powder	Pouring, mixing	Higher
		Suspended in liquid	Spray application, sanding after application	Higher
			Application with roller or brush	Lower
Coatings - glass/ceramic	39	Suspended in liquid	Spray application, polishing after application	Higher
			Wipe application	Lower
Insulation - Heat/Frost	38	Physically bound/ encapsulated	Cutting, demolition	Higher
Cement-based	32	Physically bound/ encapsulated	Breaking cured/dried masonry	Lower
			Cutting, grinding, sawing, drilling, tuckpointing	Higher
		Dry powder	Pouring, mixing	Higher
Lubricants	23	Suspended in liquid	Pouring, spreading	Lower
			Spray application to construction equipment and tools	Higher

This figure shows how we obtained our sample of safety data sheets (SDSs)



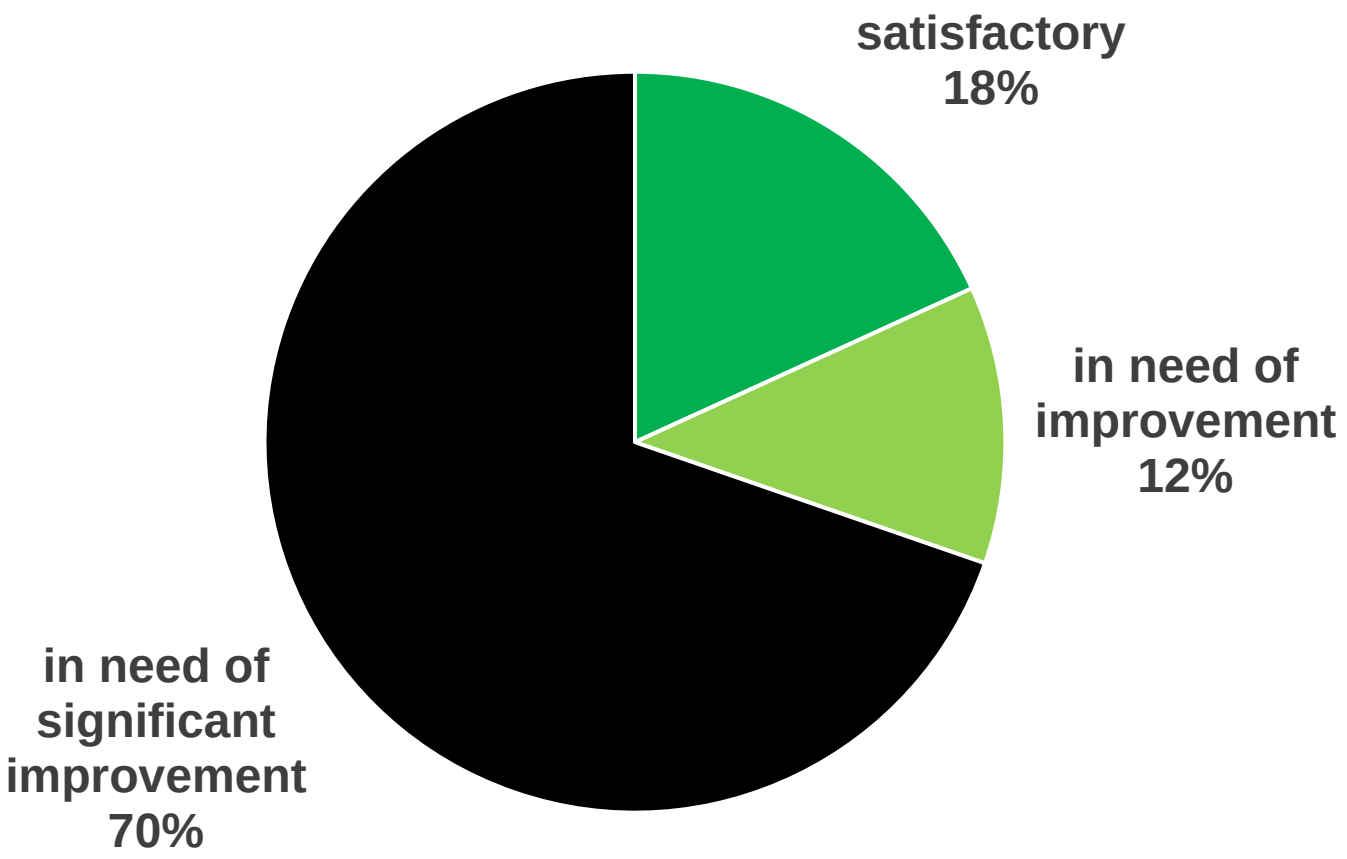
- **Unknown number**
- No registry or reporting requirements
- No way to estimate amount of products

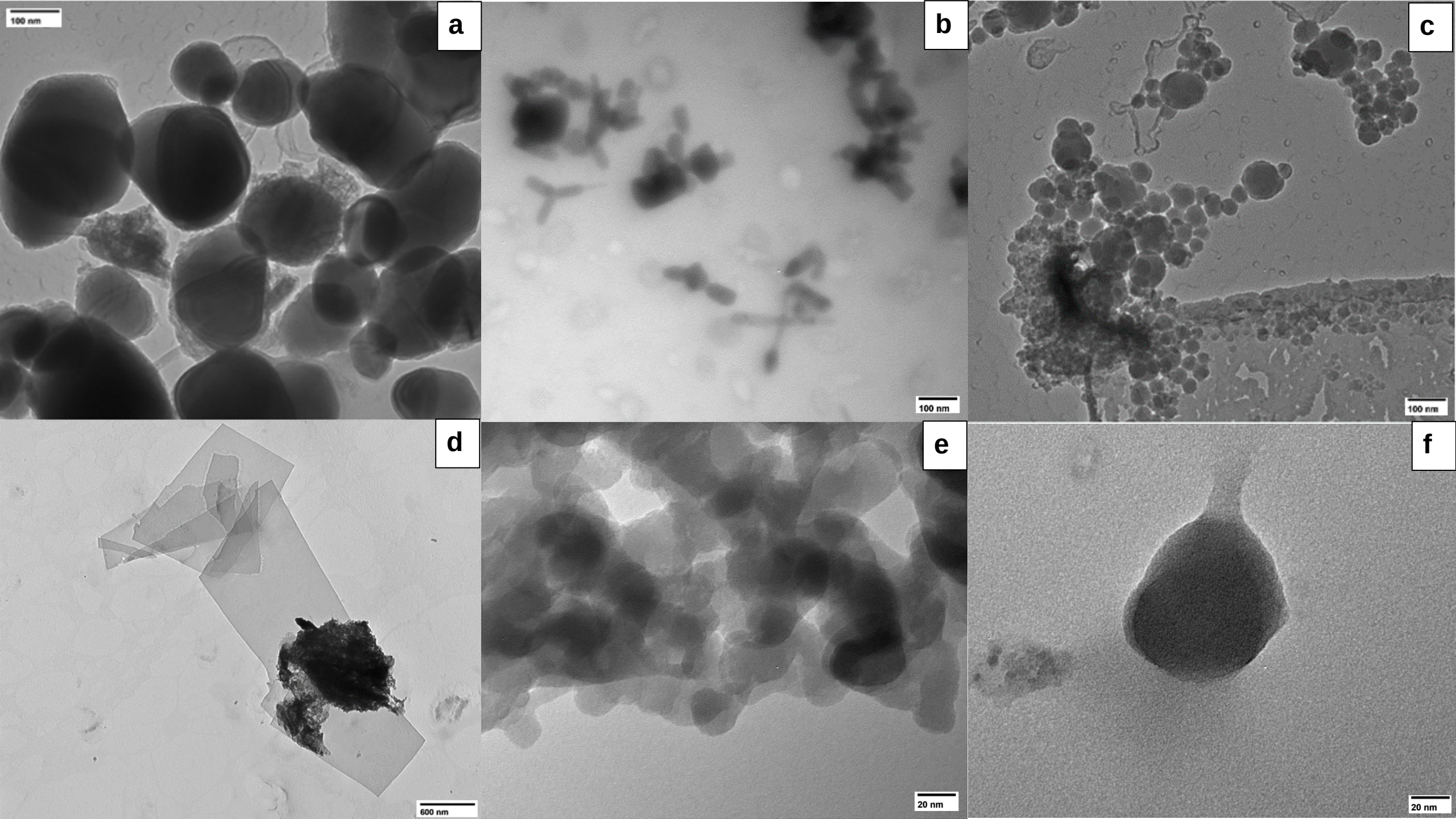
- **N = 907**
- Based on search criteria that do not include verification
- As of January 2024

- **N = 457**
- Manufacturers do not have to post SDSs online

- **N = 33**
- Manufacturers reported use of ENMs that have a NIOSH Recommended Exposure Limit

We rated SDSs using modified criteria developed by NIOSH researchers and found < 1 in 5 to be satisfactory




a
100 nm
b
100 nm
c
100 nm
d
600 nm
e
20 nm
f
20 nm

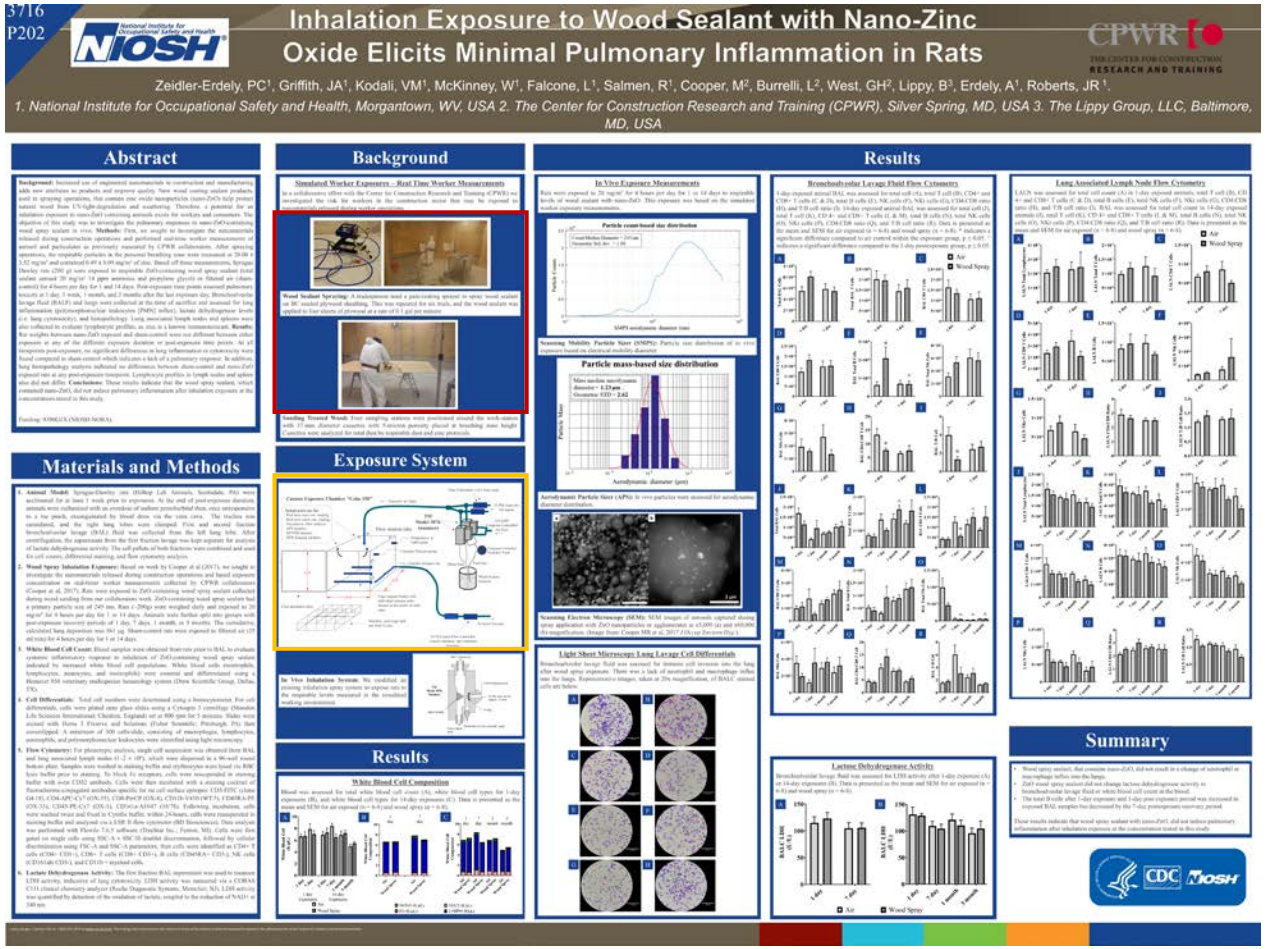
Here is one illustrative example of a safety data sheet in need of improvement

