CONSTRUCTION
SAFETY RESEARCH ALLIANCE

Safety Through Science



2025

Annual Review





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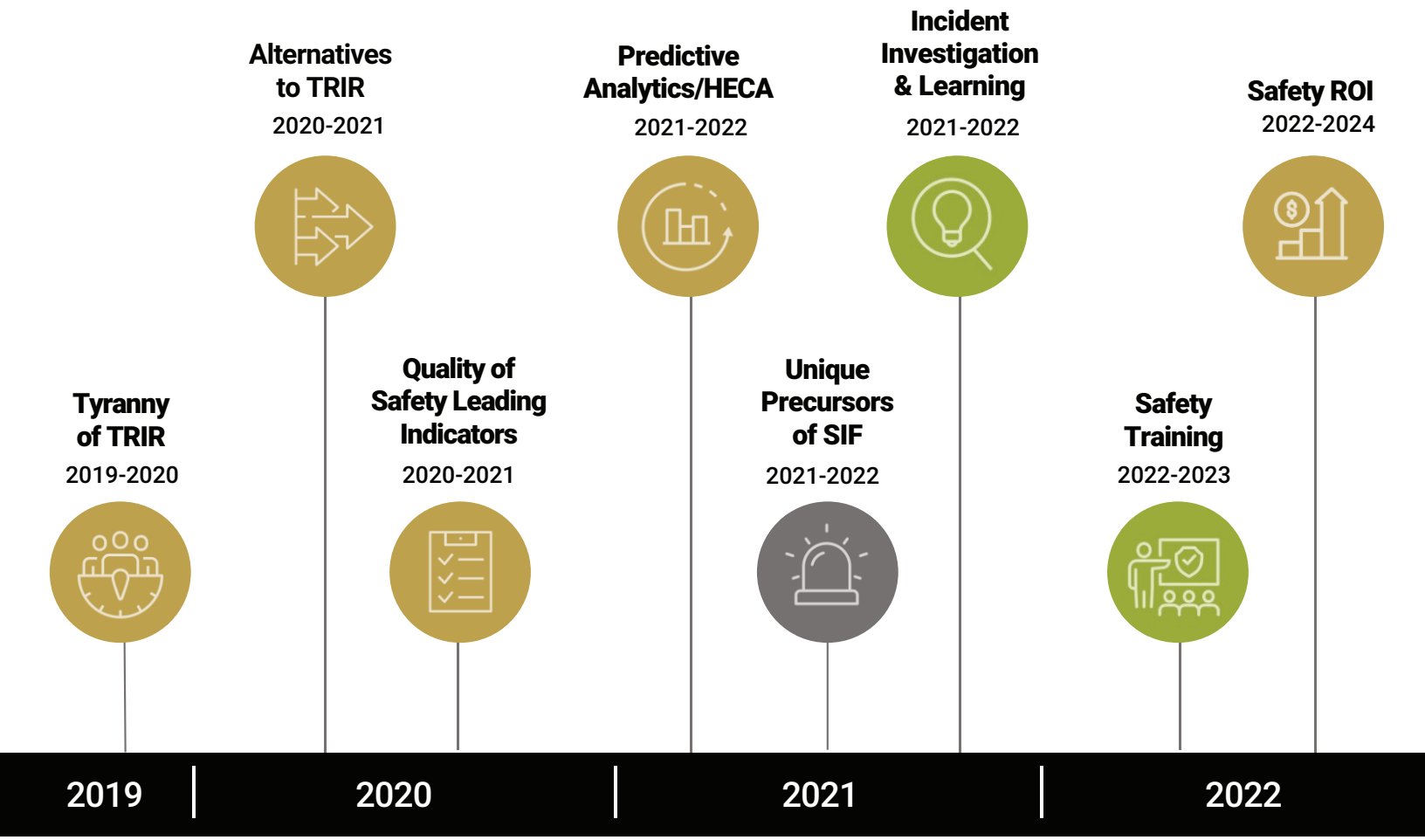
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THE CSRA JOURNEY

