



THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Welcome to CPWR's 2026 r2p Seminar & Partnership Workshop



NIOSH Updates

Donald R. Peterson, PhD, MS

Director, Division of Safety Research

Acting Associate Director, Construction Safety
and Health Program

All images from NIOSH or Microsoft Stock unless otherwise noted.



R2P Seminar & Partnership Workshop 6/9/2026

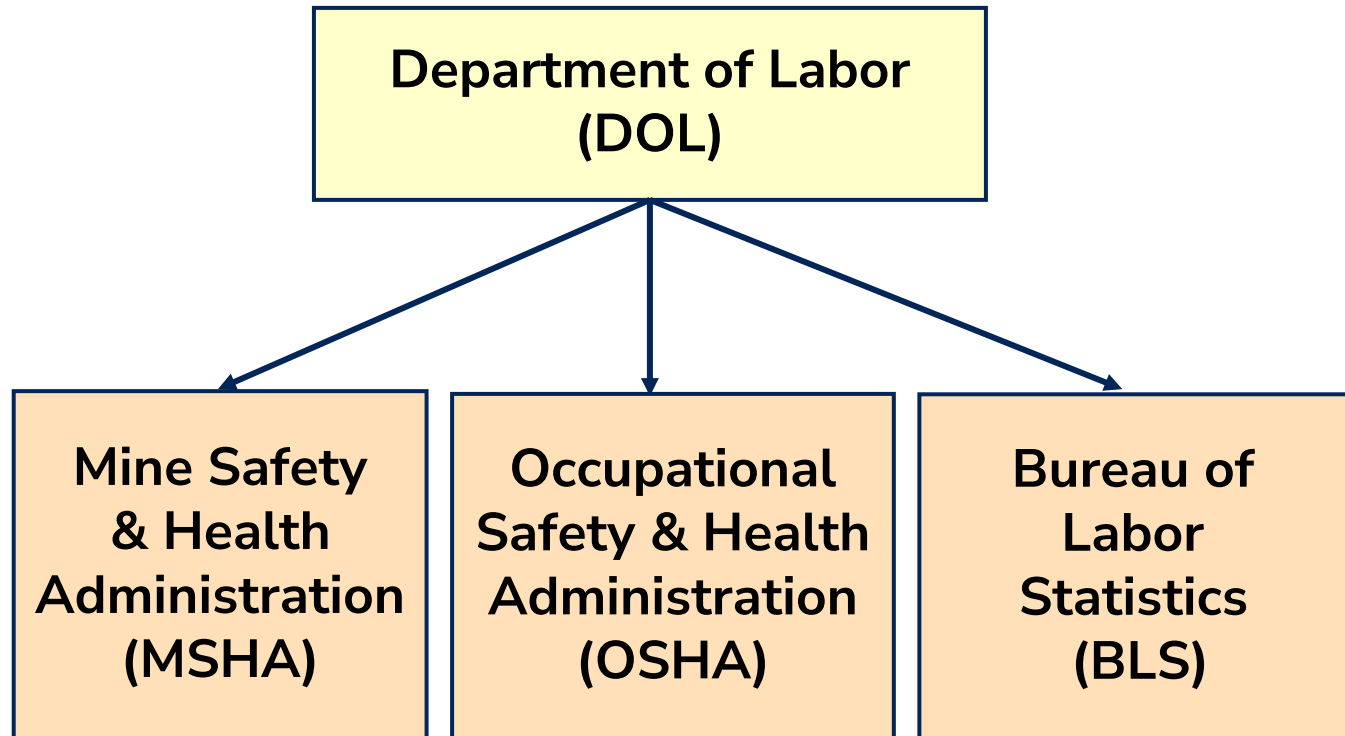


The NIOSH Mission

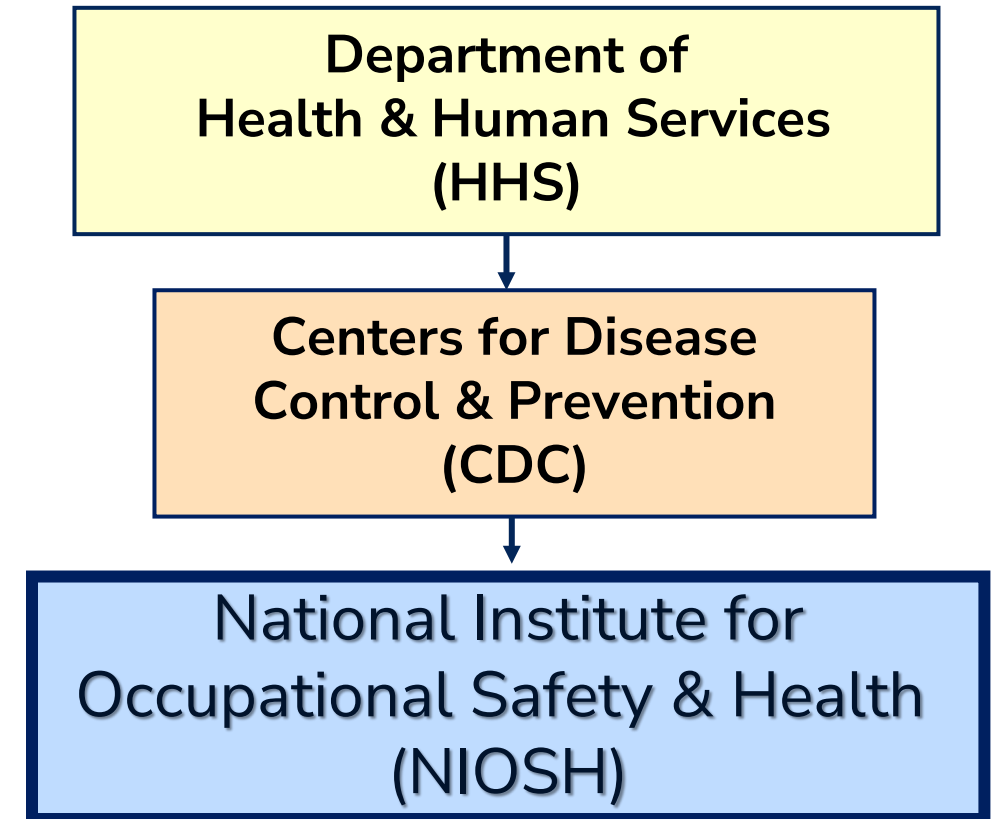
To develop new knowledge in the field of occupational safety and health, and to transfer that knowledge into practice

Occupational Safety and Health Framework

Regulation and Enforcement



Research, Prevention, Training



r2p Motivation

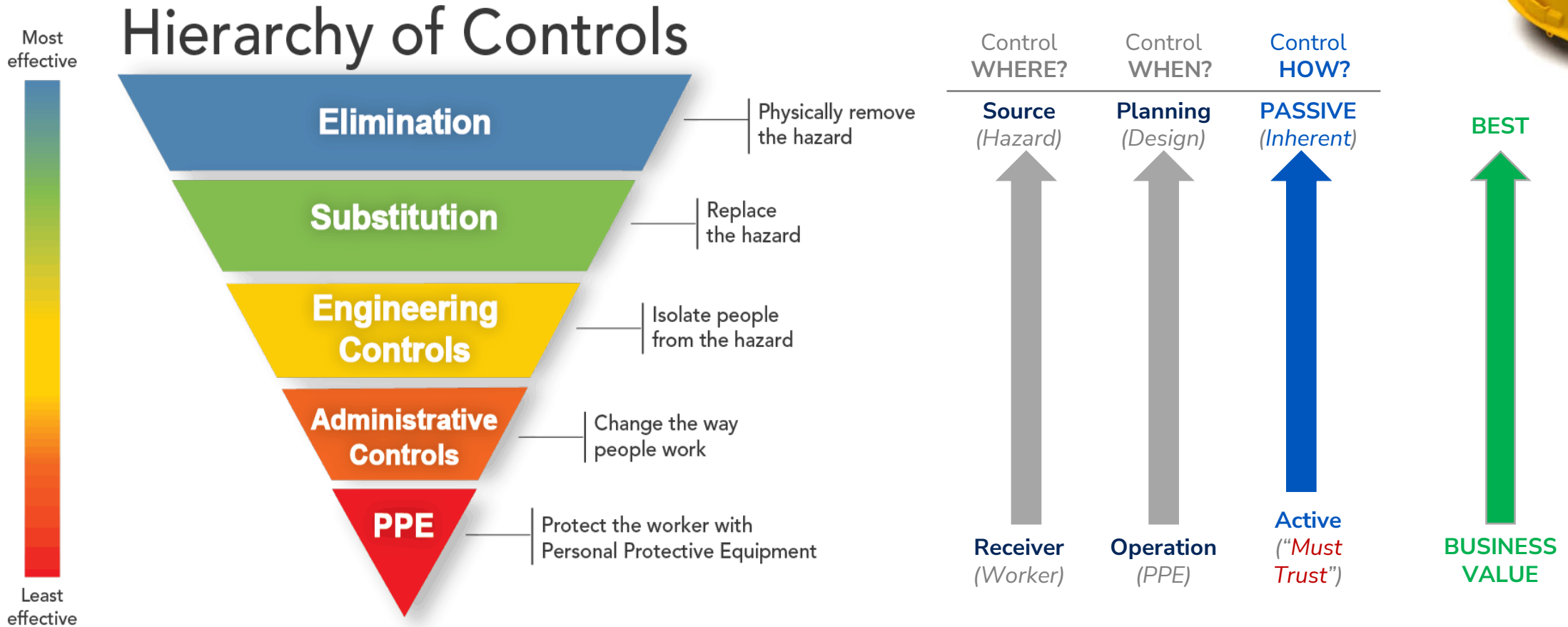


Image from www.cdc.gov/niosh/topics/hierarchy

- Seek more passive controls at every level
 - *Less actions to take means less mistakes to make!*

NIOSH Facilities in 8 Cities Across 4 Time Zones

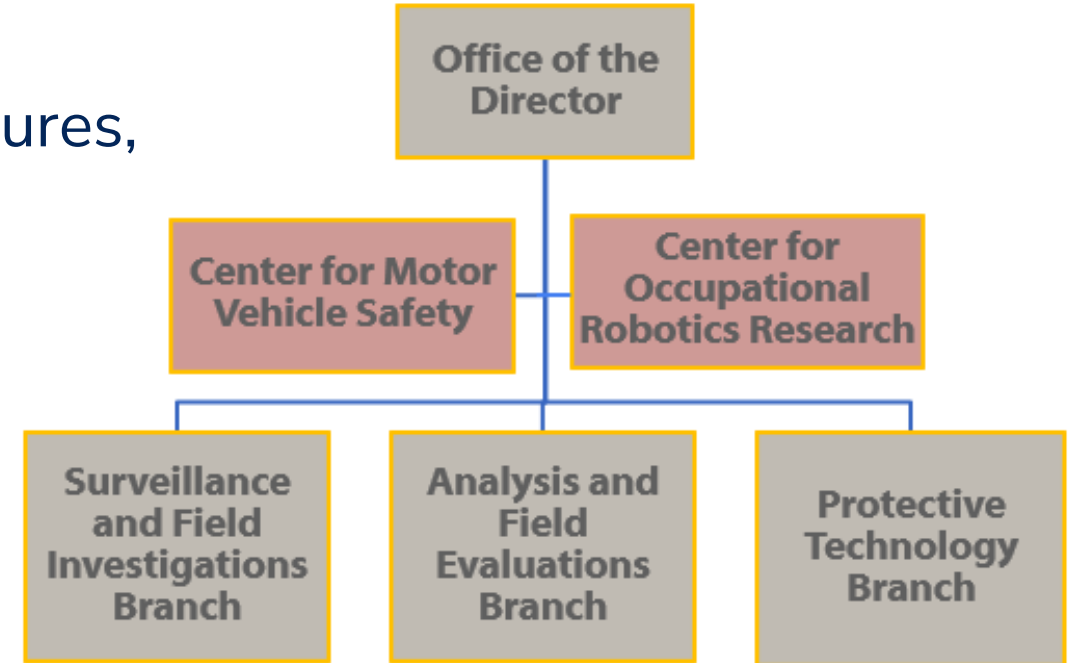
10 Divisions, Labs, or Offices (DLOs)



- Division of Compensation Analysis and Support (*DCAS*)
- Division of Field Studies and Engineering (*DFSE*)
- Division of Science Integration (*DSI*)
- Division of Safety Research (*DSR*)
- Health Effects Laboratory Division (*HELD*)
- Pittsburgh Mining Research Division (*PMRD*)
- Spokane Mining Research Division (*SMRD*)
- National Personal Protective Technology Laboratory (*NPPTL*)
- Respiratory Health Division (*RHD*)
- Western States Division (*WSD*)

DSR Focuses on Traumatic Injuries in the Workplace

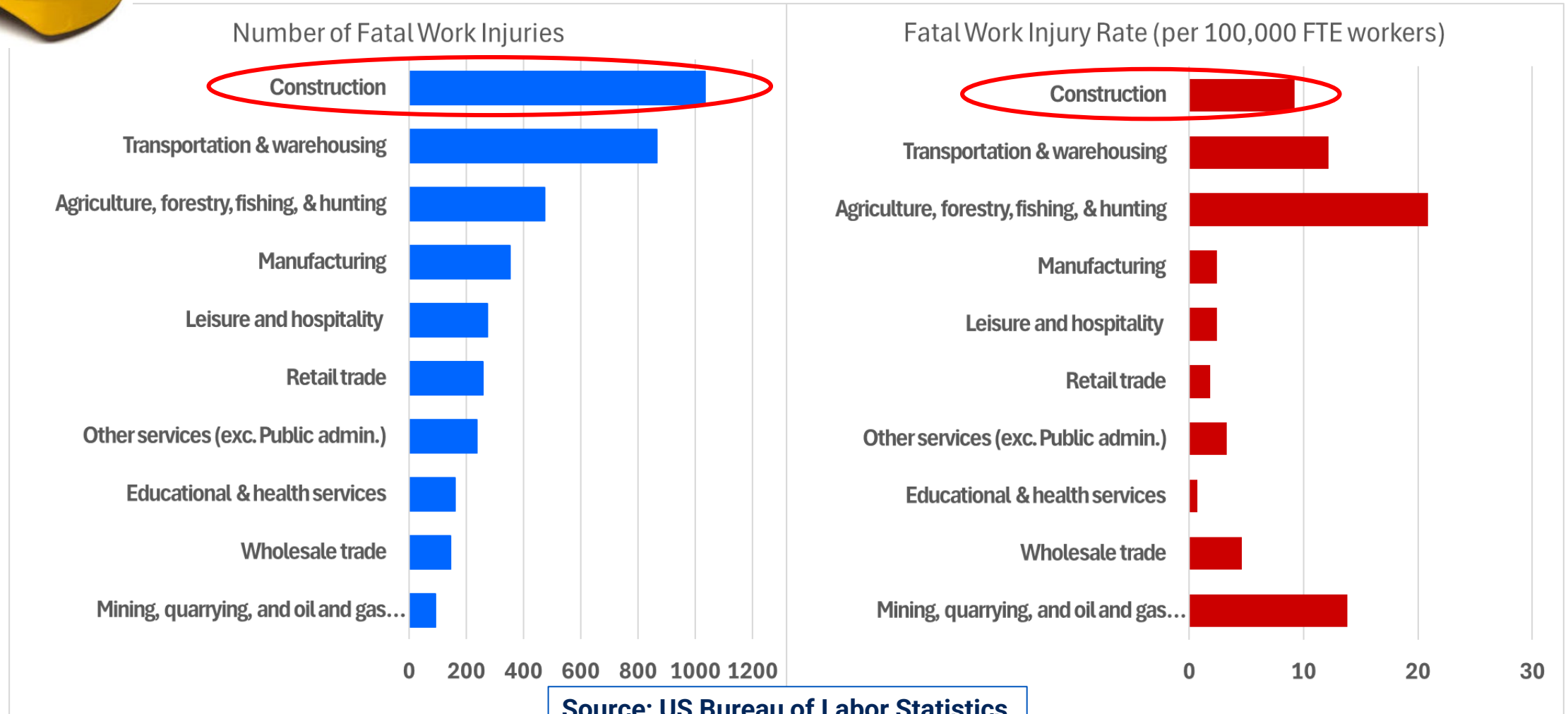
- *DSR* = acute (single) and multiple exposures, traumatic injuries
 - Surveillance
 - Evaluation
 - Engineering





Number and Rates of Fatalities by Major Industry, 2024

(Approximately 12+ million Construction Workers in the U.S.)



Mission of the Construction Program



To eliminate construction fatalities, injuries, and illnesses through a focused program of research and prevention

Fulfill mission through high quality research, practical solutions, partnerships, and research to practice (**r2p**)

NIOSH Construction Safety and Health Program



Coordinates and Integrates Construction Work
Across ALL of NIOSH DLOs



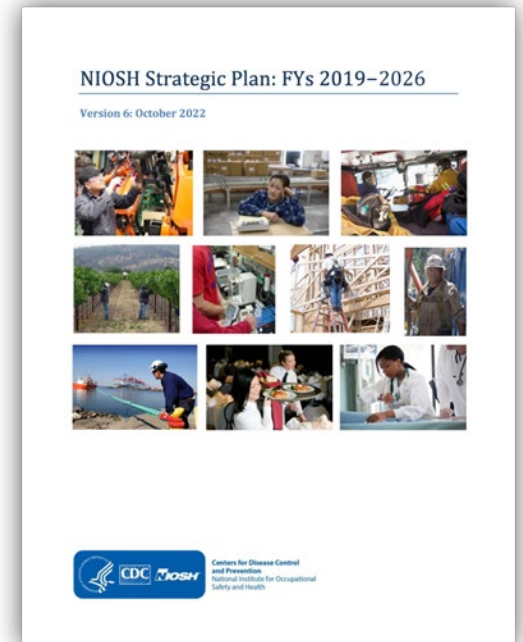
- Division of Compensation Analysis and Support (*DCAS*)
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- Western States Division (*WSD*)

NIOSH Strategic Plan and Goals (**Construction**)

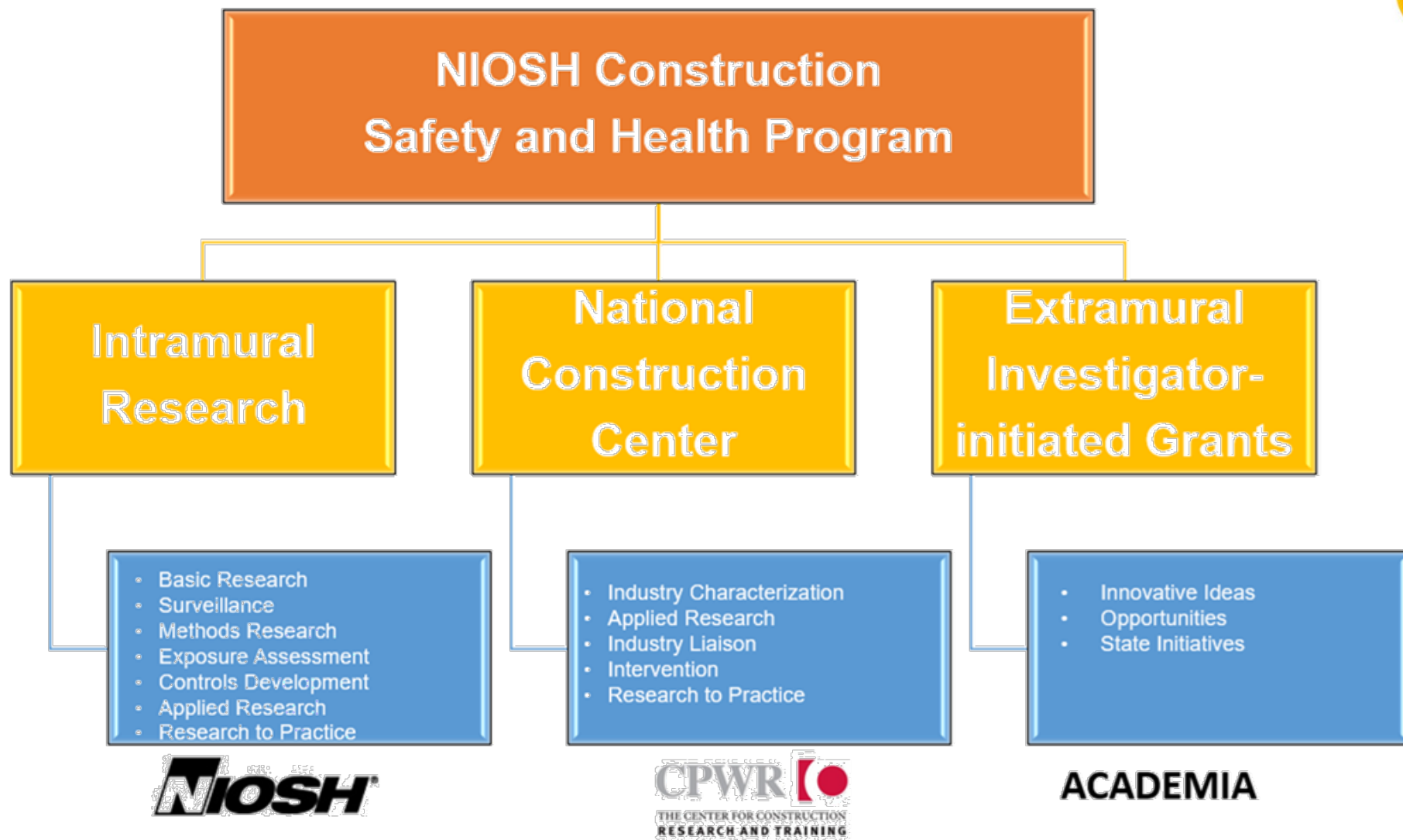
Contains Seven Strategic Goals and Internal Sector and Cross-sector Goals



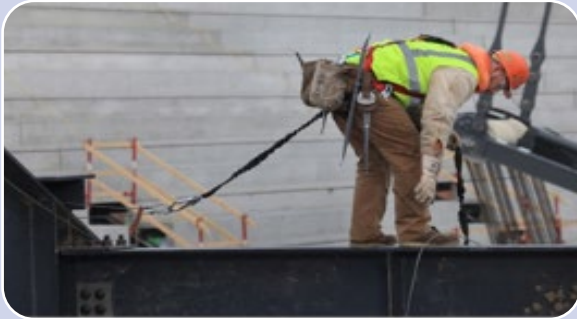
1. Reduce occupational respiratory disease
2. Improve workplace safety to reduce traumatic injuries
3. Promote safe and healthy work design and well-being
4. Reduce occupational cancer, cardiovascular disease, adverse reproductive outcomes, and other chronic diseases
5. Reduce occupational hearing loss
6. Reduce occupational immune, infectious, and dermal disease
7. Reduce occupational musculoskeletal disorders



Construction Program Structure



NORA Construction Sector and Current Work Groups



Preventing Falls

Co-Chairs:

Cheryl Ambrose (NRCA)

Adrienne Anglin (NRCA)



Preventing Struck-by

Co-Chairs:

Brad Sant (ARTBA)

Alanna Klein (CNA)

NORA

Some Construction-Related Projects in NIOSH



FALL PROTECTION

Fall protection performance when anchoring near foot level

INDUSTRIAL HELMETS

Improving industrial helmet shock performance

AUTOMATION

Hazards and risk factors for demolition robot operators

AUTOMATION

Smart masonry robot for struck-by hazard prevention

VEHICLES

Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents

HEAT STRESS

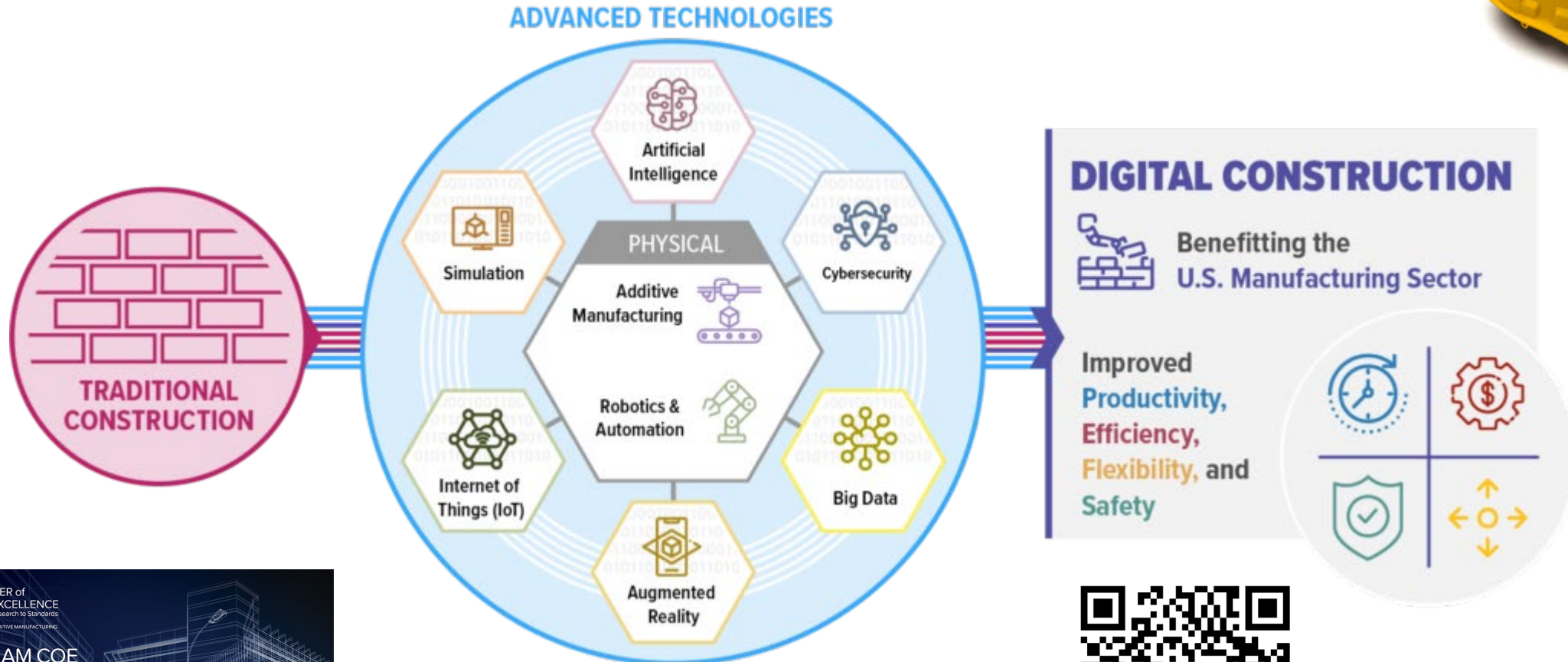
Occupational Heat Stress and NIOSH Resources

NOISE

Sell and Buy Quiet Programs to Reduce Hazardous Noise in the Workplace



Digitalization of the Construction Industry



CENTER of
EXCELLENCE
Research to Standards
ADDITIVE MANUFACTURING

3rd ASTM AM COE
SPECIALTY WORKSHOP
DIGITALIZATION OF THE
CONSTRUCTION INDUSTRY

January 25 - 26
ASTM HQ | West Conshohocken, PA

<https://amcoe.org/event/constructionworkshop/>

Recent Construction Outputs



- Various [**NIOSH Science Bulletins**](#) (formerly the NIOSH Science Blogs)
- [**Robotics and Automation Risks in Construction**](#) in *Frontiers in the Built Environment*
- [**Occupational Safety and Health Considerations for 3D Printing Construction**](#) in the *Journal of Management in Engineering*
- [**Industrial Robotics and the Future of Work**](#) in the *American Journal of Industrial Medicine*
- CPWR Construction Fact Sheet on [**Cut-off Saw Safety**](#) done in collaboration with USACE, NORA, and CPWR
- [**Prevention through Design in Construction**](#) workshop series with Arizona State University from 2020-2024
- Participation in NSF and ASCE meeting on *Construction Engineering Research* and input to a research agenda

Recent FACE Reports



CONSTRUCTION FATALITY NARRATIVE

INCIDENT FACTS

REPORT #:
71-264-2025

REPORT DATE:
March 17, 2025

INCIDENT DATE:
July 15, 2022

WORKER:
44 years old

INDUSTRY:
Siding Contractors

OCCUPATION:
Construction Framer

SCENE:
H-2A housing construction site

EVENT TYPE:
Fall from elevation



Circle shows area where
framer fell.

For a slideshow version,
[click here.](#)



This narrative was developed to alert employers and workers of a tragic incident and is based on preliminary data ONLY and does not represent final determinations regarding the nature of the incident or the cause of the injury. Developed by WA State Fatality Assessment and Control Evaluation (WA FACE) and the Division of Occupational Safety and Health (DOSH), WA State Dept. of Labor & Industries. WA FACE is supported in part by a grant from the National Institute for Occupational Safety and Health (NIOSH grant# SU600H008487). For more information visit www.inl.wa.gov/safety-health/safety-research/ongoing/projects/work-related-fatalities-face.



Framer Falls 8 Feet from Rim Joist

SUMMARY

A 44-year-old experienced framer fell eight feet from a rim joist while working on a wall. He worked for his employer, a residential contractor, for five years.

The framer was with a co-worker removing previously installed second-level floor joists to relocate an inside kitchen wall that was framed in the wrong place. After finishing his task, he went to an outside wall where his co-worker was working. He sat down on a rim joist to wait. The joist was eight feet above the floor decking and had a window opening just below it. He was straddling the joist to support himself above the opening. He then leaned to the inside of the wall and lost balance. Unable to regain balance due to the opening, he fell headfirst to the floor decking below.

His co-worker saw him fall, called 911, and began CPR. When first responders arrived, he was breathing but unresponsive. He was then airlifted to the hospital and placed on life support. He died five days later.

Following the incident, investigators found:

- The framer fell from an inside wall height of eight feet, three-quarters inches. The fall hazard to the outside of the wall was nine feet, nine and three-quarters inches. Fall protection was not used because workers were under the 10-foot trigger height for fall protection requirements while installing structural members.
- The framer attended weekly safety meetings where fall protection was a recurring main topic.
- The employer had a written accident prevention program (APP) with a fall protection plan.

REQUIREMENTS

Employers must:

- Maintain conditions within the workplace that will not endanger the health, safety or welfare of employees. See [WAC 296-800-11005](#)

RECOMMENDATIONS

FACE investigators concluded, that to help prevent similar occurrences employers, should:

- When workers must walk on top plates, joists, rafters, trusses, beams or other similar structural members, provide fall protection by using scaffolding, aerial lifts, edge protection platforms, guardrails, safety nets, or personal fall protection systems. Train workers to use these methods and equipment properly and periodically evaluate their fall protection knowledge and skills.
- Arrive on-site before work begins or appoint a supervisor to jointly conduct a site hazard assessment with workers to identify fall hazards and develop fall protection solutions.
- During the pre-job safety meeting, review the site hazard assessment and discuss workers' responsibilities to use fall protection and follow fall prevention safe work practices.

RESOURCES

[Falls \(From Heights\) safety resources](#) – Washington State Dept. of Labor & Industries



Framer fell from rim joist (x) above
window opening to floor deck.



CONSTRUCTION FATALITY NARRATIVE

INCIDENT FACTS

REPORT #:
71-265-2025

REPORT DATE:
April 18, 2025

INCIDENT DATE:
April 1, 2022

WORKER:
53 years old

INDUSTRY:
Other Building Finishing
Contractors

OCCUPATION:
Day Laborer

SCENE:
Commercial building

EVENT TYPE:
Explosion and Fire



Pictograms and labels on
bucket showing chemical
flammability and health
hazards.

For a slideshow version,
[click here.](#)



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Day Laborer Burned in Adhesive Explosion

SUMMARY

A 53-year-old day laborer died when the vinyl flooring adhesive he was applying ignited and the vapor exploded. He worked for his employer, a general contractor, for four years doing random odd jobs on an informal, as-needed basis.

He and an assistant were installing vinyl flooring in a commercial building under renovation. They were working alone and unsupervised but received instruction from the employer over the phone. They hoped to finish quickly, but the liquid flooring adhesive was not bonding well. The laborer said the room was too cold and decided to use an open-flame propane torch to heat up the adhesive and flooring.

Forty minutes later, the torch ignited either the adhesive vapor or liquid on the floor. The workers tried to stamp out the fire with their feet but were unable to.

The assistant yelled at the laborer to flee and ran for an exit door. He then felt an explosion, looked back, and saw the laborer trying to shut off the torch as smoke filled the room. Dizzy and nauseous, he yelled again to the laborer but lost sight of him as he continued toward the door. When he reached the door, a second explosion threw him outside. He was then able to move further from the building. The laborer came out shortly after, in flames and screaming. He fell near the door just before a third explosion blew it off. The area around him was too hot for the assistant to approach. Neighbors called 911. First responders rescued the assistant and extinguished the blaze. The laborer died at the scene from burns and smoke inhalation.

Following the incident, investigators found:

- The employer did not have an accident prevention program (APP) nor provide the workers Safety Data Sheets (SDS), chemical hazard training, and fire extinguishers before the job began.
- The SDS for the flammable liquid adhesive indicated it had a high risk of explosion at a low vapor concentration in the air. The adhesive spread over the large surface area in the unventilated building emitted enough vapor to reach the lower explosive limit and ignite while the torch was lit.
- Four 5-gallon buckets of adhesive were left open in the building, increasing the vapor concentration.

REQUIREMENTS

Employers must comply with rules regulating:

- Fire protection [WAC 296-155-260](#), flammable liquids [WAC 296-155-270](#), and temporary heating devices [WAC 296-155-280](#).
- Safety data sheets [WAC 296-901-14014](#) and worker information and training [WAC 296-901-14016](#).

Management must:

- Instruct workers required to handle or use flammable liquids, gases, or toxic materials in the safe handling and use of these materials and ensure they follow the specific requirements contained in Parts B-1: occupational health and environmental control, B-2: hazard communication, D: fire protection and prevention, and other applicable parts of this standard. See [WAC 296-155-100\(4\)\(a\)](#)

RECOMMENDATIONS

FACE investigators concluded, that to help prevent similar occurrences, employers should:

- Develop their APP to include a written [chemical hazard communication program](#). The program should require container warning labels, obtaining current SDS sheets and making them available, supplementing exposure controls with personal protective equipment (PPE), and providing training.
- Conduct a pre-work site hazard analysis to identify chemical hazards and explosion risks, monitor for worker exposures, and prepare emergency response plans for uncontrolled releases and fires.

RESOURCES

[Chemical Safety Basics](#) – Washington State Dept. of Labor & Industries



Open bucket of
adhesive in building.



CONSTRUCTION FATALITY NARRATIVE

INCIDENT FACTS

REPORT #:
71-260-2024

REPORT DATE:
November 1, 2024

INCIDENT DATE:
April 27, 2023

WORKER:
60 years old

INDUSTRY:
Oil and Gas Pipeline and
Related Structures
Construction

OCCUPATION:
Construction Welder

SCENE:
Storage tank construction site

EVENT TYPE:
Fall from elevation



Hole in roof where welder fell.

For a slideshow version,
[click here.](#)



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Welder Fell 32 Feet from Storage Tank Roof

SUMMARY

A 60-year-old welder fell 32 feet while constructing the leading edge of a storage tank roof. His employer was an aboveground storage tank manufacturer. He had over 40 years of job experience.

He was with three other workers constructing the leading edge with sheets of metal sheathing. The roof was 76-feet wide by 34.5-feet high, with a 1 in 12 pitch. He was acting as a "spotter" for a crane operator who was hoisting the sheets to cover a 16-foot hole remaining on the roof. After unloading the sheets, he needed to tack weld one near the center peak of the roof. He stepped from the leading edge to a rafter over part of the hole. He then sat down on the rafter and extended his legs two and a half feet across the hole to another rafter.

While sitting on the rafter, he used a pry bar to bend and move the sheet into place for welding. As he pried, he fell backward through the hole between the rafter and leading edge. After landing on the ground, he was badly hurt but still conscious and breathing. Emergency responders arrived and had a critical care helicopter airlift him to the hospital. He died the next day.

Following the incident, investigators found:

- The welder and his co-workers had tied off while riding a boom lift to the roof, but their supervisor allowed them to remove their personal fall arrest system (PFAS) harnesses on the roof.
- The workers and their supervisor discussed the fall hazards and the general contractor's fall protection expectations on the roof, but they chose not to use PFAS believing that lifelines would create a tripping hazard.
- The employer lacked a fall protection work plan (FPWP) and did not know about state requirements to have one. The supervisor only told the workers not to walk out on the rafters. The project manager also never conducted any safety inspections at the jobsite.

REQUIREMENTS

Employers must:

- Ensure that a fall protection system is provided, installed, and implemented in accordance with [WAC 296-880-400](#) Fall protection system specifications when employees are exposed to fall hazards of six feet or more to the ground while constructing a leading edge. See [WAC 296-880-30005\(1\)\(b\)](#)
- Develop and implement a written FPWP including each area of the work place where the employees are assigned and where fall hazards of ten feet or more exist. See [WAC 296-880-10020](#)
- Conduct, document, and maintain records of pre-work walk-around safety inspections until the completion of the job. See [WAC 296-155-110\(9\)\(b\)](#)

RECOMMENDATIONS

FACE investigators concluded, that to help prevent similar occurrences employers, should:

- Use a crane instead of workers to move sheathing near roof leading edges.
- Develop FPWP and PFAS policies in their accident prevention program (APP). Policies should require pre-planning the use, training, and inspection of site-specific fall protection.
- Have supervisors review fall protection requirements with workers at pre-job crew meetings, routinely check that they are following them, and implement corrective action when needed.
- Demonstrate fall prevention leadership by prioritizing fall prevention at pre-job crew meetings, monthly safety meetings, annual stand-downs, and in company newsletters and social media.

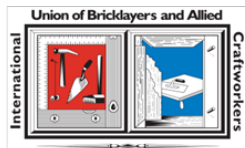
RESOURCES

[Fall Prevention Overview, Policies, Training](#) – Washington State Dept. of Labor & Industries

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<https://www.cdc.gov/niosh/face/about/index.html>

Interactions with Many Construction Partners



Pandemic Response



OSHA Construction Alliance Roundtable



IPAs with 3+ universities



CPWR r2p Workgroup

CPWR Technical Advisory Board



Hearing Loss Cross-sector

NIOSH FACE program



NIOSH Substance Use and Work Coordination Team

National Science Foundation



NPPTL



OSHA Advisory Cmte for Construction Safety and Health



Construction Activities We Want to Continue



- Interactions with external partners **
 - OSHA ACCSH and Alliance
 - NORA Sector Council meetings **
 - NIOSH leadership for Falls and Struck-by Stand-downs **
 - NORA Construction Workgroups (Falls and Struck-by) **
 - NABTU meetings/interaction
- Construction falls video and infographic development
- Prevention through Design
- Mental Health/Suicides/Overdose Activities
- MSD comms product collaborations
- Other activities including Science Blogs development on topics of interest such as heat, HPD fit, and auto-flagger struck-by

*** Emphasis is NORA - working with persons external to NIOSH*

Potential New Collaborative Efforts



- Injuries and Fatalities involving motor vehicles
 - Struck-by incidents and emergency response personnel
 - Transportation in general (Center for Motor Vehicle Safety)
- Expansion of Prevention through Design (PtD) in the construction sector
- Construction Fatality Investigations in collaboration with FACE program
- Increasing participation with National groups interested in construction OSH
 - NSF panel and report on Construction engineering research
 - Presentation to Construction Safety Research Center on NIOSH research

Thank you!



Donald R. Peterson, biu7@cdc.gov



For more information, contact CDC

1-800-CDC-INFO (232-4636)

TTY: 1-888-232-6348 <https://www.cdc.gov/> | <https://www.cdc.gov/niosh>

Follow us on social @CDCgov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U. S. Centers for Disease Control and Prevention or the National Institute for Occupational Safety and Health.



Research Project Updates: Using Industry Data to Advance Safety and Health

Moderator: Christina Socias-Morales, DrPH, Research Epidemiologist, NIOSH
Division of Safety Research

Construction Industry Data and Statistical Core
Amber Trueblood, DrPH, CPWR Data Center Director

Understanding the Effectiveness of OSHA Construction Consultations in Reducing Serious Hazards

Wayne B. Gray, Ph.D., Emeritus Professor, Clark University
John Mendeloff, Ph.D., Emeritus Professor, University of Pittsburgh

Advancing Heat Safety in Construction
Gavin West, MPH, CPWR Health Research Director

Using Industry Data to Advance Safety and Health

CPWR's Data Center Update

r2p Seminar 2026

June 9, 2026

Amber B. Trueblood, DrPH

atrueblood@cpwr.com

datacenter@cpwr.com

Special thanks to:

- William Harris, M.S.
and Derek Dufoe, M.S.
CPWR Research Analyst
- CPWR's r2p and
communication teams



THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Poll Questions (to come later)

<https://app.sli.do/event/5iwUNbxzPmfA2RxxdtKS1e>

Or Join at
slido.com
#2709 772





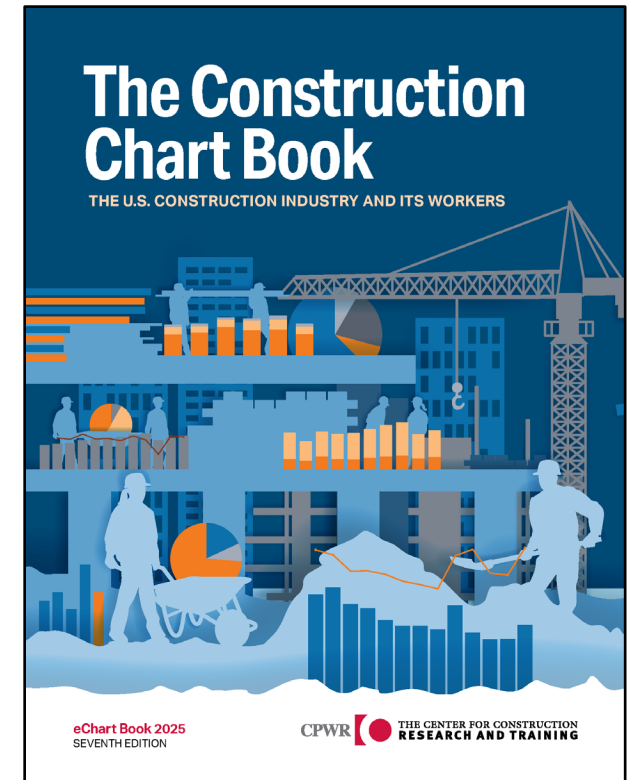
Using Data

Recent Publications

Available at:

www.cpwr.com/research/data-center/

- Construction Chart Book
 - PDF
 - Interactive Dashboards
- Data Bulletins
 - Construction Injury Trends by Major Subsector
 - Small Establishments in Construction
 - Transportation Injuries in the Construction Industry
 - Occupational Exposures in Construction
 - Medical Expenditures in Construction, 2021-2022
 - Heat Injuries and Illnesses among Construction Workers



Workshop Series: Getting the Most Out of CPWR's Data Resources

#1: Using the Chart Book and Accompanying Data Dashboards to Support Intervention and Prevention Efforts

#2: Using the Chart Book & Accompanying Data Dashboards to Support Research

#3: Addressing Data Center FAQs

Recordings available at:

<https://www.cpwr.com/news-and-events/informational-webinar-series/>

2025 Safety Management Survey

Since 2012, CPWR has partnered with the Dodge Construction Network to survey safety management among construction firms. The surveys have kept many questions consistent, allowing for comparisons over time, and topics have been added as they have emerged, including COVID-19, PPE, heat exposure, and mental health and substance use.