Section 3

Composition/ Information on Ingredients:

Chemical Name	CAS Number	Weight %
Dieethylene Glycol Monoethyl Ether	111-90-0	10 – 20%
Zinc Ammonium Carbonate Compound	38714-47-5	25 – 30%
Titanium Nano Drivers	13463-67-7	5 – 10%
Tributoxy Ethyl Phosphate	78-51-3	5 – 10%
Polymeric Hybrid Nano Particles	25586-24-7	1.0 – 3%
Plexi Acrylic Nano Fusion	9063-87-0	10 – 20%
Polycarbonate Nano Drivers	25037-45-0	15 – 25%
Hydrogen Hydroxide	7732-18-5	50 – 60%

NIOSH collaborators presented initial findings at the 2024 Society of Toxicology Annual Meeting



1. Our team published a prior study on exposure to nano zinc oxide
2. NIOSH collaborators exposed rats 4 hours per day for up to 14 days
3. Assessed toxicity for up to 3 months post-exposure
4. Occupationally relevant exposure levels induced minimal pulmonary inflammation, which is good news for workers!

Stay tuned for a new “one-stop nano shop” on cpwr.com that will feature a collection of resources from CPWR, OSHA, and NIOSH

New resources developed since the last R2P meeting include:

1. Nanomaterials in Construction Data Dashboard
2. Two new toolbox talks
3. Training curricula for bricklayers and allied trades
4. AIHA e-book chapter in *Essential Trends and Emerging Issues in OEHS*
5. CPWR webinar recording
6. NIOSH Future of Work Webinar recording

Thank you! Questions?

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University of Massachusetts Lowell &
Center for *Construction Research and Training (CPWR)*

Reactive Chemical Systems in Construction: Part B Developing Data-Driven Interventions

Dhimiter Bello, Sc.D., MSc.
Anila Bello, Sc.D., MSc.
Kushal Biswas, doctoral student
Paridhi Patel, doctoral student
Suresh Bhandari, doctoral student
Karyn Heavner, PhD

CPWR r2p meeting - June 2024

Part B – Reactive chemical systems

Last cycle: *Assessment and Control of Exposures to Reactive Chemicals in Construction – Part A: Isocyanates and Epoxies*

Current research focuses on Part B chemicals: *Amine catalysts & hardeners, Flame retardants, Solvents, Nanofillers: (double hit & triple hit hypothesis)*

- **Spray Polyurethane Foams Insulation (SPF)**
- **Metal Structure Coating**

Goal: To minimize exposure to chemicals in the reactive chemical systems

- Document exposure levels, work practices, and existing controls
- Data-driven recommendations
- Partner with the construction industry

Outputs: Peer reviewed publications (2020-2024)

Contents lists available at ScienceDirect

International Journal of Hygiene and Environmental Health

journal homepage: www.elsevier.com/locate/ijheh

Exposures and urinary biomonitoring of aliphatic isocyanates in construction metal structure coating

Anila Bello[a,*], Yalong Xue[b], Rebecca Gore[c], Susan Woskie[a], Dhimiter Bello[d]

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[b] University of Massachusetts Lowell, Department of Chemistry, Kennedy College of Sciences, Lowell, MA, 01854, USA
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ABSTRACT

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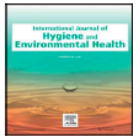

Exposures and urinary biomonitoring of aliphatic isocyanates in construction metal structure coating

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Annals of Work Exposures and Health, 2024, **68**, 280–294
https://doi.org/10.1093/annweh/wxad084
Advance access publication 24 January 2024
Original Article

The Chartered Society for Worker Health Protection

OXFORD

Evaluation of disposable protective garments against epoxy resin permeation and penetration from anti-corrosion coatings

Michael P. Mellette[1], Dhimiter Bello[*,2], Anila Bello[1], Yalong Xue[3], Michael Yost[4], Susan Woskie[1]

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*Corresponding author: Department of Biomedical and Nutritional Sciences, 883 Broadway Street, Lowell, MA 01854, USA. Email: Dhimiter_Bello@uml.edu

OXFORD

Original Article

Characterization and Quantitation of Personal Exposures to Epoxy Paints in Construction Using a Combination of Novel Personal Samplers and Analytical Techniques: CIP-10MI, Liquid Chromatography–Tandem Mass Spectrometry and Ion Chromatography

Yalong Xue,[1] Anila Bello[2] and Dhimiter Bello[3,*]

[1]Department of Chemistry, Kennedy College of Sciences, University of Massachusetts Lowell, Olney Hall 525, One University Ave. Lowell, MA 01854, USA; [2]Department of Public Health, Zuckerberg College of Health Sciences, University of Massachusetts Lowell, 61 Wilder St., O'Leary 540D, Lowell, MA 01854, USA; [3]Department of Biomedical and Nutritional Sciences, Zuckerberg College of Health Sciences, University of

Title:
Identifying and prioritizing hazardous chemicals in construction metal structure coating systems: A roadmap for data-driven disease prevention

Short Title: Chemicals hazards in metal structure coatings

Complete names (full first and last) and academic degrees of all authors:
Paridhi Patel[1] B.Sc
Dhimiter Bello[2] Sc.D, M.Sc
Anila Bello[1] Sc.D, M.Sc

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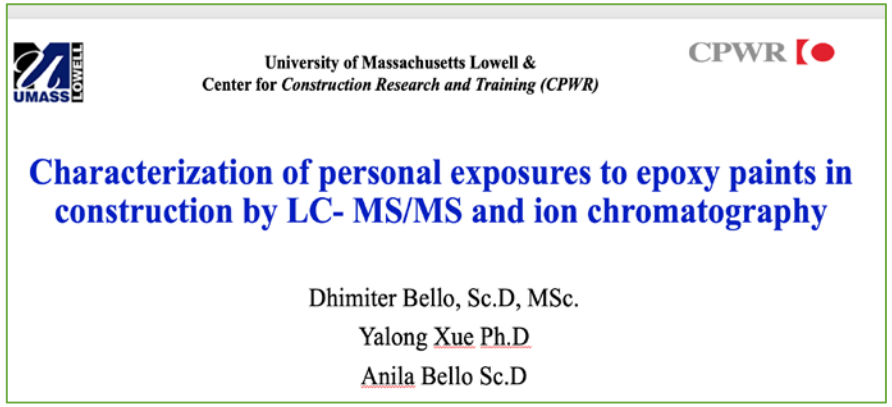
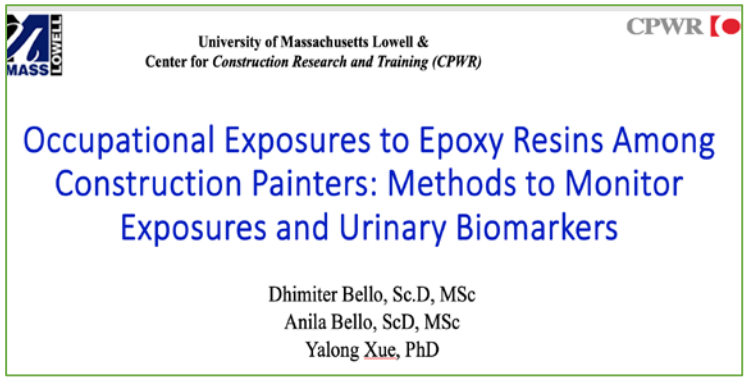
[2]University of Massachusetts Lowell, Department of Biomedical and Nutritional Sciences, Zuckerberg College of Health Sciences, Lowell, MA 01854.

Presentations (2020-2024)

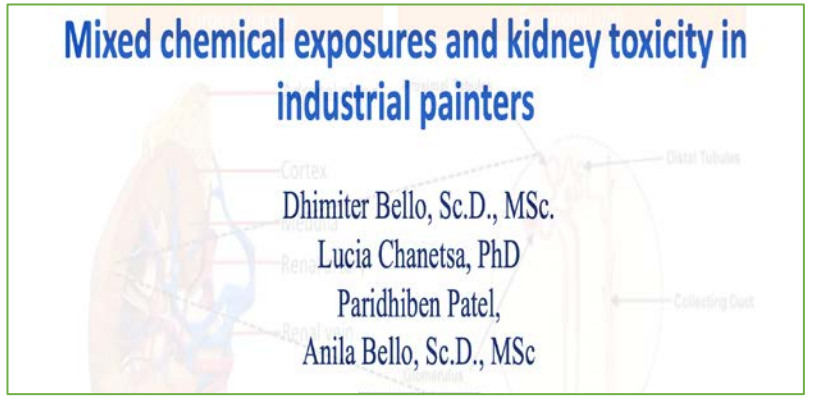
AIHce, 2021



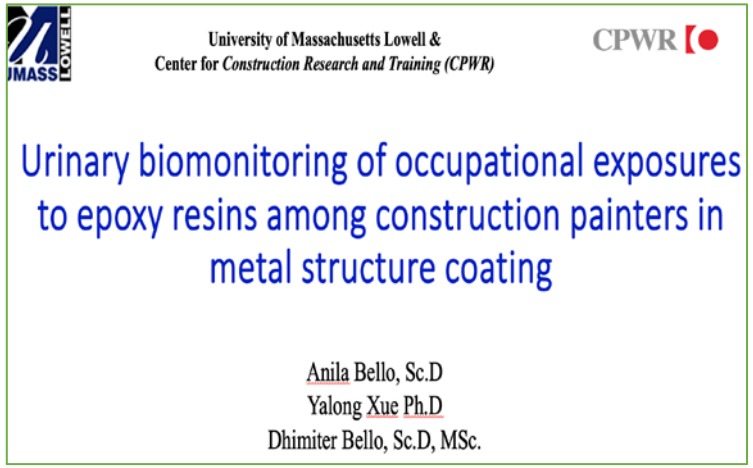
CPWR webinar # 3: 2021

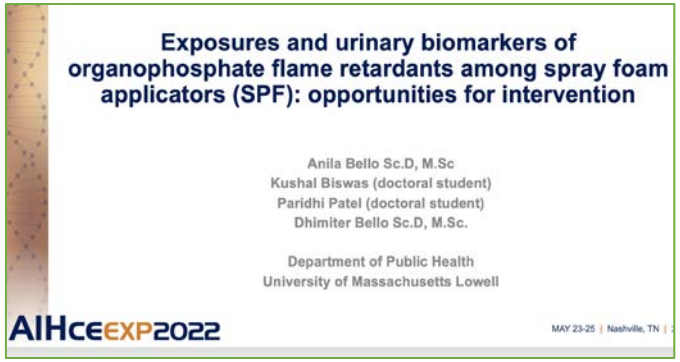


ISBM-12 Porto, 2023

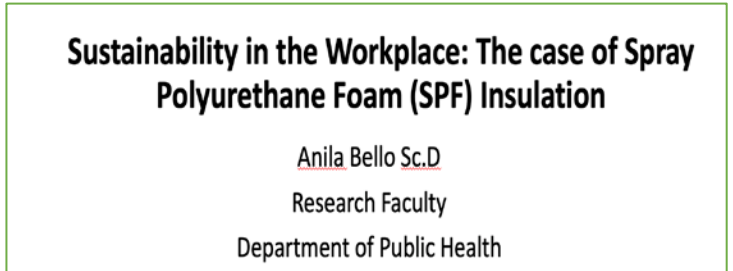


AIHce, 2021

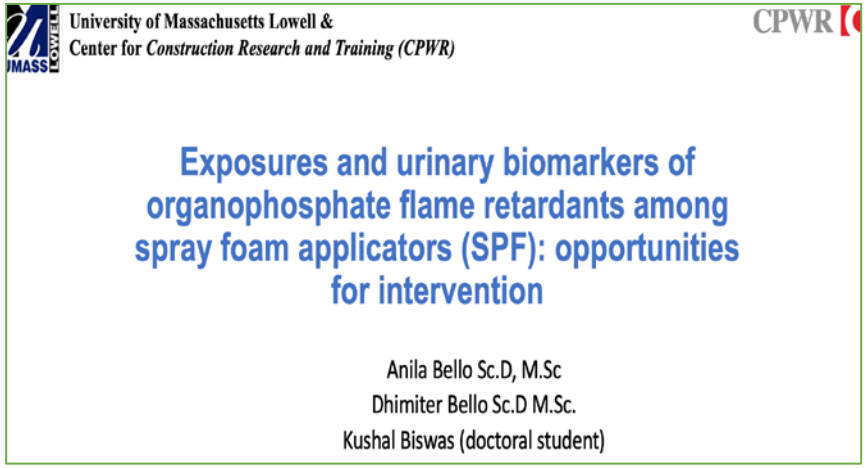




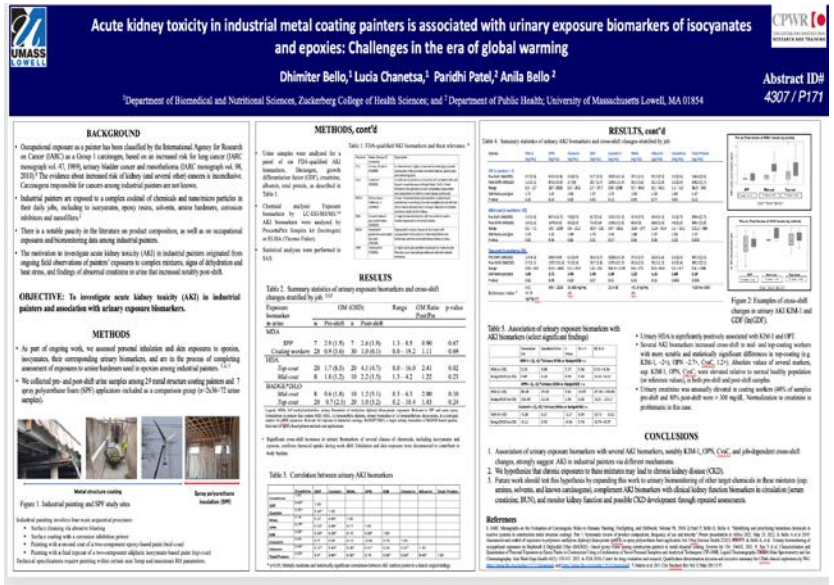
UMASS Lowell Sustainability Symposium, 2022

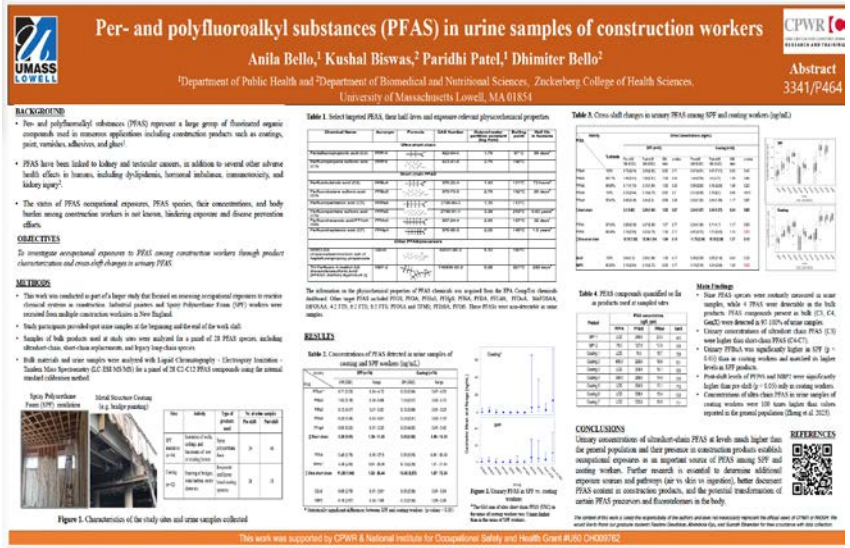


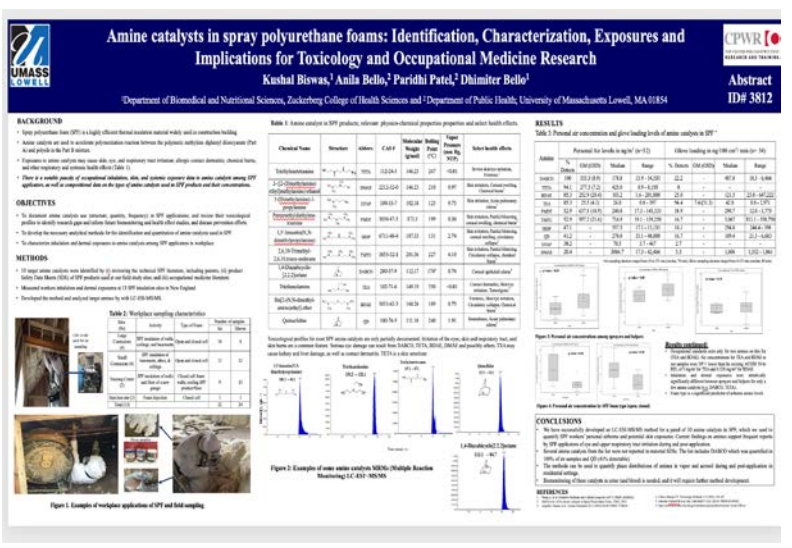
ISBM-12 Porto, 2023

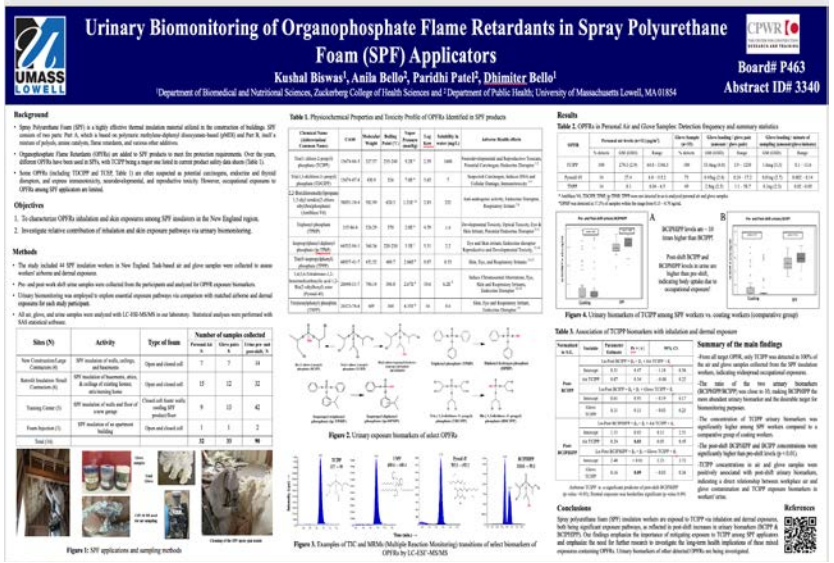


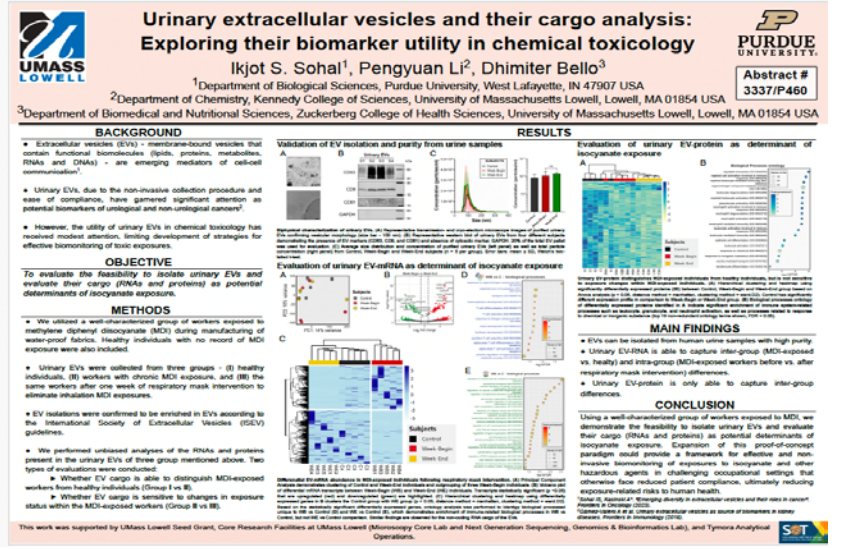
SOT: Poster presentations (2020-2024)

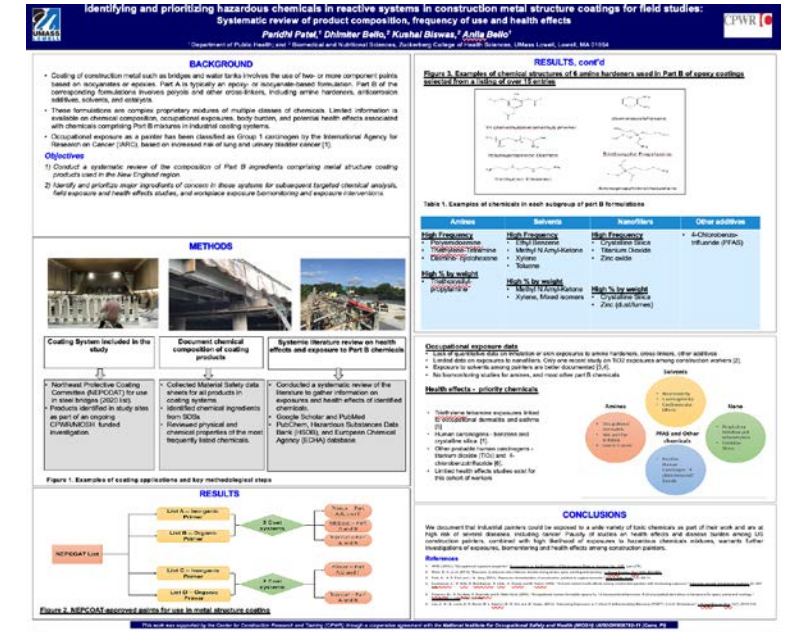












Manuscripts in preparation/ near submission

1. Bello D, Lucia C, Patel P, A Bello. Acute kidney toxicity in industrial metal coating painters and association with urinary exposure biomarkers of isocyanates and epoxies.