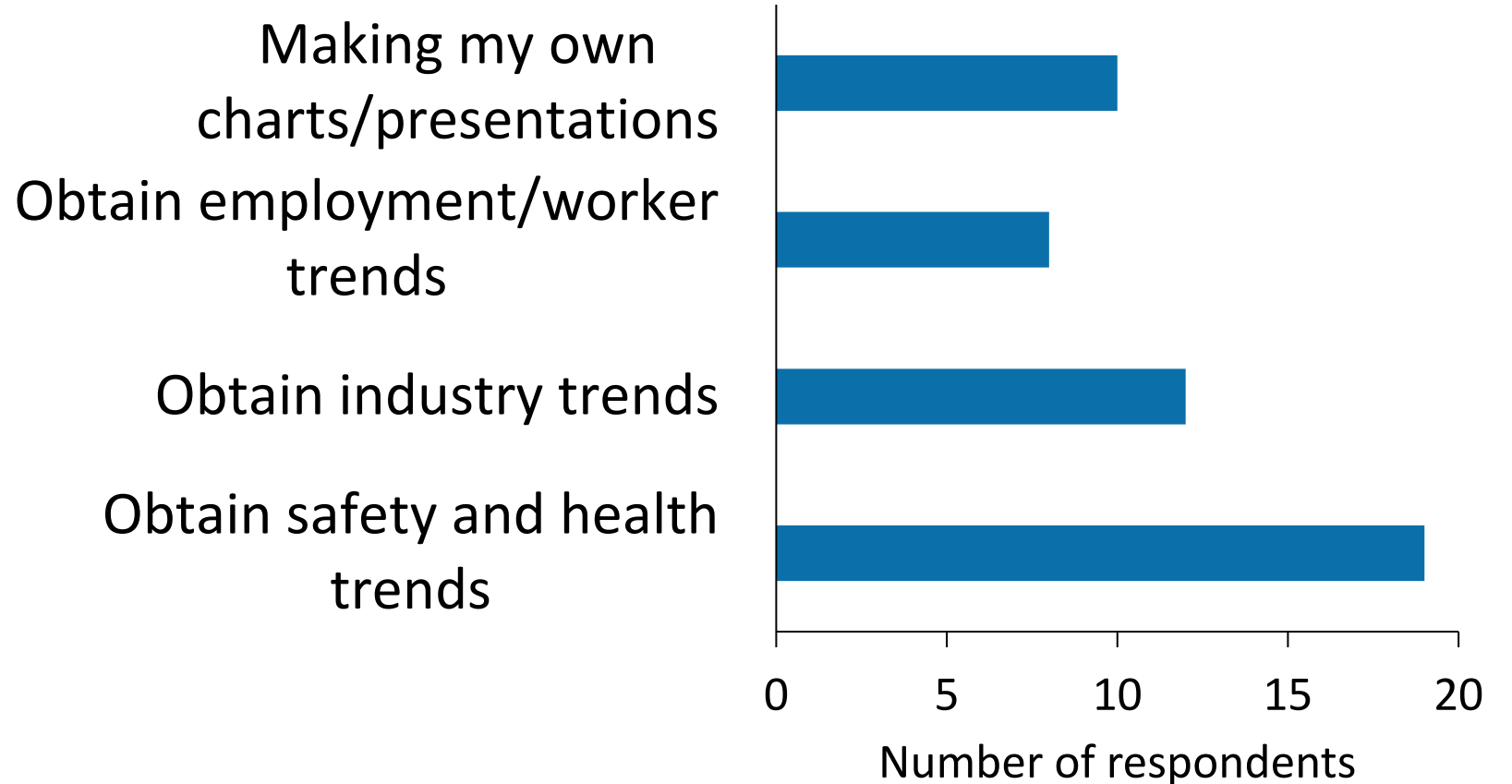


Available at: <https://www.cpwr.com/research/data-center/safety-management-in-the-construction-industry-surveys/>

Evaluation

- Survey
- Interviews

Why do you use CPWR Data Center products?



Poll Questions

<https://app.sli.do/event/5iwUNbxzPmfA2RxxdtKS1e>

Or Join at
slido.com
#2709 772





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RESEARCH AND TRAINING

Special thanks to:

- William Harris, M.S. and Derek Dufoe, M.S. CPWR Research Analyst
- CPWR's r2p and communication teams

Contact us at:

datacenter@cpwr.com



Understanding the Effectiveness of OSHA Construction Consultations in Reducing Serious Hazards

Wayne Gray

Professor Emeritus of Economics, Clark University

John Mendeloff

Professor Emeritus of Public Affairs, University of Pittsburgh

2026 CPWR R2P Seminar & Partnership Workshop

June 9, 2026



How have our research questions evolved?

- 1. We observed large variations in state construction fatality rates
- What could explain such large variations in fatality rates?
- Statistical analysis showed a relationship with state's consultation visit rate (along with a variety of other factors)
- 2. We then explored the state consultation programs in more detail
- In what ways do states differ in their consultation programs?
- What factors are driving those differences across states?
- How might those differences affect workplace hazards?
- 3. We're now doing a deeper dive using statistical analyses
- Test wider range of hazard measures – fatalities, injuries, OSHA violations
- Consider different visit characteristics
- Examine causal link from consultations to workplace hazard reductions



1. What explains the large variation in construction fatality rates across states?

- Statistical analysis – explain annual state construction fatality rates 1992-2016
- We focused on state-level public policies:
 - Workers Compensation: small-firm exemptions, long waiting periods
 - OSHA: enforcement inspection rate, average penalty per inspection
 - OSHA: state consultation visit rate
- Controlled for many other factors that might matter:
 - Industry composition: % heavy construction, unionization
 - Construction workforce composition: age, experience, education
 - State attitudes towards risk: seatbelt use



What explains the large variation in construction fatality rates across states?

- Statistical analysis – explain annual state construction fatality rates 1992-2016
- We focused on state-level public policies:
 - Workers Compensation: small-firm exemptions(+), long waiting periods(+)
 - OSHA: enforcement inspection rate(-), average penalty per inspection(0)
 - OSHA: state consultation visit rate (-) = more visits, fewer fatalities
- Controlled for many other factors that might matter:
 - Industry composition: % heavy construction(+), unionization(+)
 - Construction workforce composition: age(+), experience(-), education(-)
 - State attitudes towards risk: seatbelt use(-)
- Statistically significant results highlighted in yellow
- Correlation, not proof of causation, but motivated additional study
- Wayne Gray and John Mendeloff, “Preventing Construction Deaths—The Role of Public Policies”, *Regulation and Governance*, vol 17(3), July 2023, p. 726-754.
<https://doi.org/10.1111/rego.12486>.



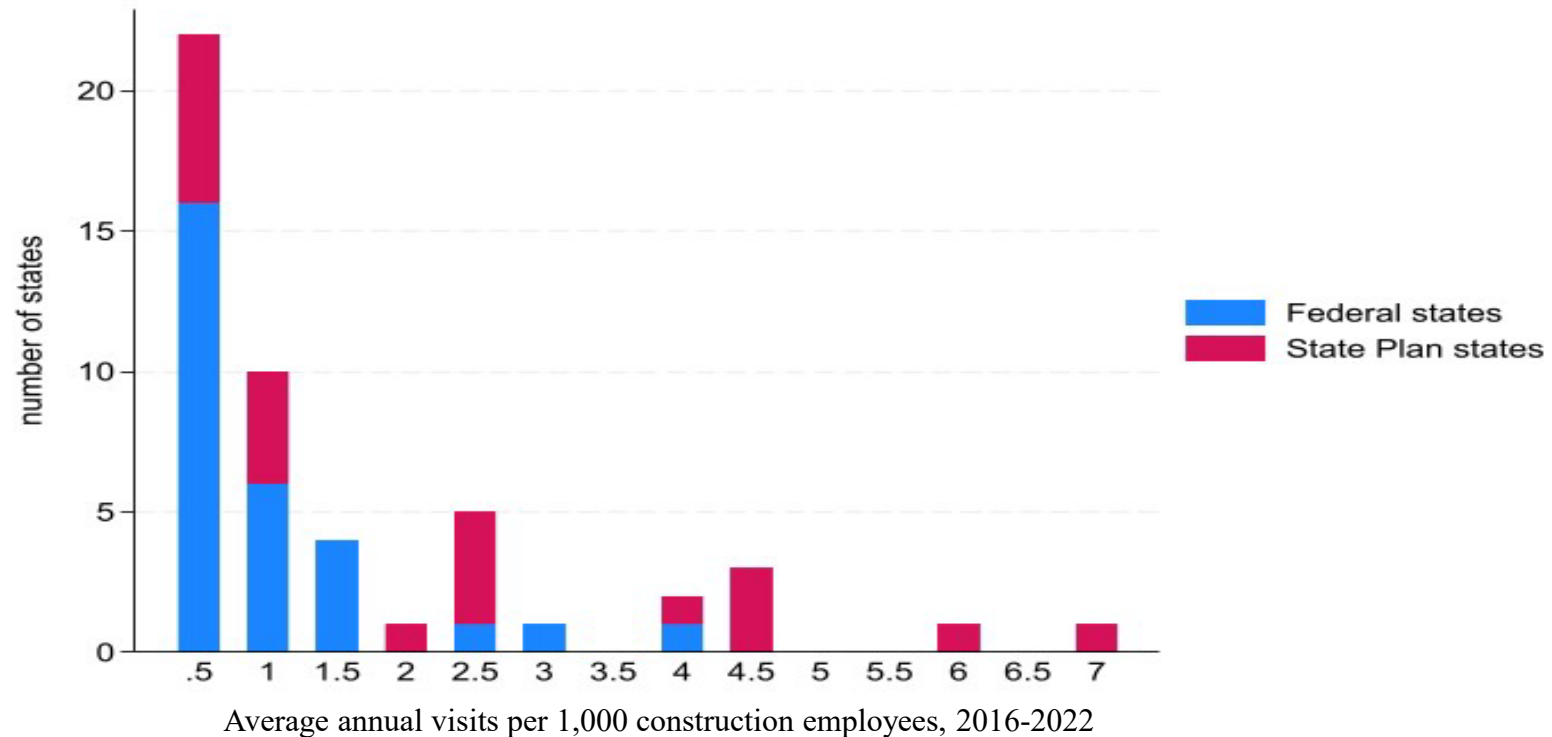
2. What varies across the 50 State OSHA Consultation Programs?

- 1. Examined OSHA's OIS database on consultations during 2016-2022
 - Focus on consultations in construction sector
 - Variations across states in numbers of consultations and % in construction
 - Variations in many characteristics of consultation visits
- 2. Interviewed 31 states' Consultation Program Managers
 - (All 21 state-plan states plus 10 federal OSHA states)
 - Details of program activities and visit characteristics
 - Connected their responses to their state's characteristics in the OIS data
- Report - https://www.cpwr.com/wp-content/uploads/SS2024-States_OSHA_Construction_Consultation_Programs.pdf
- Key Findings - https://www.cpwr.com/wp-content/uploads/KF2024-states_construction_consultation_programs.pdf

Consultation Visit Rates in Construction

Big Differences in State Plan and Federal states

- State Plan states averaged higher construction consultation rates than Federal states and also showed more variation across states.



- 21 State Plan states did nearly 3/4 of all visits in construction
- (especially large numbers in CA, MN, NC, SC, WA)

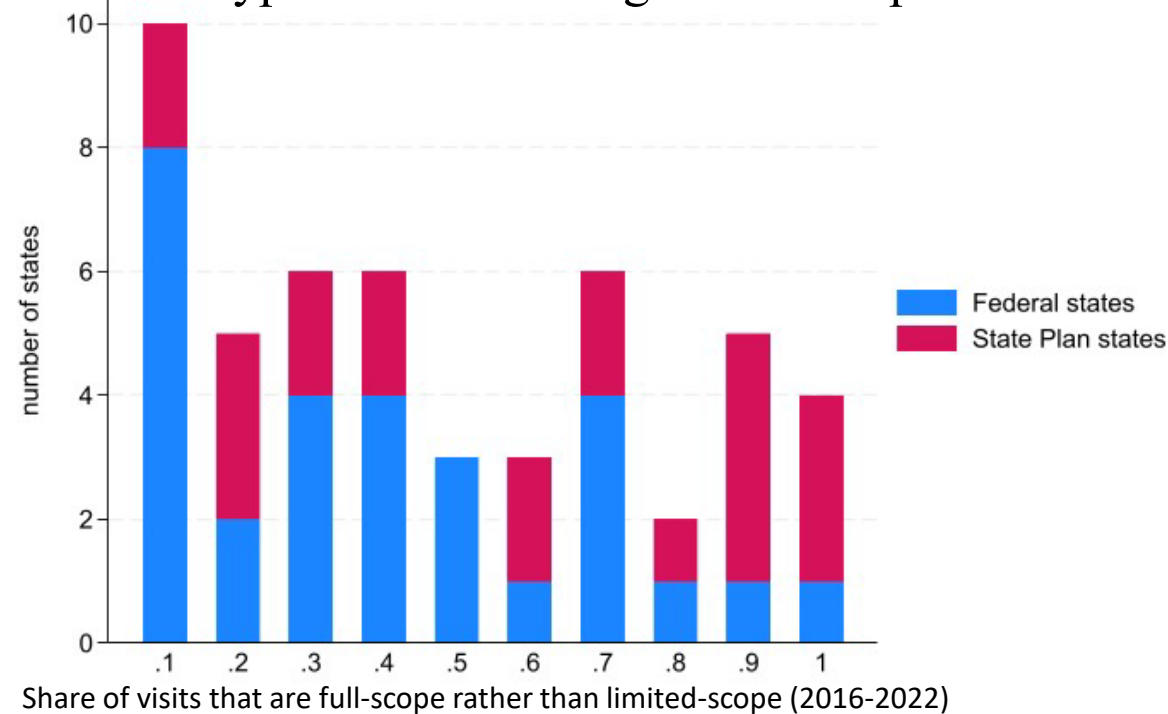


Why higher construction sector visit rates in State Plan states vs Federal states?

- Puzzle - 1970s State Plan decision was about enforcement, not consultations
- State Plan states contribute more financially than Federal states – why?
 - Different funding mechanisms – from WC premiums rather than general state budget?
 - Political support for more safety enforcement = more support for consultations?
 - Programs run by state agencies rather than housed in universities?
- State Plan states focus more on the construction sector - why?
 - Coincidence – bigger construction sector in SP states? (not much - 5.4% vs 5.0%)
 - Bigger budget enables hiring consultants who specialize in construction?
- Consultation visits are voluntary – why more requests in State Plan states?
 - Lower enforcement penalties lead firms to greater trust in OSH programs?
 - Bigger budgets enable more outreach efforts, generating more requests?

Visit characteristics vary across states: Visit scope (how much of worksite is covered)

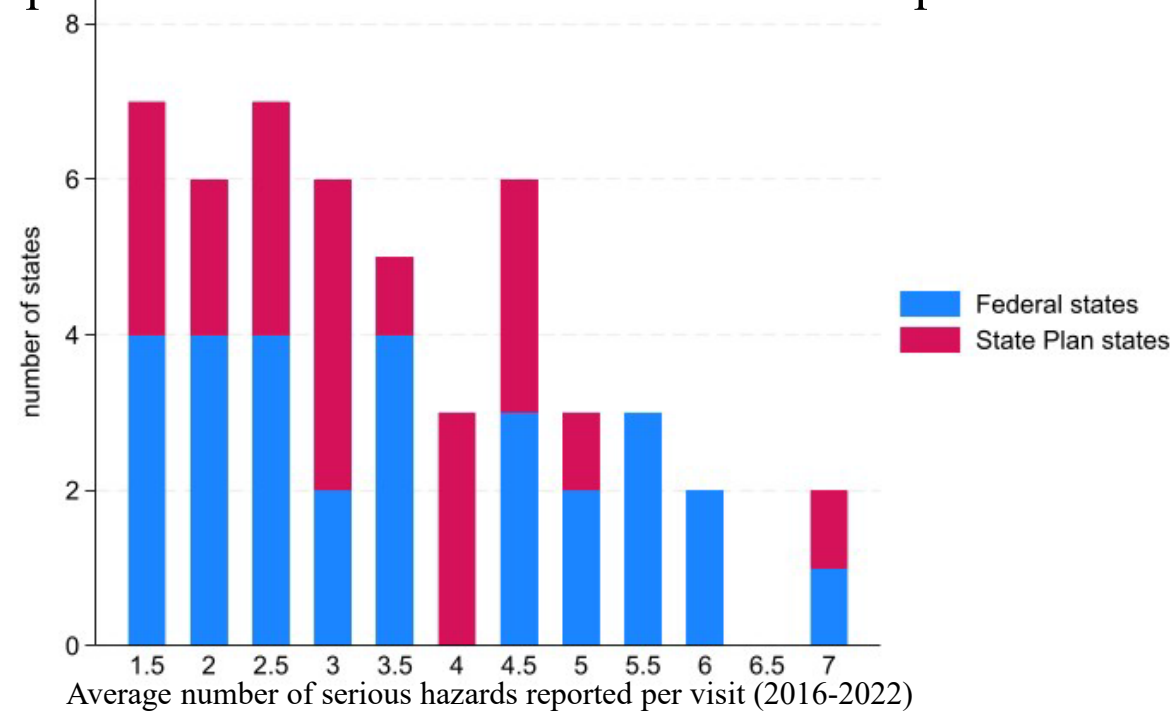
- States differ in their typical visit coverage – full-scope or limited in coverage.



- State Plan states do somewhat more full-scope visits (less clear difference).

Visit characteristics vary across states: Serious Hazards reported per visit

- States report different numbers of serious hazards per visit.



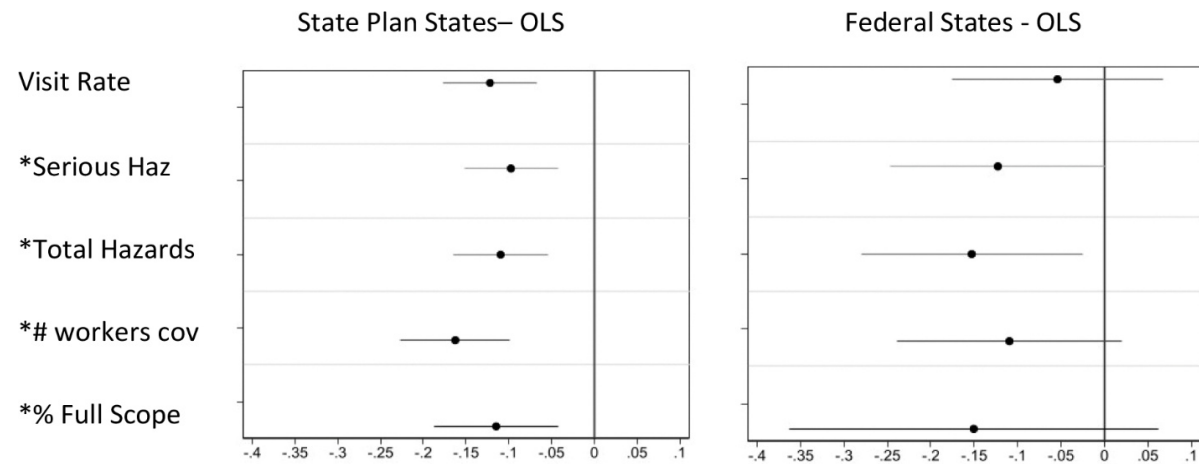
- State Plan states report fewer serious hazards per visit than Federal states
 - Ambiguity – less thorough visits or less hazardous worksites?



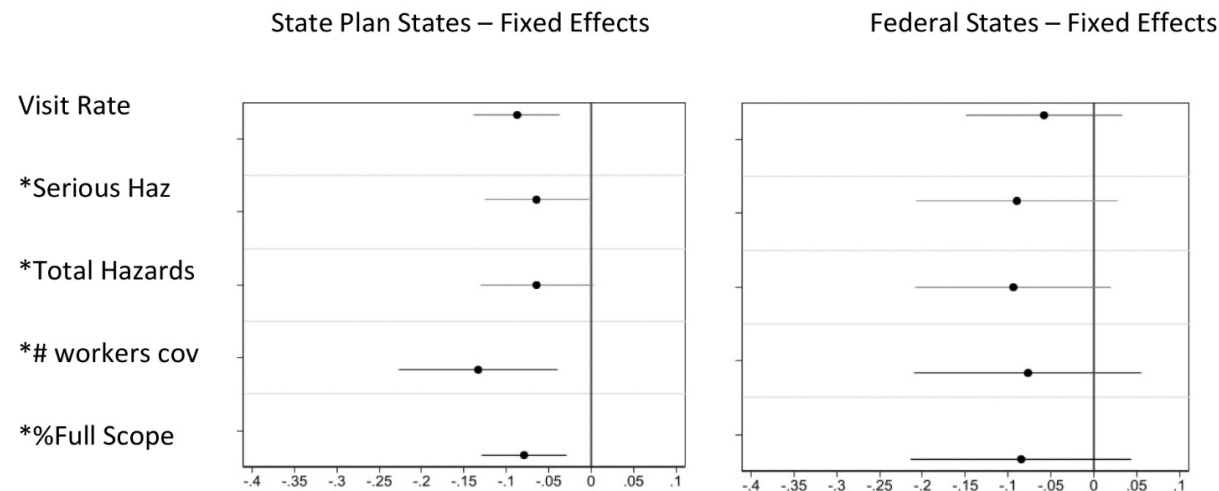
3. Do visit characteristics matter for the impact of visits on fatality rates?

- Statistical analysis on annual state construction fatality rates 1992-2016
 - Similar explanatory factors as used in earlier analysis
 - Allows for State Plan vs Federal state differences in impact
- Calculated average visit characteristics by state (2016-2022)
 - Serious hazards, total hazards cited per visit
 - % Full Coverage visits, average employees covered per visit
 - State visit characteristic * annual consultation visit rates (1992-2016)
- Results showed lower fatality rate where consultation visit rate is higher
 - Also lower fatality rate where visit rate*characteristic is higher
 - Results in State Plan states - more statistical significance, similar magnitude
- Wayne Gray and John Mendeloff, “Do Variations in State Consultation Programs Affect Construction Fatality Rates?”, American Journal of Industrial Medicine, 69(3), March 2026, 163-176 <https://doi.org/10.1002/ajim.70050>.

Impact on State Construction Fatality Rate



Higher visit rate
and/or
Higher value of
characteristic
=
Lower construction
fatality rate



Visit rate
* Average serious hazards/visit
* Avg. total hazards/visit
* # Workers covered/visit
* % of visits that are Full-scope

Impact of 1 s.d. change in terms of s.d. of fatality rate – i.e. coefficient of -0.1 means 1 s.d. higher visit rate = 0.1 s.d. lower construction fatality rate in state.



(Preliminary) results – individual firms and visits Impact on OSHA inspection violations and penalties

Need to link visits to outcomes over time – gets complicated

- Multiple firms at worksite – only see firm(s) that requested a visit
- Construction worksites are temporary - we focus on firm-level outcomes
- Injury data are annual injury rates for firm, not worksite-specific injuries
- Connect data using firm name, mailing address - not worksite street address

We linked data for each firm over 2016-2024 time period – annual data

- Consultation visit at worksite, requested by specific firm
- OSHA enforcement inspections at that firm – violations and penalties assessed
- Firms with inspections both before + after their consultation visit (3-yr window)
- Significantly fewer violations and penalties on inspections after the consultation visit relative to inspections before the visit
- (only considers firms that received a consultation visit)



(Preliminary) results – individual firms and visits

Impact on annual firm injury rates

We linked data for each firm over 2016-2024 time period – annual data

- Consultation visits, including characteristics of the visit
 - Total hazards, serious hazards, full scope, number of workers covered
- OSHA Injury Tracking Application (ITA) – annual DART rate reported by firm
- Includes firms not getting visits or inspections
- Significantly bigger declines in annual injury rates in years after getting a consultation visit, compared to firms that didn't get a consultation visit
- Controlling for having had a visit, the characteristics of the visit (e.g. number of hazards, Full vs Limited) didn't show a significant additional impact

How should we interpret these firm-level results?

1. Visit identifies hazards, firm fixes hazards, fewer hazards in later years
2. Firm requesting consultation is “getting serious” about reducing hazards
 - Hazard reduction due to change in firm's motivation at time of request
3. High injury rate year motivates firm to request visit – injury rate declines naturally



Conclusions

- There are differences across states in consultation visit rates and characteristics
 - Some differences are related to State Plan vs Federal (enforcement) distinction
 - Higher state consultation visit rates are associated with lower fatality rates
 - Preliminary evidence of firm-level responses to consultation visits
 - (suggestive, not definitive, given voluntary nature of consultation requests)
-
- Next steps – additional firm data at Census Bureau
 - More sophisticated statistical analysis – testing for causal connection

Thank you for listening – we’d appreciate your feedback:

- Wayne Gray – wgray@clarku.edu, 508-793-7693
- John Mendeloff – jmen@pitt.edu, 412-225-1026

Thanks to CPWR and NIOSH for funding (U54-OH012761)

Advancing Heat Safety in Construction

CPWR 2026 Research to Practice (r2p) Seminar and Partnership Workshop
June 9-10, 2026
Silver Spring, MD

Gavin H. West, MPH
Director, Health Research
CPWR – The Center for Construction Research and Training
301-495-8522
www.cpwr.com

Image credit:
U.S. Department of Agriculture

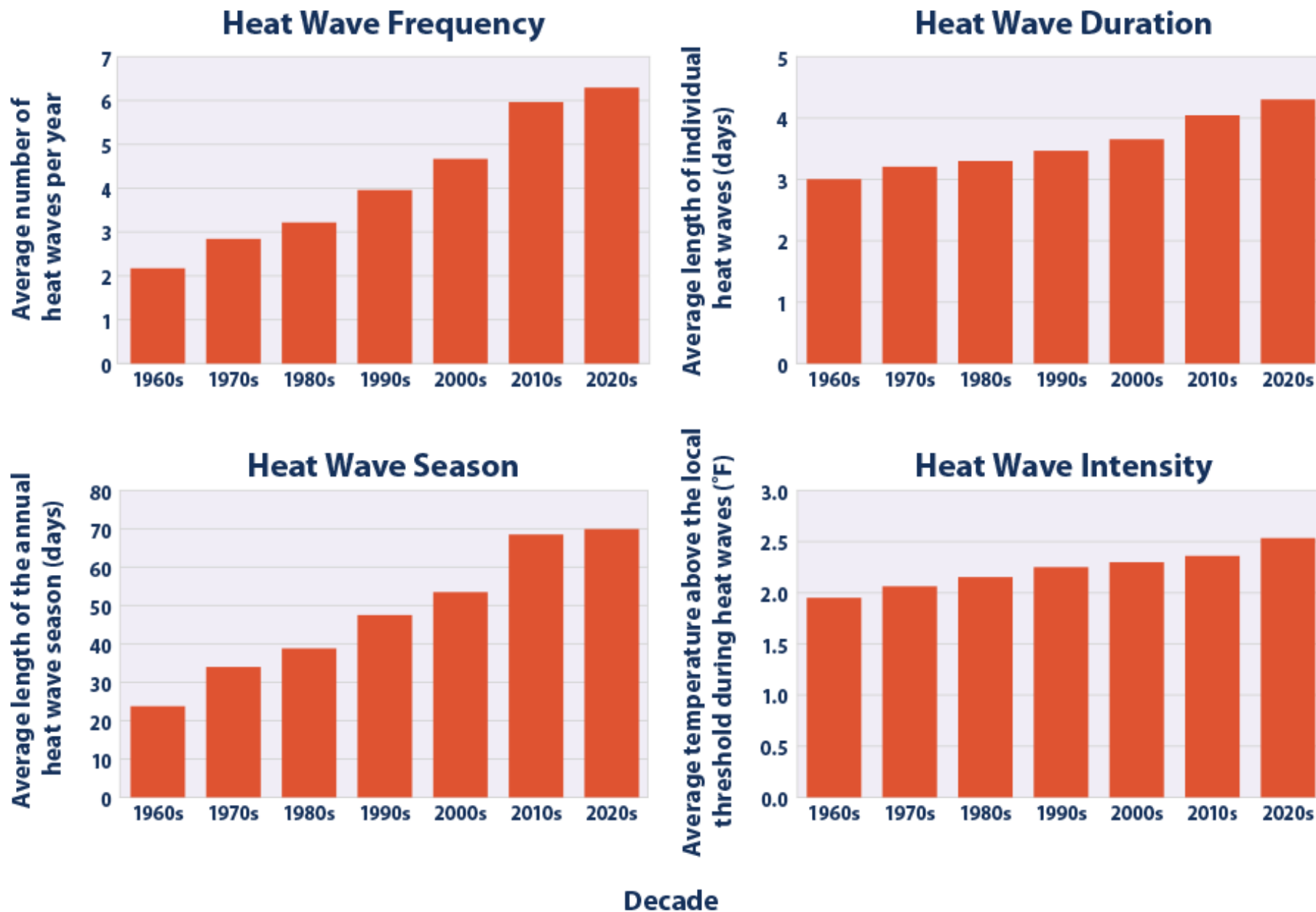


Today's talk
will cover two
broad topics
and questions

The bigger picture: Why
should we care about
heat stress?

CPWR research: What
are we doing to solve
the problem?

**Some hazards
can be banned
or eliminated,
but heat is
pervasive and
persistent**



Data Source: NOAA 2024.

For more info: <https://19january2025snapshot.epa.gov/climate-indicators/climate-change-indicators-heat-waves/index.html>



Key Messages for March Western U.S. Heat

Issued: Tue, Mar 17, 2026
12:35 PM PDT

Rare, widespread record-breaking temperatures expected into early next week

This year, part of the country experienced an unusual early spring heat wave

- **Unusual Early Spring Heat Wave**

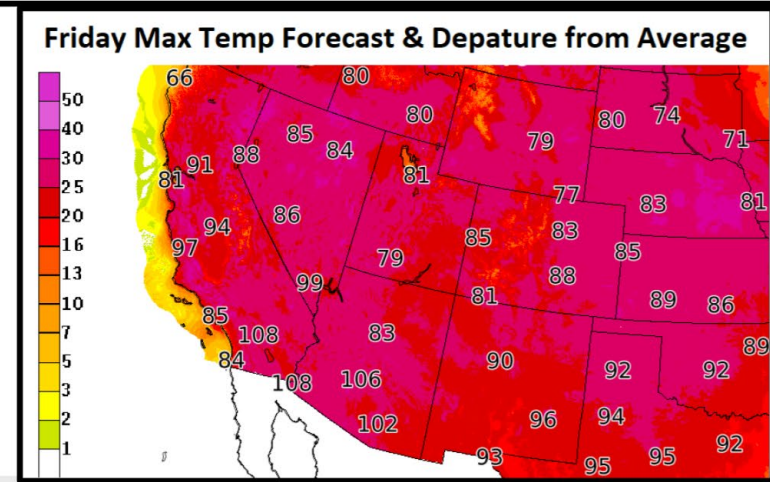
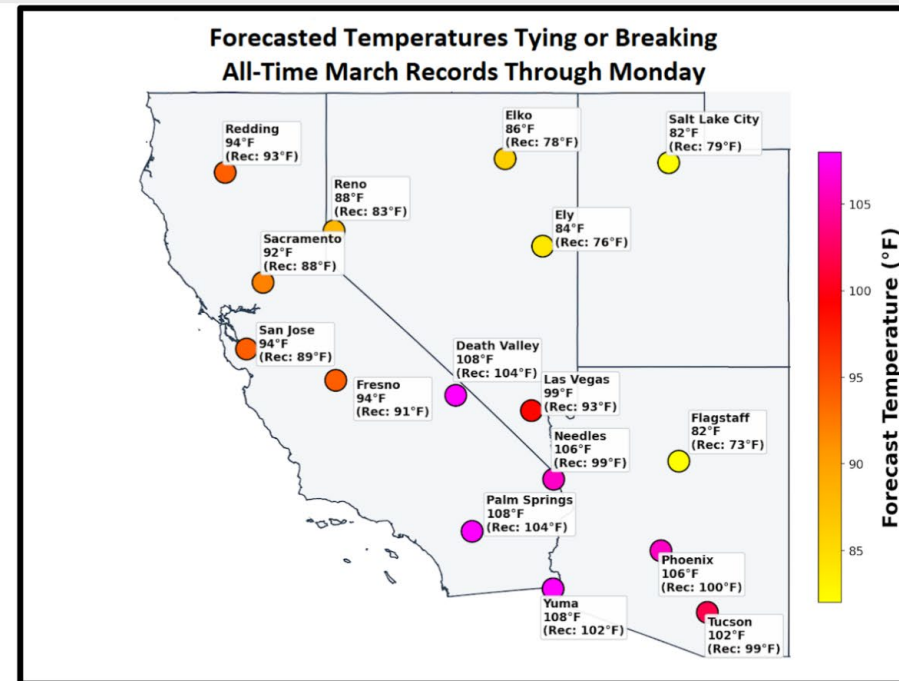
An unusual weather pattern will bring a prolonged period of much above-normal temperatures to the Southwest into early next week. Temperatures will be 20° to 30° above normal, with afternoon highs well into the 90s and 100s. Numerous daily temperature records are expected and many locations are likely to set both all-time high temperatures for the month of March and their earliest 100° temperature on record.

- **Increasing HeatRisk for Vulnerable Populations**

The early time of year, prolonged nature of this heat wave, and limited seasonal acclimation will increase the risk of heat impacts especially among sensitive populations.

- **Snowmelt/River Hazards**

Rapid snowmelt due to the hot air temperatures will cause river rises resulting in swift currents on nearby rivers. While air temperatures are warm, water temperatures remain dangerously cold. Anyone entering the water is at risk of cold water shock and hypothermia.



National Oceanic and
Atmospheric Administration
U.S. Department of Commerce

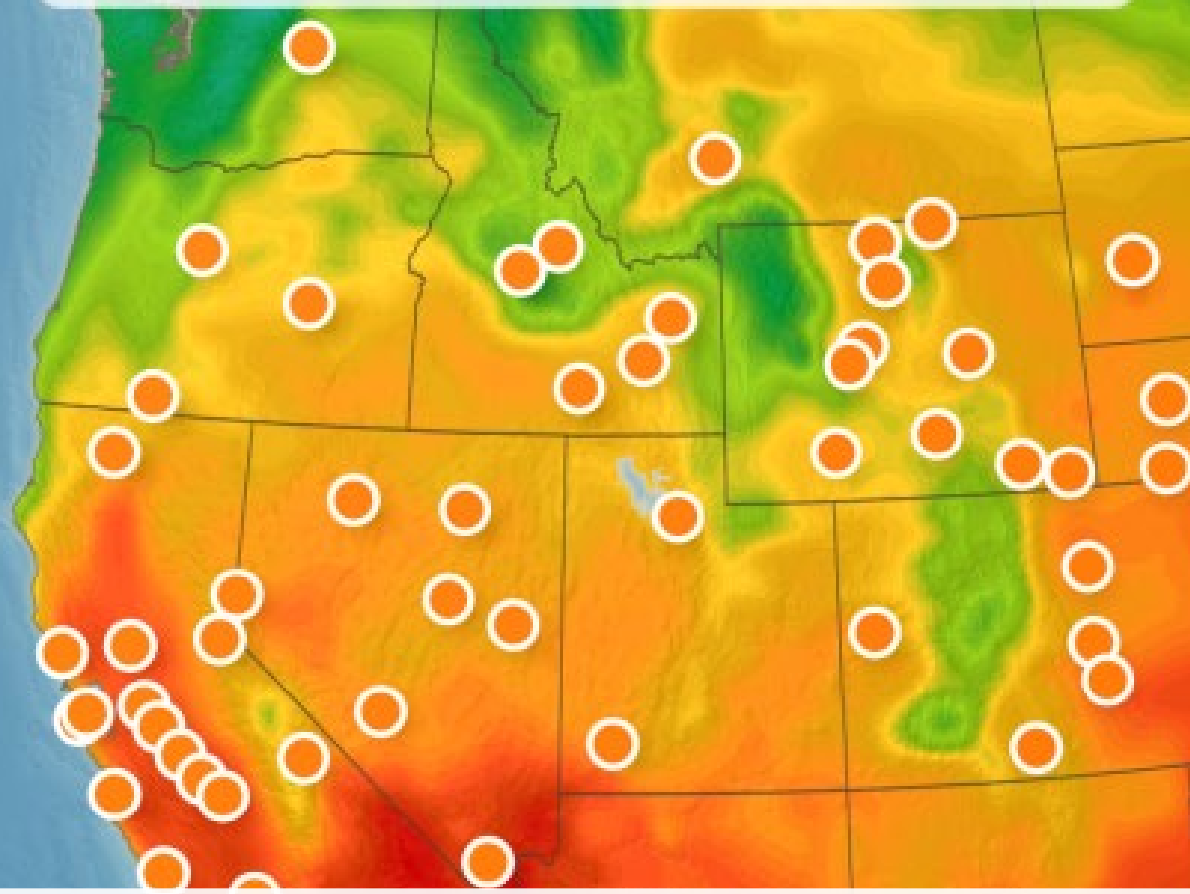
For more information go to:

www.wpc.noaa.gov and www.weather.gov

Weather Prediction Center
College Park, Maryland

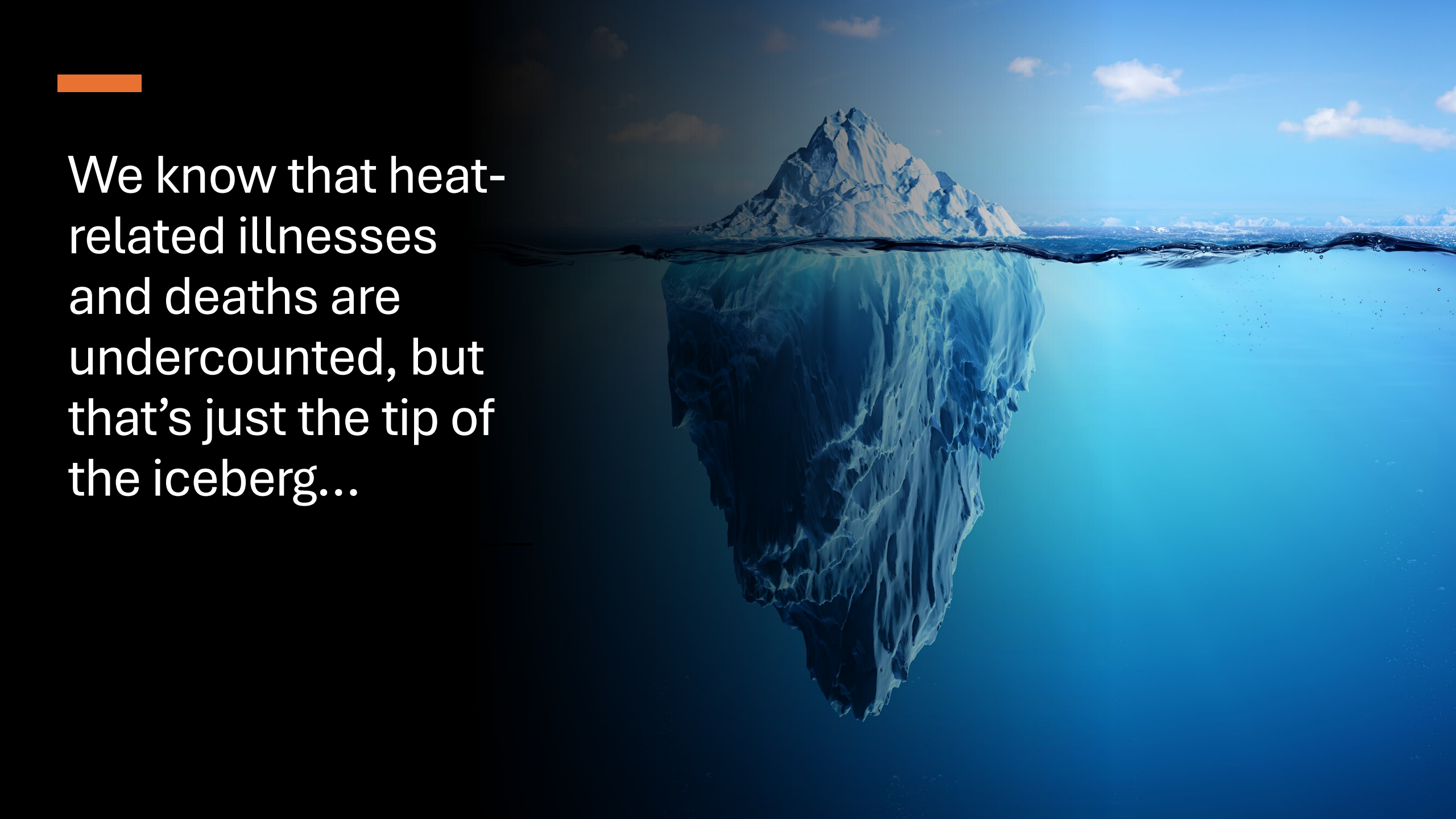
All-time March record highs tied or broken

Monday - Thursday



The hottest temperature ever recorded in the US in **March was 109 °F in Yuma, AZ on 3/21/26**

<https://edition.cnn.com/2026/03/20/weather/us-heat-record-march-climate>

A large iceberg floats in a blue ocean under a clear sky. The visible tip of the iceberg is small and jagged, while the much larger, submerged portion is hidden beneath the water's surface. This visual metaphor represents the concept of hidden or undercounted issues.

We know that heat-related illnesses and deaths are undercounted, but that's just the tip of the iceberg...

A woman in denim overalls and light green rubber boots is using a hoe to work the soil in a field. She is looking down at her work. In the background, another person is visible working in the field. The field has rows of young green plants. The sky is bright and clear.