2. Bello A , Biswas K, Patel P, Bello D. Per- and poly-fluoroalkyl substances (PFAS) in construction: first evidence on body burden and external exposures.

3. Bello A, Biswas K, Patel P, Heaver K, D Bello. Urinary exposures biomarkers, inhalation and whole-body dermal exposures to organophosphate flame retardants among spray foam applicators (SPF): opportunities for intervention.

4. Biswas K, Bello A , Patel P, Heaver K, D Bello D. Amine catalysts in spray polyurethane foams: Identification, Characterization, Exposures and Implications for Toxicology and Occupational Medicine Research.

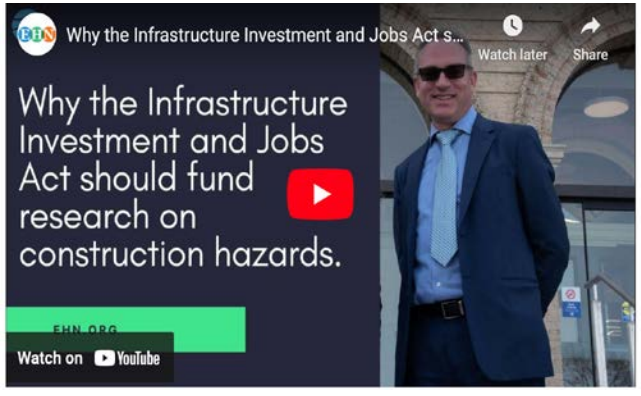
5. Wisnewski A, Y Xue, Liu, CA Redlich, D Bello. Di-lysine-diisocyanate: Translation of a diisocyanate exposure biomarker from mice to humans.

6. Patel P, Bello A, Biswas K, Bhandari S, Bello D. Association of urinary oxidative stress markers among construction painters as measured by a panel of urinary biomarkers of DNA/RNA, lipid, and protein damage with exposure biomarkers for isocyanates and epoxies.

7. Patel P , Bello A, Bhandari S, Heavner K, Biswas, K, Bello D. Characterization of heavy metals in urine samples collected among industrial painters performing metal structure coating and their association with urinary oxidative stress biomarkers.

Project's r2p major activities

April 2023



IUPAT Health and Safety Instructor Symposium and Workshops

Occupational Exposures to Chemicals in Construction Metal Structure Coating: Assessment, Control, and a Roadmap for Disease Prevention

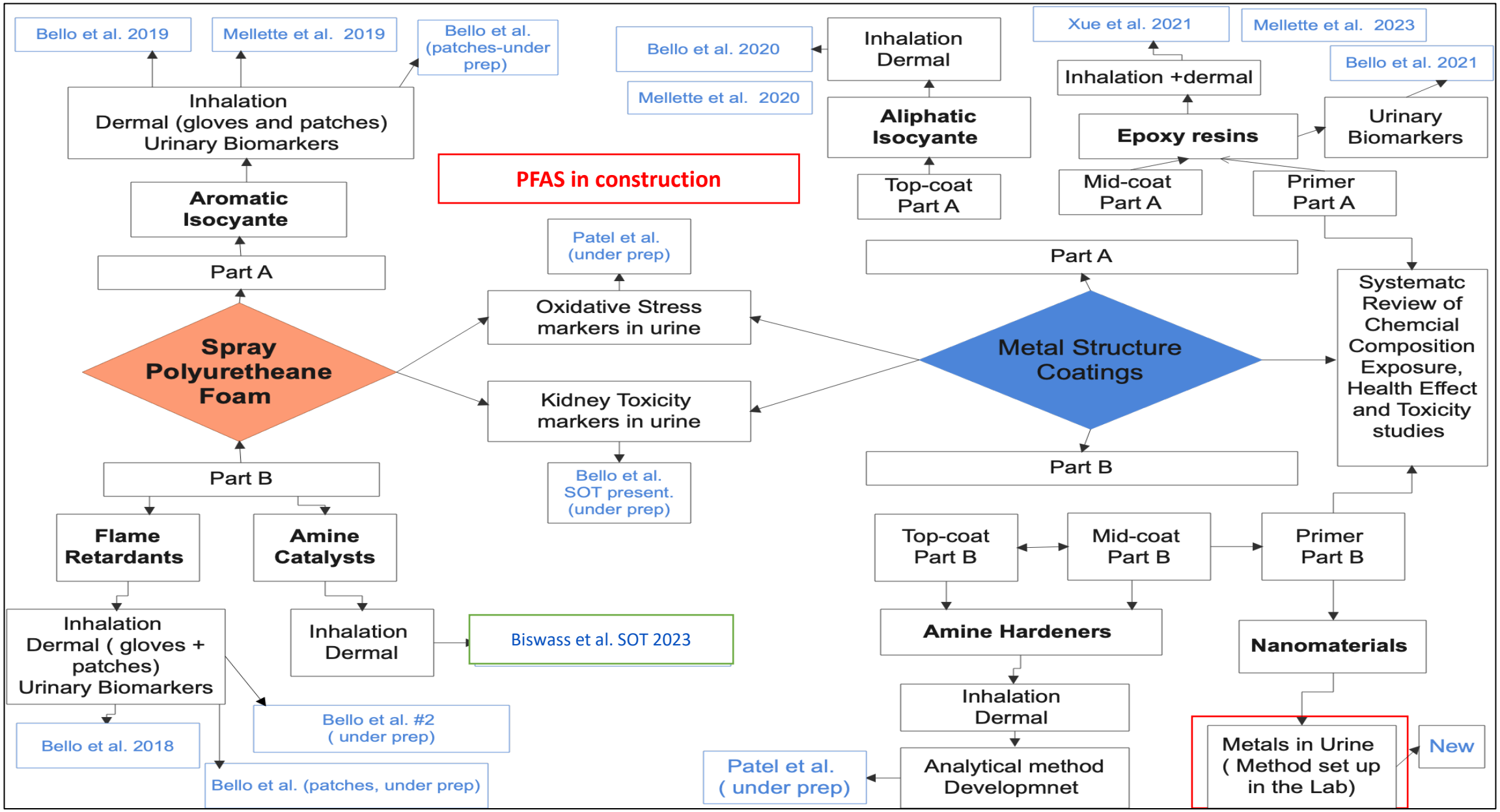
October 26-27, 2022

July 18, 2023

October 6, 2023

Hazard Alert Card (CPWR)

Reactive Chemical Systems in Construction Progress



Urinary levels of 21 metals in SPF and Coating

Urinary metals	% detects	SPF (n=39) GM (GSD)	Coating (n=41) GM (GSD)
(µg/L), ppb			
Aluminium (Al)	100	119 (1.9)	148.7 (2.4)
Titanium (Ti)	99.3	82.2 (2.6)	87.2 (5.2)
Vanadium (V)	25.3	M* 0.2	M 0.2
Chromium (Cr)	2.7	M 29	N/D
Manganese (Mn)	24	M 1.8	M 1
Iron (Fe)	83.3	25.7 (8)	28 (7.8)
Cobalt (Co)	80	0.1 (6.5)	0.3 (4.1)
Nickel (ni)	62	0.1 (41.4)	2.1 (14.5)
Copper (Cu)	98.7	11.1 (2.9)	22 (2.3)
Zinc (Zn)	100	486.5 (2.3)	717.2 (3.8)
Arsenic (As)	83.3	8.5 (4.9)	16.6 (7.2)
Molybdenum (Mo)	98	64.7 (6.1)	59.4 (6.1)
Cadmium (Cd)	100	0.3 (2)	0.7 (2.2)
Tin (Sn)	84.7	2.6 (9.3)	1.7 (15.3)
Antimony (Sb)	71.3	0 (9.2)	0.2 (6.2)
Barium	1.3	N/D	M 22.9
Cerium	50.7	<0.01 (11.1)	<0.01 (15.2)
Lead	36.6	M 0.6	M 9.3
Mercury	11.3	M 2.04	n/d
g/L			
Boron	98	0.9 (5)	1.3 (4.2)
Magnesium	100	71.32 (2.3)	84.5 (2.1)
Calcium	100	128.20 (2.2)	131.5 (2.3)

- Zinc, Aluminum, Copper, and Arsenic urinary levels
  - significantly higher in coating than SPF workers
- Metals – multiple present in coating systems:
  - Zn/ZnO / FeOx/ TiO2/ SiO2/ Sn/Mg (talk)/Ca
  - Alumina
- Potential exposure to lead paints and steel (Ni, Cr, Co, Mn, Mo) during abrasive blasting
- Comparison with general population, BEIs and clinical guidance values are in progress.

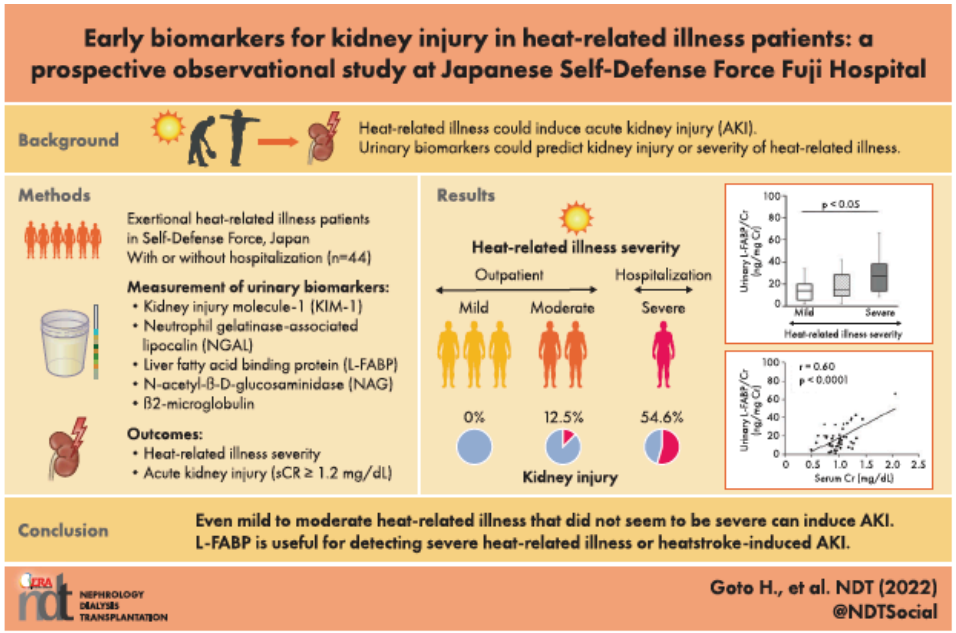
The double hit hypothesis – chemical cocktail & heat

Nephrology Dialysis Transplantation (2022) 0: 1–11
https://doi.org/10.1093/ndt/gfac166
Advance Access publication date 2 May 2022

Early biomarkers for kidney injury in heat-related illness patients: a prospective observational study at Japanese Self-Defense Force Fuji Hospital

Hiroyasu Goto[1], Shinichi Shoda[2], Hiroyuki Nakashima[3], Midori Noguchi[1], Toshihiko Imakiire[1], Naoki Ohshima[1], Manabu Kinoshita[3], Soichi Tomimatsu[2], and Hiroo Kumagai[1]

[1]Department of Nephrology and Endocrinology, National Defense Medical College, Tokorozawa, Saitama, Japan, [2]Self-Defense Force Fuji Hospital, Subashiri, Shizuoka, Japan and [3]Department of Immunology and Microbiology, National Defense Medical College, Tokorozawa, Saitama, Japan



KEY LEARNING POINTS

What is already known about this subject?