Epidemiology studies show a link between occupational heat stress and chronic kidney disease

<https://time.com/6303020/chronic-kidney-disease-climate-change/>

Heat exposure increases core body temperature, sweat rate, and dehydration, leading to repeated subclinical acute kidney injury, a suspected pathway to chronic kidney disease progression

Gagnon et al (2025)

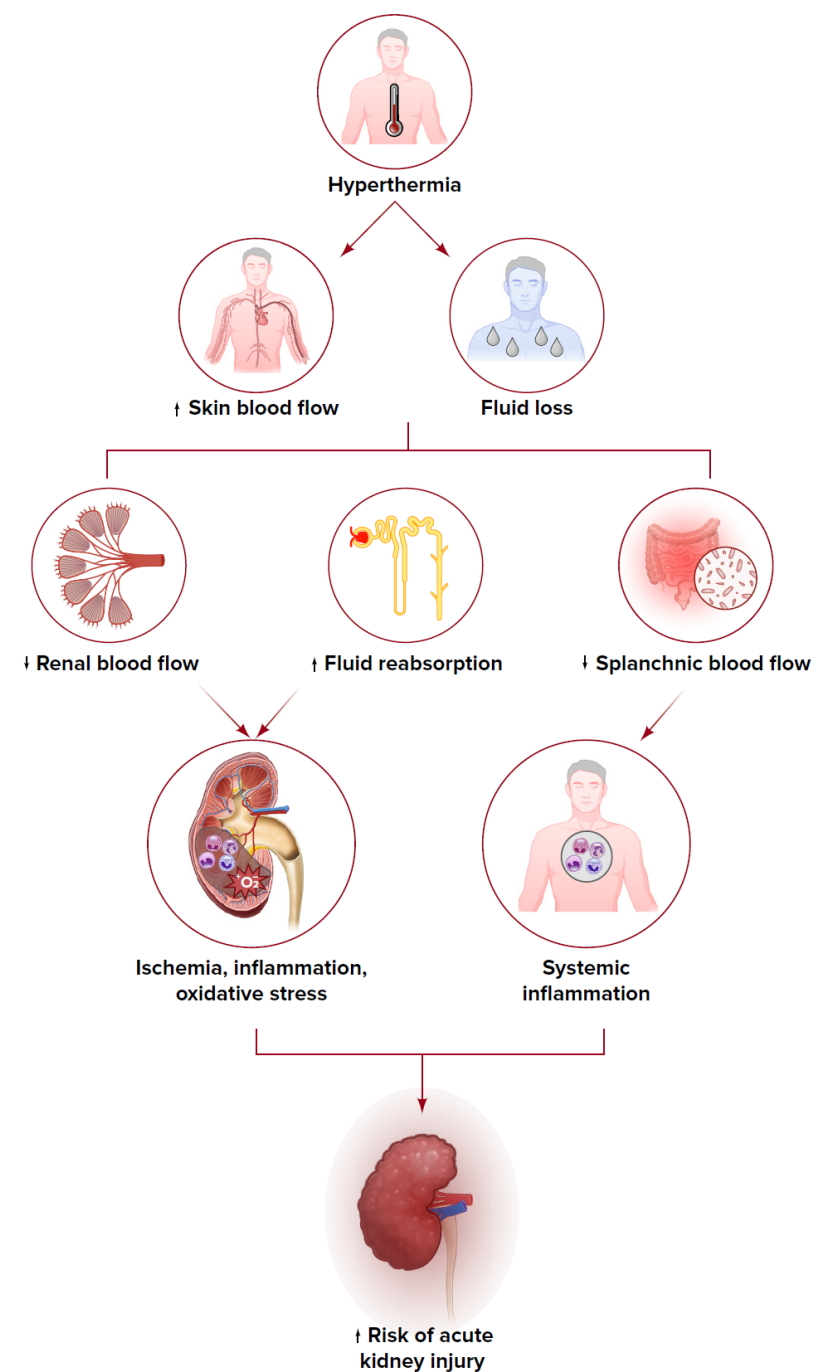
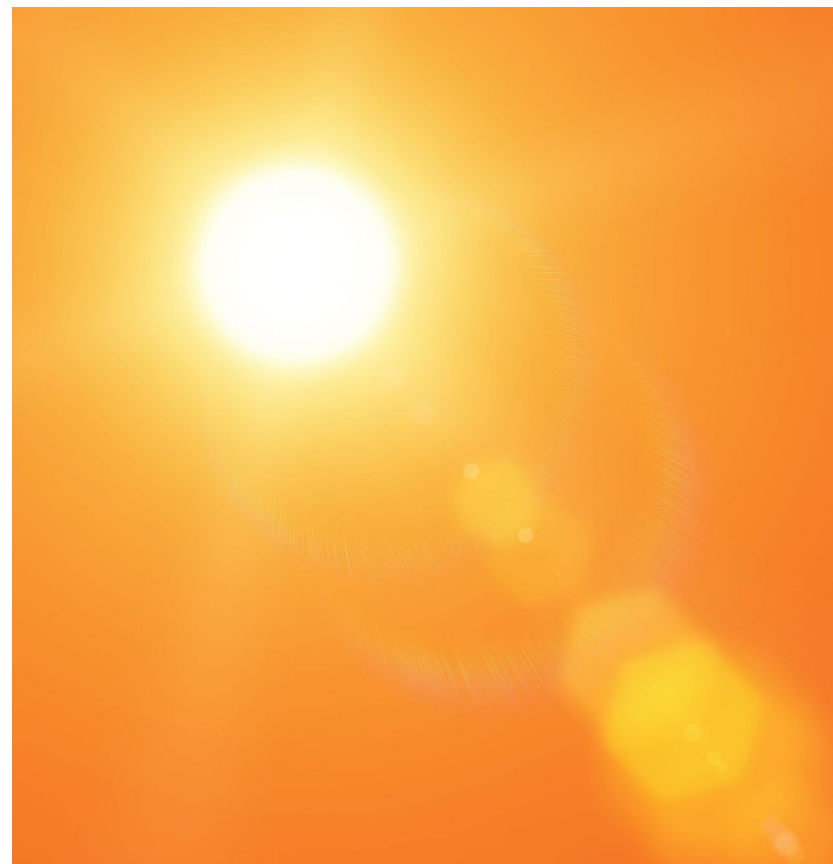


FIGURE 4. The pathophysiology of heat-related kidney risk

Research examining kidney health in relation to heat stress among US construction workers is minimal

- One-day pilot study in Florida ([Chicas et al 2025](#))
 - 58 construction workers surveyed and monitored pre- and post-shift
 - Mean heat index 88.4°F
 - Severe dehydration increased from 16% to 33%
 - 42% reported heat illness symptoms
 - Acute kidney injury observed in 38%



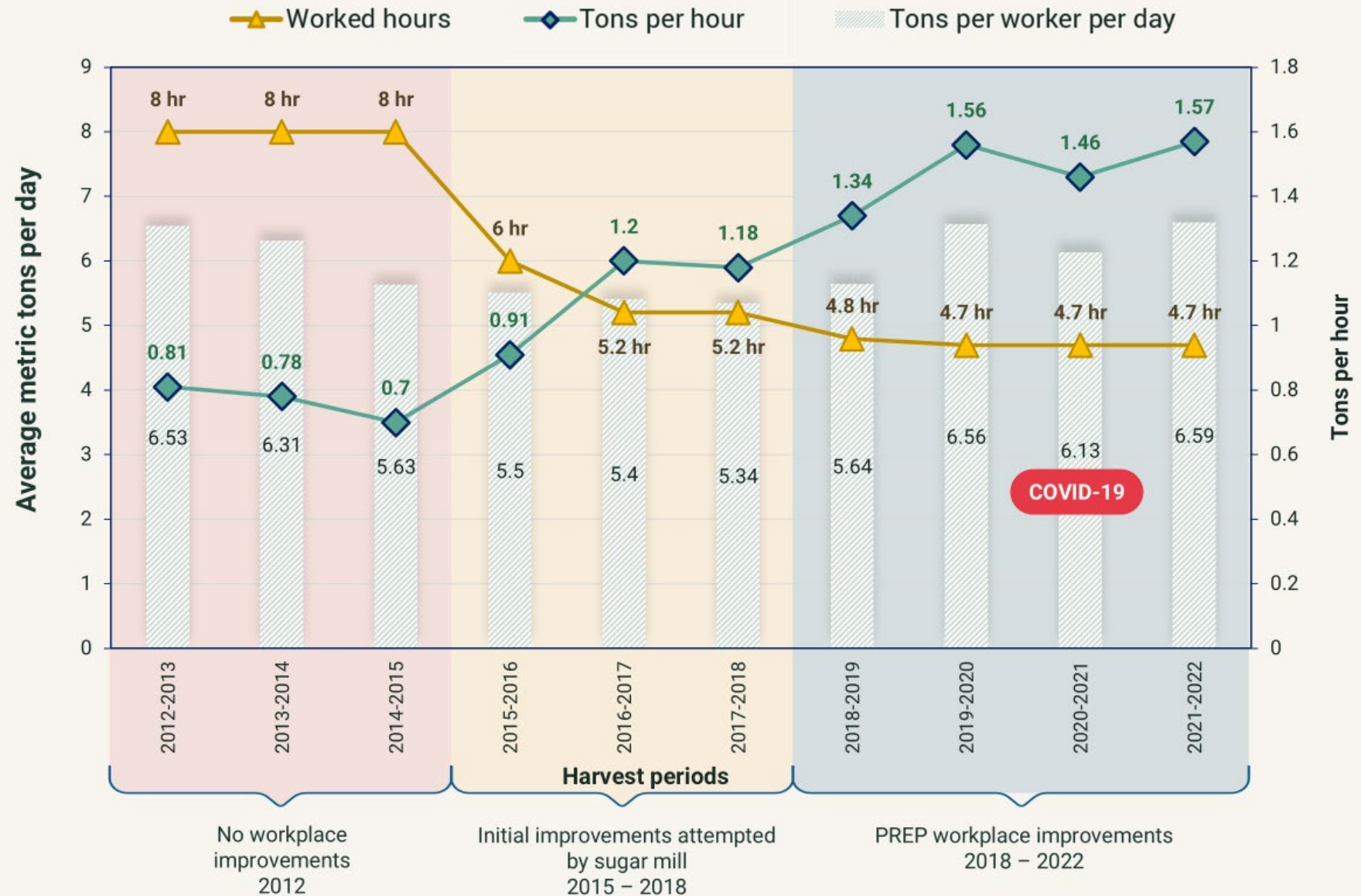
Sugar Farms in Nicaragua

Slide courtesy of Dr. Barrak Alahmad, Harvard University



Data driven interventions:

1. Rest (intervals throughout)
2. Shade
3. Water
4. Sanitation



Heat exposure can exacerbate or trigger a wide range of health conditions:

- ischemic heart disease
- cardiac dysrhythmias
- ischemic stroke
- asthma
- chronic obstructive pulmonary disease
- respiratory tract infections
- hyperglycemia
- kidney failure
- neuropsychiatric disorders (e.g., psychosis, suicides, homicides, anxiety, and depression),
- adverse birth outcomes



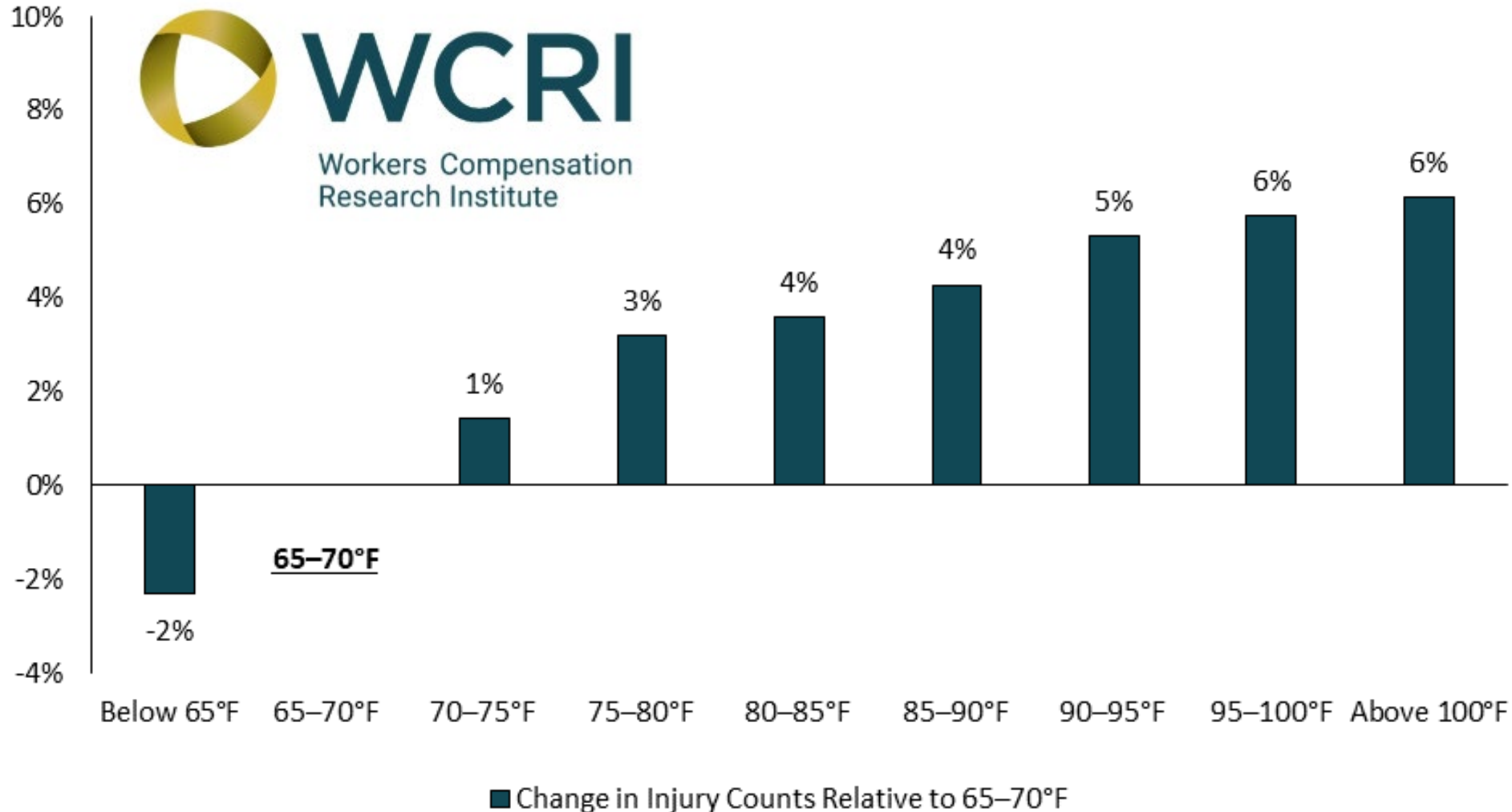
Sorensen C, Hess J.
Treatment and Prevention
of Heat-Related Illness.
N Engl J Med. 2022 Oct
13;387(15):1404-1413.

Even prior to the onset of heat illness, heat stress can increase the risk of injuries and work errors

- Cognitive Impairment
- Muscle fatigue
- Reduced endurance
- Loss of fine motor control
- Cardiovascular strain



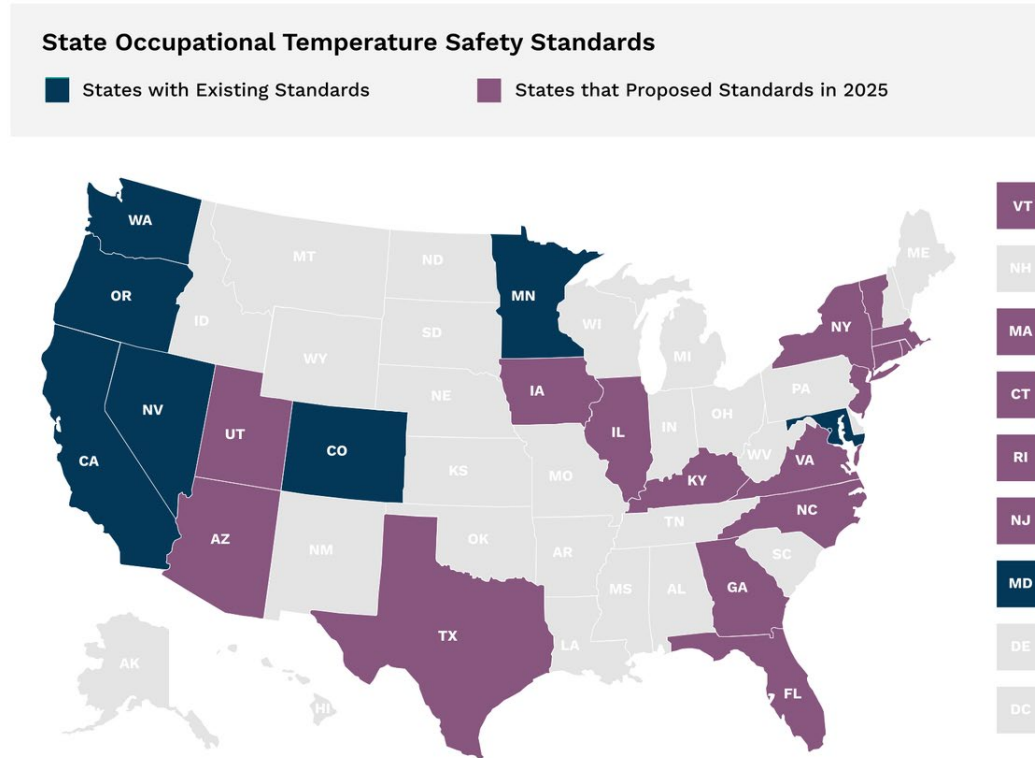
Workers' comp data from 24 states show that injuries go up when the temperature rises



This effect was even stronger in construction!

https://www.wcrinet.org/news/news_info/wcri-study-explores-excessive-heats-influence-on-workplace-injuries

This effect appears to be consistent across nearly all industry sectors and more pronounced in states without occupational heat standards



Source: MultiState. Data as of July 9, 2025. Note: Current Colorado regulations only apply standards to agricultural workers, but a bill was introduced in 2025 to apply temperature safety standards to all employers. Nevada introduced a bill in 2025 to codify its regulations with a few modifications.



- For Heat Index 110 F vs. 80 F, the odds of work injury increased:
 - 22% in states without heat standards
 - 9% in states with heat standards
- 28k injuries attributable to heat annually (likely an underestimate)



Research shows that hotter temperatures are associated with increased risk of:

- 1. Suicide**
- 2. Hospital admissions for mental illness**
- 3. Violent crime**



Studies published within the last few years show that heat stress and dehydration are associated with an **increased risk of new-onset chronic diseases, accelerated aging, and premature mortality**



Changes in DNA markers tied to aging have also been linked to chronic heat exposure.

HUMAN BODY'S AGEING 'CLOCK' TICKS FASTER AFTER HEAT STRESS

Preliminary study suggests link between long-term heat exposure and molecular markers of ageing.

By Heidi Ledford

Exposure to extreme heat events is linked to molecular changes that could reflect accelerated ageing, according to a preliminary analysis of DNA markers in more than 3,000 people.

The US-based work, presented at the Gerontological Society of America's Annual Scientific Meeting in Seattle, Washington,

in November, joins a host of efforts to understand the effects of rising temperatures on human health, as heatwaves strike around the world with increasing frequency.

Heat is known to strain the heart and kidneys and to slow cognition. But extreme heat could also have effects that are invisible – at first. “The physical toll might not immediately manifest as an observable health outcome, but rather could affect our body at the cellular and molecular

SCIENCE ADVANCES | RESEARCH ARTICLE

PUBLIC HEALTH

Ambient outdoor heat and accelerated epigenetic aging among older adults in the US

Eun Young Choi*, Jennifer A. Ailshire

nature reviews nephrology

Review article

<https://doi.org/10.1038/s4>

nature climate change

Article

Long-term impacts of heatwaves on accelerated ageing

Received: 14 January 2025

Accepted: 23 July 2025

Published online: 25 August 2025

Siyi Chen¹, Yufei Liu¹, Yuanyuan Yi¹, Yiling Zheng¹, Jun Yang², Tiantian Li³,
Ta-Chien Chan⁴, Rui Duan⁵, Shenjing He^{1,6} & Cui Guo^{1,6}✉

Long-term health outcomes associated with hydration status

Natalia I. Dmitrieva¹✉, Manfred Boehm¹, Paul H. Yancey² & Sofia Enhörning^{3,4}

Productivity losses due to heat stress cost the US economy an estimated \$98 billion annually



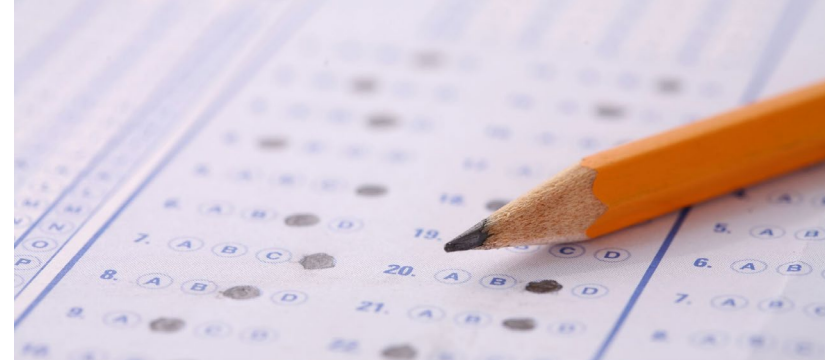
**CPWR research
seeks to better
understand the
impacts of heat
stress, as well as
risks and solutions
that are specific to
construction**

Primary Data Collection

- Site visits
- Interviews
- Surveys
- Document review

Secondary Data Analysis

- BLS
- OSHA
- CDC
- CPWR Fatality Map



We are actively enrolling study participants and distributing free prevention resources

Construction Workers and Contractors Help prevent heat-related deaths

Share your experiences and knowledge about working in the heat and make jobsites safer.

CPWR—The Center for Construction Research and Training is the country's leading nonprofit and dedicated to reducing injuries, illnesses, and fatalities in construction. We are conducting a research study to improve heat illness prevention and better protect construction workers.



Two ways you can help

- 1 Take a short survey and share the survey.

→ cpwr.com/heat-survey



- 2 Invite CPWR researchers to one of your worksites this summer so they can see the protections you've already developed.

→ If interested, contact Project Director, Gavin West at 301-495-8522 or gwest@cpwr.com.

CPWR already offers a number of **FREE** resources to keep workers safe on the job, such as:

- Daily Heat-Illness Prevention Checklist for Construction
- Hazard Alert Cards
- Infographics
- Overall Heat-Illness Prevention Program Checklist for Construction
- Toolbox Talks
- Training Materials

Many resources are in both English and Spanish. See them at: cpwr.com/heat, or scan the QR Code.



CPWR  THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Trabajadores y contratistas de la construcción Ayude a prevenir las muertes relacionadas con el calor

Comparta sus experiencias y conocimientos sobre el trabajo en condiciones de calor cómo hacer que los lugares de trabajo sean más seguros.

El Centro de Investigación y Capacitación en Construcción (Center for Construction Research and Training, CPWR) es la principal organización sin fines de lucro del país dedicada a reducir las lesiones, enfermedades y muertes en la construcción. Actualmente llevamos a cabo un estudio de investigación para mejorar la prevención de enfermedades causadas por el calor y proteger mejor a los trabajadores de la construcción.



Dos formas de ayudar

- 1 Responda una breve encuesta y compártala.

→ cpwr.com/encuesta-calor



- 2 Invite a los investigadores del CPWR a uno de sus lugares de trabajo este verano para que puedan ver las protecciones que ya ha desarrollado.

→ Si está interesado, póngase en contacto con el director del proyecto, Gavin West, en el 301-495-8522 or gwest@cpwr.com.

El CPWR ya ofrece una serie de recursos **GRATUITOS** para mantener la seguridad de los trabajadores en el trabajo, como:

- Lista de comprobación diaria para la prevención de enfermedades causadas por el calor en la construcción
- Tarjetas de alerta de riesgos
- Infografías
- Lista de comprobación general del programa de prevención de enfermedades causadas por el calor en la construcción
- Charlas informativas sobre seguridad
- Materiales de capacitación

Muchos recursos están tanto en inglés como en español. Puede verlos en: cpwr.com/heat, o al escanear el código QR.



CPWR  THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

<https://cpwr.com/heat>



We are also teaming up with CPWR's r2p team on a localized effort to reach small contractors

Doing Construction in Maryland?

We want to talk to you!

CPWR-The Center for Construction Research & Training (CPWR) is interested in learning about heat safety challenges and solutions directly from construction contractors.

To participate in this research and help save workers from heat-related illness, please contact Gavin West at 301-495-8522 or gwest@cpwr.com.

What we want to learn about...

- Impacts of extreme heat
- Solutions used to manage heat
- Successes and challenges
- Opportunities for improvement



For **FREE** checklists, training materials, and other resources on working in heat and hot weather, visit www.cpwr.com/heat



CPWR 
THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

We worked with CPWR's Data Center and Dodge Construction Network to publish these resources, and we will continue to monitor trends in heat-related morbidity and mortality

Heat Injuries and Illnesses among Construction Workers

William Harris, MS, Amber Trueblood, DrPH, Derek Dufoe, M.S., Raina D. Brooks, MPH, Gavin West, MPH, Cora Roelofs, ScD¹

OVERVIEW

Construction workers are disproportionately affected by heat stress. Their jobs often require prolonged physical exertion in hot or humid environments, both indoors and out, where heat sources (e.g., high temperature and humidity, sun exposure, indoor heat sources) and personal protective equipment (PPE) can increase the risk of heat-related illnesses and injuries (HRI). Although construction workers are only **7% of the overall workforce**, they account for **more than one-third** of occupational heat-related deaths. Heat—the **leading cause** of weather-related deaths globally—also increases the risk of injuries from **safety hazards** such as working at heights, and it can trigger or **worsen existing health conditions** like asthma, diabetes, or cardiovascular disease. Heat's impact is likely even higher given the well documented **underreporting and undercounting** of HRI's. New research also suggests that **chronic underhydration** contributes to the development of chronic diseases and premature mortality. With each of the past **10 years being the warmest ever recorded**, HRI prevention remains critical for construction workers and other occupations impacted by heat.

This issue examines heat-related illnesses and injuries among construction workers using multiple data sources. Fatal injury data comes from the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) and CPWR's **Fatality Map**. Nonfatal injury data come from the BLS Survey of Occupational Injuries and Illnesses (SOII) and OSHA's **Severe Injury** database. SOII data shows nonfatal injuries that resulted in **days away from work (DAFW)** among private industry workers and are shown in two-year periods due to the data changing to biennial estimates in 2021. Rates per 100,000 **full-time equivalents (FTEs)** were calculated using Current Population Survey (CPS) estimates in chart 1, chart 4, chart 5, chart 6, and chart 10.



¹CPWR-The Center for Construction Research and Training. Correspondence to: datacenter@cpwr.com.

THIS ISSUE

This issue examines heat-related injuries and illnesses among construction workers.

KEY FINDINGS

In 2023, the construction industry accounted for over one-third of heat-related fatal injuries in the U.S.

Chart 2

Heat-related fatalities occur throughout the year, with the majority of deaths (71.4%) taking place during the summer.

Chart 3

Construction had the highest number of fatal heat-related injuries and the fifth-highest number of nonfatal heat-related injuries resulting in days away from work.

Charts 2 and 6

Specialty Trade Contractors (NAICS 238) made up the largest share of heat-related severe construction injuries reported to federal OSHA (55.2%) from 2015 to 2023.

Chart 11

NEXT DATA BULLETIN

Medical Expenditures among Construction Workers

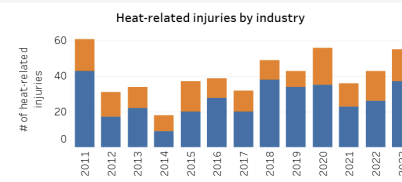
Heat Illnesses and Injuries

Year: (All)
Injury Type: Fatal/Severe

Fatal/Severe heat injuries

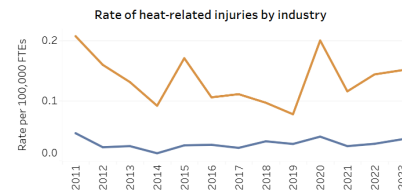
On average annually from 2011 to 2023, there were **41** fatal heat-related injuries. By industry there were:

- **14** fatal heat-related injuries among construction workers
- **27** fatal heat-related injuries among non-construction workers



During this time, the rate of fatal heat-related injuries was:

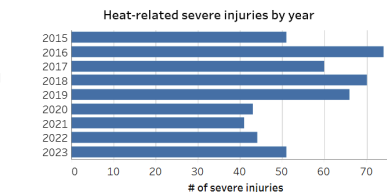
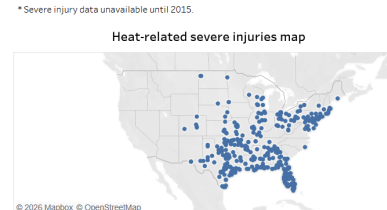
- All industries: **0.03 per 100,000 FTEs**
- Construction: **0.1 per 100,000 FTEs**



Heat-related severe injuries

On average annually from 2015 to 2023*, states with the highest number of heat-related severe injuries in construction were:

1. Texas: **15** severe injuries
2. Florida: **12** severe injuries
3. Arkansas: **3** severe injuries
3. Georgia: **3** severe injuries

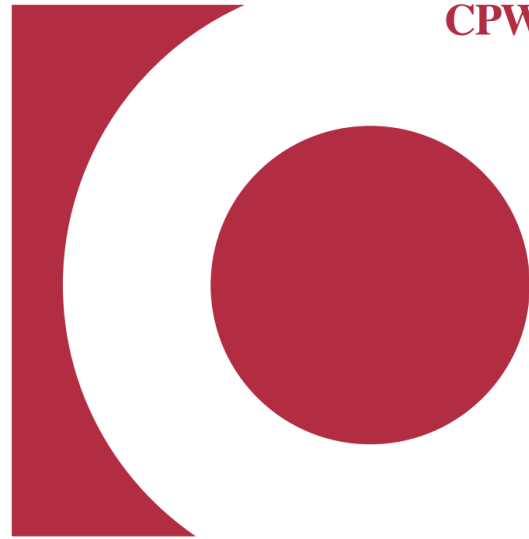


During this period, there were an average of **56** severe heat-related injuries annually.

Safety Management in the Construction Industry 2026



CPWR funded two small studies on heat over the past 2 years



CPWR KEY FINDINGS FROM RESEARCH

Heat-Related Injuries and Barriers to Heat Program Implementation

Heatwaves, Traumatic Injuries, and Barriers to Heat Safety Program Implementation

Miranda Dally. CPWR Small Study, 2025.

Overview

Rising global temperatures pose safety risks for outdoor workers. Although construction workers face significant heat-related hazards, research on workplace heat safety remains limited. Prior studies have linked higher temperatures to increased injuries, but gaps exist in understanding barriers to effective heat safety implementation. This study examined the association between temperature and traumatic injury risk among construction workers in Colorado, as well as current workplace heat safety programs. Through a mixed-methods approach of meteorological data, workers' compensation data, interviews with managers, and surveys of field workers, researchers analyzed safety trends and explored safety training, acclimatization practices, and workplace culture.

Key Findings

- The research highlighted challenges in heat safety adoption, including varying levels of awareness, difficulties in program implementation, and the importance of peer support in compliance.
- Each 1°C increase in weekly mean temperature correlated with a 2.4% rise in traumatic injury claims among Colorado construction workers.
- Higher temperatures were not significantly associated with increased workers' compensation claim costs.
- No significant association was found between relative humidity and injury claims.
- Workplaces have struggled to implement acclimatization programs effectively.
- There are mixed thoughts on the importance of heat as a safety concern and the effectiveness of heat safety training.
- Strong safety workplace culture improves heat safety compliance.
- Safety programs often do not extend to subcontractors, leading to inconsistent workplace protections.

<https://www.cpwr.com/research/small-studies-program/recent-small-studies/>

“Construction workers, even in low to moderate environmental heat exposure, experienced significant heat strain, primarily due to an elevated metabolic rate.”

32 construction workers

3 days of monitoring

43% exceeded
38°C core temp

4% exceeded
38.5°C core temp

Peak metabolic rate and post-shift hydration status were most associated with core temp.

CPWR's Heat Hazards page offers a wealth of guidance organized by topic



HANDOUTS, PLANNING TOOLS & TRAINING PROGRAMS

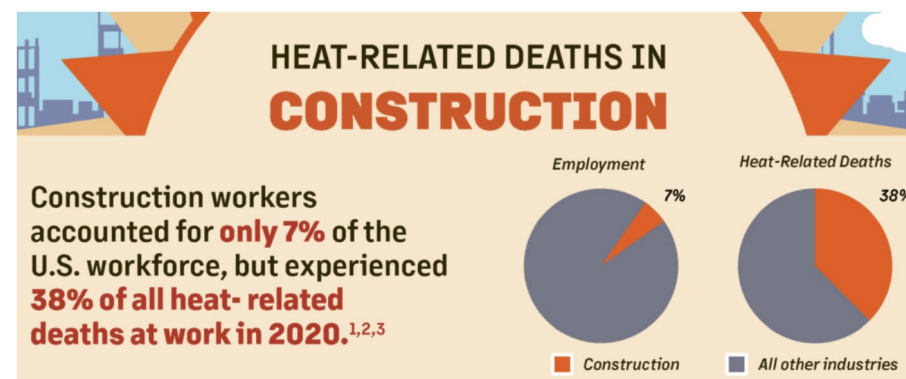
[Home](#) > [Research](#) > [Research to Practice \(r2p\)](#) > [r2p Library](#) > [Handouts, Planning Tools & Training Programs](#) > [Heat Hazards](#)

Heat Hazards

Construction workers, who often work outdoors in direct sunlight or in hot, enclosed spaces, are at risk for heat-related illnesses and, in severe cases, death. Rising global temperatures in recent decades increase that risk. However, **these illnesses and deaths are preventable.**

The resources below are organized by topic and contain information about heat hazards in construction and ways to prevent related illnesses. The sections correspond to the following new checklists from the CPWR-OSHA Alliance:

- [Overall Heat-Illness Prevention Program Checklist for Construction \(en español\)](#)
- [Daily Heat-Illness Prevention Checklist for Construction \(en español\)](#)



CPWR's collection of free resources includes programmatic and daily checklists to develop and implement effective plans

June 2023

HEAT ILLNESS PREVENTION PROGRAM CHECKLIST

According to OSHA, employers are responsible for providing workplaces free of known safety and health hazards, including heat-related hazards. Use this checklist to make sure your Heat Illness Prevention (HIP) program is up to date and follows best practices, aligning with heat abatement recommendations made by OSHA and promoted through their 2022 [National Emphasis Program on Outdoor and Indoor Heat-Related Hazards](#). To help execute the measures identified in this list on the job, see [CPWR's Daily HIP Checklist](#).

Place a check next to each measure you plan to implement as part of your HIP program on this specific jobsite:

- ☐ Identification of a competent person to ensure a HIP program is in place and operational.
- ☐ Procedures for pre-task heat stress hazard analyses for tasks that could cause heat-related illness
- ☐ A site-specific, written HIP plan, shared with all employees, that incorporates methods to reduce exposure, including unlimited access to water, scheduled rest breaks, access to shade and cooling solutions, scheduling adjustments (e.g., earlier start), buddy systems, and other best practices
- ☐ An acclimatization plan included in the written HIP program to closely supervise and adjust work schedules and work practices for workers newly exposed to heat, temporary or contract workers, pregnant workers, those new to the region or returning from extended leave, and during periods of significantly higher heat conditions. The plan should include specific monitoring of workers who are acclimatizing. Special attention should be given to regional heat waves, physical demands of the work, and changing PPE that may increase heat effects.
- ☐ Established trigger conditions for implementation of HIP plan (e.g., local or national heat index alerts)
- ☐ Employee training on risk factors, protection against heat-related illness, the importance of hydration, recognizing and reporting signs and symptoms, administering first aid, and contacting emergency personnel
- ☐ A method to monitor temperature and relative humidity whenever workers are exposed to heat, both outdoors and indoors, as well as a method to monitor and factor in levels of work exertion
- ☐ A response and rescue plan in the event of heat-related illness

If you left boxes unchecked or think there may be room to improve on a checked box, visit CPWR's Working in Hot Weather webpage for additional information and guidance or consult OSHA's generic template for a Model Heat Illness Prevention Plan at <https://bit.ly/3ZIX10G>.

 CPWR: Working in Hot Weather
www.cpw.com/heat

 OSHA National Emphasis Program: Outdoor & Indoor Heat-Related Hazards
<https://bit.ly/3Hm1WPt>

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 **CPWR**
THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

June 2023

DAILY HEAT ILLNESS PREVENTION CHECKLIST

Before beginning work, ask yourself whether your crew will be exposed to heat or hot weather. Are you working outside in the heat or direct sunlight? Are you working indoors in a hot environment or in a space with heat-generating machinery? If you and your crew might be at risk for heat-related illness or death, make sure you have a heat-illness prevention (HIP) program in place. A HIP program should include plans for training workers, monitoring heat conditions, ensuring controls and solutions are available when needed, acclimatizing workers, and more. The plan should be updated for each job site with clear guidance on when and how it will be implemented at the worksite for (new and experienced) workers. Use [CPWR's Heat Illness Prevention Program Checklist](#) before continuing to the checklist below if you do not have an established program in place.

Once you have a HIP plan set up, use the following checklist to identify daily risks and preventive and protective measures that will be implemented accordingly. If you have questions about the items on the checklist visit cpwr.com/heat for more information

Date: _____

Jobsite: _____

Heat Illness Prevention (HIP) Competent Person: _____

1. Are any of these risk factors for heat exposure present on your job site today? (check all that apply)

- ☐ Outdoor work in warm/hot weather or direct sun
- ☐ Radiant heat sources such as hot asphalt, power tools, machinery, furnaces, boilers, steam piping, or other radiant heat sources
- ☐ Low wind speed and/or physical elements of the construction site that block wind
- ☐ Work in confined spaces - for example, attics, crawl spaces, and/or the interior of tanks
- ☐ Moderate to strenuous physical activity performed in warm/hot indoor or outdoor environments
- ☐ Heavy or non-breathable work clothes and/or personal protective equipment worn in warm/hot indoor or outdoor environments
- ☐ High relative humidity combined with a warm/hot indoor or outdoor environment (heat index)
- ☐ Mobile worksites with the potential for variable levels of heat exposure
- ☐ Workers that have not yet been trained on heat exposure and heat-related illness

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Continued →  **CPWR**
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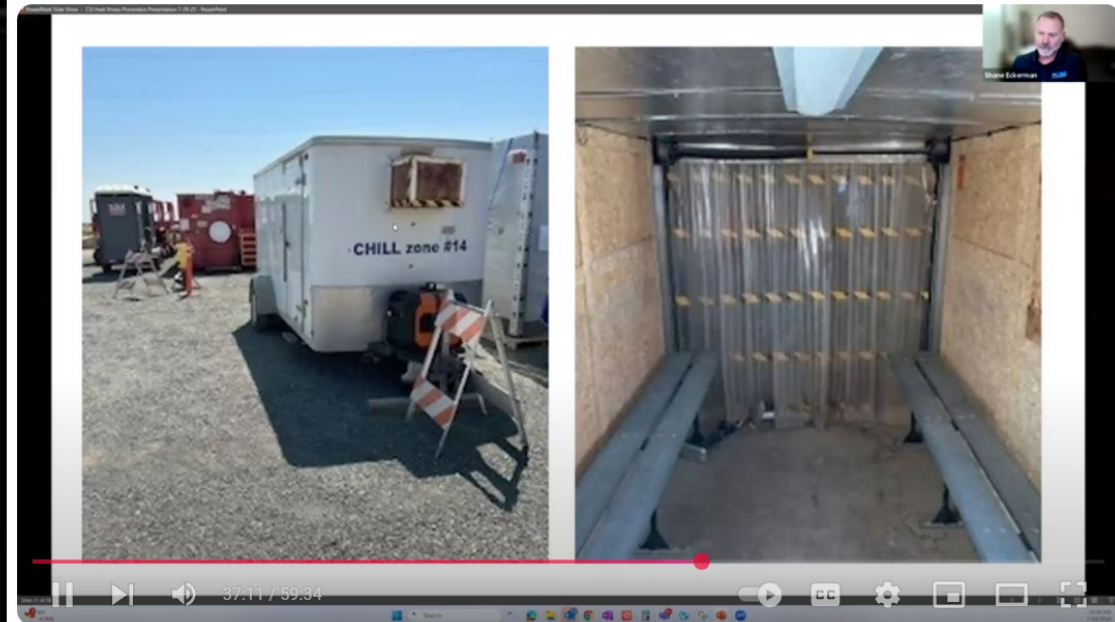
Check out the NABTU-CPWR Summer Heat Webinar recording on YouTube to learn more about effective solutions being used in the field

Engineering Controls

- Shade structures, tents, or canopies.
- Fans, misters, portable evaporative cools, or trailers/containers with air conditioning.
- Improved ventilation.



CSI
ELECTRICAL CONTRACTORS, INC.



https://www.youtube.com/watch?v=bSWnZJ7h_Lw

Thank you! Questions?

Gavin H. West, MPH
Director, Health Research
CPWR – The Center for Construction
Research and Training
gwest@cpwr.com | (301) 495-8522



Research Project Updates: Using Industry Data to Advance Safety and Health

Questions?

Research Project Updates: Investigating Under-Researched Hazards and Solutions

Moderator: Christopher Wendt, MPH, Health Scientist, NIOSH Division of Science Integration

Enhancing the Long-term Acceptance, Usability, and Effectiveness of Passive Exoskeletons among Construction Workers Who Vary by Sex, Age, and Prior Injury Status
Sunwook Kim, Ph.D., Research Associate Professor, Virginia Tech

Developing a National Roadmap to Reduce Chemical Exposures and Associated Health Risks among Construction Painters
Dhimiter Bello, Sc.D., Associate Dean for Research and Graduate Studies, and Professor, University of Massachusetts Lowell

Anila Bello, Sc.D., Research Associate Professor, University of Massachusetts Lowell

Integrating PtD Education in Civil Engineering Programs
Ahmed Al-Bayati, Ph.D., PE, Associate Professor, Lawrence Technological University, and Founding Director, Construction Safety Research Center (CSRC)

Enhancing the Long-Term Acceptance, Usability, and Effectiveness of Passive Exoskeletons among Construction Workers who Vary by Sex, Age, and Injury Status



Carisa Harris, PhD

Alan Barr, MS



Maury Nussbaum, PhD

Sunwook Kim, PhD

The burden of work-related musculoskeletal disorders (WMSDs) in construction



www.neurosurg.org

19.4

per 10,000 FTEs

WMSD rate in construction ^[1]

10.3%

higher

back injury rate than all private industries ^[1]

40%

of cases

Involve back injuries

Median lost workdays: 10 days ^[2]

12%

of cases

Involve shoulder injuries

Median lost workdays: 30 days ^[2]

Occupational Exoskeletons

An exoskeleton is a “**wearable** device that augments, enables, assists, and/or enhances motion, posture, or physical activity, through **mechanical interaction** with the body.”

ASTM F48.91 Terminology

Showing 1–50 of 147 results

50 products per page



Arm Support (40)



Back Support (94)



Leg Support (12)



Neck Support (4)



Power Glove (3)



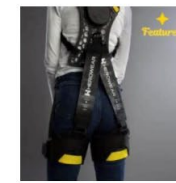
Tool Holding Exoskeleton (6)

exoskeletonreport.com



Apex

HEROWEAR



Apex 2

HEROWEAR



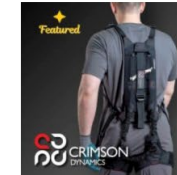
ARTUS

DIGITY



CarrySuit

AUXIVO



CDYB-Fit

CRIMSON DYNAMICS



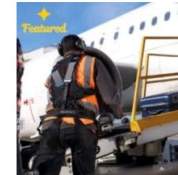
CDYS-S2

CRIMSON DYNAMICS



DeltaSuit

AUXIVO



LiftSuit

AUXIVO



MOVI

PROTESO



OmniSuit

AUXIVO



Skelex 360

SKELEX



Skelex Edge

SKELEX



Skelex Ironhand

SKELEX



Skelex Neck

SKELEX



Agadexo Lowback

AGADE SRL



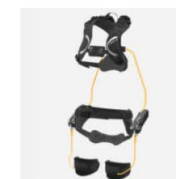
Agadexo Shoulder

AGADE SRL



ALoad Gravity

SEEPPO



ANGEL X

ANGEL ROBOTICS



Ant-A1

KENQING



Ant-A10

VIGX

What we learned in our lab studies

Arm-Support Exoskeleton (ASE) Efficacy

Shoulder load reduction – Overhead work

Casu et al. 2024, 2025

- ↓ up to 47% shoulder muscle activity
- Higher support torque →
Altered arm posture (more flexed)

Back-Support Exoskeleton (BSE) Efficacy

Back load reduction

Choi et al. 2026; Usmani et al., 2025

- Rigid BSE: ↓ 11–17% lumbar activation (Roofing)
- Both BSEs ↓ perceived low-back effort ~16%
- Load transfers elsewhere: legs or shoulders
- Floor tiling: BSE increased back effort

What we learned in our lab studies (cont'd)

Safety & Usability

Balance & task performance

Arippa et al. 2026; Ojelade et al., 2026

- Static balance largely unaffected
- Step-down stability ↓ 6–10%
- Smaller/lighter workers: greater balance effects
- BSE use → More perceived restriction

Adoption & Acceptance

Who will use exoskeletons – and why?

Kim et al. 2019 & 2024; Behjati Ashtiani, et al., 2025; Gutierrez et al., 2024

- Generally open to adoption for fatigue & productivity
- Barriers: comfort, PPE compatibility, social acceptance
- Readiness differs by race, sex & age

Overall, promising intervention, but benefits are task-specific, device-specific, and vary by worker. Field-based research with diverse populations is the next step.

Project overview

Building on earlier lab studies, evaluate exoskeletons (EXOs) with real construction workers in the field

- **Aim 1: Training protocol (Completed)**
 - Develop & evaluate training for ASE and BSE use
- **Aim 2: Medium-term field study (IRB Pending)**
 - 2–4 weeks of EXO use across diverse trades & worker populations
- **Aim 3: Long-term field study (Years 3–5)**
 - 3–4 months of EXO use with randomized delayed-start design (first randomized EXO trial in construction)

Aim 1: Training protocol development

Core training modules

- Why use an EXO
- When to use an EXO
- Tips on proper fit
- Optimizing support level
- Safety tips

Training delivery

- In-person tailgate with hands-on practice
 - don and adjust the EXO during or after the session
- Training trainers
 - equipping supervisors and safety personnel to deliver training themselves

Online training resource



Welcome to the Exoskeletons in
Construction User Guide

SELECT YOUR LANGUAGE

ENGLISH

ESPAÑOL

Main menu

GETTING STARTED

CHOOSE MY EXO

QUICK LINKS

GO BACK

Getting Started

Why use an Exo?

+

When to use an Exoskeleton

+

Tips on Proper Fit

+

Optimizing Support

+

Safety Tips

+

GO BACK

NEXT PAGE

Updated fit and support estimator

Shoulder Exoskeletons

Back Exoskeletons

DEVICE

Hilti ExoS

ACTIVITY

Overhead Work

SEX

Female

HEIGHT

CM

IN

70

WEIGHT

KG

LB

180

GET RECOMMENDATION

SETTINGS — HILTI EXOS

SUPPORT LEVEL

5

Required support force

11.9 lbf

Est. 11.9 lbf required

ARM LENGTH

N/A

Not applicable

SPINE LENGTH

L

SHOULDER BREADTH

N/A

Not applicable



Shoulder Exos

Back Exos

Shoulder Exoskeletons

Back Exoskeletons

DEVICE

HeroWear Apex 2

SEX

Male

HEIGHT

CM

IN

75

WEIGHT

KG

LB

235

GET COMPONENT SIZES

COMPONENT SIZES · NHANES

SHOULDER STRAPS

Size 6

Chest: 56.4 in · 6' and up

CLUTCH LENGTH

Long

Sizes 1-4 → Short
Sizes 5-6 → Long

BAND SIZE

Size 4

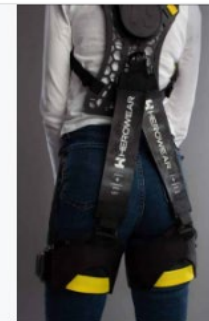
Height: 75.0 in

BAND STRENGTH

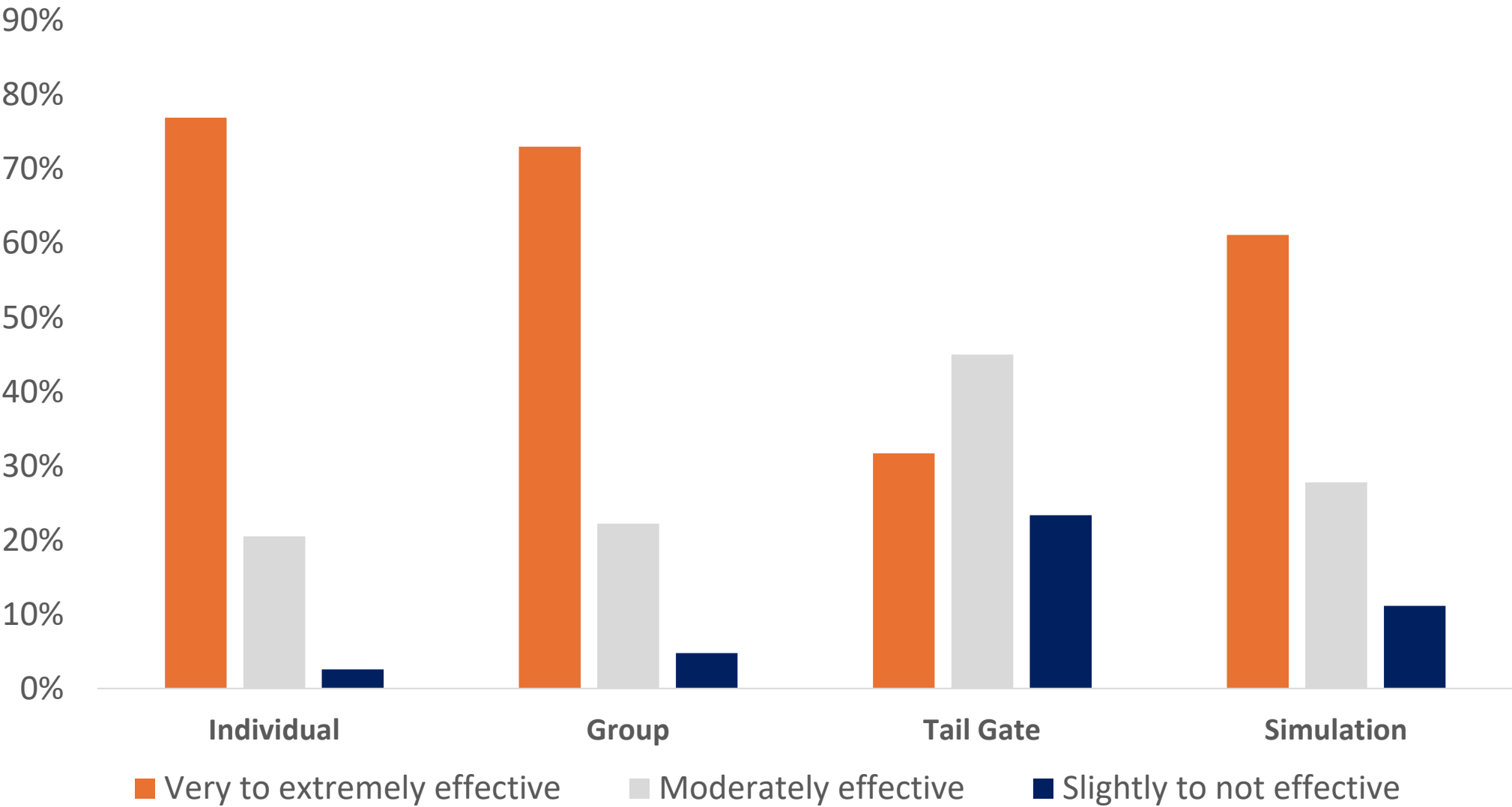
S1500

THIGH SLEEVES

Size 3



Effectiveness of Training when Trying New Tools





Example field visit (n=7 workers)

- Roles: Carpenter, foreman, electrician, Safety manager, cleaning
- Ages: 27–52 yrs
- Previous EXO experience: mostly none
- EXOs tested
 - BSEs: HeroWear Apex 2, Ottobock backX
 - ASEs: Hilti shoulder, Ekso Bionics EVO

What workers said

"Hands-on practice is better — you're already experiencing it."

"First time you definitely need someone to help. After that, I think I could do it alone."

"We do a lot of work in ceiling grids — two-foot by two-foot squares. I don't see an easy way to have a harness on with the exoskeleton."

"I wished we could have a facilitator and work through it as a group — show and tell."

"Technology has to adapt to us, not us to it"

Aim 2: Medium-term field study



- Aim to include workers varying by sex, age & injury history
- Diverse trades: grinding, drywall, roofing, electrical, tiling, general
- Eligible:
 - No current pain limiting work
 - No shoulder/back surgery in past 5 yrs

Tracking EXO use & environmental conditions



Accelerometer Logger

- Attached directly to the EXO
- Detects motion vs. stationary (non-use)
- Complement self-reported usage data

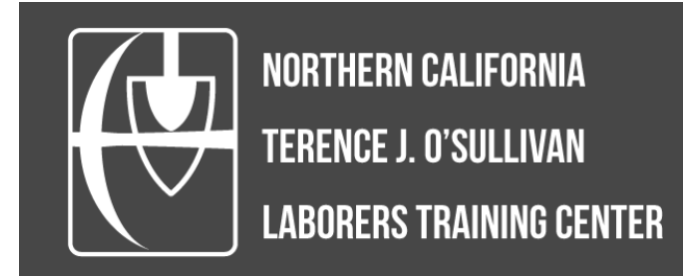


Temp & Humidity Sensor

- Attached directly to the EXO
- Informs heat stress questionnaire data
- Supports future heat guidelines for EXO use

Current partners

- At UCSF/UC Berkeley
 - Northern Cal. Labor Training Center
 - LiUNA!
 - Local companies of various sizes
- At Virginia Tech
 - Skanska



LiUNA!

SKANSKA

Timeline

- **June:**

- Obtain IRB approval
- Begin field testing
- Recruit additional partners

- **July-Novemeber:**

- Continue data collection
- Data analysis
- Reporting

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>

Developing a national roadmap to reduce chemical exposures among construction painters and allied trades

Dhimiter Bello, Sc.D; MSc.
Anila Bello, Sc.D; MSc.

UMass Lowell
Zuckerberg College of Health Sciences

CPWR Annual Meeting June 9, 2026

Project Goals and Specific Aims

The long-term goal of the project is to reduce and, where possible, eliminate PFAS exposures at the source, ultimately minimizing health risks among construction painters and allied trades.

Aim 1. Identify construction trades with the highest PFAS burden via serum and urinary biomonitoring.

- Assess PFAS burden through serum and urinary biomonitoring among painters and allied trade workers.

Aim 2. Assess PFAS occupational exposure sources among painters and allied trades through product characterization, inhalation and dermal exposure measurements, and matched blood and urine biomonitoring.

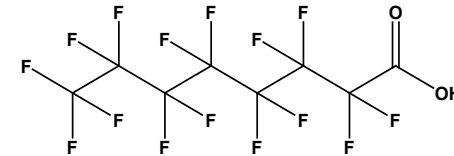
- Determine PFAS species and their concentrations in products used by painters and allied trades workers via independent chemical analyses.
- Identify major PFAS occupational exposure sources and pathways through simultaneous assessment of airborne and dermal exposure with matched blood and urine biomonitoring.

Aim 3. Translate and disseminate the findings (e.g. guidelines for clinicians)

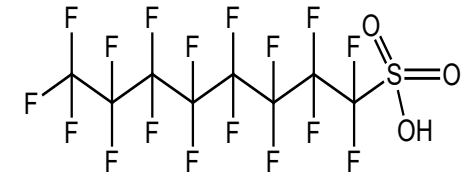
Per-polyfluoroalkyl substances (PFAS)

- PFAS are man-made - a large class of fluorinated organic substances
 - > 14,000 compounds in the PFAS group
- Very diverse chemical structures and properties
 - Carbon – Fluorine (C- F) bond
 - Perfluoroalkyl moiety $C_nF_{2n+1}-$
 - Functional group (e.g carboxylic group, sulfonate group)
 - Extent of fluorination (per- versus polyfluorinated)
- Based on the number of carbons
 - **Long chain** PFAS with ≥ 7 perfluorinated carbons
 - **Short-chain** PFAS with ≤ 6 perfluorinated carbons
 - **Ultrashort-chain** PFAS with ≤ 3 perfluorinated carbons

Legacy PFAS: PFOA and PFOS

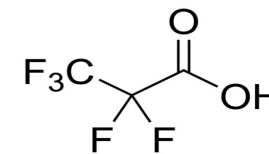


Perfluorooctanoic acid
(PFOA)

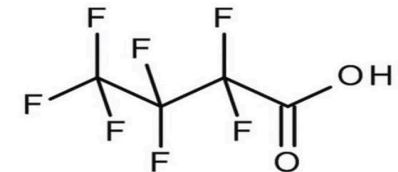


Perfluorooctane sulfonic
acid (PFOS)

Short-chain and ultrashort-chain PFAS



Perfluoropropionic acid
(PFPrA)



Perfluorobutanoic
acid (PFBuA)

PFAS use in consumer and industrial products

- The C-F bond is the strongest bond in organic chemistry
- Heat, fire, and friction-resistant
- Water and heat resistant (hydrophobic and lipophobic)
- Excellent technical performance as surfactants and polymers

The main challenge is to determine

PFAS exposure pathways:

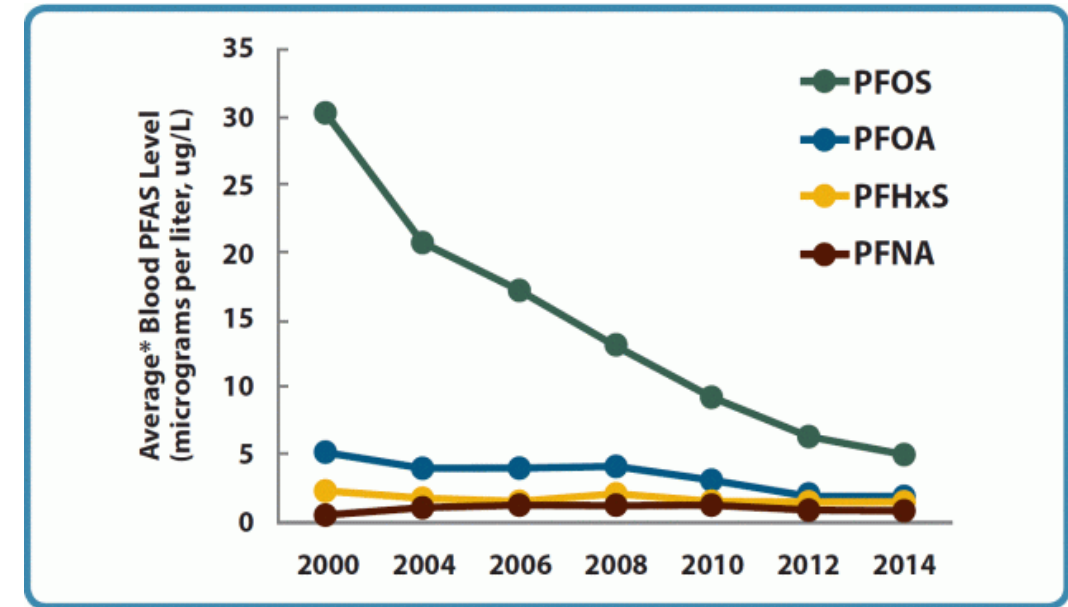
Occupational vs. general population
exposures

Important for intervention



PFAS in humans

- CDC, National Health and Nutrition Examination Survey (NHANES) – serum PFAS since ~2000s
- Measured in multiple biological media – blood, urine, stool, breast milk, tissues
 - Brain, thyroid, liver, placenta, bone, all organs
 - T1/2 – PFAS specific, months-years
- Legacy PFAS levels are going down in the general population- changes in formulations
- Ultra-short and short chains are now commonly detected



Summary of estimated elimination half-lives for select PFAS*

	Humans	Nonhuman primates	Rats	Mice
PFOA	2.1–10.1 years	20.1–32.6 days	Males: 44–322 hours Females: 1.9–16.2 hours	
PFOS	3.3–27 years	110–170 days	179–1,968 hours	731–1,027 hours
PFHxS	4.7–35 years	87–141 days	Males: 382–688 hours Females: 1.03–41.28 hours	597–643 hours
PFNA	2.5–4.3 years		Males: 710–1,128 hours Females: 33.6–58.6 hours	619.2–1,653 hours
PFBS	665 hours	8.0–95.2 hours	2.1–7.42 hours	
PFBA	72–81 hours	40.3–41.0 hours	1.03–9.22 hours	2.79–13.34 hours

*ATSDR,2021.Toxicological Profile for Perfluoroalkyls. Agency for Toxic Substances and Disease Registry, Atlanta,GA.

Serum Concentrations of 11 Polyfluoroalkyl Compounds in the U.S. Population: Data from the National Health and Nutrition Examination Survey (NHANES) 1999–2000

Antonia M. Calafat, Zsuzsanna Kuklenyik, John A. Reidy, Samuel P. Caudill, Jason S. Tully, and Larry L. Needham

Why PFAS in construction?

Increased risk of developing cancer

We have been working with two cohorts: Painters and Firefighters

- Occupational exposure as a painter has been classified as a Group 1 carcinogen by the IARC (2007)
 - Based on the increased risk of lung and urinary bladder cancers
- Occupational exposure as a firefighter was classified as a Group 1 carcinogen by the IARC in 2023
 - Based on the increased risk of mesothelioma and urinary bladder cancers
- In 2024, IARC classified PFOA as a Group 1 carcinogen and PFOS as possibly carcinogenic (Group 2B)

Emerging Question: Could PFAS Play a Role?

- Lack of data on PFAS occupational exposure among U.S. construction workers

PFAS in construction materials

PFAS in CONSTRUCTION PRODUCTS
- a literature study overview

Danmark: PFAS in construction conference was held on
September 9, 2025

Green Science Policy Institute



<https://greensciencepolicy.org/our-work/building-materials/pfas-in-building-materials/>

**Limited data on PFAS content and
often proprietary!
SDS do not report PFAS!!!**

<https://rgo.dk/en/new-literature-study-pfas-is-hiding-in-many-places-in-construction/>

Aim 1 progress

- ***Aim 1. Identify construction trades with the highest PFAS burden via serum and urinary biomonitoring.***
 - Assess PFAS burden through serum (panel of 50 PFAS) and urinary biomonitoring (ultra-short and short-chain PFAS) among painters and allied trade workers.
 - Identify occupational groups with the highest PFAS body burden based on matched biomonitoring results and individual exposure history data from the survey.
- **Methods**
 - **Field investigations**
 - Survey health outcomes and exposure history for each participant
 - The survey is administered via REDCap (Research Electronic Data Capture)- an online platform to build and manage surveys
 - Biomonitoring for blood and urine
 - **PFAS chemical analysis**
 - The LC-MS/MS analytical method in our lab tests for 47 PFAS species (long chain, short, and ultrashort chain)
 - Non-targeted analysis of PFAS

Biomonitoring field work

- Recruited 237 participants + 10 repeats = 247 participants
 - Compensation \$50/ per individual or a hoodie with the project logo
 - Local DC35



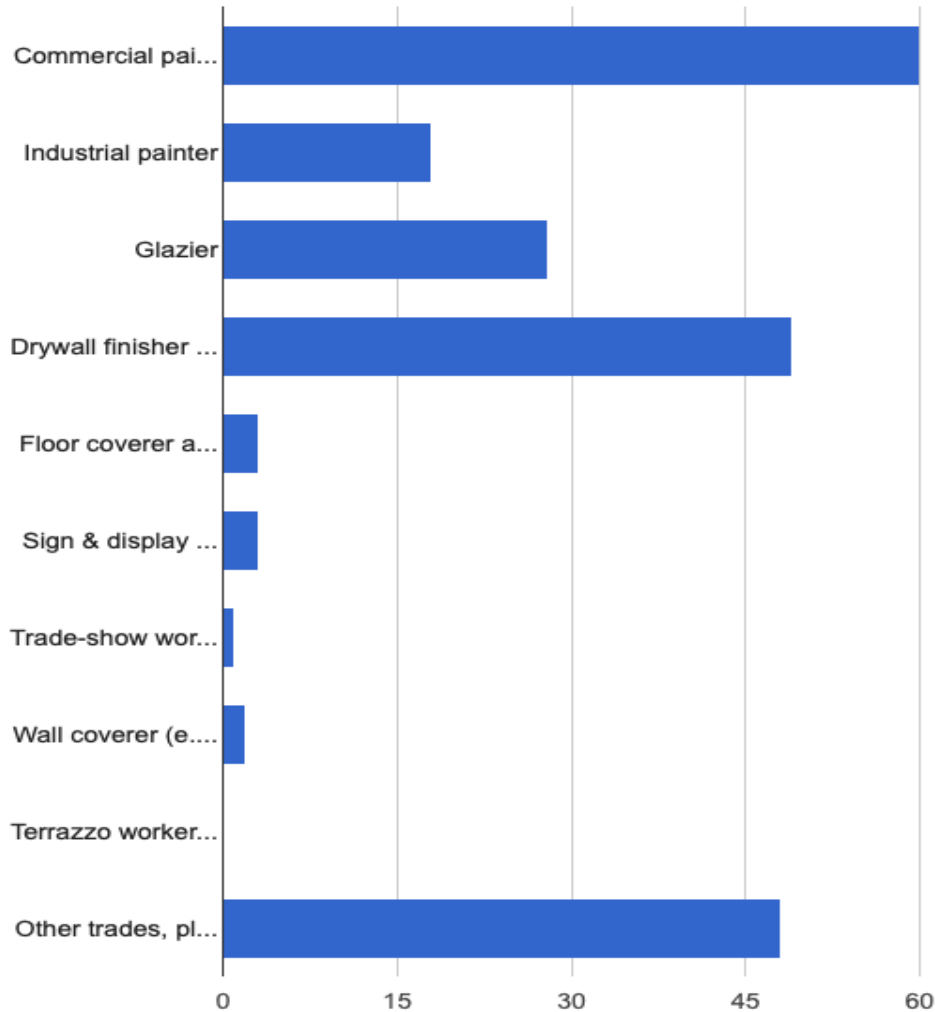
- To date, we have collected
 - ~1,096 **BLOOD** samples (4/worker)
 - ~ 274 **URINE** samples
- Biobanking samples for long-term storage and multiple purposes
- Survey data for all participants.

OUR SAMPLING TEAM



Anila Bello and Dhimiter Bello, PIs
Kushal Biswas, Abimbola Ojo; Suresh Bhandari, all PhD
candidates; Talita- master's student
Noemi D, a talented phlebotomist, and Mike

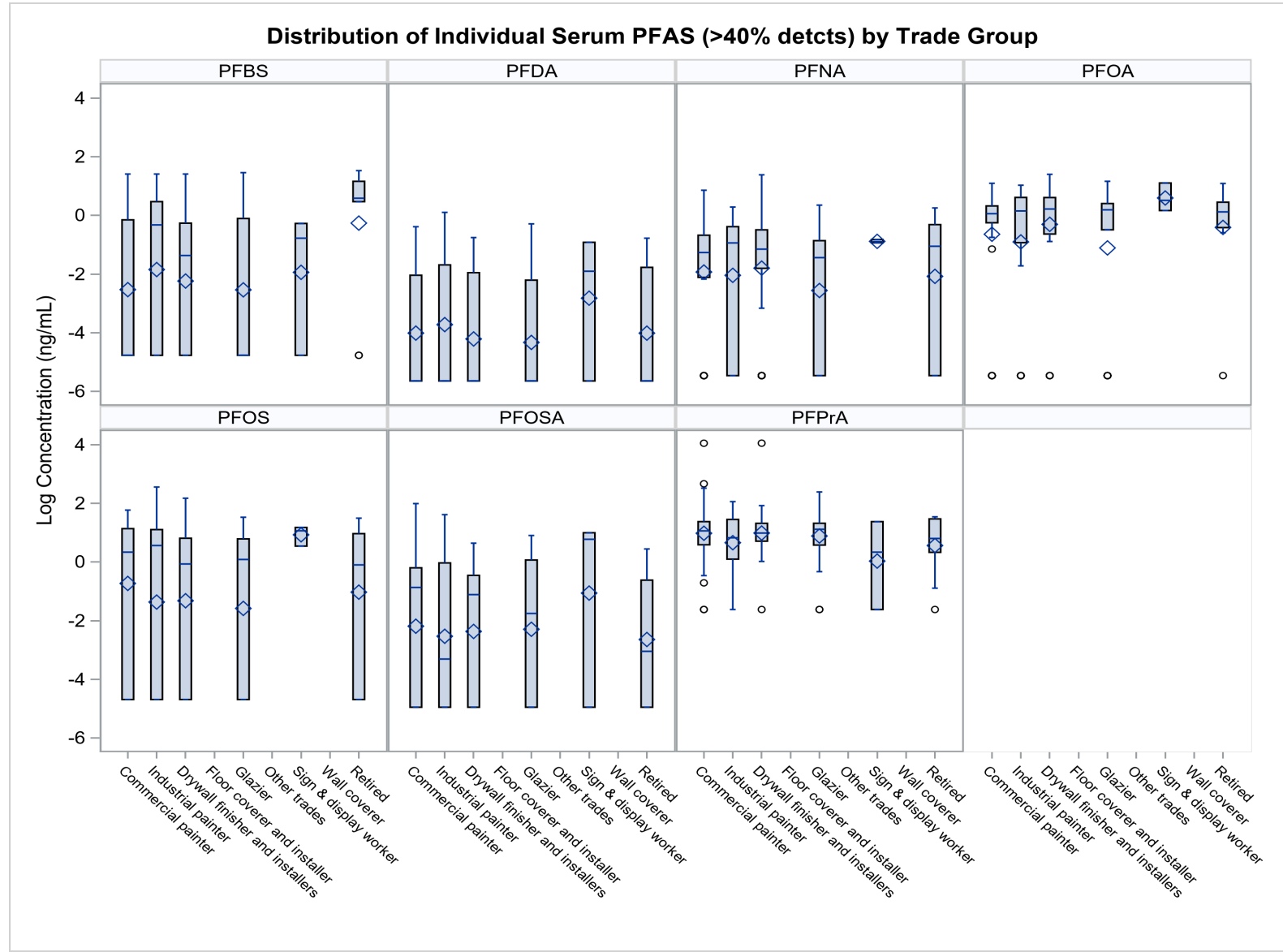
Study participants by trade



Trade	
Commercial painter	60 (28%)
Industrial painter	18 (8.5%)
Drywall finisher and installers	49 (23%)
Floor coverer and installer (carpet, hardwood and laminate floor installers, floor finishers)	3 (1.4%)
Glazier	28 (13.2%)
Sign & display worker	4 (1.9%)
Wall coverer (e.g. wallpaper hangers)	2 (0.9%)
Other trades	48 (22%)

Other trades include Electrician, Custodian, Maintenance, Laborer, Taper, Office worker, Cleaner, and Trainer.

Individual PFAS serum concentrations by trade



- PFAS exposure profiles differ by compound
 - occupational differences are generally modest
 - substantial variability among individual workers
-
- Sign & display workers have the highest PFOS and PFOSA (n very small)

Additional samples will be included

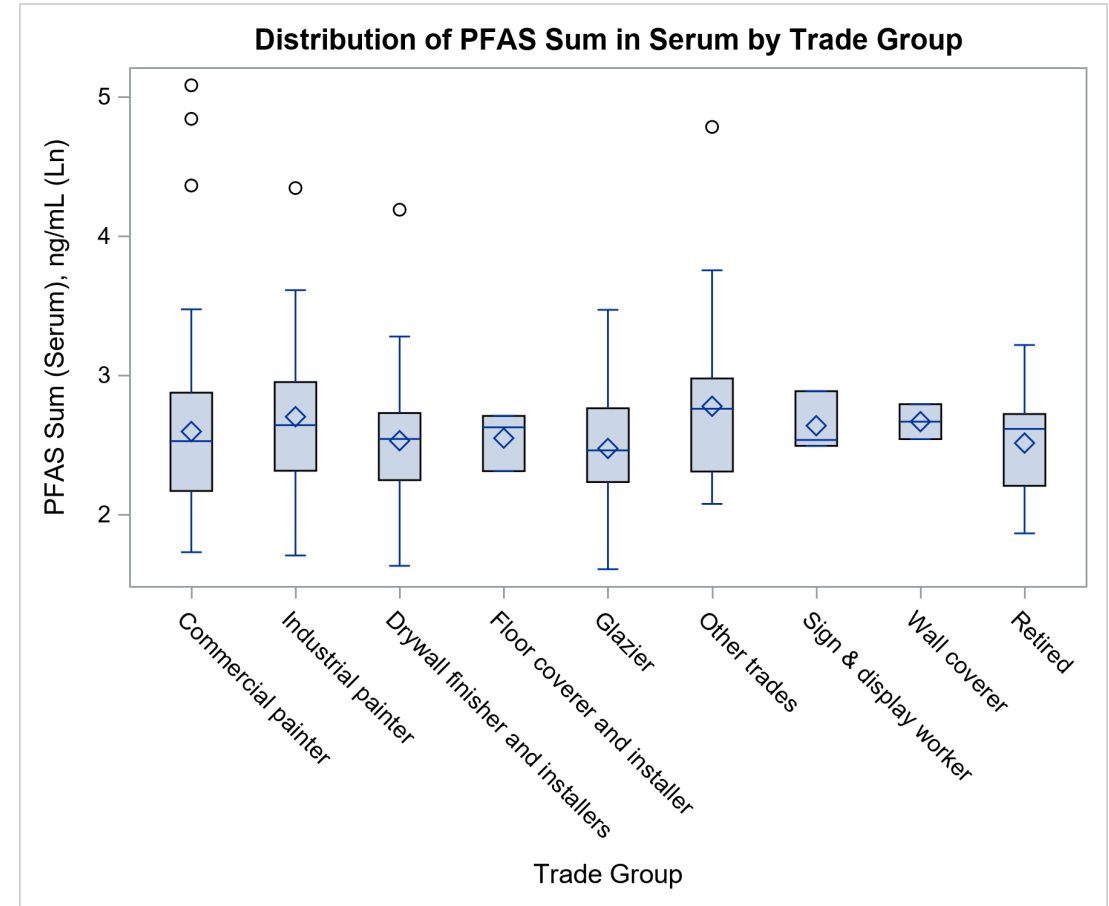
Σ PFAS Serum Concentrations (n=196)

Trade Group	N	GM (ng/mL)	GSD (ng/mL)	Min	Max
Commercial painter	58	13.41	1.95	5.63	161.15
Industrial painter	24	14.91	1.83	5.50	77.03
Drywall finisher and installers	43	12.55	1.53	5.11	65.93
Floor coverer and installer	3	12.78	1.23	10.09	14.99
Glazier	28	11.87	1.57	4.99	32.12
Other trades, please specify	25	16.07	1.82	7.97	119.48
Sign & display worker	3	13.98	1.24	12.09	17.91
Wall coverer	2	14.39	1.19	12.69	16.31
Retired	10	12.34	1.53	6.45	24.95

Other trades include Electrician, Custodian, Maintenance, Laborer, Taper, Office worker, Cleaner, and Trainer.

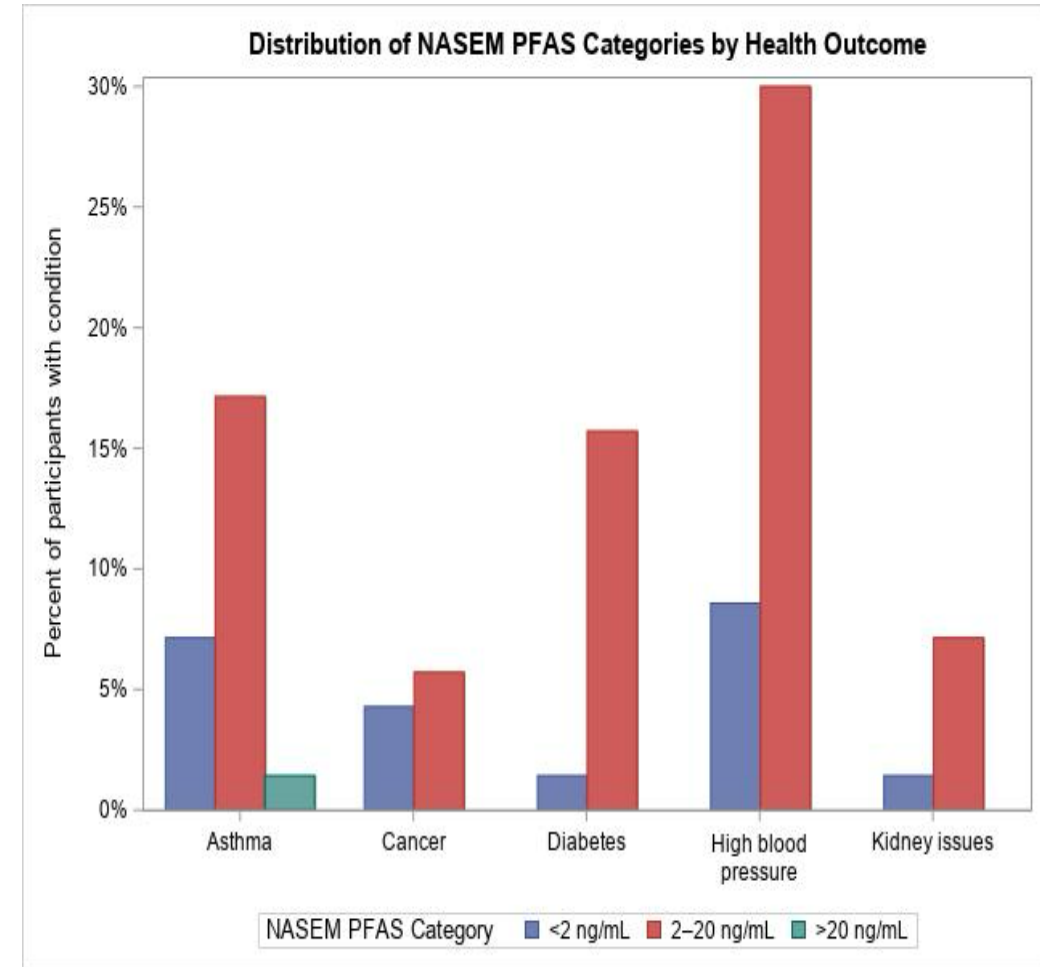
Floor coverers include carpet, hardwood and laminate floor installers, floor finishers.

Wall coverers include wallpaper hangers



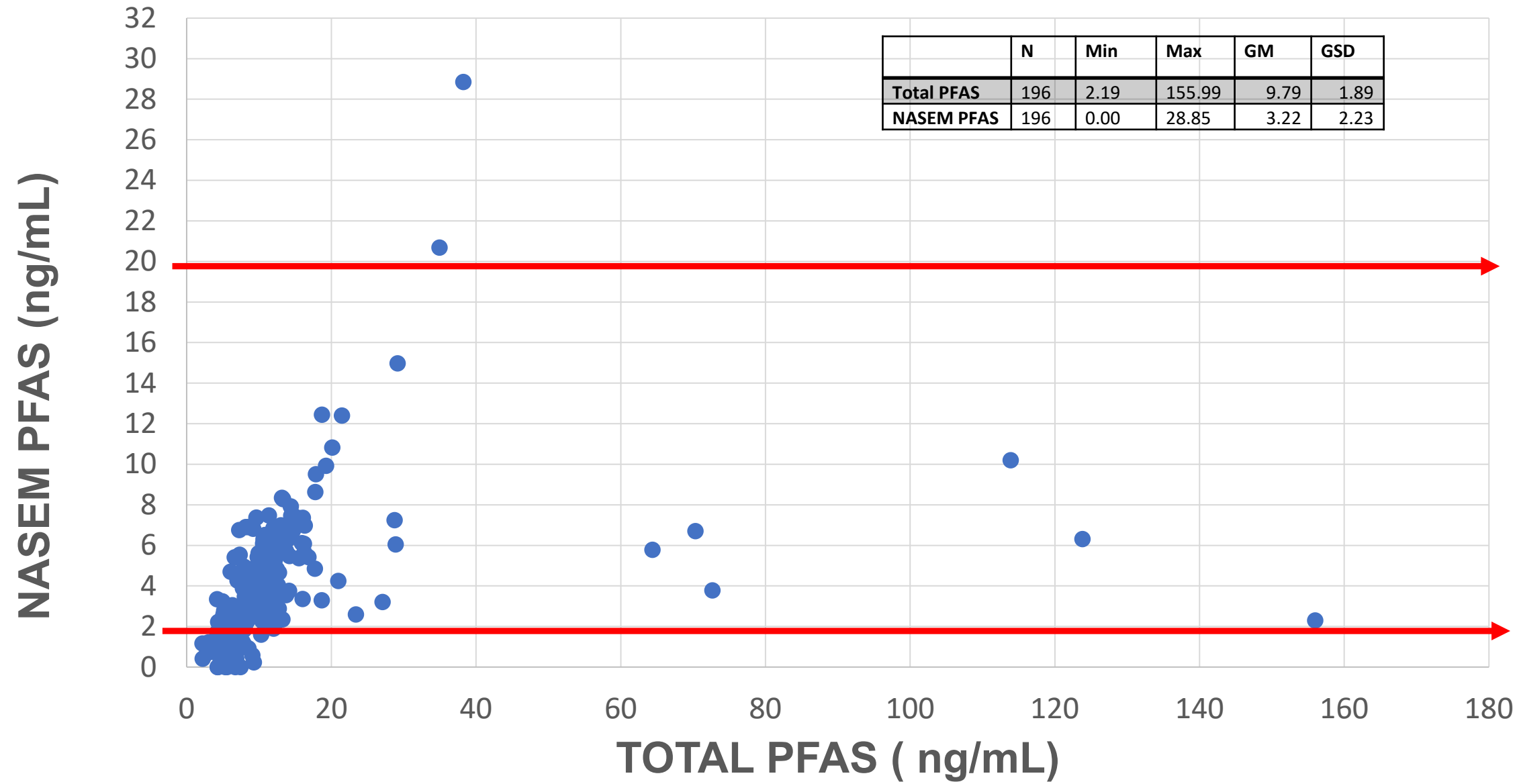
Preliminary data: PFAS in blood serum NASEM by trade

Trade Groups	N (Min- Max conc.)			
	<2 ng/mL	2-20 ng/mL	>20 ng/mL	Missing
Commercial painter	9 (0.92 - 1.84)	48 (2.03 - 8.63)	.	2
Industrial painter	4 (0.98 - 1.77)	18 (2.00 - 14.97)	1 (20.68)	1
Drywall finisher and installers	11 (0.41 - 1.95)	31 (2.28 - 12.44)	.	2
Floor coverer and installer	.	3 (2.88 - 8.28)	.	.
Glazier	11 (0.23 - 1.89)	15 (2.59 - 7.47)	.	3
Sign & display worker	.	3 (3.98 - 6.87)	.	.
Wall coverer	1 (0.42)	1 (7.47)	.	.
Other trades	6 (0.17 - 1.93)	19 (2.20 - 10.20)	1 (28.85)	3
Retired	4 (1.20 - 1.64)	6 (2.67 - 6.90)	.	.

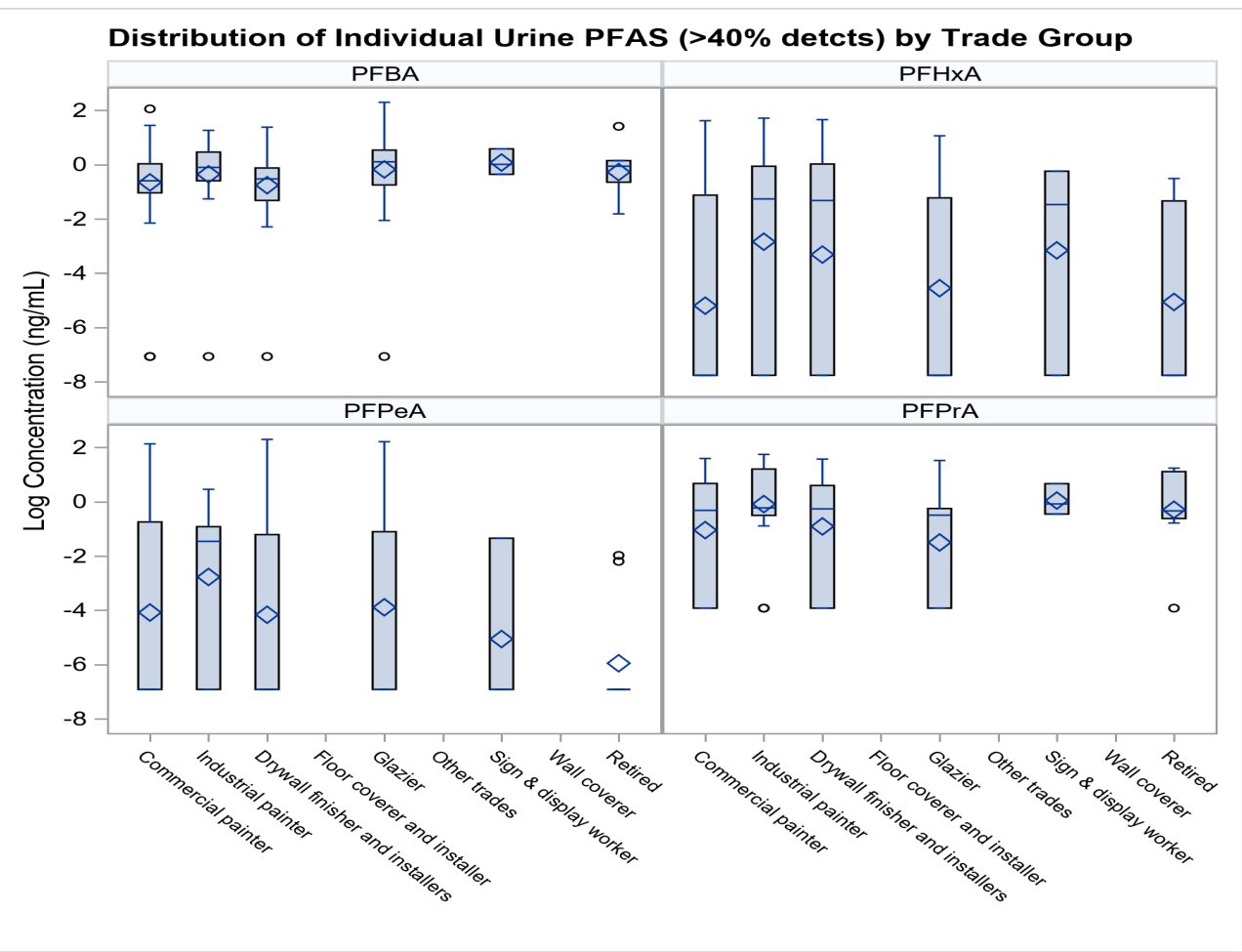


NASEM vs. Total PFAS

	N	Min	Max	GM	GSD
Total PFAS	196	2.19	155.99	9.79	1.89
NASEM PFAS	196	0.00	28.85	3.22	2.23



Individual PFAS concentrations in Urine



PFAS	N	% Detect	GM(GSD)	Min	Max
PFBA	192	95	0.53 (5.53)	0.10	9.95
PFPrA	147	72.8	0.38 (7.02)	0.24	5.73
PFHxA	97	48	0.01 (40.74)	0.11	5.55
PFPeA	94	46.5	0.02 (23.19)	0.01	9.95

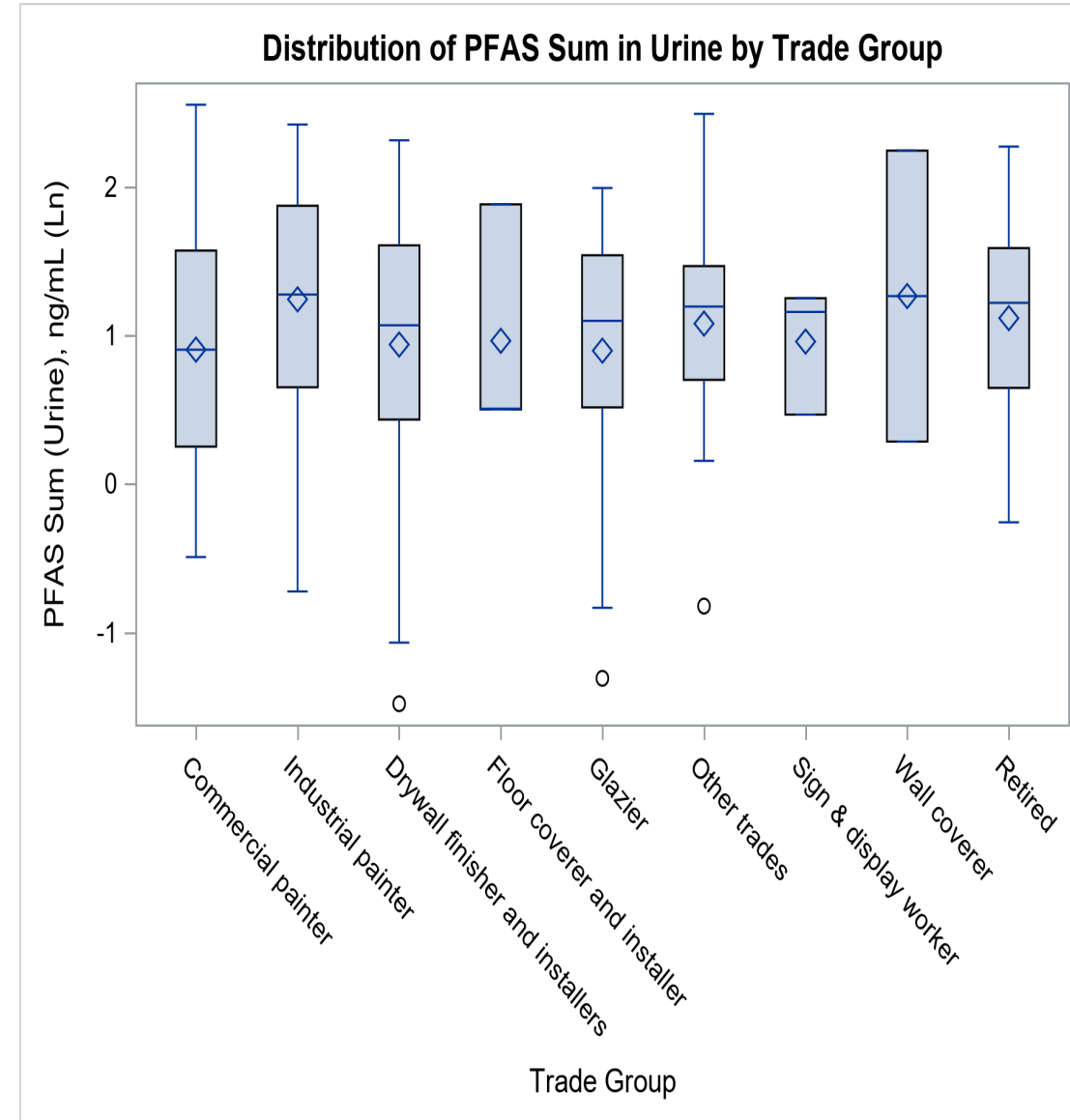
<40% Detects					
	N	% Detect	Median	Min	Max
PFOA	44	21.8	0.29	0.10	3.52
PFOSA	39	19.3	0.38	0.06	9.85
PFNA	36	17.8	0.24	0.06	9.43
6:2 FTS	26	12.9	0.53	0.11	1.99
PFBS	25	12.4	1.04	0.00	3.63
PFUnA	23	11.4	0.60	0.49	0.99
GenX	19	9.4	0.47	0.11	7.34
PFDA	17	8.4	1.16	0.10	8.75
PFOS	14	6.9	0.51	0.14	1.76
PFHpA	13	6.4	0.23	0.11	2.56

ΣPFAS concentrations in urine

Trade	N	GM (ng/mL)	GSD (ng/mL)	Min	Max
Commercial painter	58	2.47	2.15	0.61	12.86
Industrial painter	24	3.47	2.20	0.49	11.26
Drywall finisher and installers	43	2.56	2.27	0.23	10.13
Floor coverer and installer	3	2.62	2.22	1.65	6.58
Glazier	28	2.46	2.34	0.27	7.34
Other trades, please specify	25	2.95	2.05	0.44	12.10
Sign & display worker	3	2.61	1.53	1.60	3.50
Wall coverer	2	3.55	4.00	1.33	9.45
Retired	10	3.06	2.16	0.77	9.70

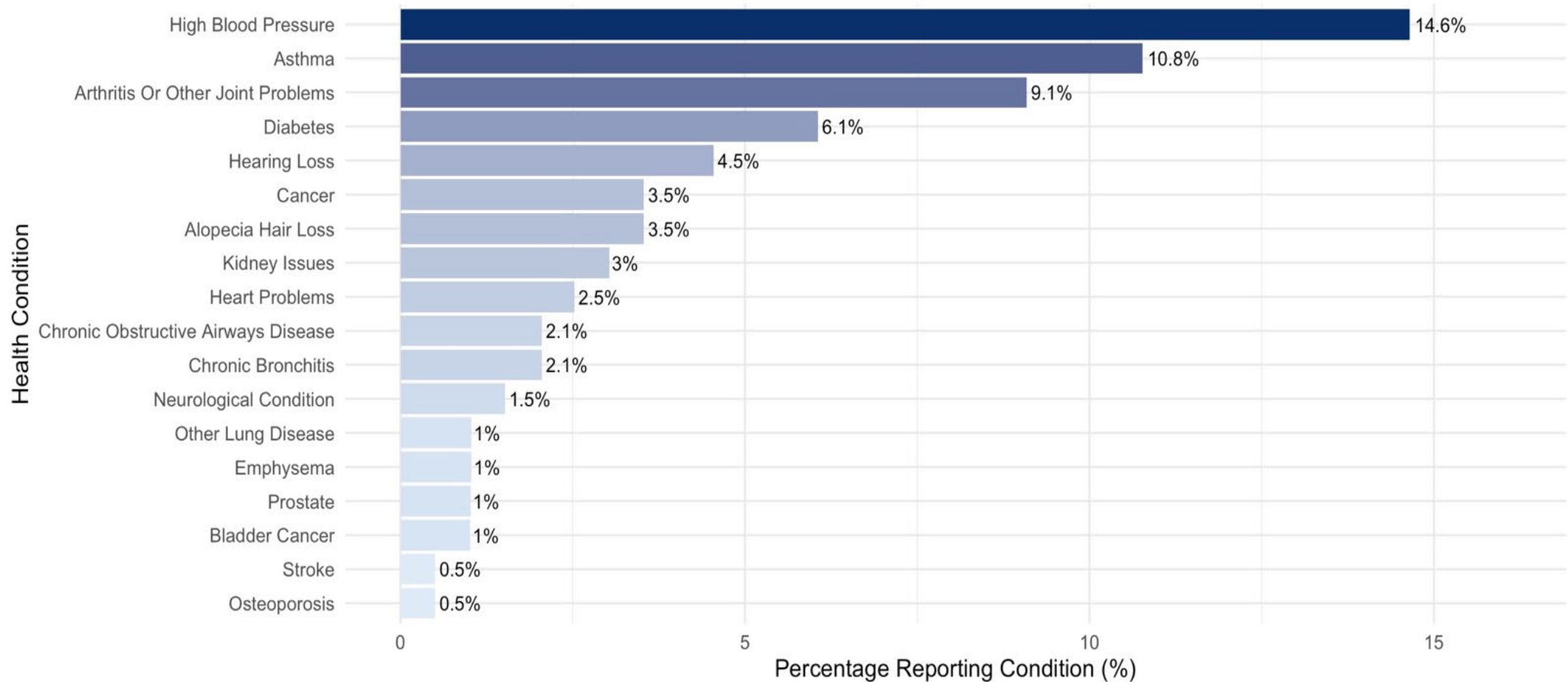
Overall, we do not see major differences between groups

However, the same groups with high serum PFAS have higher urine PFAS concentrations!