- Heat-related illness can induce acute kidney injury (AKI) by damaging kidney tubular cells.
- Although 30–40% of exertional heatstroke patients develop AKI, most studies have focused on patients hospitalized for heatstroke and it is not well known whether AKI also occurs in patients with mild to moderate heat-related illness.
- Urinary liver fatty acid–binding protein (L-FABP) and kidney injury molecule-1 (KIM-1) are well known to be useful for the early detection of AKI, but the relationship between these biomarkers and the severity of heat-related illness or AKI due to heatstroke remains unclear.

What this study adds?

- Twelve percent of moderate heat-related illness patients who did not require hospitalization had AKI.
- The urinary L-FABP levels were higher in severe heatstroke patients than the levels in mild heat-related illness patients and positively correlated with the serum creatinine levels.
- The urinary KIM-1 levels showed a marked correlation with serum cystatin C (sCysC).

What impact this may have on practice or policy?

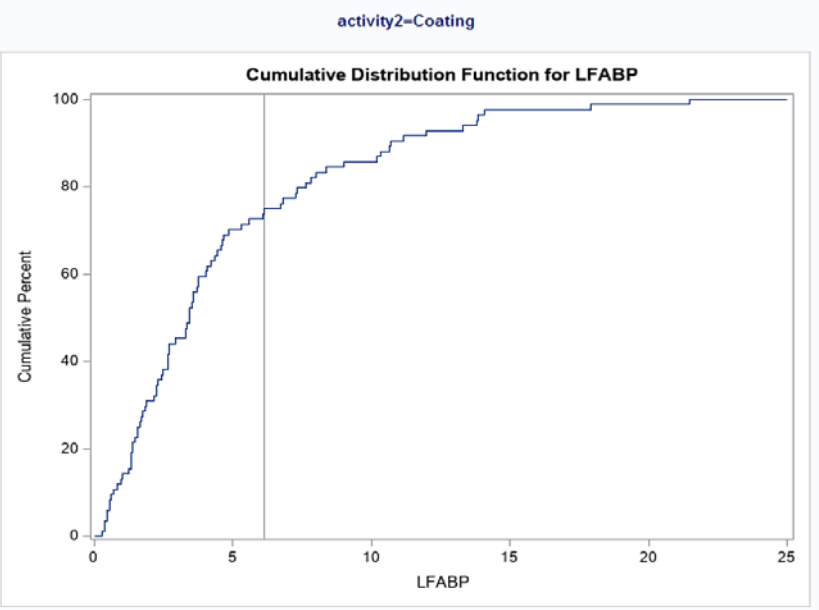
- It should be noted that even mild to moderate heat-related illness can cause kidney damage.
- L-FABP is useful for monitoring athletes and laborers in hot environments to identify individuals who need to be treated immediately to prevent severe kidney injury.
- Although KIM-1 was not associated with the severity of heat-related illness, it had the potential to detect heatstroke-induced AKI in terms of sCysC.

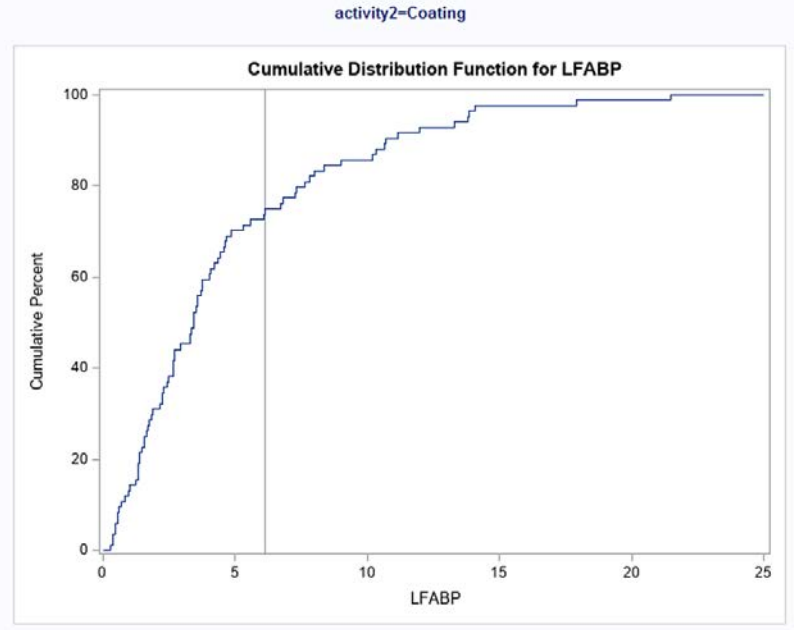
Liver-type Fatty Acid Binding Protein, L-FABP

- 14 kD protein
- Expressed primarily in proximal tubules
- Good predictor of AKI, recovery, and HEAT Stress
- KIM-1 also promising

Heat stress biomarker

L-FBAP (ng/ml)	n	Mean	Median	GM (GSD)	Range
Overall	156	4.33	3.87	2.84 (2.7)	0.28 - 21.46
Pre	69	3.73	2.64	2.52 (2.7)	0.28 - 13.32
Post	87	4.81	3.50	3.13 (2.7)	0.30 - 21.46
SPF					
Overall	70	3.82	2.51	2.52 (2.7)	0.28 - 13.62
Pre	30	3.76	2.51	2.53 (2.7)	0.28 - 11.01
Post	40	3.87	2.64	2.52 (2.7)	0.30 - 13.62
Coating					
Overall	84	4.67	3.42	3.07 (2.7)	0.28 - 21.46
Pre	38	3.66	2.67	2.46 (2.7)	0.28 - 13.32
Post	46	5.50	3.68	3.68 (2.6)	0.47 - 21.46
Injection					
Overall	2	8.00	8.00	7.6 (1.6)	5.50 - 10.50



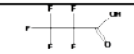
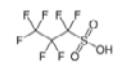
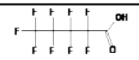
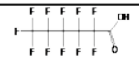
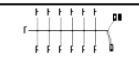
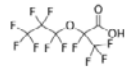
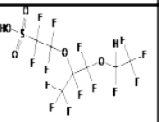


Spearman Correlation between L-FABP and exposure and kidney biomarkers

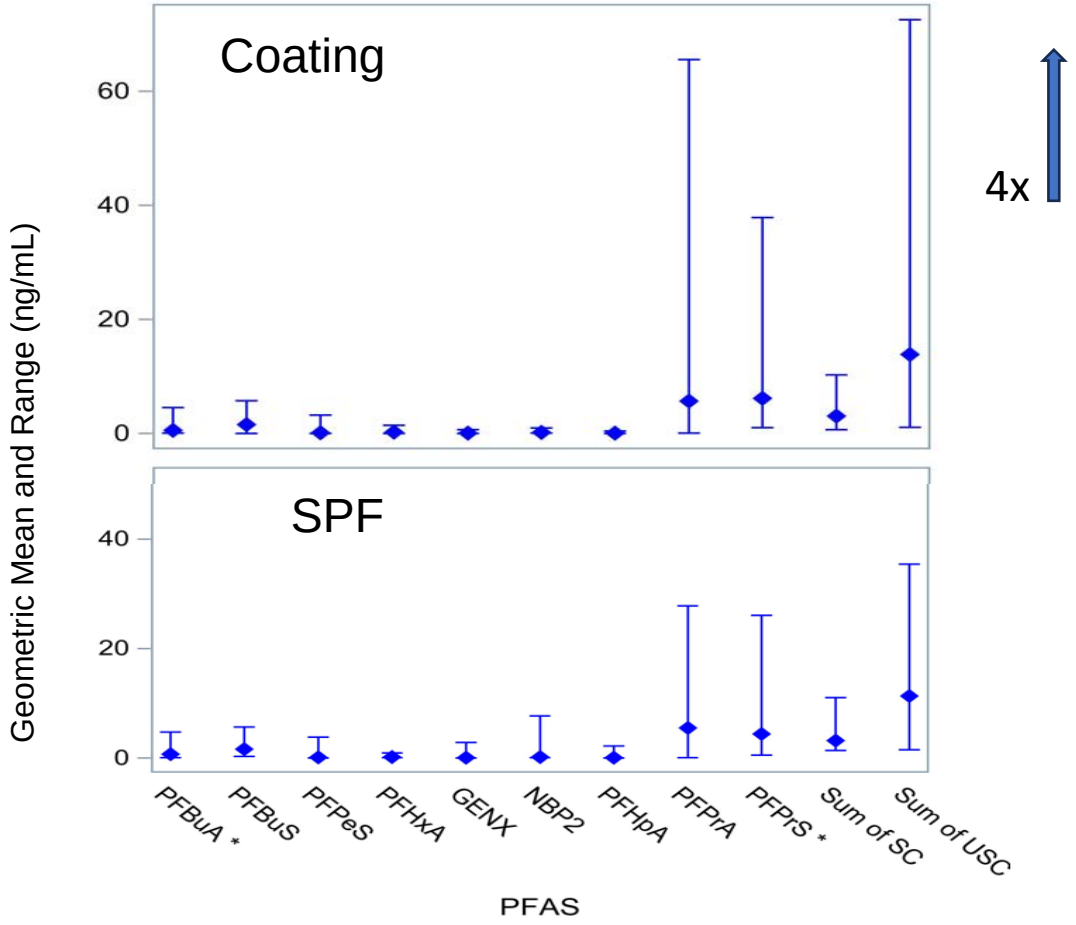
	Coating (n=49)		**SPF (n=14)**	
Biomarkers	L-FABP	p-Value	L-FABP	p-Value
Creatinine	0.42	**<0.01**	0.48	0.11
MDA	0.24	0.09	0.37	0.24
HDA	0.46	<0.01	-	-
Badge*2H2O	-0.04	0.78	-	-
KIM-1	0.41	**<0.01**	0.79	**0.03**
OPN	0.31	**0.03**	0.61	**0.03**
NGAL	0.28	**0.05**	0.06	0.84