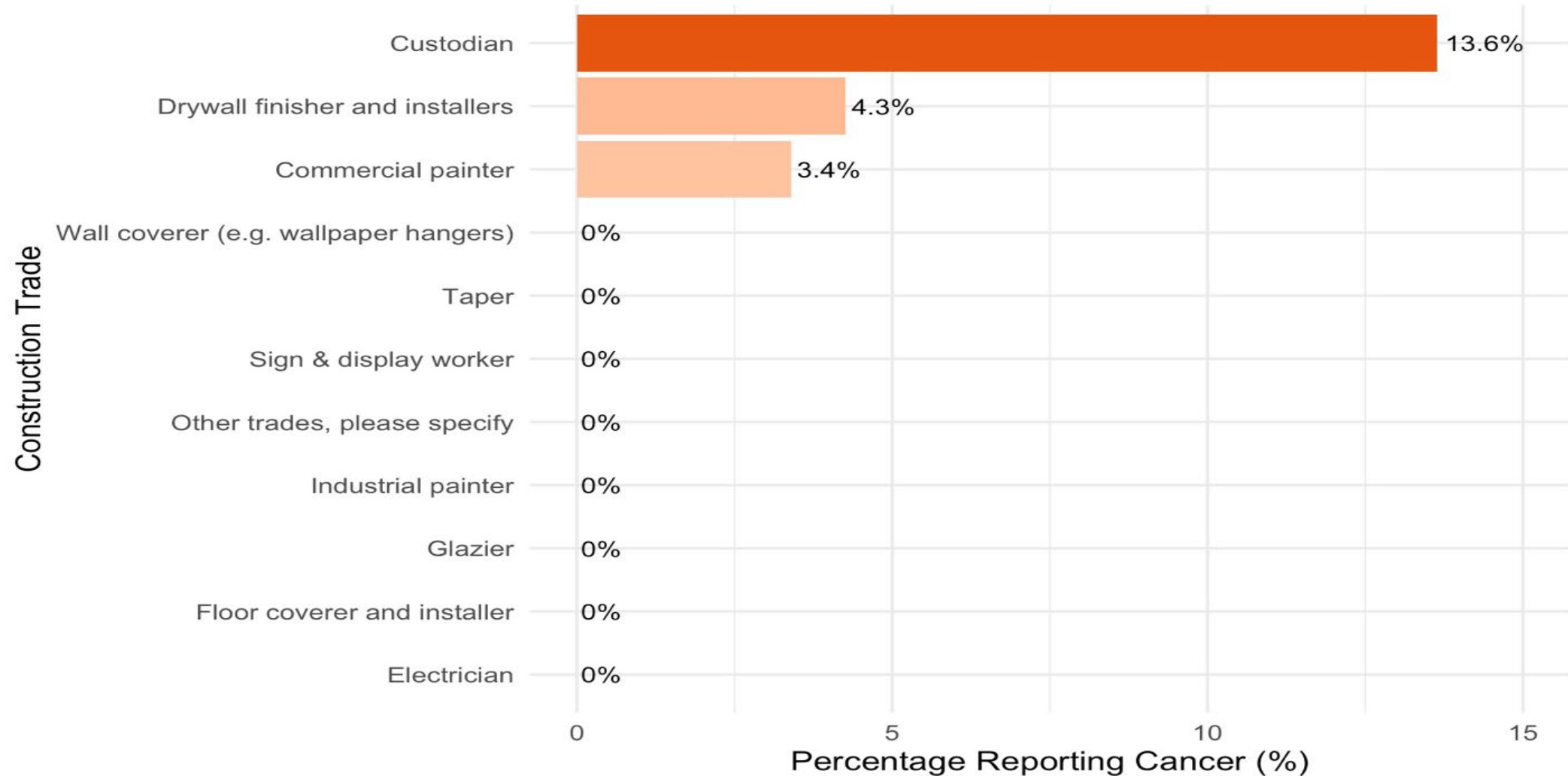


Preliminary data - survey results

Prevalence of Self-reported Health Conditions Among Construction Trade Workers



Self-reported Cancer Incidence by Trade



IUPAT - International Union of Painters and Allied Trades

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**Our work.
Our union.
Our future.**

We're making our trades safer, building transformational and vital infrastructure across the U.S. and Canada, and providing security for millions of working families in our trades.

[Learn more about IUPAT](#)



Come build the future with us. [Join the Union](#)

Work in Our Trades ▲ Fc

Commercial Painter
Drywall Finisher
Floor Coverer
Glazier and Glassworker
Industrial Painter
Sign and Display Worker
Trade Show Worker



iFTI Health and Safety instructors have supported our efforts since the early stages of this project.

Aim 2 progress

Aim 2. Assess PFAS occupational exposure sources among painters and allied trades through product characterization, inhalation and dermal exposure measurements, and matched blood and urine biomonitoring.

- Determine PFAS species and their concentrations in products used by painters and allied trades workers via independent chemical analyses.
- Identify major PFAS occupational exposure sources and pathways through simultaneous assessment of airborne and dermal exposure with matched blood and urine biomonitoring.

Products to be tested

Commercial Painter	
	Sherwin Williams Promar 200 Zero VOC: flat, eggshell, semigloss,
	Benjamin Moore Ultra Spec 500: flat, eggshell semigloss
	DAP Alex Plus caulking
	Sherwin Williams Shermax caulking
	Sherwin Williams 950A caulking
	3M BONDO Glazing Spot putty
	3M BONDO Body Filler
	DAP DryDex spackle
	DAP Fast and Final spackle
	MH Ready Patch spackle
	Crawfords Patch spackle
	Goof Off
	Denatured Alcohol
	Mineral Spirits
	Laquer Thinner
	Flowtrol
Wall Coverer	
	Roman Strippable Clay Paste 774
	Roman Strippable Clear Paste 880
	Roman Extreme Tack Paste
Drywall Finisher	
	3M fire barrier caulking
	3M fire block caulking
	STI fire barrier caulking
	DAP fire stop caulking
	USG premixed light, medium and heavy drywall mud
	Sheetrock premixed light, medium and heavy drywall mud
	USG Easy Sand 45
	USG Easy Sand 20
	USG Easy Sand 90
Glaziers	

Collected 80+ products. Chemical analysis is ongoing



PFAS and Your Work

Understanding “Forever Chemicals” in Trade Work

WHAT ARE PFAS?



PFAS, or per- and polyfluoroalkyl substances, are man-made chemicals that resist water, oil, and stains.

PFAS are also used in paints, adhesives, glues, and other construction materials.

WHY SHOULD YOU CARE?

PFAS are called “forever chemicals” because they don’t break down easily and can build up in the body over time. Studies link PFAS exposure to increase risk of:

- Cancer (e.g., liver, kidney, and testicular)
- Thyroid problems
- High cholesterol and/or risk of obesity
- Reproductive and immune system issues



Scan the QR code to start the survey!



HELP US UNDERSTAND HOW PFAS IS AFFECTING YOUR HEALTH

We're asking you to complete a **survey**:

- The survey takes about 20-30 minutes
- Your answers will be kept anonymous

Your responses will help researchers identify:

- Your trade/work history
- Your health status

Results will help improve safety for all IUPAT members and construction workers!

OR Click this LINK to start the survey:

<https://arcsapps.umassmed.edu/redcap/surveys/?s=F7HAMAKJ8RFA9RA9>

Questions? - Contact our research team. We're here to help!

Dr. Anila Bello - anila_bello@uml.edu



Nationwide Survey is OPEN

CPWR – newsletter, social media

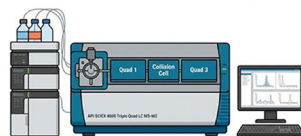
Share your experiences with occupational exposure to forever chemicals! A CPWR-supported research team is examining the impact of “forever chemicals” on the health of painters and allied trades workers. Take their anonymous survey on job activities, materials used, and health conditions at <https://bit.ly/49fPqyY>.

So far, we have 46 responses in addition to the short survey health effects data (n=237).

Association of PFAS in urine with PFAS in air and glove samples

PFAS chemical analysis

- Air, glove, and pre- and post-shift urine samples were analyzed in our laboratory
- Targeted a panel of 28 C2-C12 PFAS compounds using an internal standard calibration method.



Targeted Analysis by
LC-ESI-MS/MS

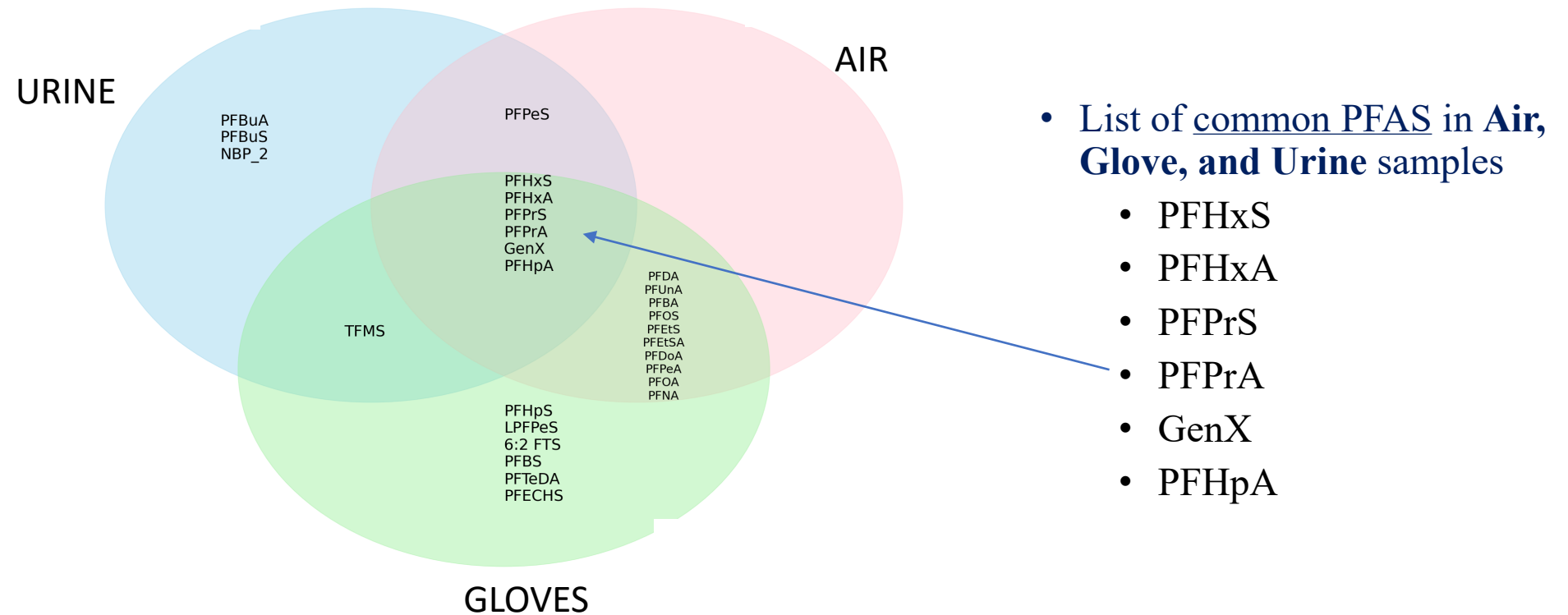
Statistical analysis

Descriptive statistics and regression analysis were conducted using SAS and R.

List of targeted PFAS

Nr	PFAS Names	Abbreviation / Common Name	Molecular Weight (g/mol)
1	Trifluoromethyl Sulfonate	TFMS	150
2	Perfluoropropanoic Acid	PFPrA	164
3	Perfluoroethylsulfonamide	PFEtSA	199.1
4	Perfluoroethanesulfonate	PFEtS	200.1
5	Perfluorobutanoic Acid	PFBuA	214.06
6	Perfluoropropanesulfonate	PFPrS	250.1
7	Perfluorobutylsulfonate	PFBuS	300
8	Perfluorohexanoic acid	PFHxA	314.06
9	1H,1H,2H,2H-Perfluorohexanesulfonic acid	4:2 FTS	328.1
10	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	GenX	330.05
11	Perfluoroheptanoic acid	PFHpA	364.06
12	Perfluoropentanesulfonate	PFPeS	372.08
13	Perfluorooctanoic acid	PFOA	414
14	Perfluorohexanesulfonate	PFHxS	438.2
15	Perfluoroheptanesulfonate	PFHpS	449
16	1H,1H,2H,2H-Perfluorooctanesulfonic acid	6:2 FTS	428.1
17	Perfluorononanoic acid	PFNA	464.07
18	Nafion byproduct-2	NBP-2	464.1
19	Perfluorooctanesulfonamide	PFOSA	499.1
20	Perfluorooctanesulfonate	PFOS	500
21	Perfluorodecanoic acid	PFDA	514.08
22	Ethylperfluorooctanesulfonamide	Sulfluramid	527.2
23	1H,1H,2H,2H-Perfluorodecanesulfonic acid	8:2 FTS	528.18
24	Perfluoroundecanoic acid	PFUnA	564.08
25	N-methylperfluoro-octanesulfonamidoacetic acid	Me-FOSAA	571.2
26	N-ethylperfluoro-octanesulfonamidoacetic acid	Et-FOSAA	585.2
27	Perfluorododecanoic acid	PFDoA	614.08
28	Perfluorododecane-sulfonate	PFDoS	700.1 ⁴¹

Common PFAS detected in urine, air, and glove samples



Is occupational exposure an important contributor to PFAS concentrations in urine?

Multivariable regression modeling

Urinary concentrations of the <u>Sum of Common</u> PFAS metric (ng/mL)	Dependent variable	Parameter Estimate	Standard Error	Pr > t
	Intercept	2.67	0.34	<.0001
	SUM PFAS Air Conc (ng/m3)	0.15	0.07	0.038
	Amount of Sum PFAS in gloves (ng/100ml)	-0.04	0.10	0.644
Urinary concentrations of PFPrA* (ng/mL)	Intercept	1.71	0.30	<.0001
	PFPrA Air Conc ((ng/m3)	0.08	0.08	0.34
	Amount of PFPrA in gloves (ng/100ml)	0.05	0.10	0.63

*PFPrA was the only PFAS detected at > 50% in all 3 media

Air concentrations of PFHxS, PFHxA, PFPrS, PFPrA, GenX, and PFHpA predicted urinary concentrations
Inhalation is an important contributor to PFAS body burden!

Aim 3 progress

Translate and disseminate the findings (e.g. guidelines for clinicians)

- January 13- presentation at the annual symposium of the iFTI Health and Safety Training Center, Hanover, MD
- May 7 –presentation via Zoom at the NBTU monthly meeting
- April 14 - NEWMOA PFAS conference podium presentation
- June 6– Prepared and delivered a PFAS class at Local DC35 as part of the STAR certification
- Continue to report individual results to study participants

Manuscripts accepted this year:

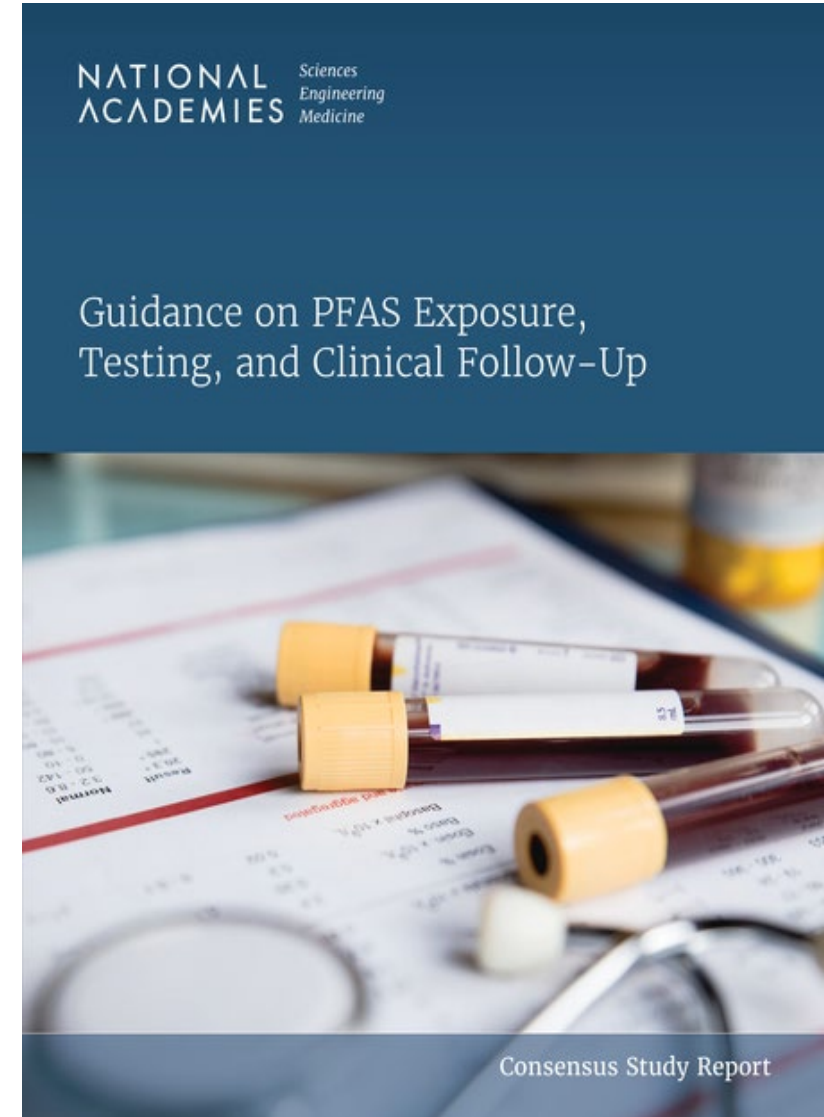
- Patel P, Bello A, Bhandari S, Biswas K, Palacios N, and Bello D. Urinary biomonitoring of metals in construction painters and their association with urinary biomarkers of oxidative stress. International Journal of Hygien Hanover, e and Environmental Health.
- Ojo A, Heavner K, Bello D, Li W, Bello A. Occupation and serum concentrations of per- and polyfluoroalkyl substances: Data from the 2013–2014 National Health and Nutrition Examination Survey. Revised and resubmitted to Annals of Work Exposures and Health.

PFAS awareness 2hr course- IUPAT DC 35



Benefits to participants

- We will compare PFAS in blood with the **National Academy of Sciences guidelines for Clinicians**.
- Individual serum concentrations of the sum of 7 PFAS*:
 - < 2ng/mL- Adverse health effects related to PFAS exposure are not expected at less than 2 nanograms per milliliter (ng/mL).
 - 2-20ng/mL: There is a potential for adverse effects, especially in sensitive populations, between 2 and 20 ng/mL.
 - > 20ng/mL There is an increased risk of adverse effects above 20 ng/mL. Clinical follow-up for dyslipidemia, thyroid function, urine analysis for kidney function, liver function; kidney and testicular cancer screening
- Sum of 7 PFAS: MeFOSAA, PFDA; PFHxS, PFNA, PFOA, PFOS and PFUnDA.



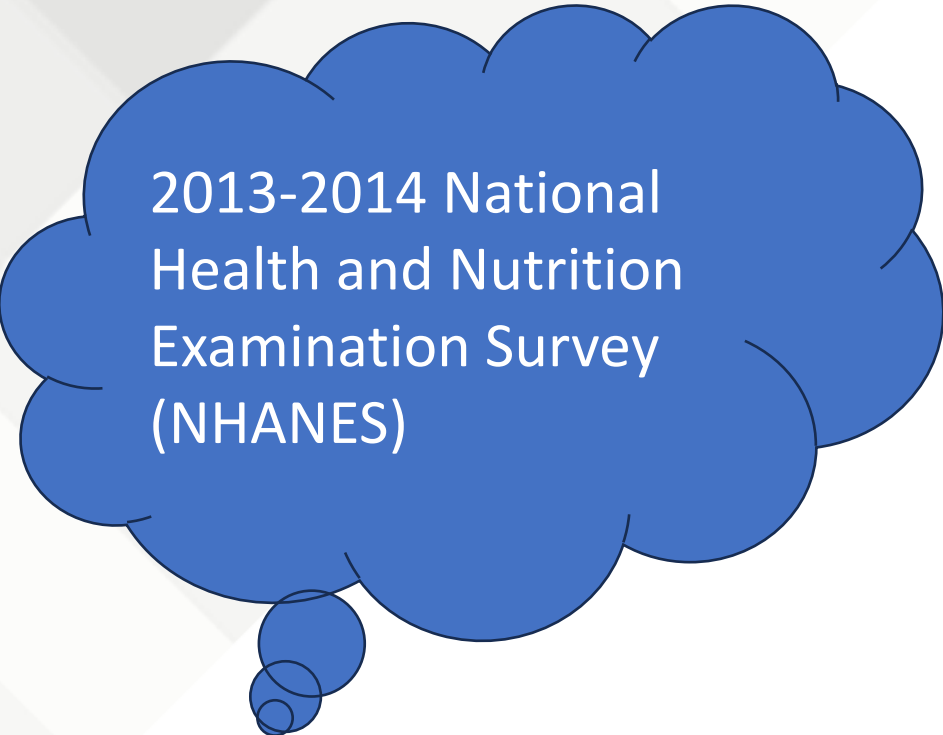
Next Steps

- Analyze the data to identify specific health concerns for different trades
- Analyze PFAS in products – expand the list /sample size
- Communicate findings and develop an intervention to reduce PFAS body burden and detox PFAS and other toxins!
- Biomonitoring follow-up study (n=50)
- Identify and communicate PFAS exposure sources
- Expand PFAS biomonitoring nationwide!
- Complete a nationwide survey of exposures and health outcomes

**Thank you for
your attention!**

Backup Slides

Individual PFAS serum concentrations



2013-2014 National Health and Nutrition Examination Survey (NHANES)

NHANES is a national survey conducted to assess the health and nutritional status of adults and children in the United States.

Occupation data: 2010 U.S. Bureau of the Census Industrial & Occupational Classification coding system.

Code/Values	Occupation Groups
1	Management Occupations
2	Business, Financial Operations Occupations
3	Computer, Mathematical Occupations
4	Architecture, Engineering Occupations
5	Life, Physical, Social Science Occupations
6	Community, Social Services Occupations
7	Legal Occupations
8	Education, Training, Library Occupations
9	Arts, Design, Entertainment, Sports, Media Occupations
10	Healthcare Practitioner, Technical Occupations
11	Healthcare Support Occupations
12	Protective Service Occupations
13	Food Preparation, Serving Occupations
14	Building & Grounds Cleaning, Maintenance Occupations
15	Personal Care, Service Occupations
16	Sales & Related Occupations
17	Office, Administrative Support Occupations
18	Farming, Fishing, Forestry Occupations
19	Construction, Extraction Occupations
20	Installation, Maintenance, Repair Occupations
21	Production Occupations
22	Transportation, Material Moving Occupations
23	Armed Forces

Table S2: Association Between Longest Occupation Groups and PFAS Serum Concentration Levels (Unadjusted), compared to sales occupation ^{a, b, c}

Occupation	Estimated Regression Coefficients exp β (p-value) ^d						
	Total PFOA	Total PFOS	PFHxS	PFNA	PFDA	MeFOSAA	Total PFAS
Architecture, Engineering	1.54 (<0.01)**	1.96 (<0.01)**	1.82 (<0.001)***	1.37 (0.07)	1.19 (0.39)	1.25 (0.40)	1.71 (<0.01)**
Armed Forces	1.78 (<0.01)**	2.62 (<0.01)**	2.62 (<0.01)**	1.57 (0.04)*	1.40 (0.12)	1.20 (0.34)	1.84 (0.01)*
Arts, Design, Entertainment, Sports, Media	1.38 (0.02)*	1.52 (0.04)*	1.33 (0.17)	1.49 (0.02)*	1.31 (0.14)	1.18 (0.30)	1.45 (0.01)*
Building & Grounds Cleaning, Maintenance	1.15 (0.15)	1.13 (0.35)	1.13 (0.36)	1.02 (0.89)	0.98 (0.87)	1.28 (0.09)	1.08 (0.50)
Business, Financial Operations	1.34 (<0.01)**	1.40 (0.03)*	1.46 (0.03)*	1.36 (0.03)*	1.27 (0.07)	1.03 (0.72)	1.25 (0.10)
Community, Social Services	1.22 (0.02)*	1.50 (0.14)	1.16 (0.38)	1.02 (0.93)	1.05 (0.79)	0.97 (0.77)	1.16 (0.36)
Computer, Mathematical	1.32 (0.02)*	1.29 (0.24)	1.29 (0.17)	1.11 (0.50)	1.01 (0.95)	1.05 (0.76)	1.30 (0.11)
Construction, Extraction	1.55 (<0.01)**	1.63 (<0.001)***	1.87 (<0.001)***	1.28 (<0.01)**	1.09 (0.24)	1.34 (0.02)*	1.46 (<0.01)**
Education, Training, Library	1.12 (0.42)	1.14 (0.41)	1.15 (0.45)	1.05 (0.72)	1.03 (0.75)	1.39 (0.02)*	1.08 (0.50)
Farming, Fishing, Forestry	0.92 (0.55)	1.03 (0.88)	1.02 (0.88)	0.82 (0.23)	0.81 (0.51)	1.54 (0.08)	0.80 (0.20)
Food Preparation, Serving	1.01 (0.92)	1.12 (0.32)	1.12 (0.39)	1.07 (0.49)	1.03 (0.73)	1.01 (0.92)	1.04 (0.64)
Healthcare Practitioner, Technical	1.15 (0.33)	1.31 (0.05)*	1.16 (0.30)	1.21 (0.08)	1.02 (0.83)	1.31 (0.07)	1.10 (0.38)
Healthcare Support	1.06 (0.78)	0.99 (0.96)	1.05 (0.85)	0.90 (0.52)	0.88 (0.36)	1.58 (0.12)	0.97 (0.91)
Installation, Maintenance, Repair	1.31 (0.02)*	1.54 (<0.01)**	1.65 (0.02)*	1.28 (<0.01)**	1.26 (0.07)	1.32 (0.03)*	1.51 (<0.01)**
Legal	1.44 (0.16)	1.81 (0.20)	1.25 (0.47)	1.59 (0.21)	1.50 (0.08)	1.19 (0.50)	1.56 (0.19)
Life, Physical, Social Science	0.96 (0.80)	1.68 (<0.01)**	1.12 (0.60)	1.16 (0.33)	1.59 (<0.01)**	0.96 (0.86)	1.23 (0.21)
Management	1.34 (<0.01)**	1.42 (0.03)*	1.45 (<0.01)**	1.28 (<0.01)**	1.04 (0.78)	1.25 (0.10)	1.34 (0.01)*
Office, Administrative Support	1.20 (0.03)*	1.18 (0.18)	1.15 (0.29)	1.11 (0.26)	1.03 (0.78)	1.12 (0.13)	1.05 (0.60)
Personal Care, Service	1.02 (0.85)	0.93 (0.59)	0.86 (0.33)	0.90 (0.42)	0.83 (0.07)	1.18 (0.44)	0.86 (0.17)
Production	1.18 (0.04)*	1.28 (0.09)	1.20 (0.16)	1.15 (0.11)	1.08 (0.40)	1.28 (<0.001)***	1.25 (0.03)*
Protective Service	1.67 (<0.01)**	2.12 (<0.01)**	2.02 (<0.01)**	1.45 (0.02)*	1.25 (0.17)	1.25 (0.11)	1.61 (<0.01)**
Transportation, Material Moving	1.17 (0.23)	1.22 (0.18)	1.38 (0.05)*	1.16 (0.27)	1.03 (0.80)	1.06 (0.41)	1.09 (0.43)

^a: Total PFOA and Total PFOS is the sum of linear and branched isomers of PFOA and PFOS (n-PFOA + Sh-PFOA, n-PFOS + Sm-PFOS)



Prevention through Design (PtD)

Ahmed Al-Bayati, PhD, PE

Imagine a Workplace Where:

- Associate Professor, Civil Engineering, Lawrence Technological University.
- Founding Director of the Construction Safety Research Center (CSRC).



Imagine a Workplace Where:

- Design unsafe features are eliminated
- The likelihood of design-related incidents is reduced
 - More than **40%** of the fatalities examined by Behm (2005) were linked to design-related factors.
 - Haslam et al. (2005) found that design changes could have prevented up to **half** of the incidents they examined.

Others Are doing it....

- The Council of the European Communities (CEC) mandates safety reviews during the design phase.
- Safe Work Australia also mandates safety reviews by a consultant when the designer lacks the necessary safety expertise.

Why Are We Behind?

- Lack of knowledge among designers/Engineers

Open Access

Article

Clearing the Path: Overcoming Barriers to Prevention through Design (PtD) Utilization in the US Construction Industry

by Ahmed Jalil Al-Bayati ^{1,*} ✉ , Karim Bazzi ², Ali A. Karakhan ³ ✉  and Elin Jensen ⁴ ✉ 

- Absence training and education

Top 4

Reaching a Safer Future

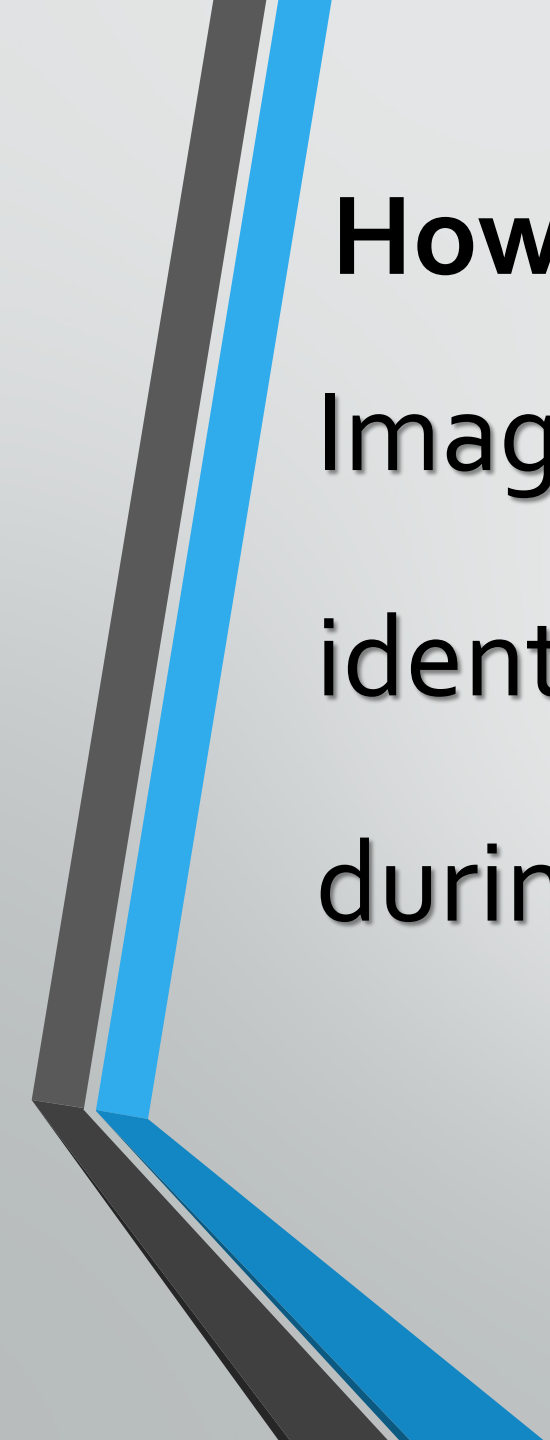
Wiley
Advances in Civil Engineering
Volume 2024, Article ID 6219987, 17 pages
<https://doi.org/10.1155/2024/6219987>

WILEY

Research Article

Pursuing Paradigm Shift in Construction Safety Management: A Theoretical Introduction to the Safety Action Evaluation

Ahmed Jalil Al-Bayati ¹, Keith J. Kowalkowski,¹ and Daniela Schröter ²



How might we get there?

Imagine that future engineers are enabled to identify opportunities to improve site safety during the design phase.

Why Engineers?

They are well positioned to lead PtD collaborative initiatives due to their regular interactions with owners, architects, and builders.



There is an Opportunity (1)

The Civil Engineering Program Criteria Task Committee (CEPCTC) established an updated CE program criteria that introduce safety as a core element of engineers' professional attitudes and responsibilities.

“Evaluation of a specific design, with respect to how it included consideration of the safety of those who construct, use, operate, and maintain the design.”

There is an Opportunity (2)

The Civil Engineering Code of Ethics:

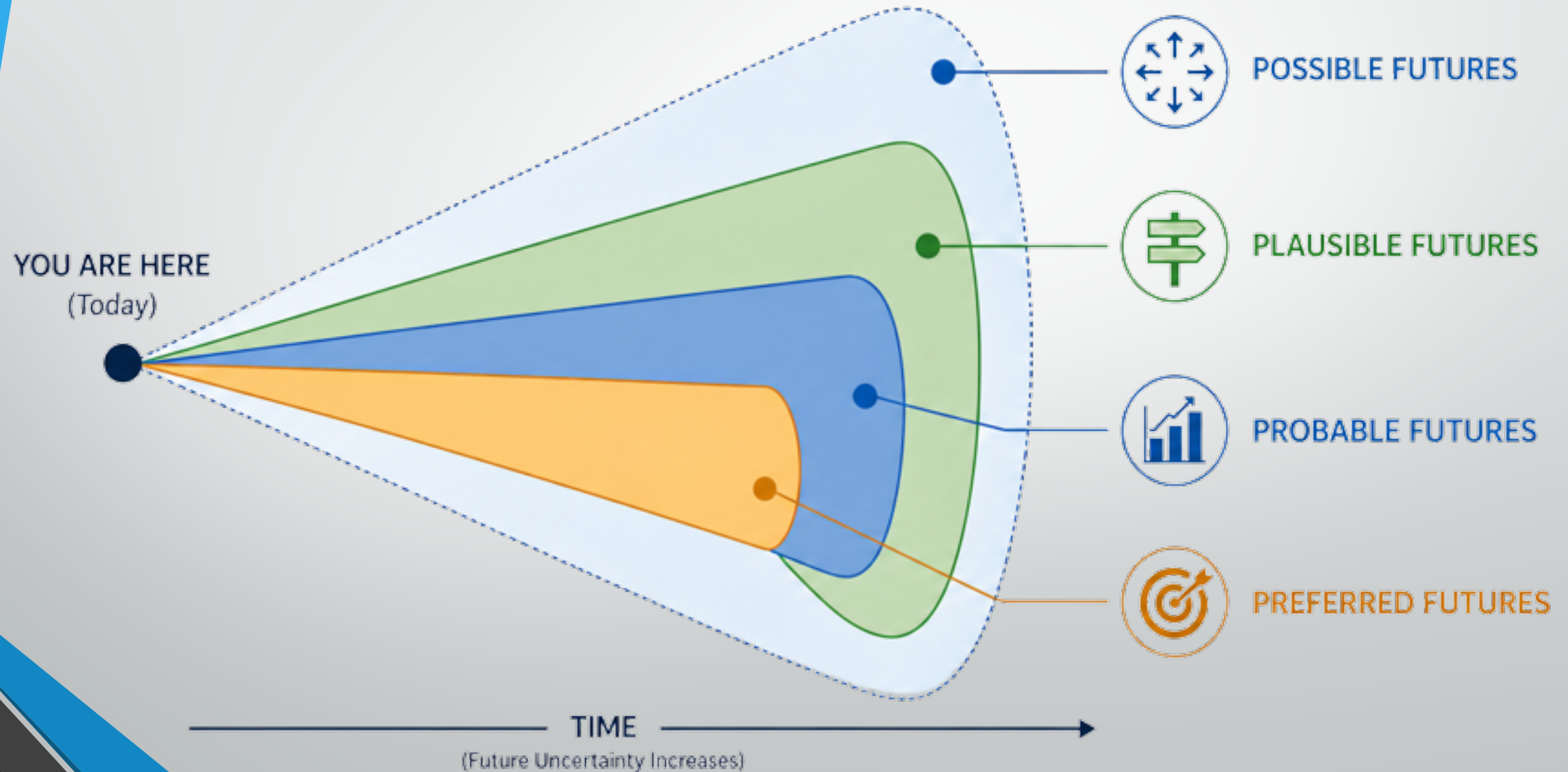
- First and foremost, protect the health, safety, and welfare of the public.
- Foster health and safety in the workplace.