PFAS in construction – first pilot data

LC-MS/SM method 47 PFAS, most comprehensive PFAS panel

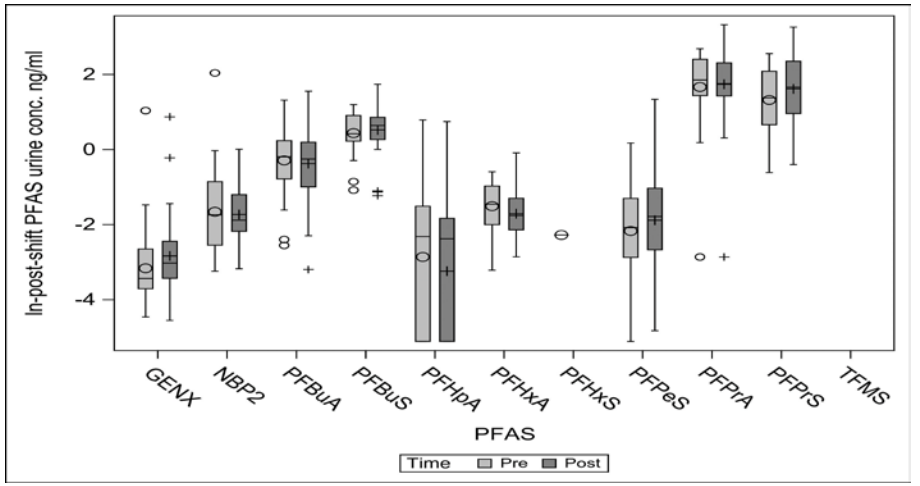
Chemical Name	Acronym	Formula	CAS Number	Octanol-water partition constant (log Kow)	Boiling point	Half life in humans
Ultra-short chain						
Pentafluoropropionic acid (C3)	PFPrA		422-64-0	1.79	97°C	88 days[3]
Perfluoropropane sulfonic acid (C3)	PFPrS		423-41-6	2.75	196°C	
Short chain PFAS						
Perflurobutanoic acid (C4)	PFBuA		375-22-4	1.43	121°C	72 hours[4]
Perfluorobutane sulfonic acid (C4)	PFBuS		375-73-5	2.79	152°C	26 days[5]
Perfluoropentanoic acid (C5)	PFPeA		2706-90-3	1.35	113°C	
Perfluoropentane sulfonic acid (C5)	PFPeS		2706-91-4	3.38	218°C	0.63 years[6]
Perfluorohexanoic acid PFHxA (C6)	PFHxA		307-24-4	2.85	157°C	32 days[7]
Perfluoroheptanoic acid (C7)	PFHpA		375-85-9	2.05	146°C	1.5 years[8]
Other PFAS/precursors						
HFPO-DA propanoateammonium salt of heptafluoropropoxy-propanoate	GEnX		62037-80-3	5.12	180°C	
7H-Perfluoro-4-methyl-3,6-dioxaoctanesulfonic acid/ [PFESA (Nafion) Byproduct 2]	NBP-2		749836-20-2	5.98	221°C	292 days[9]

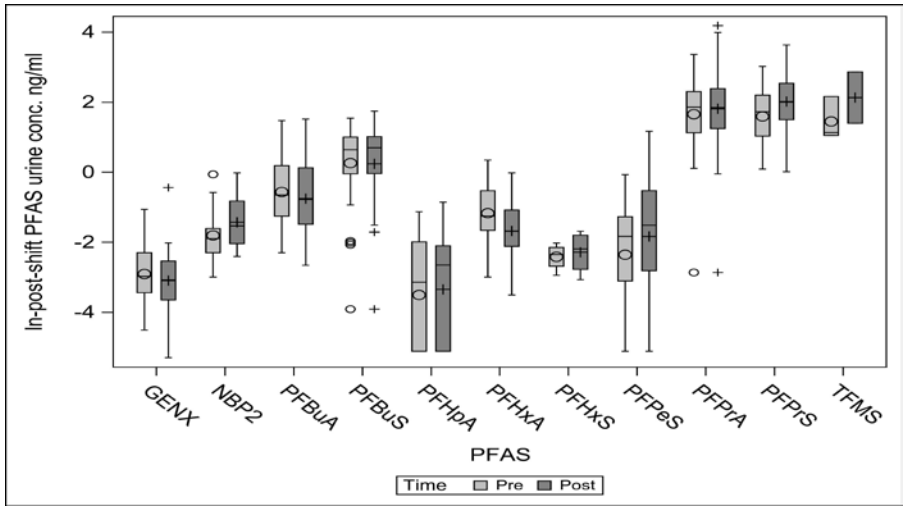
- 9 PFAS routinely measured in urine
- USC/SC and alternative PFASs
- Important contribution from occupational exposure



Cross-shift changes in urinary PFAS among SPF and coating workers (ng/mL)

Activity / PFAS	% detects	Urine Concentrations (ng/mL)							
		SPF (n=40)				Coating (n=38)			
		Pre- shift GM (GSD)	Post-shift GM (GSD)	GM ratio	p-value	Pre-shift GM (GSD)	Post-shift GM (GSD)	GM ratio	p-value
PFBuA	100%	0.75 (3.74)	0.69 (5.02)	0.92	0.71	0.57 (4.91)	0.47 (7.51)	0.83	0.40
PFBuS	98.11%	1.55 (2.47)	1.68 (2.61)	1.09	0.53	1.46 (2.55)	1.6 (2.73)	1.09	0.69
PFPeS	84.00%	0.11 (1.73)	0.15 (1.84)	1.33	0.39	0.09 (2.62)	0.16 (2.55)	1.68	0.20
PFHxA	100%	0.22 (3.54)	0.18 (4.75)	0.82	0.2	0.31 (5.08)	0.19 (6.2)	0.60	<0.01
PFHpA	55.40%	0.06 (3.16)	0.04 (2.3)	0.68	0.38	0.03 (1.92)	0.04 (1.99)	1.17	0.67
∑short chain		**3.5 (1.66)**	**3.58 (1.66)**	**1.05**	**0.67**	**3.34 (1.67)**	**3.34 (1.87)**	**0.94**	**0.85**
PFPrA	97.45%	5.28 (2.18)	5.67 (2.08)	1.07	0.77	5.24 (1.83)	6.11 (1.7)	1.17	0.59
PFPrS	99.36%	3.74 (2.85)	5.02 (2.76)	1.34	0.17	4.91 (3.13)	7.51 (3.45)	1.53	0.03
∑Ultra short chain		**10.12 (1.92)**	**12.54 (1.94)**	**1.24**	**0.18**	**11.75 (2.09)**	**16.13 (2.38)**	**1.37**	**0.10**
GenX	100%	0.04 (1.9)	0.06 (1.96)	1.39	0.17	0.05 (2.28)	0.05 (2.19)	0.83	0.32
NBP2	80.50%	0.19 (2.84)	0.18 (2.72)	0.93	0.77	0.16 (2.19)	0.24 (2.36)	1.50	0.03



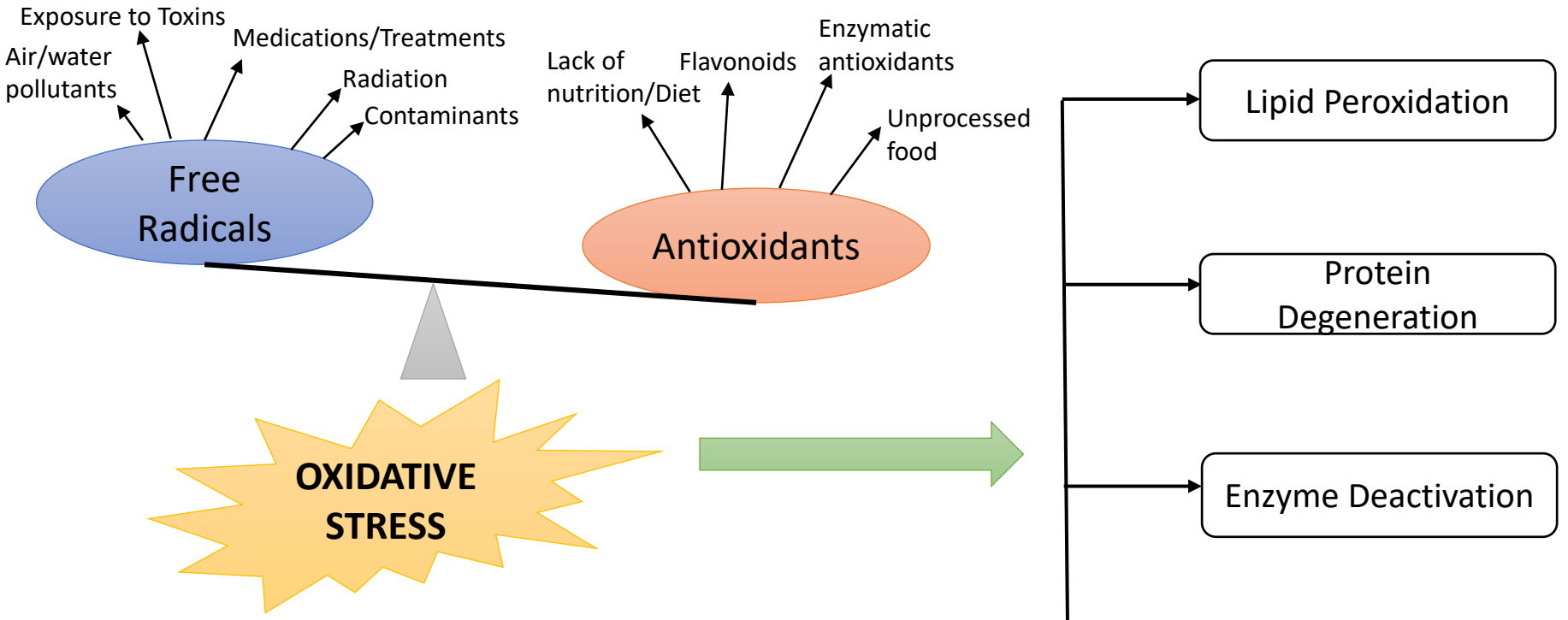


PFAS in construction: Summary of important findings

Product	PFAS concentrations (ug/G, ppm)			
	PFPrA	PFBuS	PFBuA	GenX
SPF 1	LOD	249.0	23.5	4.5
SPF 2	70.0	127.0	17.5	2.5
Coating 1	LOD	70.4	15.7	3.9
Coating 2	605.0	293.0	16.6	6.1
Coating 3	LOD	309.0	16.1	6.6
Coating 4	348.0	289.0	14.9	2.8
Coating 5	LOD	304.0	17.1	7.3
Coating 6	LOD	306.0	15.4	5.0
Coating 7	LOD	335.0	16.6	7.1

- PFAS compounds in bulk (C3, C4, GenX) were detected in 97-100% of urine samples.
- Urinary concentrations of ultrashort chain PFAS (C3) were higher than short-chain PFAS (C4-C7).
- Urinary PFBuA was significantly higher in SPF ($p < 0.05$) than in coating workers and matched its higher levels in SPF products.
- Post-shift levels of PFPrS and NBP2 were significantly higher than pre-shift ($p < 0.05$) only in coating workers.
- Concentrations of ultra-chain PFAS in urine samples of coating workers were 100 times higher than values reported in the general population (Zheng et al. 2023).