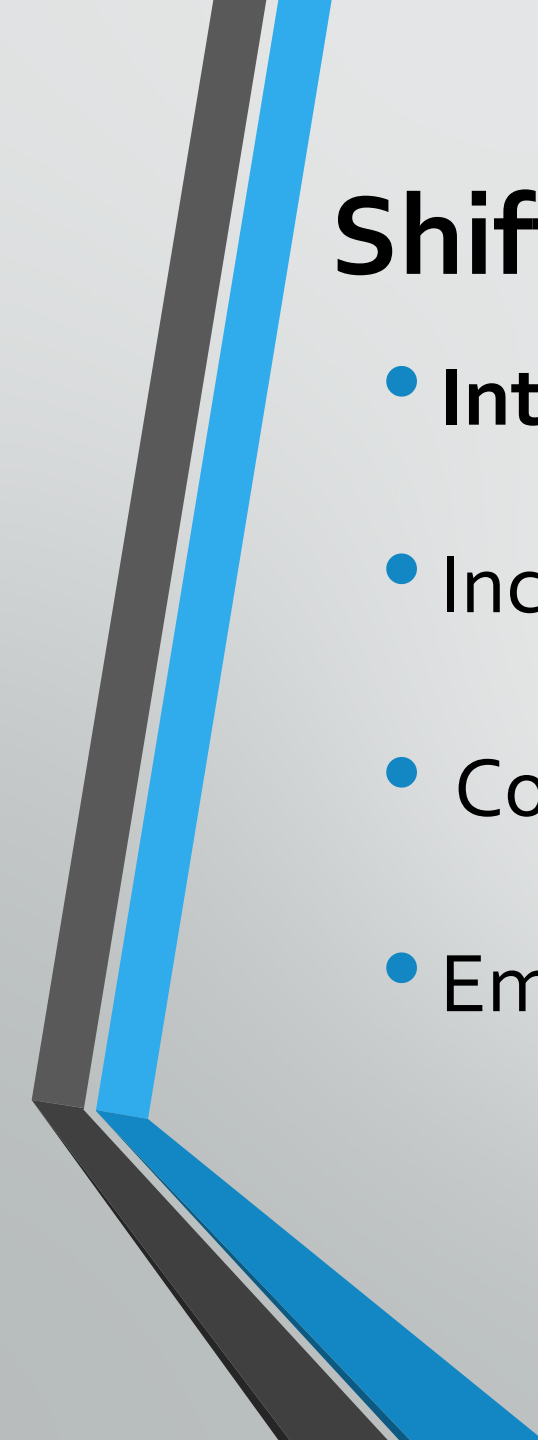


Lack of Resources and Time

- There are no resources available for civil engineering faculty members.
- The perceptions of civil engineering department chairs:
 - **93%** of civil engineering department chairs agreed that PtD is important
 - **83%** stated that there was insufficient curriculum space to offer PtD as a standalone
 - They strongly believed that introducing PtD through accessible, concise, and integrated modules across engineering design courses is more appropriate

Reaching a Safer Future





Shift the cone toward preferred futures

- Integrating PtD in engineering curricula
- Increasing knowledge and awareness among owners
- Collecting and publishing case studies
- Emphasizing the ethical responsibility

LTU Case Study

GC

A/E

Me



LTU Case Study



LTU Case Study



LTU Case Study

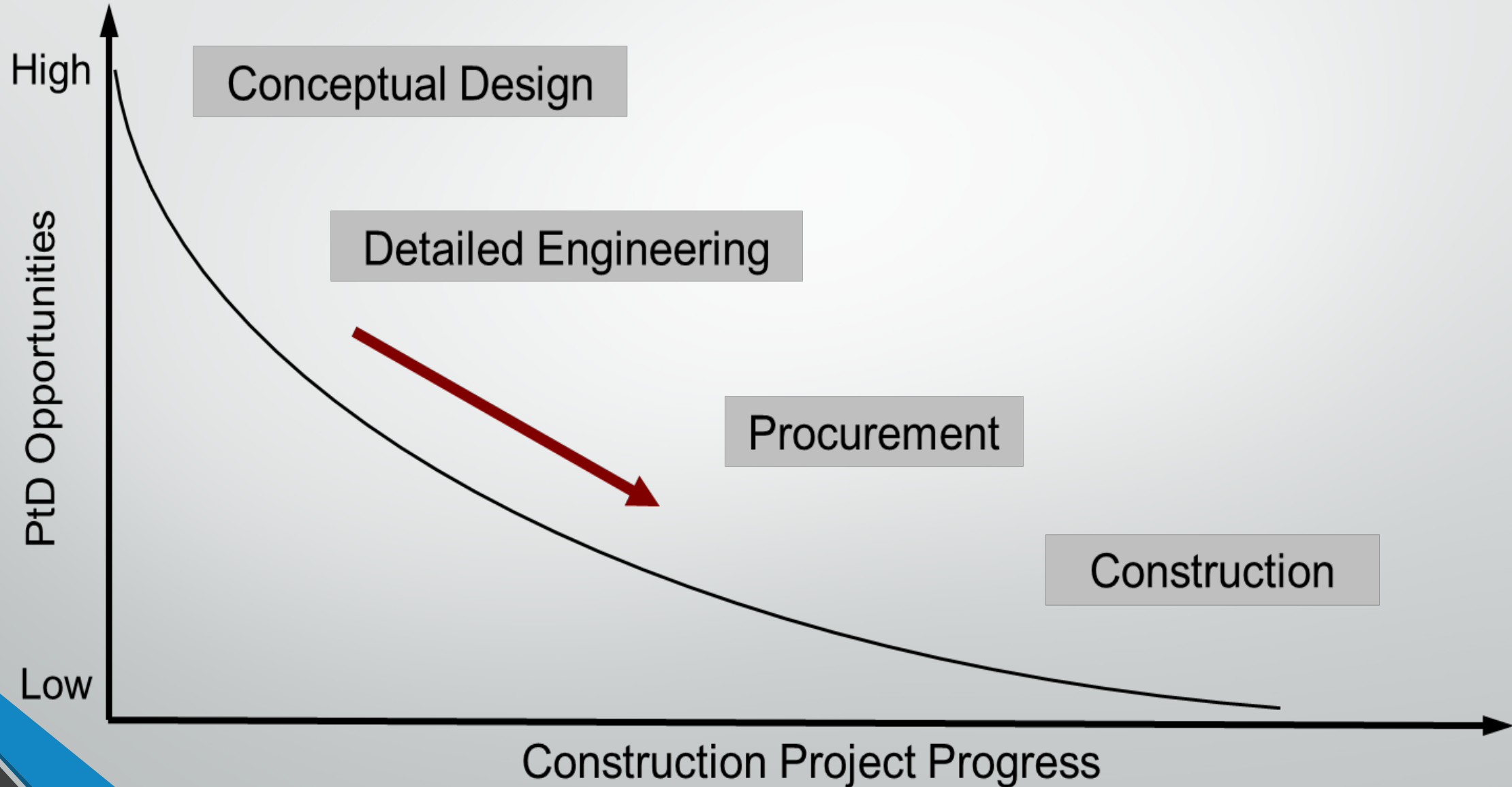
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Criteria	Excellent	Good	Fair	Poor
Hazard Identification	Clearly identifies a specific, relevant safety hazard	Identifies a general hazard	Vague or unclear hazard	No hazard identified
Design-Based Solution	Clear design change to eliminate or reduce the hazard	Helpful design change with some limitations	Minimal safe desing relevance	No safe desing solution
Constructability & Feasibility	Practical and easily implementable design change	Mostly feasible with some concerns	Difficult to implement	Impractical or unworkable or not applicable
Safety Impact	Strong potential to reduce or prevent injuries	Moderate safety improvement	Minor safety benefit	No safety improvement or Not applicable
Clarity & Support	Clear, organized, supported by examples or logic	Mostly clear, some support	Lacks clarity or evidence	Disorganized or unsupported or not applicable

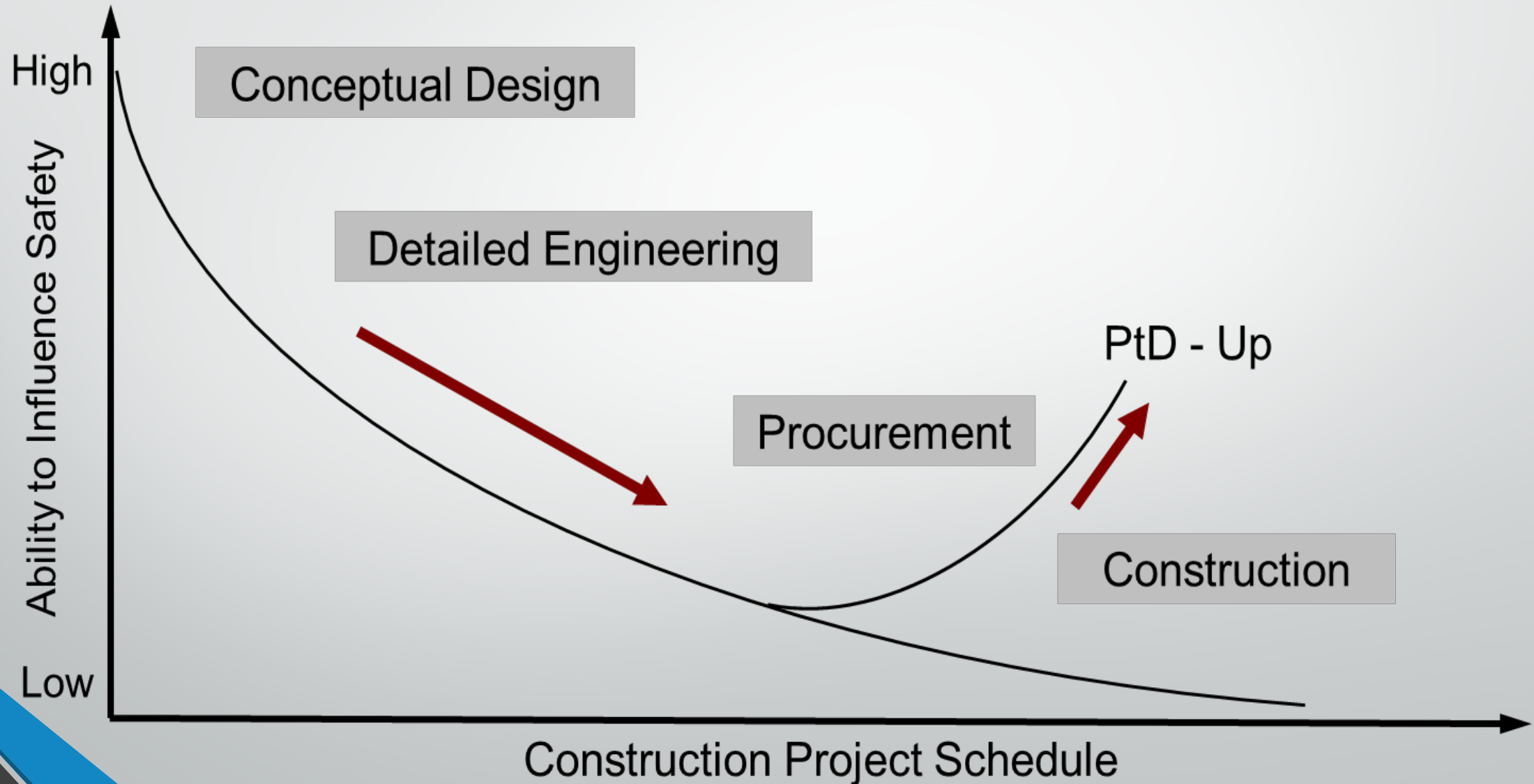


Thank You!
aalbayati@ltu.edu

Design for Safety (Dsf) – PtD



Design for Safety (Dsf) – PtD - UP



Research Project Updates: Investigating Under-Researched Hazards and Solutions

Questions?

Research Project Updates: Addressing Mental Health & Building Resilience in the Construction Industry

Moderator: Jamie Osborne, MPH, CHES, Health Scientist, NIOSH Office of the Director

Collaborative Leadership for Safety and Health in Construction

Natalie Schwatka, Ph.D., Associate Professor and Certificate in Total Worker Health
Program Director, Colorado School of Public Health

Preventing Suicide and Promoting Mental Health in Construction Workers

Sami Tayeb, MA, Clinical Research Coordinator, Washington University School of Medicine
Healthy Work Center

New CPWR and NABTU initiatives

Rick Rinehart, Sc.D., CPWR Deputy Director



Built to LastTM

A Leadership Toolkit

**Centers for Health,
Work & Environment**
colorado school of public health



Natalie Schwatka, PhD MS

Associate Professor

Centers for Health, Work & Environment

Colorado School of Public Health

University of Colorado Anschutz Medical Campus

Our Team



Natalie Schwatka

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Liliana
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Jennifer
Cavallari

Co-Investigator



Suzanne Nobrega

Co-Investigator



Serena
Rice

Co-Investigator

**Centers for Health,
Work & Environment**
colorado school of **public health**



Project aims



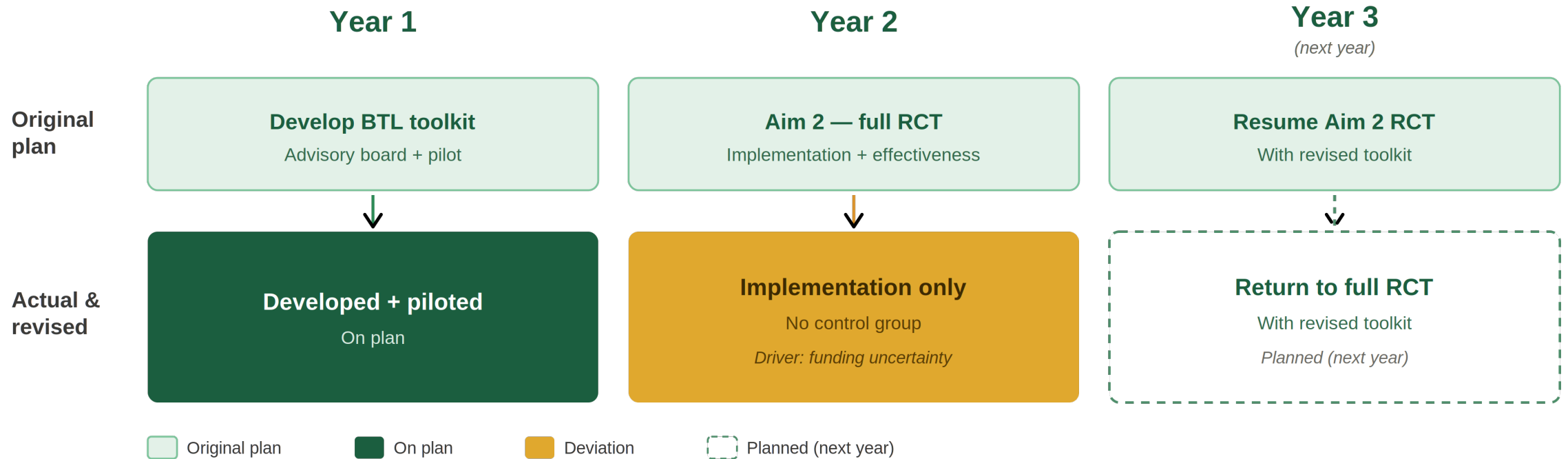
Aim 1 – Develop the Collaborative Leadership for Safety and Health in Construction (CL-SHC) toolkit.

Aim 2 – Evaluate the effectiveness and implementation of the CL-SHC toolkit amongst 8 contractors using a cluster randomized trial design.

Aim 3 – Disseminate the CL-SHC toolkit with the help of key construction industry stakeholders

Goal is to give contractors a systematic method to address both safety AND mental health and well-being concerns in the workplace.

Project timeline



What is the Built to Last Leadership Toolkit?



Built to Last is a practical, evidence-based leadership toolkit.

The toolkit:

- Helps teams identify and tackle everyday challenges affecting safety and mental health & well-being.
- Equips companies with tools, training, and support to build stronger leaders and safer worksites where mental health and well-being are valued.



What Does it Address?



Whether facing high turnover, burnout, communication gaps, or inconsistent safety practices, Built to Last delivers real solutions grounded in daily operations. **Some challenges it addresses include:**

- 1 Limited leadership support for safety and mental health and wellbeing**
- 2 Limited employee engagement in safety and mental health & well-being policies and programs**
- 3 Ineffective teamwork within safety and health committees**

What's included?



Leadership Training

Leadmen · Foremen
Project managers · Engineers
Superintendents

**LEADERSHIP
ENGAGEMENT**

+



Design Sprint

Leaders + crew members
Facilitated by a trained &
trusted
team member

**WORKFORCE
EMPOWERMENT**

=

THE GOAL



A jobsite prepared
and skilled to actively
address its own
safety and mental health
& well-being concerns

Built to Last Toolkit

Together, these components build organizational capacity to identify, design, and implement safety & mental health solutions.

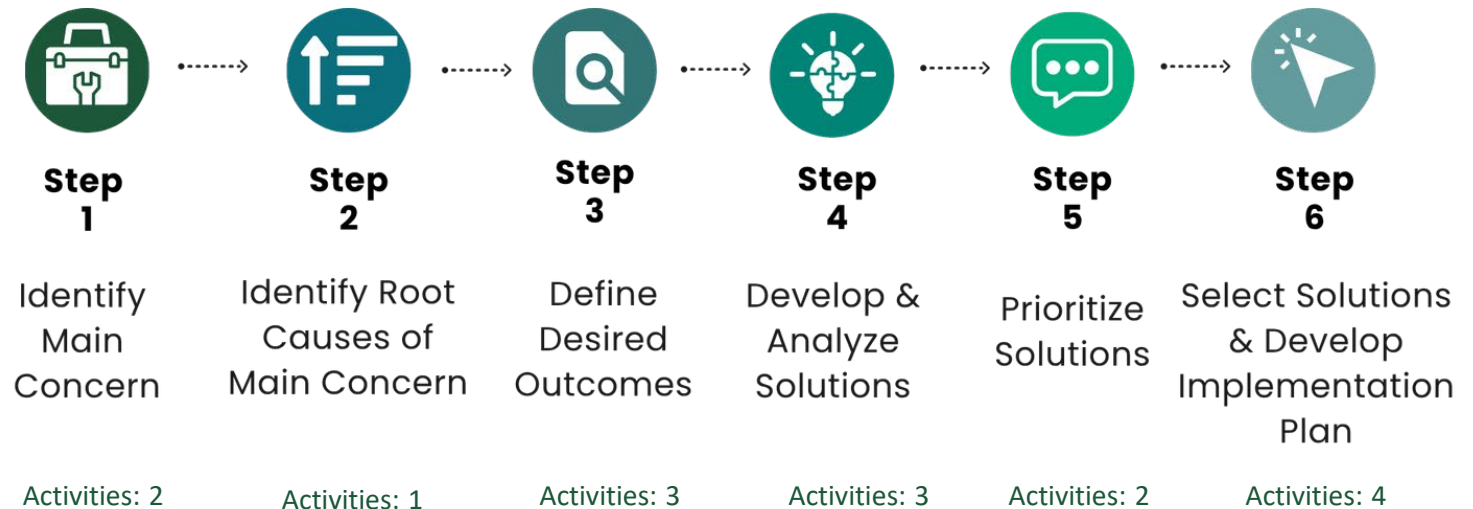
Design Sprint



Training agenda

- TWH approach
 - Defined
 - Fundamentals
 - Importance of worker involvement
 - Hierarchies of control
- Design sprint
 - Roles/responsibilities
 - Run through of each step
- Facilitation skills

Design Sprint Process: 6.5 hours



Goal of year 2 implementation study



Evaluate the implementation of the BTL with construction companies.

Question: Are the BTL toolkit characteristics aligned with achieving implementation goals?

We designed it to be...

Simple

Feasible

Appropriate

Credible

Did that translate to...

Used correctly (fidelity)

Adopted by our audience

Reaching the right people

We are testing 3 BTL use cases this year

	 Multi-state GC based out of Chicago MULTI-STATE GC	 Multi-Sub Jobsite (Denver) MULTI-SUB JOBSITE	 Roofing Subcontractor (Denver)
Who initiated?	VP of Safety reached out after seeing a news article about the BTL	GC pulled in 4 of their subcontractors	Subcontractor reached out after listening to Natalie talk at a conference
Scale	Company-wide	One jobsite, 4 trades - electrical, concrete, window/glass, and carpentry	Company-wide
What this tests	Scaling BTL across a large GC with multiple locations	Implementing BTL across multiple subcontractors on a single project with the GC initiating use	Company-wide adoption within a single subcontractor, including adaptation for bilingual and Spanish-speaking crews

What's working

Recruitment / framing of BTL approach

- The general approach, leadership + sprint for solutions for safety & mental health, resonates with contractors

Leadership training

- Ease of scheduling, a 2-hour slot works well
- Content resonates, insightful discussion

Design sprint

- Scheduling training does not appear to be an issue
- Step 1 (gather list of concerns) generates a diverse list of possible concerns around safety and mental health and well-being

BTL implementation progress

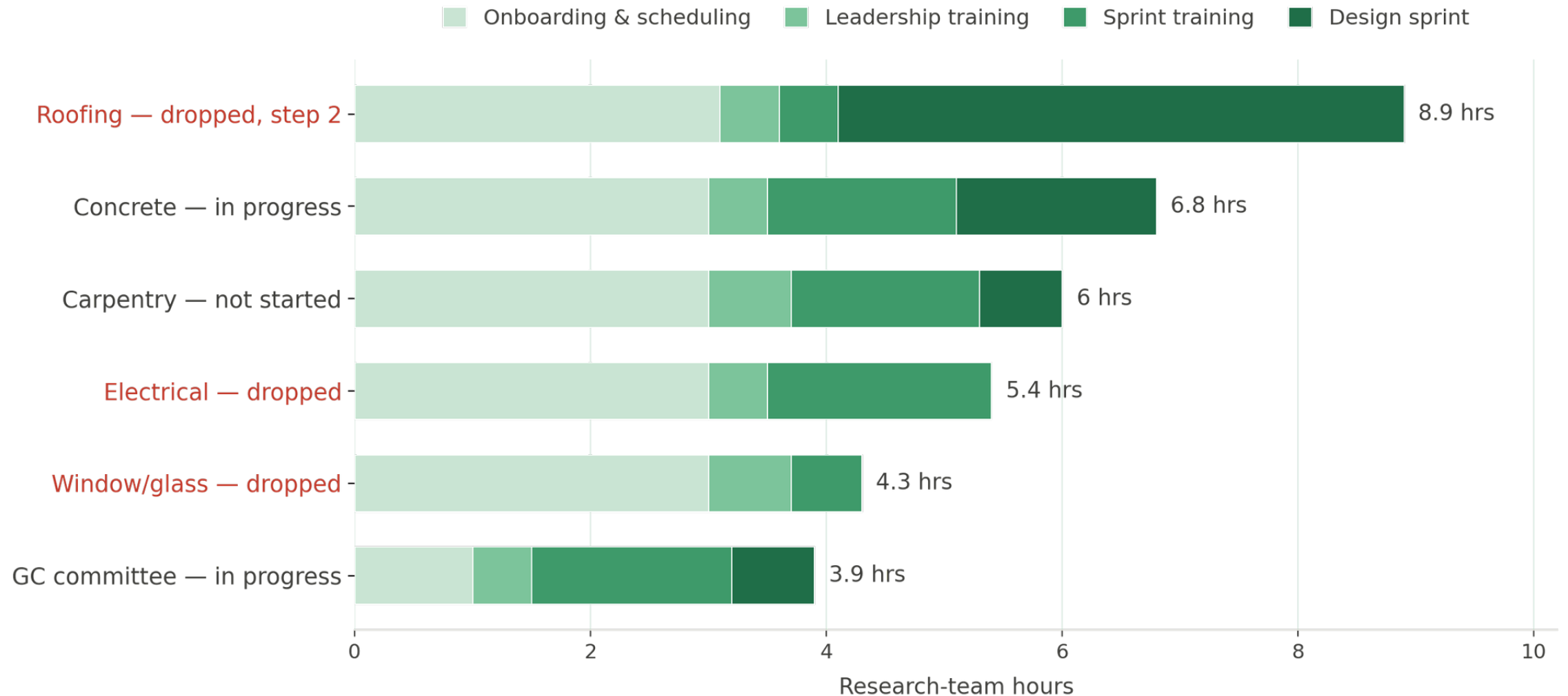
Attrition is happening during the design sprint



	 MULTI-STATE GC	 MULTI-SUB JOBSITE				
	Multi-state GC based out of Chicago	Electrical	Concrete	Window/glass	Carpentry	Roofing Subcontractor (Denver)
Leadership training	Scheduling	Nov 11, 2025	Nov 11, 2025	Feb 13, 2026	Feb 13, 2026	Jan 29, 2026
						Jan 30, 2026
Design sprint training	Mar 30, 2026	Dropped out	Feb 13, 2026	Dropped out	Mar 26, 2026	Feb 5, 2026
Design sprint start	Apr 1, 2026		Mar 6, 2026		Scheduling	Feb 6, 2026
Design sprint progress	Step 1 complete		Steps 1-2 complete		Scheduling	Steps 1-2 complete; Dropped out

Communications tracking

Most time intensive company still dropped out during the design sprint



Barriers

Companies onboard with enthusiasm, but most stall before completing the sprint. Three kinds of barriers may explain why.

- **Design — what we can fix**
 - The design sprint is too big a lift
 - Sprint steps are hard to facilitate (e.g., turning operational concerns into health outcomes)
 - Not yet fully built for Spanish-speaking crews
- **Buy-in & trust — what we have to earn**
 - Leaders and task force doubt their role in crew mental health and org change
 - Crews are hard to engage and slow to trust
 - Mistrust from past wellness efforts that didn't deliver
- **Industry context — what we design around**
 - Tight budgets, workforce movement, funding and regulatory uncertainty
 - Low appetite for anything unproven — "what's the ROI?"

How we are reframing the BTL



- **Fix the design — addressing "what we can fix"**
 - Slim the design sprint from 6.5 to ~3 hours
 - Action-oriented steps, less facilitation lift
 - Make it speak construction — and Spanish
- **Earn buy-in — addressing "what we have to earn"**
 - Recruit for readiness, not type
 - Champion-led, flexible delivery
 - Small bites and early wins (answers "what's the ROI?")
- **Work with the context — addressing "what we design around"**
 - Build other versions of the toolkit (e.g., for unions)
 - Explore policy-level solutions



Summary & next steps

- **What we learned**

- Interest is high — the leadership + sprint approach resonates and companies sign up
- Completion is the gap — most stall during the design sprint, and our most time-intensive case still dropped out
- It's the lift, not the appeal — so the fix is a lighter, more flexible toolkit

- **What's next**

- Revise the BTL — slimmer sprint, construction- and Spanish-ready, champion-led delivery
- Evaluate implementation and effectiveness starting fall 2027
- Develop other versions (e.g., unions) and explore policy levers during dissemination



THANK YOU



Natalie Schwatka, PhD, MS

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The development of this toolkit was supported by CPWR: The Center for Construction Research and Training (CPWR) through Cooperative Agreement Number U54OH012761, funded by the Centers for Disease Control and Prevention/NIOSH. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CPWR, the Centers for Disease Control and Prevention/NIOSH or the Department of Health and Human Services.

**Built to
Last**
A Leadership Toolkit
TM

**Centers for Health,
Work & Environment**
colorado school of public health



CPH-NEW
Center for the Promotion of Health
in the New England Workplace

Revised design sprint



Phase	Details	Covers Old Steps	Time saved
Phase 1 <i>Identify the problem</i>	What's the problem? What's driving it? • Short concern generation survey to surface what's on the crew's mind • Toolbox talk to do a root cause analysis of the concern most commonly raised	Step 1: Identify & Prioritize Main Concern Step 2: Identify Root Causes	~30 min
Phase 2 <i>Develop solutions</i>	What would help? Take what the crew said and shape it into a real plan • DS team meeting • Weigh solutions • Define what success looks like • Pick the top options • Quick check-back with the crew on the solution shortlist via TBT/survey	Step 3: Define Desired Outcomes Step 4: Develop & Analyze Solutions Step 5: Prioritize Solutions	~90–150 min
	How are we going to implement the solutions? • Present the solution shortlist • Commit to solutions • Plan the rollout & create the 'DS work plan' • Secure resources	Step 6: Select Solutions & Create Implementation Plan	~0 min (about the same)
Phase 3 <i>Implement solutions</i>	Is it working and how do we keep it going? • Roll out solutions • Track progress/milestone review • Close the loop with crews	— (To be developed)	
		Time saved	~2.5–3 hrs (~40% less)

Preventing Suicide and Promoting Mental Health in Construction Workers

Sami Tayeb, MA

Bradley Evanoff, MD, MPH

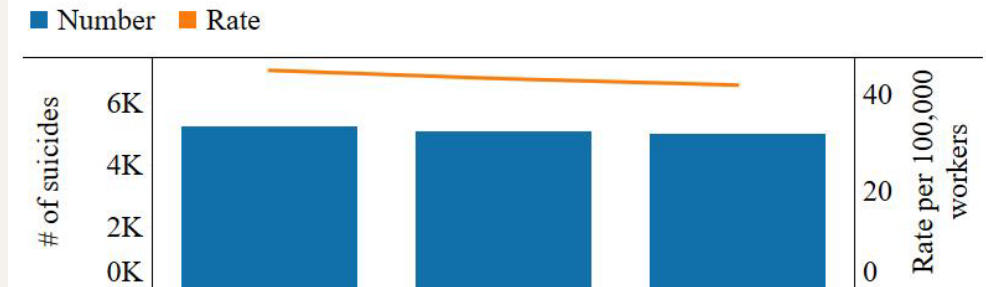
The Center for Construction Research & Training
Research to Practice Seminar
June 9, 2026
Washington, DC

Study Rationale

Addressing an Urgent Need in Construction

- Construction workers are more than twice as likely at risk of suicide compared to other male workers
- Construction workers are approximately five times more likely to die from suicide than from a workplace injury
- Organizational and cultural factors in construction increase the risk of mental health problems
 - Long working hours, precarious work, high injury rates
 - Cultural norms and stigma inhibit help-seeking
 - Highly fragmented health care offerings

Suicide and overdose deaths among construction workers aged 16 to 64 years old (2022-2024)



Source(s): : National Center for Health Statistics, 2022-2024 Mortality Multiple Cause File and IPUMS, 2022-2024 Current Population Survey. Calculations by CPWR's Data Center.

This project builds on long-running efforts to decrease addiction and improve mental health

Annual St. Louis “Stand down for suicide prevention” in construction since 2019

Created toolbox talks and other materials to improve awareness

YOU OKAY?

Suicide Prevention in the Workplace

Toolbox Talks and Facilitator Guide



Change cultural and organizational factors to increase help-seeking & help-offering by construction workers

- **Increase utilization of existing mental health resources** such as EAPs, MAPs, and health benefits
- **Improve help-offering:** know how to find help and how to direct co-workers for help
- **Increase willingness to seek help** (increase awareness, decrease stigma, normalize help-seeking)
- **Peer based programs** to increase help-offering and help seeking

Multi-level, multi-component programs are needed to effectively change risk

- Effective workplace mental health programs:
 - address both personal and organizational determinants of workplace mental health
 - identify those most at risk
 - provide timely referral
- MATES in construction: successful, multi-level, multi-component program from Australia
- Three levels of training: General Awareness (all workers); Peer Connectors (peer gatekeepers); Advanced Suicide Intervention Skills Training (ASIST) plus Case Management

Study Aims

- **Adapt** key elements of the Australian suicide prevention program “MATES in Construction” for application in the US construction industry to improve awareness, help-seeking, help-offering, & referral (differences in health care system & industry structure require changes to content, context, organization)
- **Implement** the program in six regional construction companies
- **Evaluate** implementation of the adapted intervention, resulting changes in attitudes and behaviors regarding suicide and mental health, and changes in mental health service access and use
- **Disseminate** the program to reach a wide audience in the industry



COMPASS

Construction Organizations Mobilizing for Peer Support & Suicide Safety

- A suicide prevention and mental health promotion framework that addresses the unique needs of the US construction industry
- Inspired by the Australian “MATES in Construction” program; adapts key elements of this program
- Includes three levels of suicide prevention training



Training, peer support network, and referral

Level 1: General Awareness Training (GAT)

1-hour annual training to all workers on site: increase awareness, willingness to seek help

Level 2: Peer Connector Training

5% of workforce receives 4-hour training – train peers to increase help-seeking, help-offering; “hand off” workers in crisis

Level 3: Applied Suicide Intervention Skills Training (ASIST)

2-day training for employees of the MATES trust who provide evaluation and referral



Tarlton Pilot Program Overview*

- Two-day ASIST training for HR & safety managers — August '23
- Half-day safeTALK Training for Peer Connectors in — October '23
- GAT for all workers: Five days of TBTs in — September '23
- Hard Hat Stickers; resource cards
- Final TBT promoting the program — January '24
- Interviews with trained personnel — March-May '24



*Supported by CPWR small grant

Semi-structured Interviews: HR, Workforce management, Superintendents, Safety Managers (n=11)

Value of training:

- Increased awareness of mental health, suicide, and substance use
- Enabled people to talk openly about mental health, in a way they had not been able to before
- Promoted cultural shift within the industry toward more accepting and understanding climate for workers struggling with mental health concerns
- SafeTALK and ASIST seen as valuable and useful; increased confidence and perceived skills - many had already used skills
- Program seen as an acceptable solution to an unmet need in the industry; addressed stigma and promoted mental health awareness in a way that stakeholders felt was congruent with industry culture

Icon Interview Quotes

“On the training

“Taking the class, I learned quite a bit of just how the first initial 60 seconds of your conversation can change [...] that person’s outlook on the day...We got 300-plus people in this office. I may not deal with them every single day, but I may see somebody for about 60 seconds of, “hey, how are you doing?” and then, on to the next. That 60-second interaction actually changes a lot for you...Because you’re doing that every day. We get to see anywhere from 20 to 700 guys. Are you gonna know all 700? No. But are you gonna know that somebody’s having an issue that day? You can tell by the body language, by the talk, the conversation, that they’re presenting to you just by saying, “hey, how’s today going? Or, hey, how’s the week been? Or, thanks for being that smiling face, showing up, and then they break down.”

Icon Interview Quotes

Making mental health and suicide prevention part of the existing safety training

“Some of our customers and clients are asking that in order for a safety rep to be on the job site, they have to have some sort of mental health first aid. Not only do you have to have your OSHA 30 or a higher training of that level, they want that mental health first aid.”

“[For] toolbox talks,...we talk about these physical things that can get you hurt, but we’re not talking about the guy who walked through the gate and he just found out that his wife’s divorcing him, and he’s distracted, you know with this. Is he necessarily thinking about suicide? No, but he definitely is mentally struggling and mentally not present. And all of those things, I think, build up and leads to this bigger issue of suicide because, eventually, they get to a point where they can’t take it anymore. So just trying to incorporate more of that into the [trainings].”

Icon Interview Quotes

Acceptability

“Office staff didn’t [initially] want to participate, and then all of a sudden they came back [after workers went through the first training] and they were like, “we were never invited,” and we were like you 100% invited. So I think the more they hear about people going through the training, the more encouraged they are to do it...We had buy-in from our upper management, you know, like our vice president and people like that. They really encouraged participation in this program so I think that really helped as well.”

Study Updates

- We've partnered with three regional contractors:
 - Emery Sapp & Sons
 - Icon Mechanical
 - Guarantee Electrical
- Strong support from company leaders
- Working closely with their safety teams and HR benefits personnel
- All three have completed LivingWorks ASIST and safeTALK trainings
- Several additional contractors have expressed interest in partnering with us
- Guarantee Electrical has fostered a strong partnership with IBEW 1 to administer the GAT to 700+ electrical workers this summer

Study Updates (Evaluation)

- Collected and analyzed Organizational Readiness for Implementing Change (ORIC) survey data
- Collected worker surveys from two contractors, will start collecting surveys from third later this month
 - 10 question mobile phone survey before GAT, then again at 1 week and 3 months after training
 - Document changes in attitudes, help offering and help seeking
- Analyzed high-level company provided EAP utilization data
- Have conducted 17 post-implementation evaluation interviews
 - Currently coding using the Proctor Implementation Framework using metrics of *acceptability, adaptation, appropriateness, feasibility, fidelity, implementation cost, penetration, & sustainability*

Study Updates (Dissemination)

- We've presented the COMPASS framework to local, regional, and national audiences
- Version 1 of COMPASS playbook is available to download from the CPWR Website
- Version 2 will come out later this year with a new redesign
- We're working to collaborate with national organizations to promote COMPASS

Download the COMPASS playbook at CPWR



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Reach out to us to further discuss the COMPASS framework





Addressing Mental Health in Construction

New CPWR & NABTU Initiatives

R2P Seminar & Partnership Workshop. June 9, 2026

Rick Rinehart, ScD

Deputy Director, CPWR

Principal Investigator, Building Trades National Screening Program (BTMed)



Overview

- Resources
- Research and Action Agenda
- August 2026 Workshop

Resources

www.cpwr.com/mentalhealth

Resources

- Mental Health Page:
[**https://cpwr.com/mentalhealth**](https://cpwr.com/mentalhealth)
 - Statistics and reports
 - Toolbox Talks, Hazard Alerts, Infographics
 - Research
 - Webinars
- Data Center Outputs



Data Center Outputs

- Data Bulletins and Publications
- The Construction Chart Book and Interactive Dashboards
 - Percentage of workers with anxiety, depression, and psychological distress by year.
- Current Statistics



Data Bulletin

WWW.CPWR.ORG

APRIL 2025

Construction Worker Injuries, Overdoses, and Suicides

Derek Duloe, MS, Amber Trueblood, DrPH, Raina D. Brooks, MPH, William Hanis, MS¹

OVERVIEW

The construction industry is *one of the most dangerous* in the U.S., accounting for nearly one-fifth of all workplace deaths in 2023. Construction workers face hazards such as dangerous equipment, falls and slips, overexertion, transportation accidents, and exposure to harmful substances. While fatal and nonfatal injuries have their greatest effects on workers and their families, they also affect construction companies, who experience *loss of productivity and financial costs*. In addition, research shows that hazardous work is associated with poor mental health.

This Data Bulletin examines fatal and nonfatal on-the-job injuries, as well as mortalities by cause of death among U.S. construction workers. Injury data was collected from the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries and Illnesses (SOII). Fatal injuries were examined by demographics, major subsector, event/exposure, work activity, and worker location. CFOI does not typically include illnesses with long latency periods, such as cancers caused by exposure to work-related carcinogens. Nonfatal injuries are only those that resulted in *days away from work (DAFW)*. Nonfatal injuries were examined by major subsector, event/exposure, and primary source. Because SOII data changed from annual to biennial estimates in 2021, nonfatal data are shown for two-year periods. Data on cause of death for construction workers 16 to 64 years old was obtained from the National Center for Health Statistics National Vital Statistics System (NVSS). NVSS data does not capture employment status (full-time, unemployed, retired, etc.) at time of death. Construction workers are defined in NVSS data as those whose usual industry was construction, including individuals currently employed, retired, or no longer in the workforce. Data for rate calculations were obtained using the Current Population Survey (CPS). Rates calculated per 100,000 full-time equivalents (FTEs) for fatal injuries and per 10,000 FTEs for nonfatal injuries.



CPWR-The Center for Construction Research and Training. Correspondence to: ADAM@CPWR.ORG

THIS ISSUE

This issue examines on-the-job injuries, as well as suicides and overdoses using mortality data.