Oxidative Stress



- Asthma
- COPD
- Chronic inflammation
- Autoimmune disease
- Myocardial infarction
- Ischemia
- Hypertension
- Chronic Kidney diseases
- Nephritis
- Parkinson
- ADHD
- Stroke
- Melanoma
- Dermatitis
- Psoriasis
- Cancer

Urinary Oxidative Stress Markers

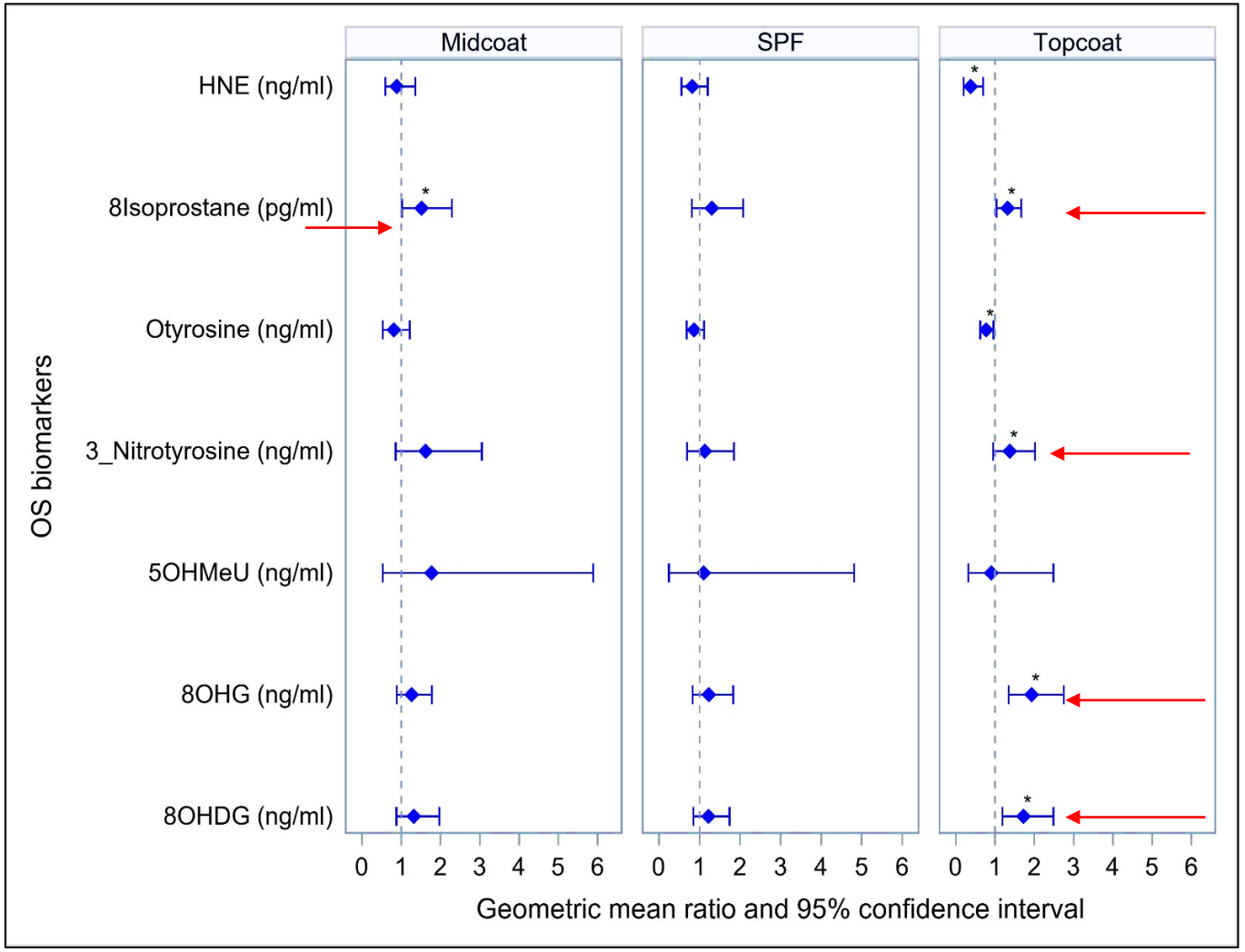
GOAL : To investigate the impact of mixed chemical exposures on oxidative

- DNA/RNA damage
- lipids peroxidation
- protein degeneration

Higher risk among coating workers compared to SPF workers!

Top-coat: 4 oxidative stress markers were significantly higher in post-shift compared to pre-shift of top coating coating workers

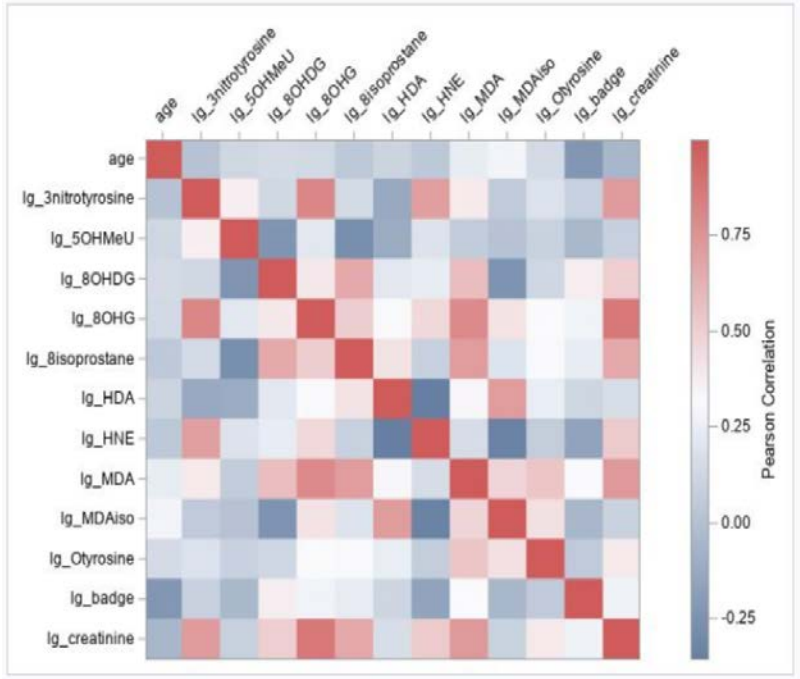
Ratio of Post/Pre –shift Oxidative Stress Markers among Coating VS SPF workers



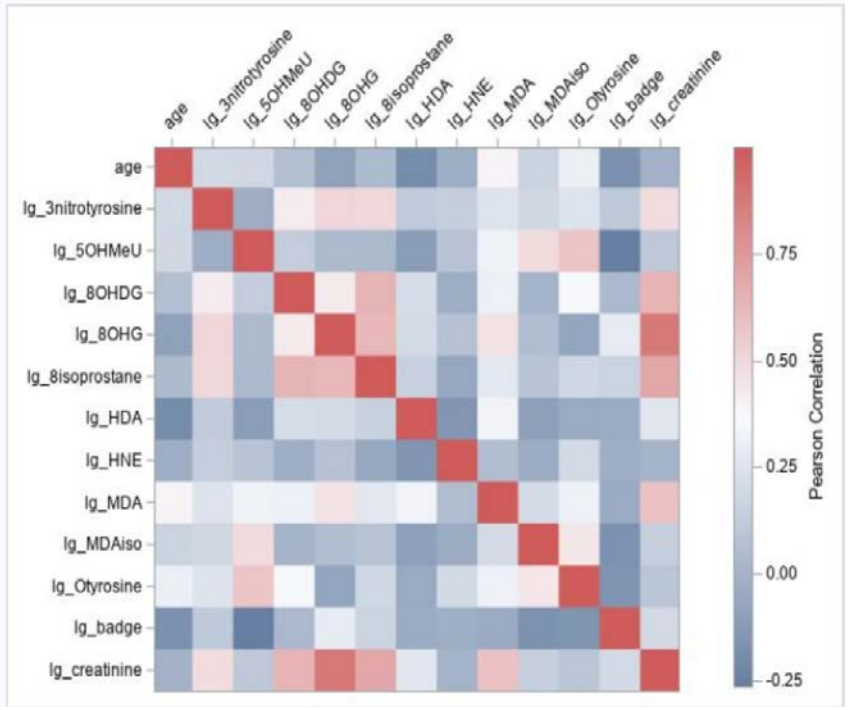
Association of oxidative markers with exposure biomarkers

Exposure biomarkers	Post-shift OS markers													
	8-OHDG		**8-OHG**		**5-OHMeU**		**3-Nitrotyrosine**		**O-Tyrosine**		**8-Isoprostane**		**HNE**	
	Estimate	p-Value	Estimate	p-Value	Estimate	p-Value	Estimate	p-Value	Estimate	p-Value	Estimate	p-Value	Estimate	p-Value
SPF														
MDA	0.66	0.05	0.27	0.53	-0.13	0.69	-0.04	0.97	-0.26	0.41	0.31	0.63	-0.62	0.31
Mid-coat (isocyanate)														
MDA	-0.16	0.55	0.16	0.63	-0.36	0.37	1.10	0.90	0.77	0.01	0.37	0.33	0.21	0.77
HDA	<-0.01	0.99	0.26	0.67	-0.27	0.75	-0.62	0.67	1.17	0.06	0.79	0.26	-1.34	0.24
Badge 2H2O	0.26	0.15	0.11	0.69	-0.27	0.32	-0.19	0.73	0.06	0.71	0.73	0.24	-0.2	0.53
Topcoat (epoxy)														
MDA	0.01	0.91	0.03	0.62	0.17	0.06	0.04	0.56	0.13	0.08	-0.01	0.83	0.07	0.46
HDA	0.19	0.03	0.06	0.52	-0.08	0.55	0.12	0.24	-0.01	0.89	0.08	0.34	-0.28	0.02
Badge 2H2O	<-0.01	0.58	0.22	0.06	-0.18	0.34	<0.01	0.94	-0.05	0.74	0.1	0.33	-0.03	0.88

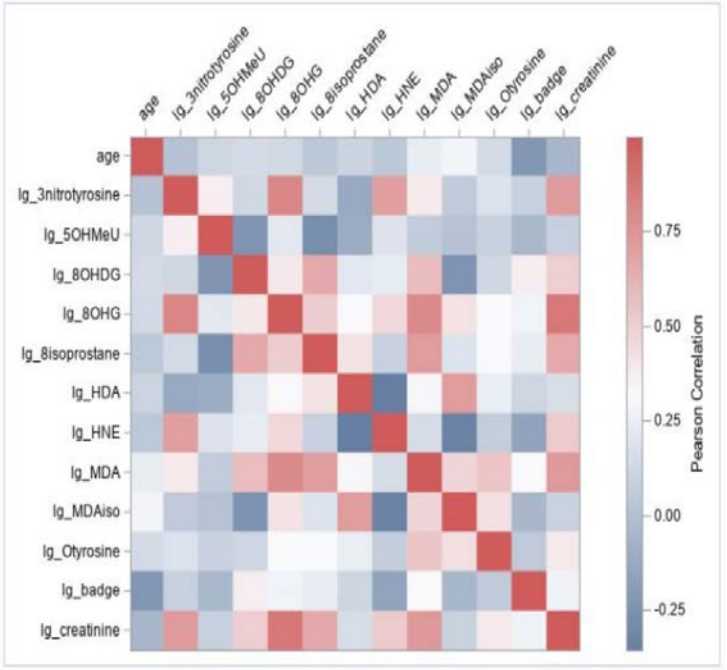
Spearman correlation coefficients OS, exposure biomarkers



SPF



Top-coat



Mid-coat

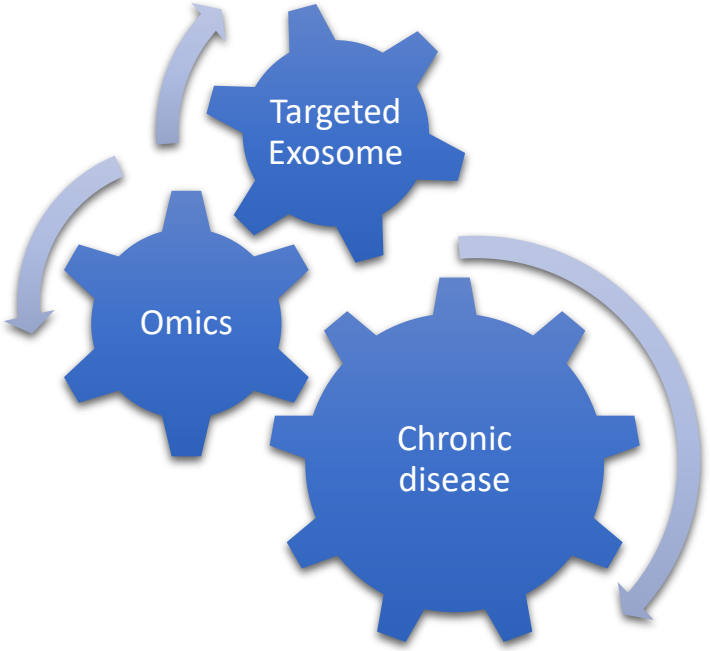
Our vision for the future of chemically-induced chronic diseases in construction

Problem !