KEY FINDINGS

In 2023, workers aged 35-44 years old had the highest number of fatal injuries (n=256), while those 65 years or older had the highest rate (20.0 per 100,000 FTEs).
Chart 1

Specialty Trade Contractors (NAICS 238) accounted for 62.0% of fatal injuries in 2023 that had a reported major subsector.
Chart 2

The rate of nonfatal on-the-job injuries decreased 29.5% from 2011-2012 (119.8K to 84.4K per 10,000 FTEs).
Chart 3

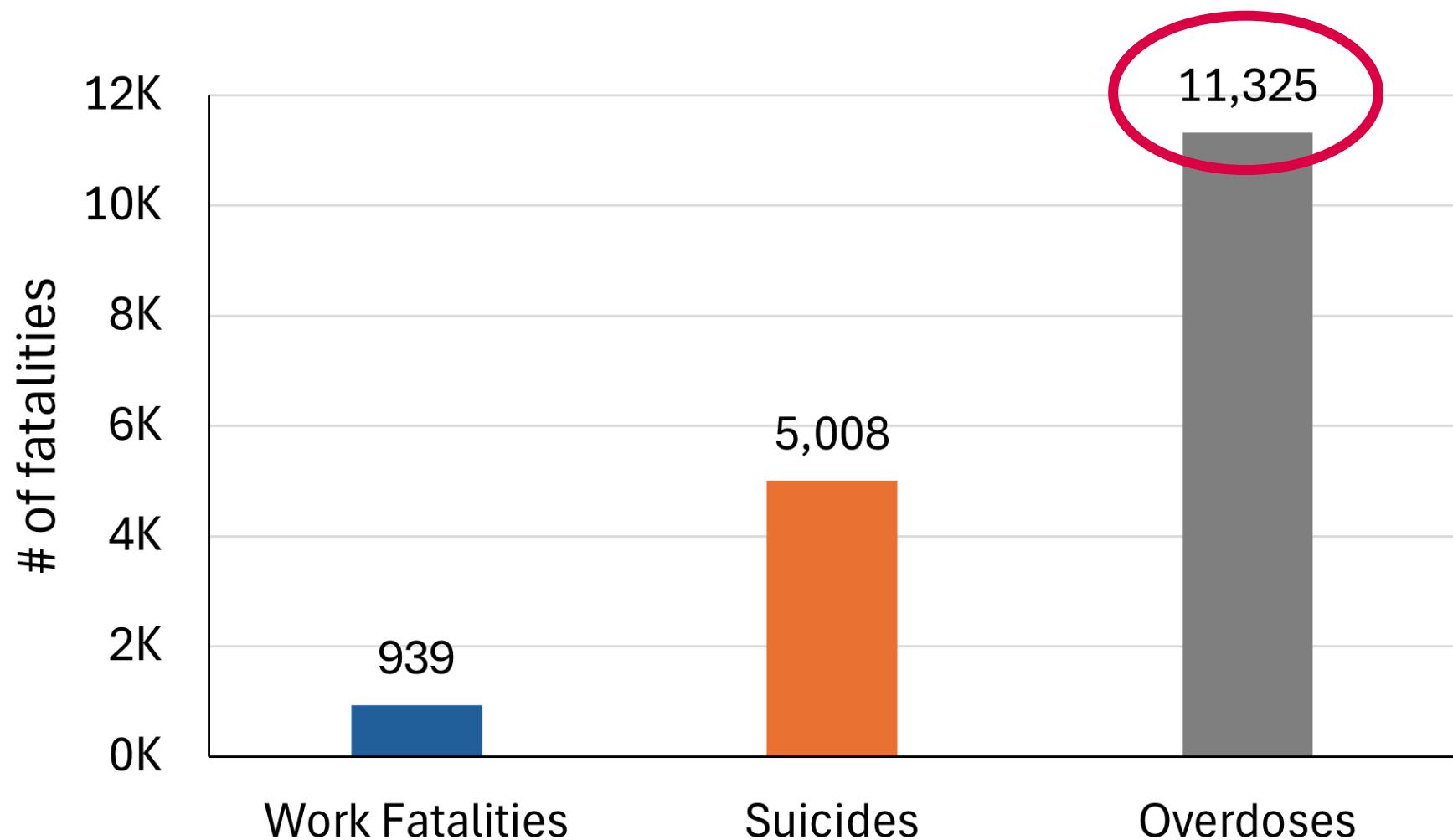
From 2021 to 2022, the most common events/exposures for nonfatal injuries were contact incidents, falls, slips, and trips, and overexertion/bodily reaction incidents (n=126.6K, 68.1%).
Chart 4

In 2023, there were 15.9K overdose deaths among construction workers, with synthetic opioids involved in three out of four overdoses.
Charts 11, 12

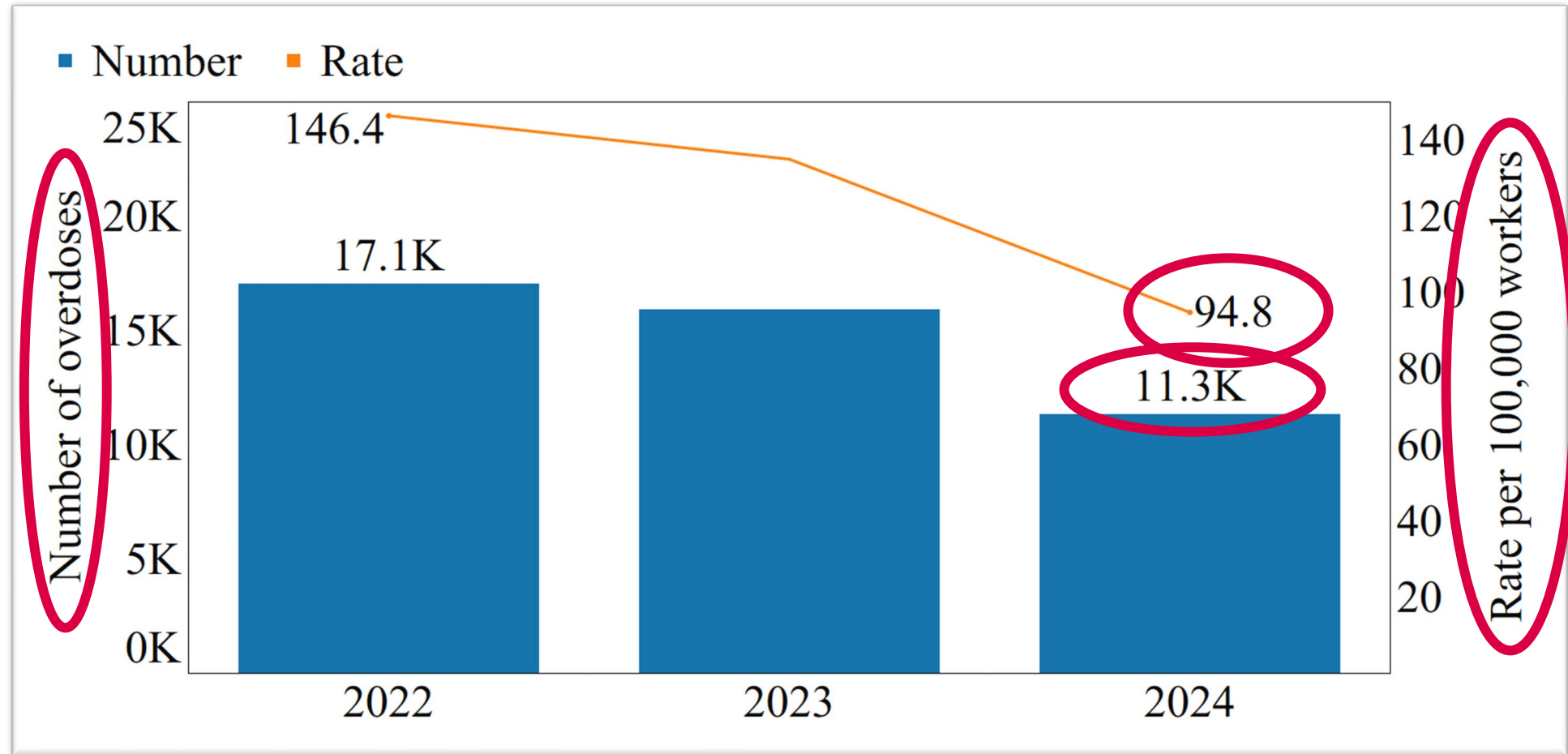
NEXT DATA BULLETIN

Musculoskeletal disorder (MDOs) trends in construction

Construction Worker Fatalities by Cause (2024)

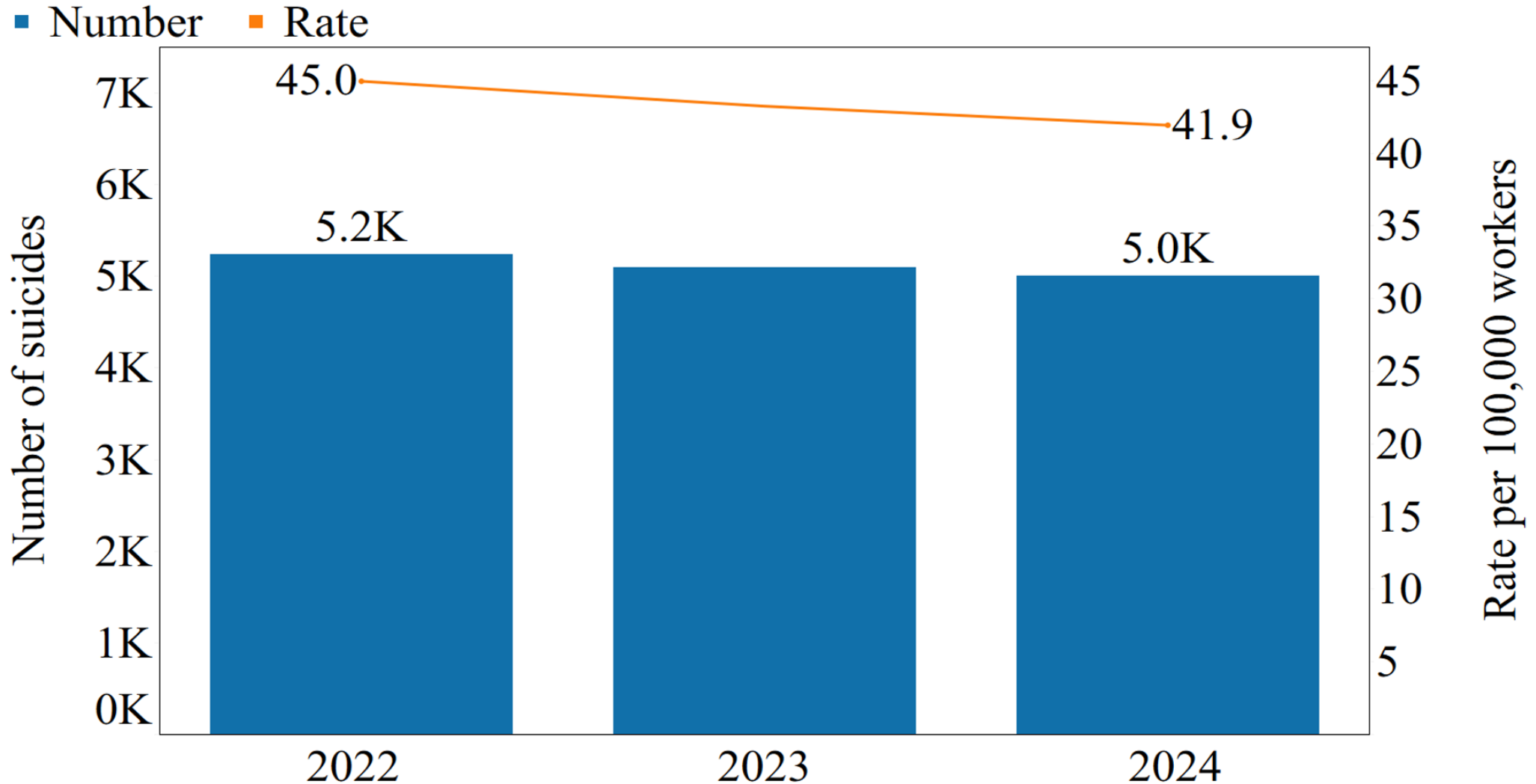


Overdose Deaths among working age construction workers (2022-2024)



Suicide Deaths

among working age construction workers (2022-2024)



Training

- Supporting unions delivering mental health awareness, train-the-trainer, and peer-led training programs
- Co-developing a **minimum standard for suicide awareness training** for construction workers with NABTU & partners



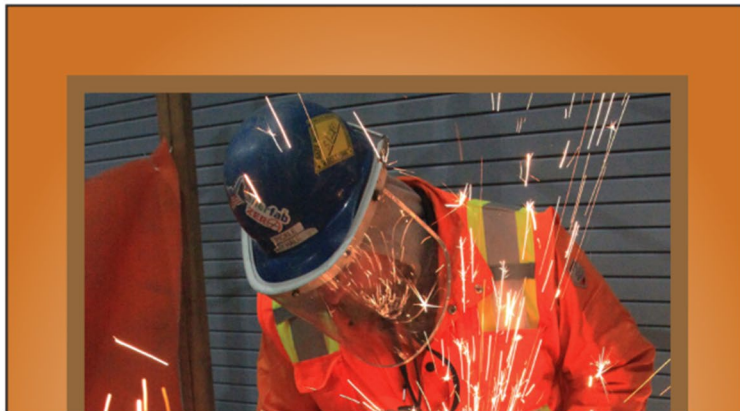
Example of Small Study funded by CPWR

Impact of Employment Laws on Construction Worker Suicide

Jonathan Davis, PhD

University of Iowa College of Public Health

February 2025



1. Female construction workers had significantly lower suicide rates in states with **family and paid leave laws**; male workers also saw benefits.
2. States with laws restricting **opioid prescribing practices** saw lower suicide rates among male construction workers.
3. **Substance use** was more commonly a **contributing factor** in construction worker suicides than in other occupations.

NABTU/CPWR Newsletter



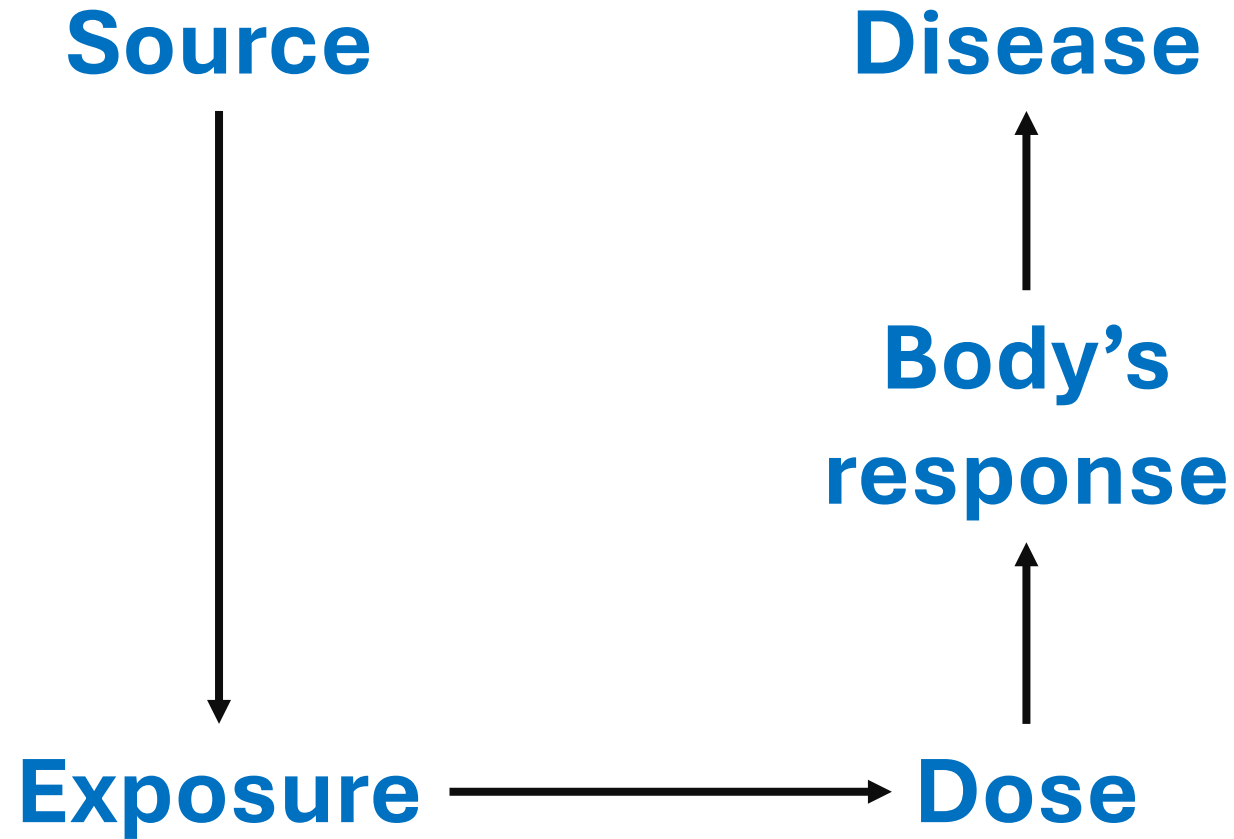
Resources and
Effective Programs
Addressing **S**uicides
and **O**pioids **N**ow



Research and Action Agenda

Upstream Focus: Risk Factors & Prevention

Paradigm of Occupational Health



Where do industrial hygienists and safety professionals engage?

Where do occupational nurses and physicians engage?

A Mental Health Paradigm for Construction

Hazards Embedded in
Construction Work
Systems

Source

(e.g., long working
hours, uncertainty of
employment, lack of
paid leave, poor safety
climate/culture)

How Workers
Experience Hazards

Exposure

Research and Action Agenda

Disease

Mental Health
Conditions and
Acute Events

**Body's
response**

Early Signs and
Warning Indicators

Dose

Cumulative
Stress Over Time



August 2026 Workshop

Intentionally emphasizing **upstream hazards at the source** to complement ongoing downstream efforts, so risks are reduced before they need to be managed individually.



CPWR 
THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

SAVE THE DATE

August 4-5, 2026 | DoubleTree by Hilton, Silver Spring, MD

COMBATING SUICIDE AND OVERDOSE IN THE CONSTRUCTION INDUSTRY

A WORKSHOP ON WORK-RELATED RISKS AND PROTECTIVE FACTORS

August 4-5, 2026
Silver Spring

The Workshop Will:

- **Deepen understanding** of upstream workplace factors contributing to mental health and substance use outcomes.
- **Share practical tools, resources, and guidance** for prevention and implementation.
- **Strengthen collaboration** to support coordinated, action-oriented efforts that build toward scalable, sector-wide approaches.

Why This Matters

- Construction has among highest suicide & overdose rates
- Not explained by individual factors alone
- Work conditions play a major role in risk

Research Project Updates: Addressing Mental Health & Building Resilience in the Construction Industry

Questions?

Research Project Updates: Continuous Improvement at CPWR: Ensuring Solutions Make an Impact

Moderator: Donald Peterson, Ph.D., Director, NIOSH Division of Safety Research and Acting Associate Director of Construction Safety and Health

Overseeing CPWR's Research Planning & Evaluation
Cora Roelofs, Sc.D., CPWR Director of Evaluation

CPWR's Research to Practice (r2p) Program
Jessica Bunting, MPH, CPWR r2p Director

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

EVALUATION OVERVIEW

Cora Roelofs, ScD
Director of Evaluation



THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

R2P Meeting

6/9/26

National Construction Center Evaluation Components

- Logic Model
- Monthly Bullets
- Touch-Base Calls/Tool (2 x year)
- All Hands Survey
- R2P Roadmaps
- Interim and Final Reports

NIOSH's Evaluation Logic Model

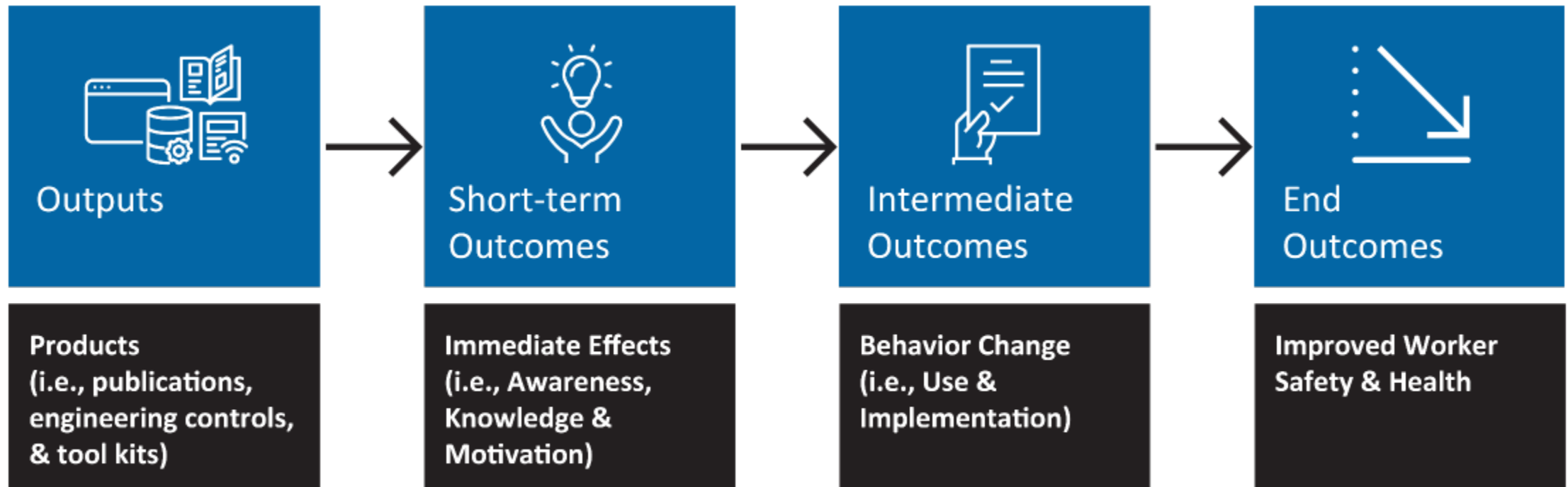


Figure 1: A graphic showing the relationship between outputs, outcomes, and what impact is achieved with the accomplishment of each type of outcome.

Touchbase Process and R2P

- *Please list research products other than peer-reviewed publications and presentations that are planned or may result from this project (e.g., training modules, employer guidance, fact sheets, etc). If you want to turn a peer-reviewed or academic oriented work into a research product, please list it here too.*
- | Product Name | Brief Description | Category | Describe "Other" | If it |
|--------------|-------------------|----------|------------------|--|
| | | | | will it be embedded in a specialized app, which one? |
| | | | | Primary Audience |
| | | | | Secondary Audience |
| | | | | Additional audience |
| | | | | Where would this product be hosted/made available? |
| | | | | Where do you see this product living in 5 years? |
| | | | | When would this product need to be updated? |
- **EXAMPLE: PFAS Hazard Alert Card**

WOULD YOU LIKE HELP FROM CPWR WITH:

Product	Target Release Date; Anticipated Draft Date; Draft Review		
Co-Branding	Design & Graphics	Publicity	Hosting a Webinar
Reaching Target Audience	Hosting Product on our Website		
Future Updates	Archiving & Storage	Commercializing, IP &	
Public Access	Other (Describe)		

Research to Practice (r2p) at CPWR

Jessica Bunting, MPH

Grace Barlet, MPH

Rosa Greenberg, MPH

Chris Le, MPH

Chris Rodman, MPH

Cora Roelofs, Sc.D.

Bill Wright

2024-2029 r2p Aims

AIM 1: Provide ongoing r2p guidance and support to researchers

- Use r2p Roadmap process with Center-funded researchers
- Provide r2p guidance and support to non-Center-funded researchers, including NIOSH and other partners

AIM 2: Engage existing and new partners to address high-priority hazards by moving research into practice

- Provide ongoing leadership and support on interagency campaigns and initiatives (e.g., heat, Safe + Sound, Struck-by Stand-Down)
- Evaluate National Falls Campaign and Stand-Down
- Collaborate with partners to identify and address high-priority hazards
- Plan and host annual r2p Seminar

AIM 3: Improve CPWR's English-to-Spanish translation process to develop culturally and linguistically appropriate resources

- ID preferences & messaging techniques via a rapid review of literature
- Develop SME panel
- Conduct survey to learn about overcoming barriers to OSH for immigrant workers
- Establish & implement new English-to-Spanish translation process
- Evaluate selected products

AIM 4: Improve understanding of and ability to reach and influence small, residential and light commercial construction contractors through a community-based outreach effort

- Conduct outreach effort w/ assistance from Virtual Roundtable & intermediaries
- Evaluate reach and impact of the outreach effort

AIM 5: Maintain and enhance the r2p Library

- Continue to update, eliminate, or consolidate existing tools and resources
- Develop and disseminate a minimum of 4 new translational products per year in support of Aims 1-4

Aim 1: Provide ongoing r2p guidance and support

Data & Trends: Dodge Smart Market Research



Ongoing Exoskeleton Research

NIOSH Study (Dr. Chris Pan): *Use of Exoskeletons on Elevated Equipment*

Objectives: to examine passive exoskeleton use on construction elevated equipment



Scissor Lift**



Construction Elevator*

*Fraco Inc. **Getty Images

Ongoing Heat-Related Research

Construction Workers and Contractors Help prevent heat-related deaths

Share your experiences and knowledge about working in the heat and make jobsites safer.

CPWR—The Center for Construction Research and Training is the country's leading nonprofit dedicated to reducing injuries, illnesses, and fatalities in construction. We are conducting a research study to improve heat illness prevention and better protect construction workers.



Two ways you can help

① Take a short survey and share the survey. → cpwr.com/heat-survey



② Invite CPWR researchers to one of your worksites this summer so they can see the protections you've already developed.

→ If interested, contact Project Director, Gavin West at 301-495-8522 or gwest@cpwr.com.

CPWR Study (Gavin West): [Advancing Heat Safety in Construction](#)

Objective: Develop evidence-based solutions to prevent heat-related illness and injury for contractors of all sizes

https://www.cpwr.com/wp-content/uploads/RP-EN_SP-Heat_study_recruitment_flyer.pdf

Aim 2: Engage existing & new partners to address high-priority hazards by moving research into practice.



Monday, April 20th at 1:00 PM Eastern
Struck-by Stand-Down Webinar on
Use of Positive Protection Devices for
Work Zone Safety

Learn about recent changes to the Federal Highway Administration's Work Zone Safety and Mobility rule, which dictates when positive protection devices must be used or considered, the practical application of this rule, plans for its implementation, and types of positive protection companies may want to consider using.

 [Register at cpwr.com/webinars](https://cpwr.com/webinars) 



 **2026 National Safety Stand-Down to Prevent Falls**
Calendar of Virtual Events

Wednesday, April 15th at 1:00pm ET
Showcase of New Resources to Prevent Falls from Premier Partners
Join several of our 2026 Falls Campaign Premier Partners - leading organizations that commit to take additional steps to advance the reach and impact of the Falls Campaign - to learn about **new FREE resources** they have developed to support the National Safety Stand-Down to Prevent Falls in Construction.
[Learn More & Register Now](#)

Monday, May 4th at 2:00pm ET
Kick-Off the 2026 Safety Stand-Down to Prevent Falls in Construction!
Start your National Safety Stand-Down week (May 4th-8th) by joining OSHA, NIOSH and CPWR for an official launch event. This webinar will feature a case study of a real fall incident, provide an overview of the most up-to-date available data on trends in falls in construction, and highlight the extensive library of free resources available from the National Campaign to Prevent Falls in Construction. It will also offer attendees the opportunity to ask questions and make recommendations to campaign leaders.
[Learn More & Register Now](#)

Tuesday, May 5th at 1:00pm ET
Prevention Through Design: Ask the Expert Webinar
By thinking about safety during the building design process and when designing the jobsite and work itself, hazards and risks can be minimized before the work ever begins. On this webinar, attendees will learn more about how project owners and contractors anticipate and "design out" fall-related hazards in buildings, work methods, processes, equipment, tools, and the overall organization of the work.
[Learn More & Register Now](#)

Friday, May 8th at 1:00 PM ET
Top Three Things to Know About Working on Roofs
Join roofing safety experts to learn about key training priorities for workers who work on roofs. Panelists will provide an overview of information on falls from and through roofs, describe the recommended breadth of fall prevention training, and then focus on three top training priorities. Attendees will also have the opportunity to ask technical questions about roofing safety and training.
[Learn More & Register Now](#) 

2b. Conduct further evaluation and formative research on the National Falls Campaign & Safety Stand-Down event.

DRAFT – DO NOT DISTRIBUTE

- Survey for all construction audiences including those who have and have not participated – currently under review
- First contractor identified for case study from Premier Partners
- Interview guide for case study participants – currently being finalized for review

Q13 How familiar are you with the annual OSHA-NIOSH-CPWR National Safety Stand-Down to Prevent Falls in Construction (Falls Stand-Down)?

- ☐ Not familiar at all (1)
- ☐ Slightly familiar (2)
- ☐ Moderately familiar (3)
- ☐ Very familiar (4)
- ☐ Extremely familiar (5)



Q14 Have you ever participated in a Falls Stand-Down?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Not sure (3)

End of Block: Stand-Down Screener

2c. Collaborate with new and existing r2p partners to identify and address high-priority hazards on an as-needed basis.



THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Preventing Workplace Harassment & Physical Violence in Construction

A Guide for Employers

1

What You Will Find in this Guide:

Topic	Page
Understanding Workplace Violence and Contributing Factors	4
Effects of Workplace Harassment and Violence	5
Contributors to Workplace Harassment and Violence	5
Your Commitment to Preventing Workplace Violence	6
Assessing Your Risks for Workplace Violence	6
Conducting a Workplace Violence Hazard Analysis	7
Identifying Warning Signs in an Individual	7
Making a Plan to Prevent Workplace Violence	8
Definitions	8
Exposure Control Planning Guidelines	9
Reporting and Responding Protocols	10
Emergency Preparedness Plans	12
Engaging Partners	13
Getting the Word Out: Outreach and Training	15
Reinforcing a Culture of Care and Respect	17
Additional Resources	18
References	19
Appendix A: Sample Policy	21



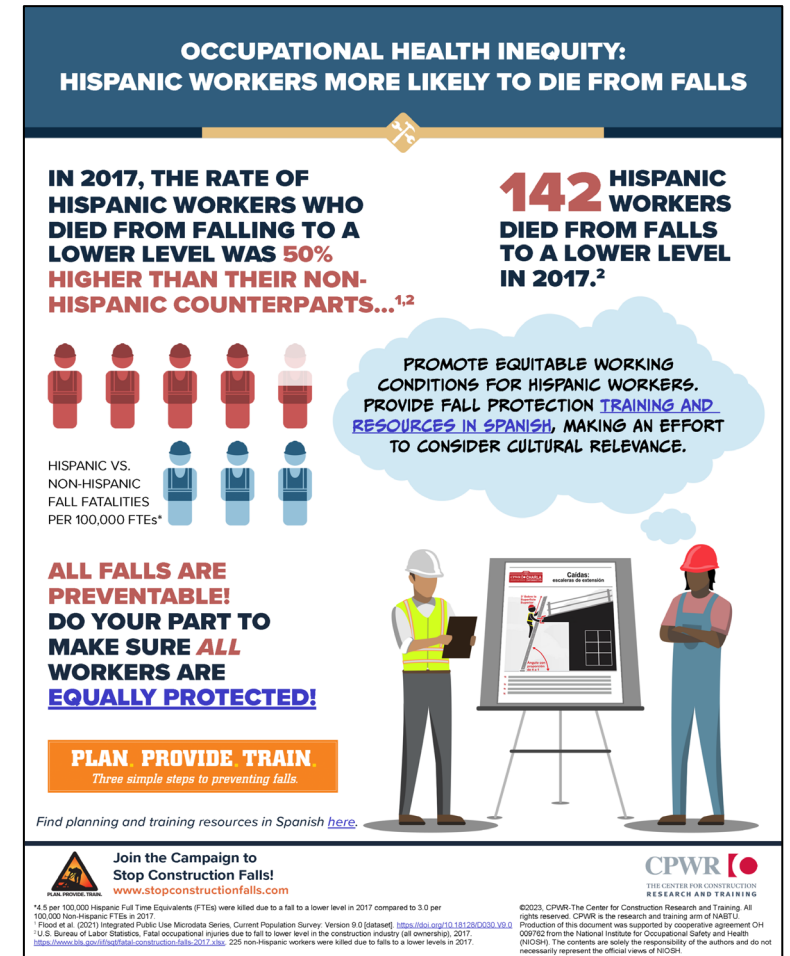
THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Aim 3: Improve our understanding of how to better educate and influence Spanish-speaking workers to enhance CPWR's English-to-Spanish translation processes and develop culturally and linguistically appropriate resources.

- Rapid review of literature completed & being reviewed by consultant Luz S. Marín
- Beginning work on surveys on overcoming barriers to health & safety for immigrant workers this summer
- *Next steps:* develop and test resources

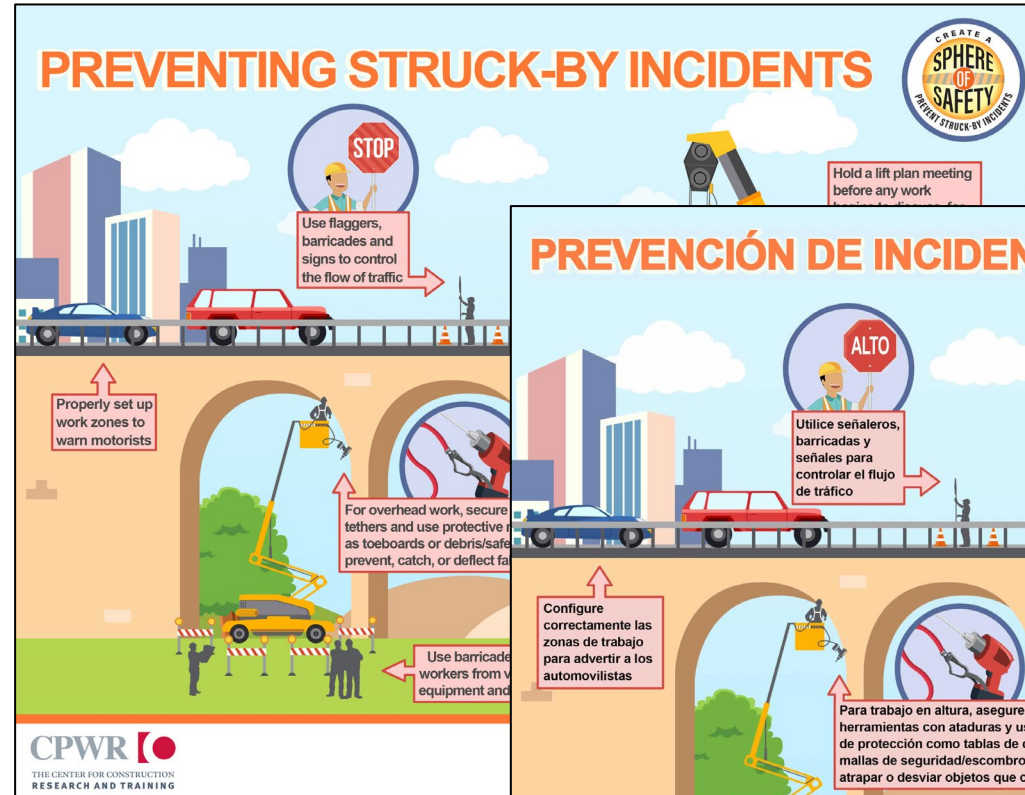
Aim 4: Improve our understanding of and ability to reach and influence small, residential/light commercial construction contractors by engaging in and evaluating a community-based (grassroots) outreach effort

- No organized structure for dissemination or involvement in research
- Limited time and resources
- Conflicting priorities
- Language barriers
- Cultural barriers
- Fewer training opportunities for both leadership and their crews



Developing Research-Based Planning & Training Resources for Small Employers

- FREE
- Streamlined for limited time and resources
- English & Spanish whenever possible
- Responsive to industry requests & needs
- Research-based



4a. Conduct a community-based outreach effort to small contractors with the assistance of our Virtual Roundtable on Small Contractors and Disproportionate Risk and local intermediaries.

- Virtual Roundtable began meeting in July 2025
- Established support for **greater Baltimore, MD area**
- Established support for focusing on **HEAT** as a topic area
- Decided to partner with Gavin West's heat project team
- Identified & categorized over 450 intermediaries
- Finalized survey and flyer
- Currently submitting for IRB review

4b. Evaluate the reach & impact on awareness of the solution/intervention.

- **Measure reach with QR codes** placed on various products, social media posts, or promotional materials.
- **Track responses** to a Maryland heat survey developed by Gavin West's team
- **Informal interviews with intermediaries** (Based on our past use of an Expert Evaluation Panel)

Construction Workers & Contractors: Help prevent heat-related deaths

Share your experiences and knowledge about working in the heat and make jobsites safer.

CPWR-The Center for Construction Research and Training is the country's leading nonprofit dedicated to reducing injuries, illnesses, and fatalities in construction. We are conducting a research study to improve heat illness prevention and better protect construction workers.

There are two ways you can help.

1. **Take & share a short, anonymous survey:** <https://bit.ly/3QPGVUw>
2. **Host CPWR researchers** on a job this summer to see protections you've already developed. Contact Gavin West at 301-495-8522 or gwest@cpwr.com.



CPWR already offers a number of **FREE** heat prevention checklists, training materials, and other resources. Visit www.cpwr.com/heat.



CPWR 
THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Aim 5: Maintain and enhance the Center's robust Research to Practice (r2p) Library of tools and resources.



Work Safely with Silica
A ONE-STOP SOURCE OF INFORMATION ON HOW TO PREVENT A SILICA HAZARD AND PROTECT WORKERS

About • Know the Hazard • Regulations & Requirements • What's New • Create-A-Plan

Know the Hazard ⚠️

Workers may be exposed to dangerous levels of silica dust when cutting, drilling, grinding, or otherwise disturbing materials that contain silica. These materials and tasks are common on construction jobs. Breathing that dust can lead to serious, often fatal illnesses. This section contains information that workers – and contractors – need to know to recognize the hazard, understand the risk factors, and work safely with silica.

Control the Dust 📋

There are ways **contractors** can reduce the dust and reduce the hazard. This easy to use planning tool takes you step-by-step through conducting a **job hazard analysis for silica**, selecting appropriate controls, and creating a job-specific plan to eliminate or reduce silica hazards. You can save as a pdf, print and/or email your plan.

CREATE-A-PLAN

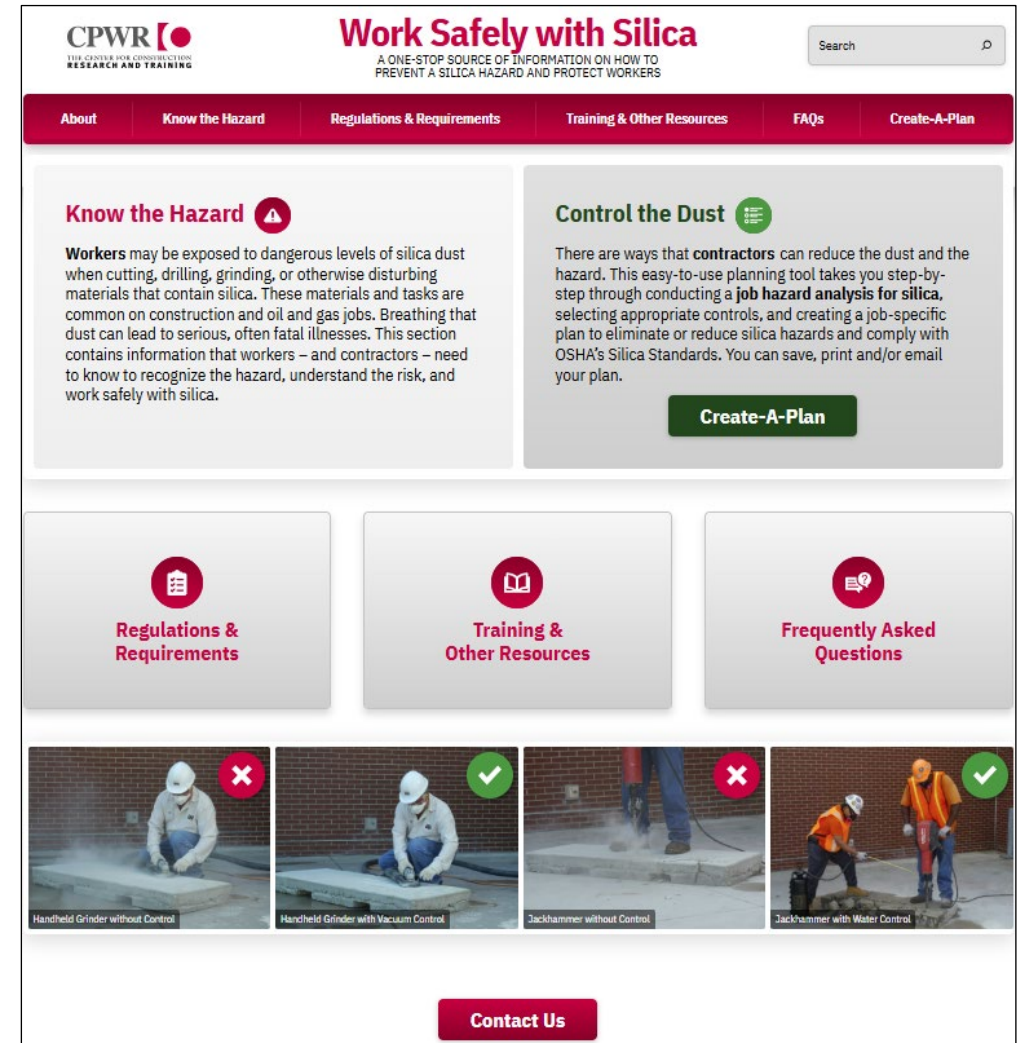
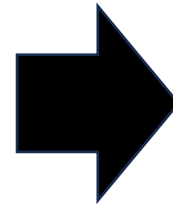
Training & Other Resources ⓘ
Find silica-related handouts, fact sheets, videos, toolbox talks and other resources for workers and contractors.

What's Working 💬
Contractors, workers, manufacturers, and researchers are on the lookout for the best ways to control silica dust. Learn what is happening in the field and share what you are doing.

Ask a Question ???
Get answers to commonly asked questions about silica and ask one of your own.

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CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Work Safely with Silica
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Know the Hazard ⚠️

Workers may be exposed to dangerous levels of silica dust when cutting, drilling, grinding, or otherwise disturbing materials that contain silica. These materials and tasks are common on construction and oil and gas jobs. Breathing that dust can lead to serious, often fatal illnesses. This section contains information that workers – and contractors – need to know to recognize the hazard, understand the risk, and work safely with silica.

Control the Dust 📋

There are ways that **contractors** can reduce the dust and the hazard. This easy-to-use planning tool takes you step-by-step through conducting a **job hazard analysis for silica**, selecting appropriate controls, and creating a job-specific plan to eliminate or reduce silica hazards and comply with OSHA's Silica Standards. You can save, print and/or email your plan.

CREATE-A-PLAN

Regulations & Requirements 📋

Training & Other Resources 📖

Frequently Asked Questions 💬

Contact Us

Handheld Grinder without Control ❌

Handheld Grinder with Vacuum Control ✅

Jackhammer without Control ❌

Jackhammer with Water Control ✅

New Lithium-Ion Battery Safety Training Module

DRAFT Learning Objectives

- Describe the properties of lithium-ion batteries and their common applications.
- Identify the safety and health hazards posed by lithium-ion batteries.
- Explain the factors that can lead to lithium-ion battery failure.
- Recognize how to safely purchase, inspect, handle, charge, store, and dispose of lithium-ion batteries.
- List actions to take in an emergency related to lithium-ion battery failure.

Thank you

For your attention and your ongoing support &
collaboration of our r2p program!

COMMUNICATIONS CORE

Bill Wright

Sharretta Benjamin



THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

r2p Seminar

Washington,
DC

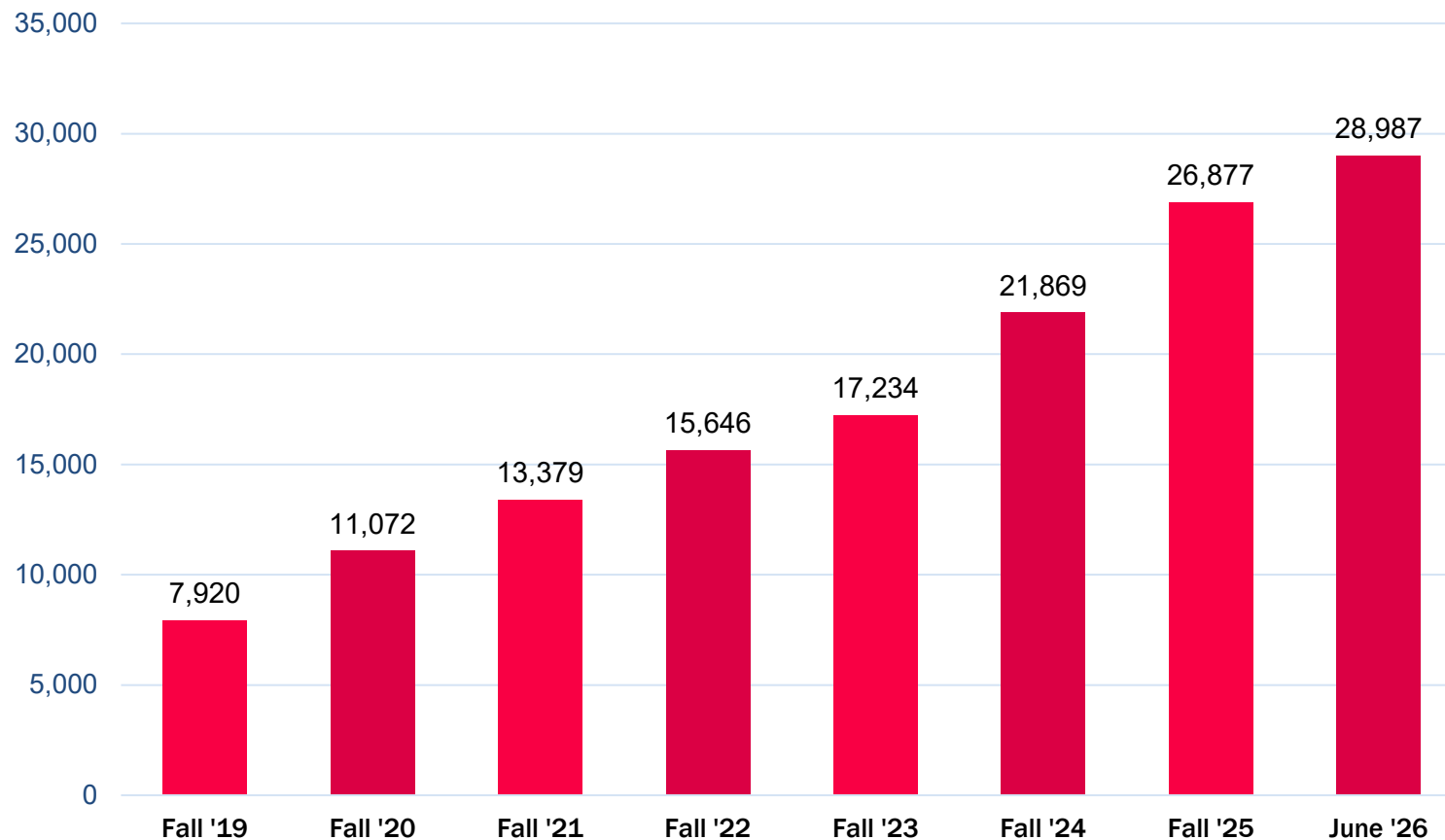
6/10/2026

Overview

1. Progress on Aims
2. Other Work

Aim 1: Expand and improve the CPWR contacts database

Subscribers to CPWR Emails



List Growth

9/19-8/20	+40%
9/20-8/21	+21%
9/21-8/22	+17%
9/22-8/23	+10%
9/23-8/24	+27%
9/24-8/25	+23%
9/25-6/28	+6%

Spanish

6/25: 3,457
6/26: 4,111

Aim 1: Expand and improve the CPWR contacts database

Account

Milender White

Business City

Business State/Province

Category
Contractor

Subcategory

Details

Related

Account Name	Milender White		Account Record Type	Organization	
Primary Contact	Jack Moeding		Parent Account		
Category	Contractor		Website		
Subcategory			Phone		
Priority Check			Description		
Company Size			D&B ID	008965775	
Foreign	☐		D&B Connect Company Profile	Milender White Inc.	
Web search	Search				
D&B Exclude Company	☐		ENR 400	☐	
D&B Activities Description	Single-family house construction		ENR 400 Ranking		
D&B Number of Employees	20		ENR 425	☐	
NAICS code ⓘ	236115		ENR 500	☐	
NAICS code description	New Single-Family Housing Construction (except For-Sale Builders)		ENR 600	☐	
DUNS number	008965775				

Address Information

Billing Address

12655 W. 54th Drive
Arvada, Colorado 80002
United States

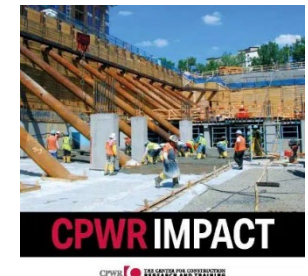
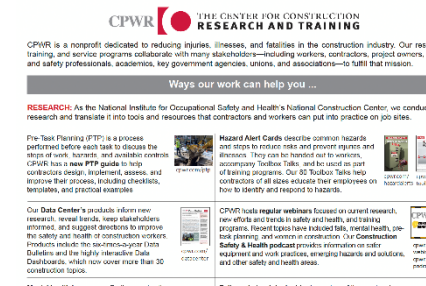
Aim 2: Employ multiple channels—including email, websites, media placements, direct mail, social media, and webinars—to share research findings and translational products.

Media Placements – Last year we were cited 90 times, and we're on a similar pace this year

Direct Mail -- Promotional mailing (8,000)
Academics
Safety and health professionals
Trainers

Impact Report (12,000)

Social Media -- Post 10 times a week per platform (mostly)

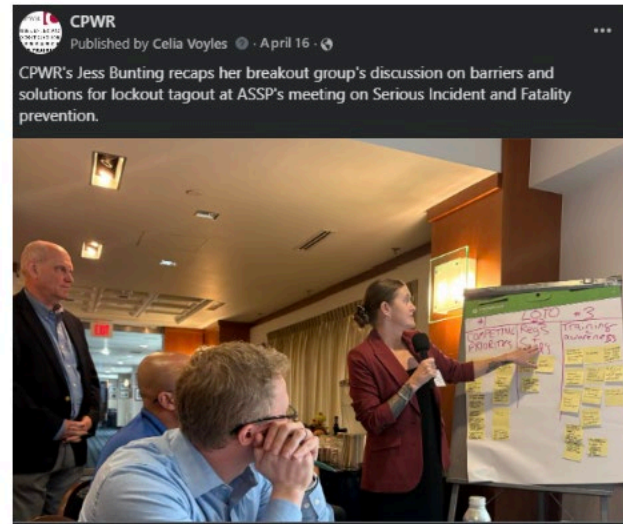


Aim 2: Employ multiple channels—including email, websites, media placements, direct mail, social media, and webinars—to share research findings and translational products.

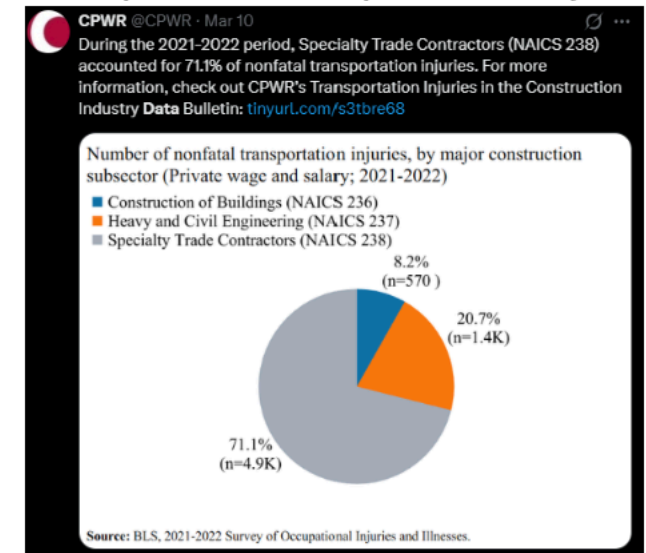
LinkedIn



Facebook



X



Aim 3: Evaluate and improve Center products and outreach methods through engagement metrics, market surveys, and interviews.

Followers

Spring 2025	Spring 2026	Change
3,922	4,005	+2.1%
5,744	6,706	+16.7%
915	1,027	+12.2%



Engagement*

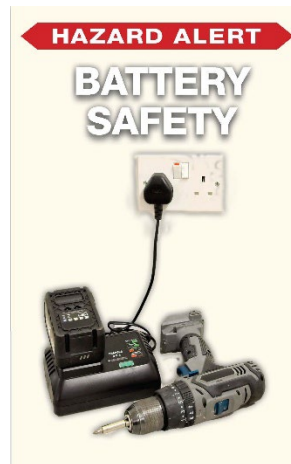
Page Views	Reach	Engagement
476	2,781	234
162	10,392	1,302
21	480	141

*May 2026

Other Work

Ongoing Support

- Researchers – Data Center: Data Bulletins, updating/improving webpages; working with Gavin on promoting surveys; editing and posting material
- Publications – Small Study reports, Key Findings
- Newsletters: Update, REASON
- Materials – Hazard Alert Cards, Infographics, Toolbox Talks



Research Project Updates: Continuous Improvement at CPWR: Ensuring Solutions Make an Impact

Questions?



Interactive Workshop: What's Next in Construction Safety & Health Research? You Tell Us

All images from NIOSH or Microsoft Stock unless otherwise noted.



CPWR r2p Meeting, June 10, 2026

Moderators

CPWR r2p Meeting



Rick Rinehart, ScD

Deputy Director,
CPWR – The Center for
Construction Research
and Training



Emily J. Haas, PhD

Associate Director for
Science,
NIOSH Division of Safety
Research

What you will hear today

- *Occupational Heat Stress and NIOSH Resources*
Brenda Jacklitsch, Research Health Scientist, DSI
- *Sell and Buy Quiet Programs to Reduce Hazardous Noise in the Workplace*
Ed Zechman, Engineer, DFSE
- *Improving Industrial Helmet Shock Performance*
Chris Pan, Research Safety Engineer, DSR
- *Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents*
Srinivas Konda, Associate Service Fellow, DSR
- *Smart Masonry Robot for Struck-By Hazard Prevention*
Marvin Cheng, Mechanical Engineer, DSR
- *Hazards and Risk Factors for Demolition Robot Operators*
Hugo Camargo, Research General Engineer, DSR



From research updates to audience input: What are we studying and what are we missing?

- Objectives

- Relay NIOSH research updates in construction.
- Connect with CPWR ongoing efforts.
- Invite comments across hazards, worker groups and their settings, interventions, and r2p needs.
- Discuss and leave with a short list of research directions that are high-impact, feasible, and useful to the field.





Occupational Heat Stress and NIOSH Resources



Brenda Jacklitsch, PhD, MS

Research Health Scientist

Division of Science Integration

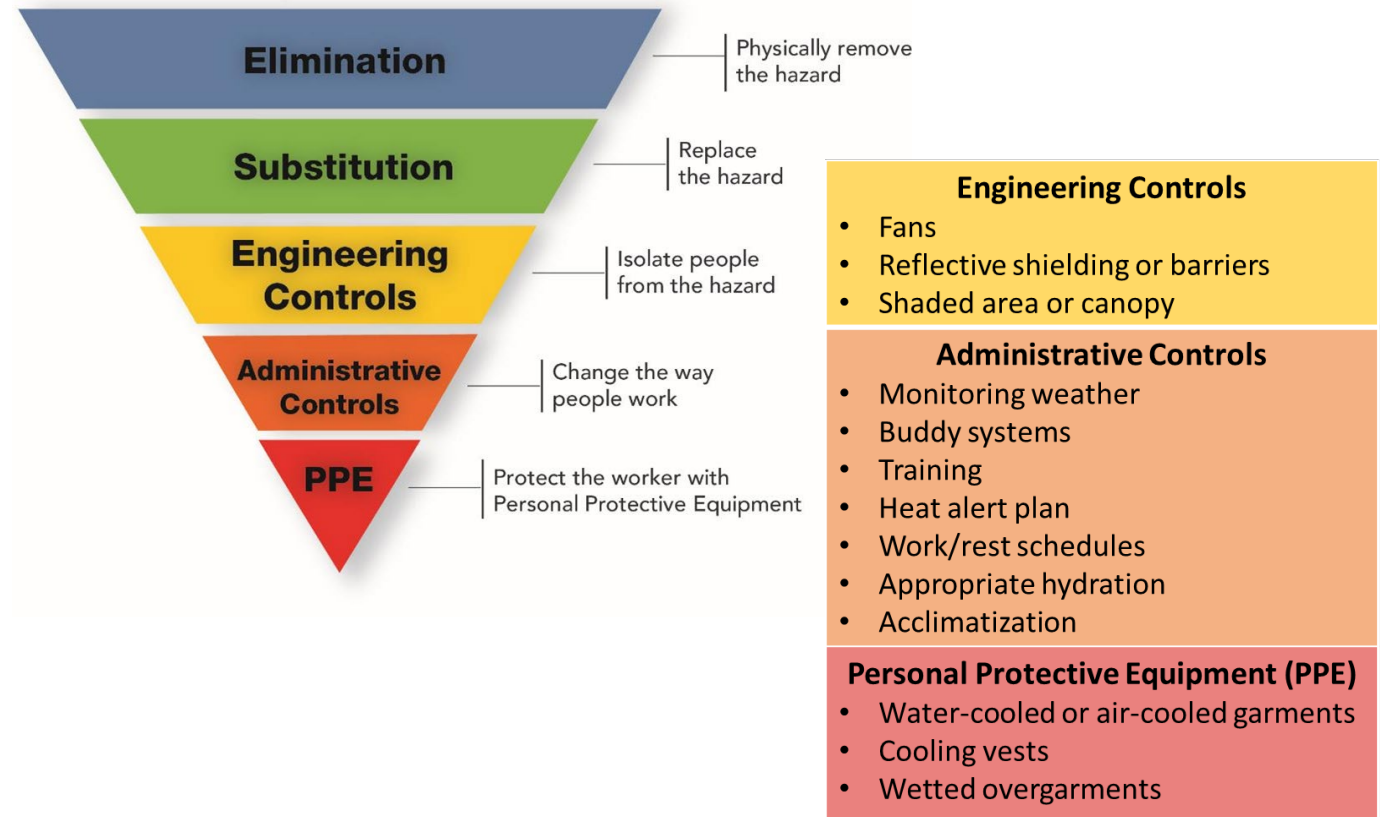
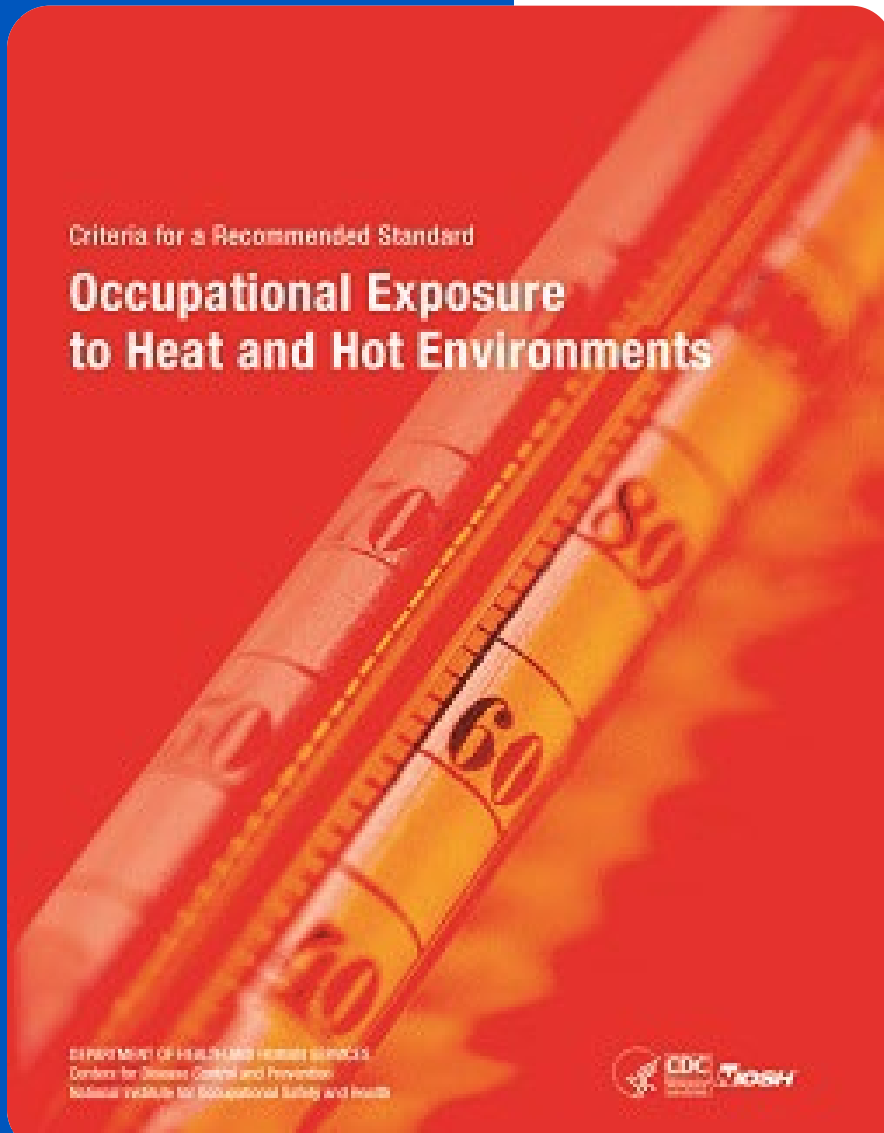
CDC/NIOSH

June 10, 2026



OCCUPATIONAL HEAT STRESS

NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments



Literature Review
(2010)

Internal Review

Public Comment

External
Peer Review

Clearance

Publication
(2016)



OCCUPATIONAL HEAT STRESS

NIOSH Heat Communication Resources

Additional products for safety and health professionals, employers, and workers.

- CDC/NIOSH website
- Infographic
- Workplace Solutions
- OSHA-NIOSH Infosheet
- Fast Facts card
- Poster
- OSHA-NIOSH app





OCCUPATIONAL HEAT STRESS

What's Next?

Evaluation of NIOSH Heat-related Products

Objectives: To evaluate NIOSH heat-related products to better reach small business owners and workers in construction and outdoor service industries.

- OSHA-NIOSH Heat App
- NIOSH Infographic
- NIOSH Fast Facts Card
- Draft Heat Stress Prevention Training for Employers of Outdoor Workers.

Methods: 13 focus groups of outdoor workers and employers across Illinois, Texas, and California.

Findings: Coming Soon!

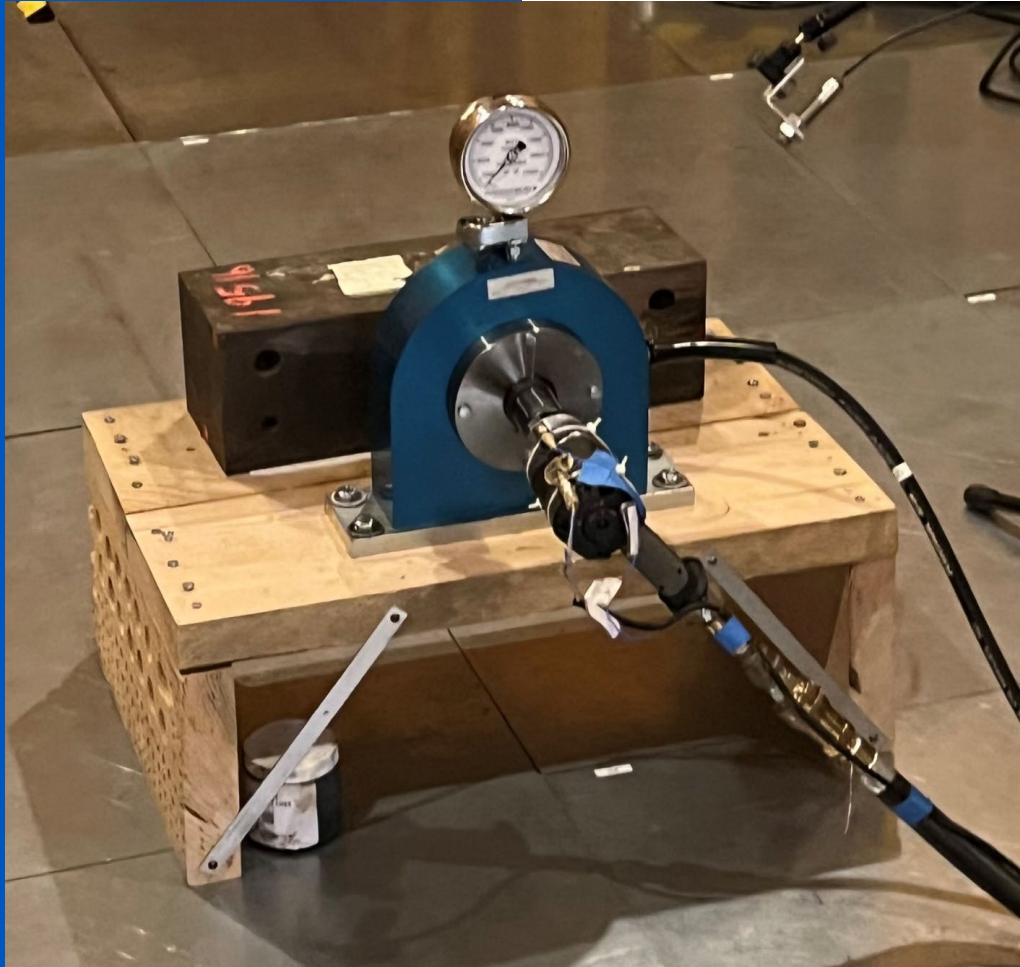


Sell and Buy Quiet Programs to Reduce Hazardous Noise in the Workplace



Ed Zechmann PE, PhD, INCE Bd. Cert.
Research Engineer (Noise Control)
DFSE
CDC / NIOSH
2026 06 10





Impact Wrench Testing

Photo Credit: NIOSH

HAZARDOUS NOISE IN THE WORKPLACE

Advancing Sell and Buy Quiet Project

Status: Project continuing to write articles, developing technologies, proposing a MATLAB executable for implementing SAE AS6228A:2023—considering safety, health, and cost factors.

Objectives:

- Identify ways to improve Sell and Buy Quiet from the manufacturers' and purchasers' perspectives
 - Identify why manufacturers have difficulty selling quieter products
 - Identify why purchasers do not consider noise and other safety hazards when buying products

Maslow's Hierarchy of Needs

Tier	Level	Psychological Need
5	Purpose	Mastery & Legacy
4	Esteem	Professional Status
3	Belonging	Brand Loyalty
2	Safety	Reliability
1	Physiological	Basic Utility

Adapted from Jurs, 2017

HAZARDOUS NOISE IN THE WORKPLACE

Survey of 3,530 respondents

Porter Novelli Survey 2023 Preliminary Results:

- 3-questions about power tool purchasing
 - Q1: General factors influencing a purchase
 - Q2: Extent that noise is considered in a purchase
 - Q3: Noise specific factors influencing a purchase
- **Noise was last out of 6-factors**
 - Cost, Durability, Compatibility, Runtime, Energy Efficiency, **Noise**
- **Maslow's hierarchy of needs is key!**
 - For noise to be considered by a purchaser all considerations more important than noise must be addressed

Factor	Weights	Sub Score	Product
Productivity	2	5	10
Ergonomics	2	6	12
Noise	1	7	7
Vibrations	2	8	16
Initial Cost	0.5	6	3
Operation Cost	1	5	5
Utility Cost	0.5	6	3
Weight	1	6	6
Total Life Cycle Score			62

Adapted from Table 1 of SAE AS6228A 2023

SAFETY PROCUREMENT CALCULATOR

Impact/Outcomes:

- **Standard for Safety Procurement – SAE AS6228A 2023**
 - Currently compare 2-3 power tools at a time
 - Good for Manufacturers to target a sale
 - Purchasers need to compare thousands of power tools
- **Increase Capacity to Thousands**
 - Developed MATLAB Programs
 - Developed an Excel Spreadsheet (Draft)
- **Proposed Next Step – Develop a MATLAB**
 - Downloadable executable for computers
 - MATLAB server Intranet



Helmet Study Updates



Chris Pan, PhD

Research Safety Engineer
Division of Safety Research
CDC/NIOSH

June 10, 2026



Photo credit: NIOSH

*Dave, H., Pan, CS, Whisler, R., Zwiener, J., and Wu, J. (under review) "Assessment of the impact of the integrated air bubble cushions on top-impact attenuation in construction helmets," Bio-Medical Materials and Engineering.

All images used in this section are from this paper, currently under review, so courtesy of NIOSH



INDUSTRIAL HELMET PERFORMANCE

Helmet study updates

Objectives:

- To assess the impact of the air-bubble cushioning systems in enhancing shock absorption performance for representative Type I and Type II hard hats.
- To compare the shock absorption performance of the hard hats enhanced with air-bubble cushioning with advanced safety helmets.

Photo credit: Microsoft

Methods & Test Procedures

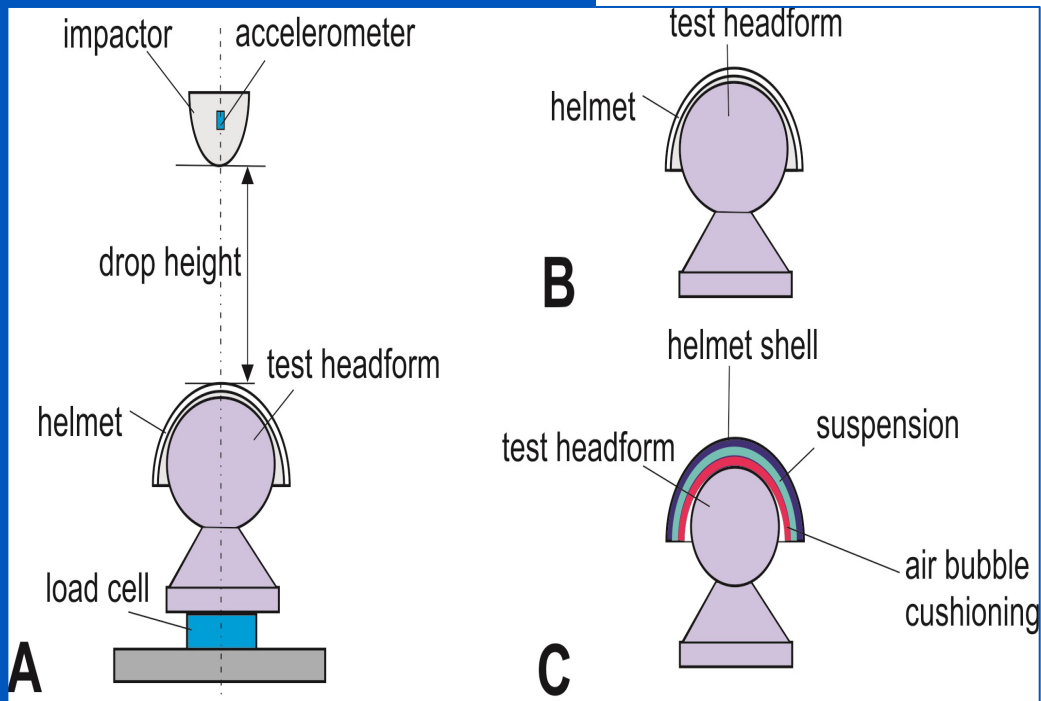


Photo credit: NIOSH

- **Head protection types:**
 - Two Type I hard hat models
 - Two Type II hard hat models
 - Two safety helmet models (one Type I, one Type II)
- **Test conditions:**
 - Control: hard hats without air-bubble cushioning liner
 - Air-bubble group: hard hats with air-bubble cushioning liner
 - Safety helmet group: safety helmets without air-bubble cushioning liner
- **Drop heights:** 6 levels (0.776, 1.158, 1.548, 1.698, 2.006, 2.261 m)
- **Repetitions:** 4 per helmet model per height
- **Impact protocol:** Up to 10 impacts per helmet, or until impact force exceeded the standard-required threshold (4.45 kN)
- **Helmet usage:** A new hard hat/helmet was used for each protection type, test condition, and repetition



INDUSTRIAL HELMET PERFORMANCE

Helmet study updates

Preliminary results:

- All tested helmet models pass ANSI Z89.1 standard tests.
- Air-bubble cushioning layers increased energy absorption and reduced impact forces, thereby enhancing head protection performance for both Type I and Type II hard hats.
- Air-bubble cushioning has substantially greater effects in reducing peak impact forces in Type I hard hats than in Type II.
- The shock absorption performances of hard hats that are enhanced with the air-bubble cushioning exceed the safety helmets.
- **Conclusion:** The findings support continued development and fabrication of these helmet prototypes through collaborative manufacturing efforts.



Photo credit: Microsoft

INDUSTRIAL HELMET PERFORMANCE

Helmet study updates

Impact:

- Collaboration with stakeholders (e.g., insurance companies, construction companies, and the International Safety Equipment Association, CPWR)
- Assist the ANSI Z89.1 standard committee, “American National Standard for Industrial Head Protection”
- Potentially reduce costs for work-related traumatic brain injury rehabilitation and workers’ compensation through improved helmet design



Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents



Srinivas Konda

Epidemiologist
Division of Safety Research
CDC/NIOSH
June 10, 2026



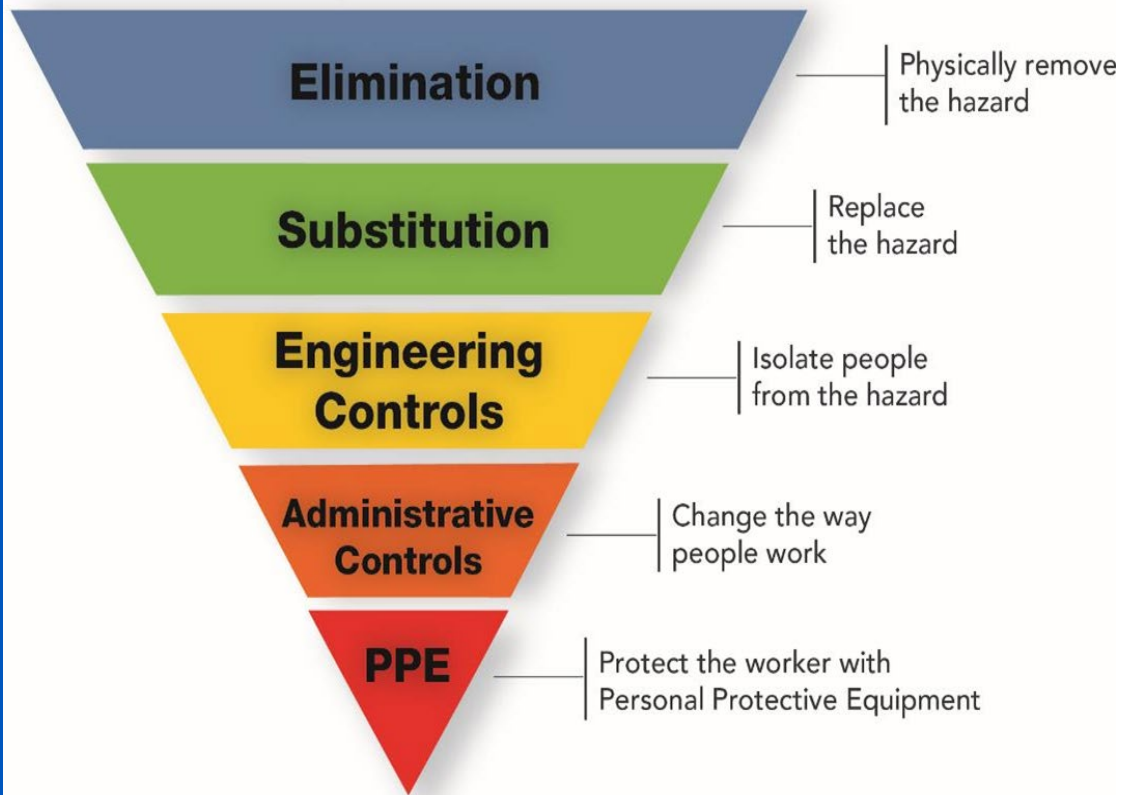
Photo by stockadobe.com

PREVENTING STRUCK-BY INCIDENTS

Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents status: Manuscript in preparation

Objectives:

- Investigate factors that contribute to fatal worker struck-by vehicle incidents using Fatal Assessment and Control Evaluation (FACE) investigative reports
- Apply the NIOSH Hierarchy of Controls (HOCs) to classify FACE recommendations and quantify their distribution across control types



PREVENTING STRUCK-BY INCIDENTS

Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents



Photo credit: NIOSH

Methods:

- Obtained 70 FACE reports (76 fatalities) from 1992 through 2022
- Developed a codebook
- Applied standardized industry and occupation codes to ensure consistency across cases
- Classified FACE recommendations using the HOCs
- Conducted descriptive analyses

PREVENTING STRUCK-BY INCIDENTS

Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents

Results:

- 1 in 3 decedents died within the first 2 years on the job
- Construction had highest proportion of fatalities (45%)
- **Key factors of struck-by incidents:**
 - Passenger vehicles (70%)
 - Driver distraction (30%) and impairment (16%)
 - Speeding (23%)
 - Work zone intrusion (31%)
 - Not wearing a vest (25%)
 - Stepping into traffic (55%)
- 334 total recommendations: Most were related to administrative controls (74%), followed by engineering controls (17%), and personal protective equipment (8%)



Photo by stock.adobe.com



Photo by stock.adobe.com

PREVENTING STRUCK-BY INCIDENTS

Examining Pedestrian Worker Fatalities Involving Struck-by Vehicle Incidents

Impact:

- Fills a critical gap in occupational safety literature on pedestrian workers struck-by vehicle incidents
- Demonstrates the value of FACE reports in providing detailed insight into these incidents
- Highlights opportunities to prioritize more effective controls within the HOCs



Smart Masonry Robot for Struck- by Hazard Prevention



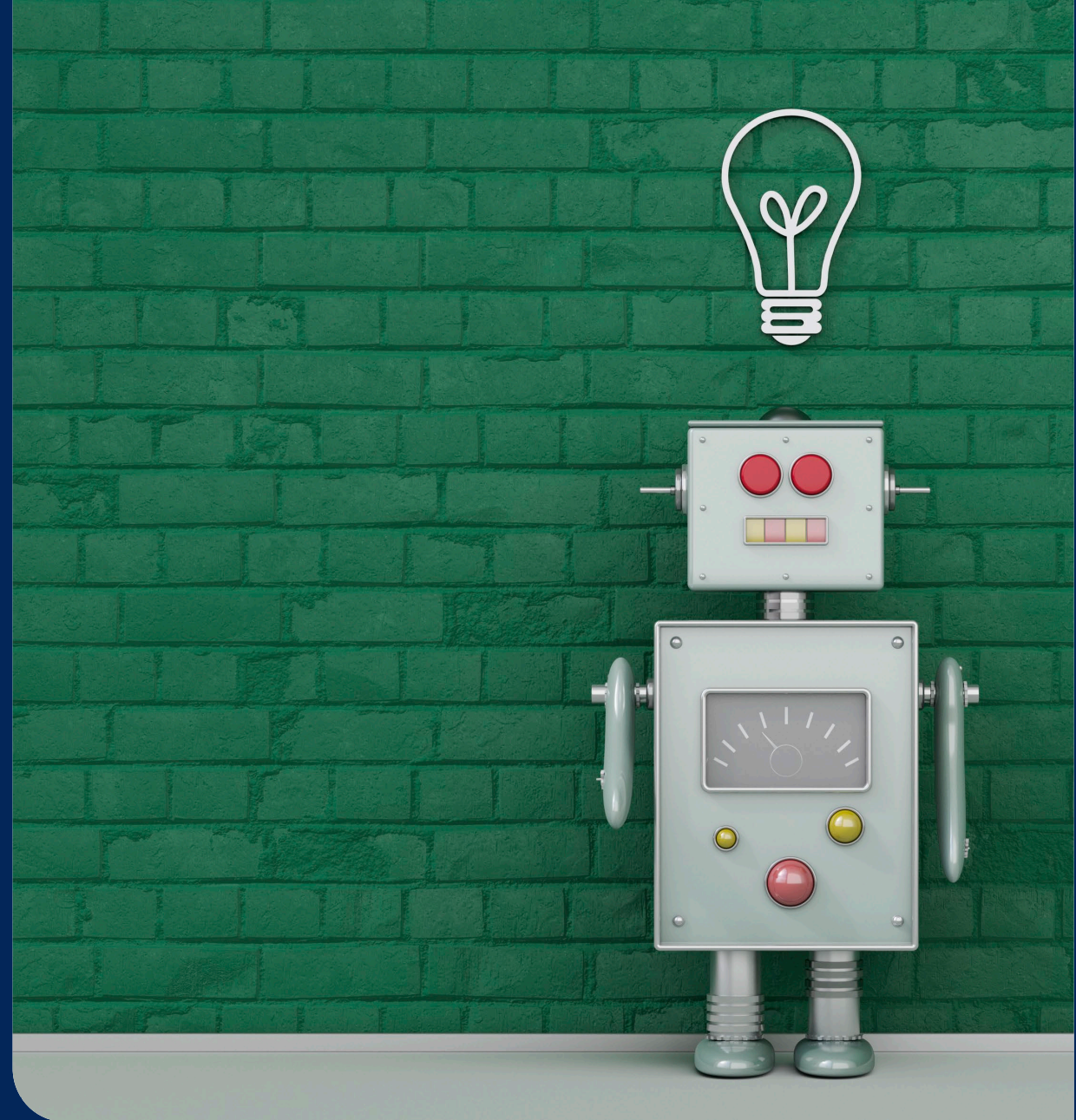
Marvin Cheng

Mechanical Engineer/Team Leader

Division of Safety Research

CDC/NIOSH

June 10, 2026



CONSTRUCTION AUTOMATION

Smart masonry robot for struck-by hazard prevention

status: testing in progress

Objectives:

- Evaluate the safety system to control a masonry robot working with a human mason in a collaborative environment
- Evaluate new proximity detection algorithm that can identify potential struck-by hazards
- Evaluate masonry alignment checking system



Photo by stock.adobe.com

CONSTRUCTION AUTOMATION

Smart masonry robot for struck-by hazard prevention

status: testing in progress

Methods:

- Develop a Learning from Demonstration (LfD) method to teach the robot how to follow the mason's lead based on mason motion capture data and force data as well as reinforcement learning
- Utilize different vision-based object recognition methods to identify objects, including human masons, robot, CMU block, and environment objects
- Evaluate the masonry alignment (flatness, verticality)

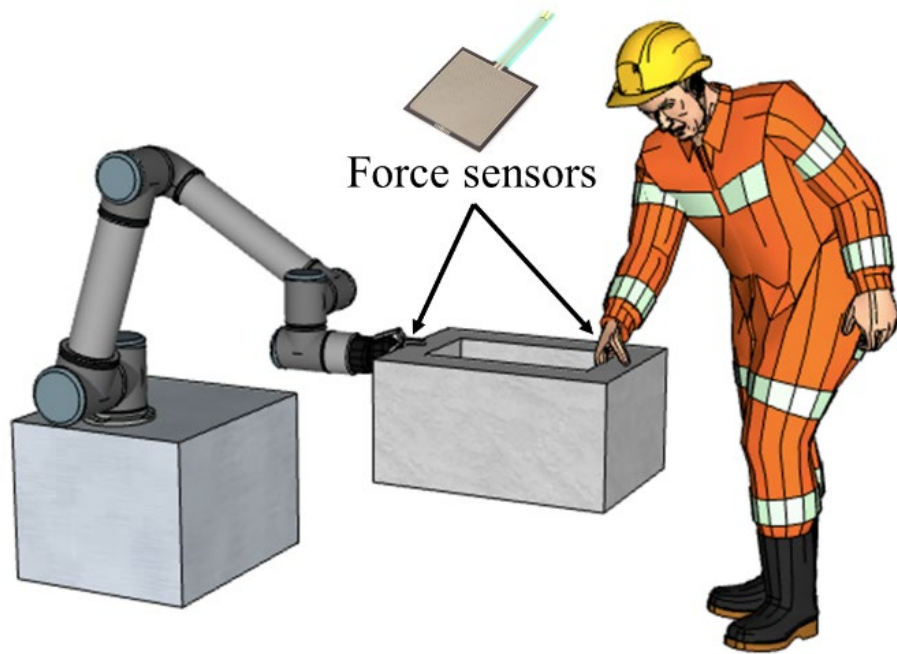


Photo credit: NIOSH

CONSTRUCTION AUTOMATION

Smart masonry robot for struck-by hazard prevention

status: testing in progress

Impact:

- Collaborate with CPWR and associated masonry partners to disseminate study results
- Contribute to robot safety standards through the Association for Advancing Automation (A3) and similar groups
- After initial testing, seek new partnerships with robot manufacturers



Photo by stock.adobe.com



Hazards and Risk Factors for Demolition Robot Operators



Hugo Camargo

Research General Engineer/Team Leader

Division of Safety Research

CDC/NIOSH

June 10, 2026



CONSTRUCTION AUTOMATION

Hazards and risk factors for demolition robot operators

status: testing in progress



Photo by stock.adobe.com

Objectives:

- Investigate hazards and risk factors (human-related, environment-related, and control-pad interface-related) that may lead the operator to locate himself/herself within the hazard area of the robot
- Investigate human behavior and perceptions of safety and trust when the robot moves unexpectedly
- Build scientific knowledge foundation for future demolition robot safety research

CONSTRUCTION AUTOMATION

Hazards and risk factors for demolition robot operators

status: testing in progress

Methods:

- Surround screen Cave Automatic Virtual Environment (CAVE)
- Virtual demolition scenarios simulate vertical wall and ground demolition
- Virtual scenarios include unexpected robot motions such as outrigger motion, arm swing motion, hydraulic hose fail, and structure failure



Photo credit: NIOSH

CONSTRUCTION AUTOMATION

Hazards and risk factors for demolition robot operators

status: testing in progress

Impact:

- Collaborate with the Association for Advancing Automation (A3) and the developing ANSI A10 standards committee on safe construction and demolition robots
- Partner with stakeholders to develop safety controls for demolition robots
- Develop training materials (e.g., infographics, videos, software) for demolition robot operation

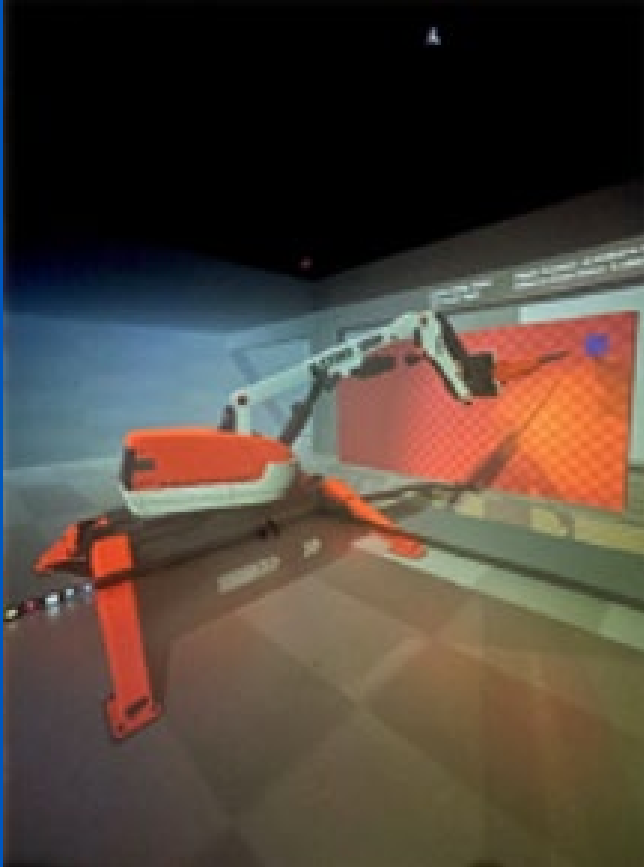
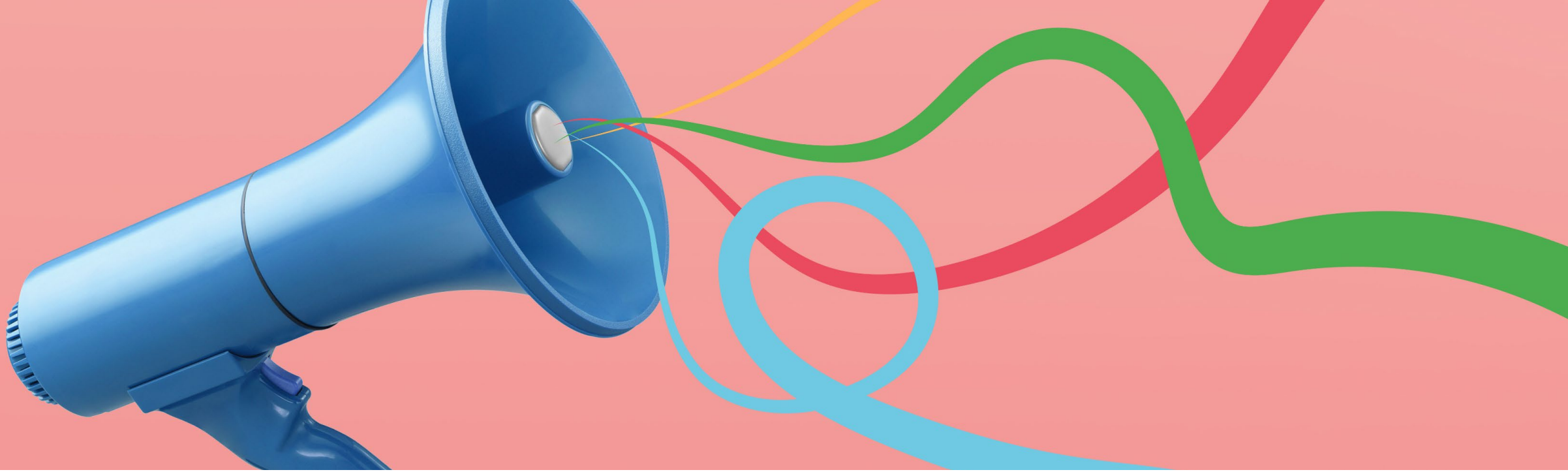


Photo credit: NIOSH



You tell us!

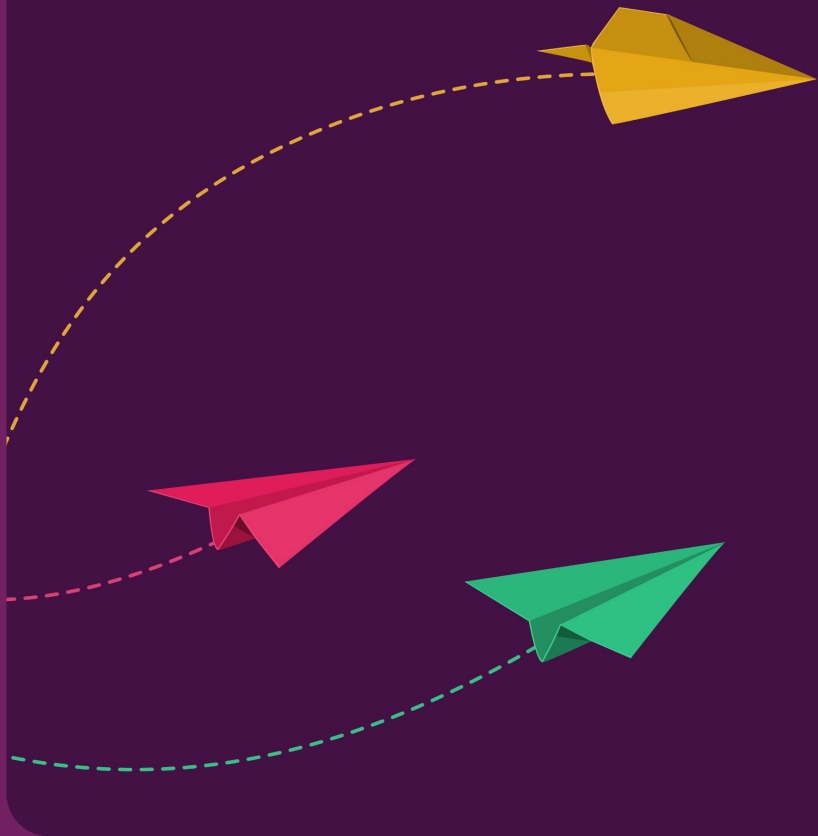
- What are big, ongoing research gaps?
- How can we enable broader adoption of safety and health practices?



Gaps and solutions: Research, implementation, and adoption (20 minutes)

- What is changing in construction that research has not fully caught up with?
- Gaps in executing and adopting safety and health practices?
- How can we support these r2p efforts?

Turning gaps into ideas, priorities, and paths forward



- Table report outs
 - Top 1 or 2 things
- Connections
- Follow-up on next steps

Concluding thoughts



Photo by stock.adobe.com

- Current and recent NIOSH construction research projects focus on
 - Heat stress
 - Reducing hazardous workplace noise
 - Industrial helmet design/performance
 - Robots/automation
 - Reducing struck-by incidents
- Collaboration is key to continually improving the design, execution, and impact of these projects
- Please reach out with research and partnership ideas

Thank you!

For more information, contact CDC

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