Painters were classified as a Class I occupational carcinogen as early as 1987.

- Real drivers of carcinogenicity not known to this day
- No methods, no tools, and no ongoing prospective longitudinal studies.
- Minor emphasis on chemical exposures as drivers of outcomes!
- BTMed – an excellent series of studies on health outcomes, but it reflects exposures of the past 30 years. Exposures of today – very different from 30 years ago - will define diseases of tomorrow!

Where environmental health is heading!



Thank you for your attention !

Additional Questions?

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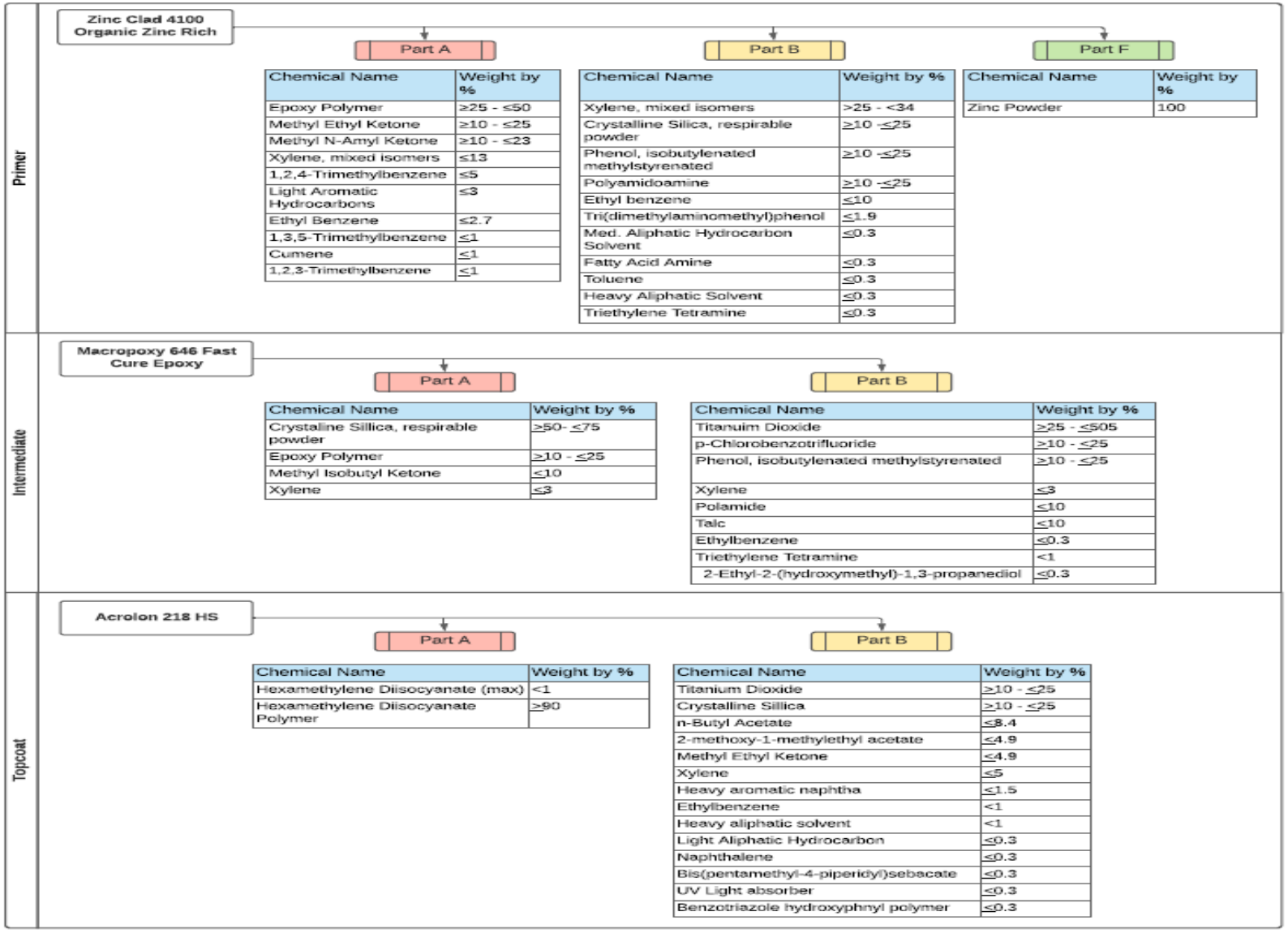
Chemistry of coating systems – A systematic review and database



Primer

Zinc Clad 4100 Organic Zinc Rich

Part A

Chemical Name	Weight by %
Epoxy Polymer	≥25 - ≤50
Methyl Ethyl Ketone	≥10 - ≤25
Methyl N-Amyl Ketone	≥10 - ≤23
Xylene, mixed isomers	≤13
1,2,4-Trimethylbenzene	≤5
Light Aromatic Hydrocarbons	≤3
Ethyl Benzene	≤2.7
1,3,5-Trimethylbenzene	≤1
Cumene	≤1
1,2,3-Trimethylbenzene	≤1

Part B

Chemical Name	Weight by %
Xylene, mixed isomers	>25 - <34
Crystalline Silica, respirable powder	≥10 -≤25
Phenol, isobutylenated methylstyrenated	≥10 -≤25
Polyamidoamine	≥10 -≤25
Ethyl benzene	≤10
Tri(dimethylaminomethyl)phenol	≤1.9
Med. Aliphatic Hydrocarbon Solvent	≤0.3
Fatty Acid Amine	≤0.3
Toluene	≤0.3
Heavy Aliphatic Solvent	≤0.3
Triethylene Tetramine	≤0.3

Part F

Chemical Name	Weight by %
Zinc Powder	100

Intermediate

Macropoxy 646 Fast Cure Epoxy

Part A

Chemical Name	Weight by %
Crystaline Sillica, respirable powder	≥50- ≤75
Epoxy Polymer	≥10 - ≤25
Methyl Isobutyl Ketone	≤10
Xylene	≤3

Part B

Chemical Name	Weight by %
Titanuim Dioxide	≥25 - ≤505
p-Chlorobenzotrifluoride	≥10 - ≤25
Phenol, isobutylenated methylstyrenated	≥10 - ≤25
Xylene	≤3
Polamide	≤10
Talc	≤10
Ethylbenzene	≤0.3
Triethylene Tetramine	<1
2-Ethyl-2-(hydroxymethyl)-1,3-propanediol	≤0.3

Topcoat

Acrolon 218 HS

Part A

Chemical Name	Weight by %
Hexamethylene Diisocyanate (max)	<1
Hexamethylene Diisocyanate Polymer	≥90

Part B

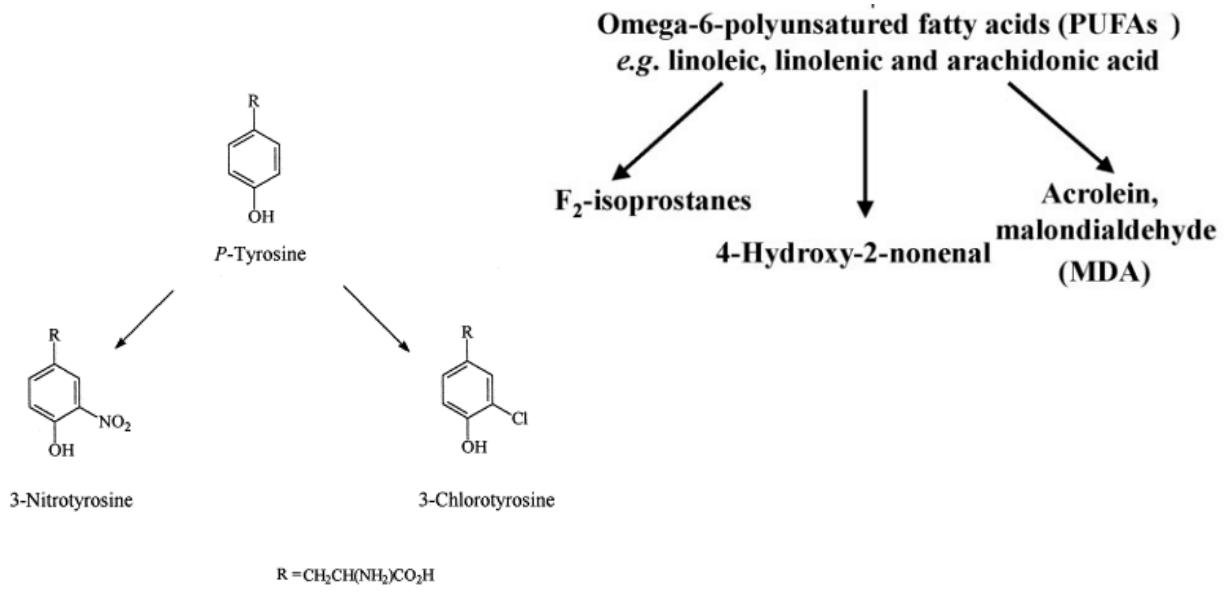
Chemical Name	Weight by %
Titanium Dioxide	≥10 - ≤25
Crystalline Sillica	≥10 - ≤25
n-Butyl Acetate	≤8.4
2-methoxy-1-methylethyl acetate	≤4.9
Methyl Ethyl Ketone	≤4.9
Xylene	≤5
Heavy aromatic naphtha	≤1.5
Ethylbenzene	<1
Heavy aliphatic solvent	<1
Light Aliphatic Hydrocarbon	≤0.3
Naphthalene	≤0.3
Bis(pentamethyl-4-piperidyl)sebacate	≤0.3
UV Light absorber	≤0.3
Benzotriazole hydroxyphnyl polymer	≤0.3

Information available from Product's Safety Data Sheets !

- 57 chemicals in primers
- 46 in intermediate coat
- 51 in topcoat

10 amines
24+ solvents
17+ nano/fillers
5 + other additives

Urinary oxidative stress markers measured



DNA/RNA damage biomarkers:

- 8-hydroxy-2'-deoxyguanosine(8OHDG)
- 8-hydroxyguanosine (8OHG)
- 5-hydoxymethyluracil (5OHMeU)

Protein oxidation biomarkers:

- 3Chlorotyrosine
- 3Nitrotyrosine
- O-tyrosine

Lipid peroxidation biomarkers:

- 8Isoprostane
- 4-Hydroxy-2-nonenal (HNE)
- Malondialdehyde (MDA)

Oxidized Guanine Species