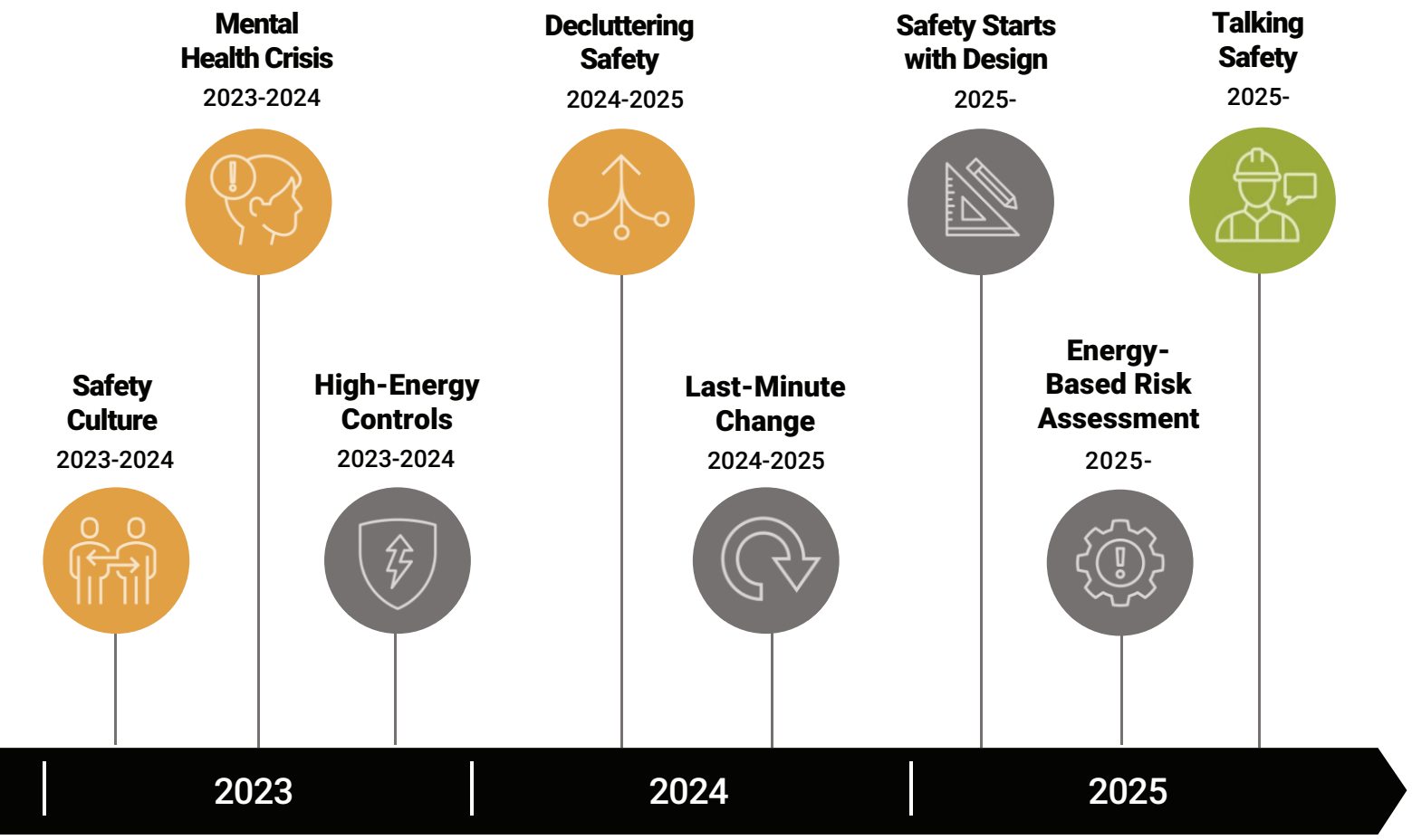
Our journey is one of steady purpose and bold innovation, grounded in rigorous empirical research and active community collaboration. Our shared mission to prevent Serious Injuries and Fatalities (SIFs) is at the core of every project. Member companies propose them, and our Board of Advisors carefully recommends which ones move forward. Every project we undertake generates knowledge and tools to drive progress in preventing SIFs.



Safety Measurement

SIF Fundamentals

Since our first project in 2020, The Tyranny of TRIR, which paved the way for much of our work in measuring what matters, our research has grown and taken root, deepening its reach and evolving with each new effort. We've broadened our scope to understand how safety functions within organizations, uncover the drivers of SIF risk, and improve safety communication. Each project reflects a collective effort to translate academic insight into action, connecting research to the field.



Organizational Safety

Communication & Learning

EXECUTIVE SUMMARY

In 2024, the CSRA continued to advance its mission to deliver transformative research and defendable science to eliminate serious injuries and fatalities (SIFs). Each project translated evidence into practical knowledge designed to drive real-world impact. This work was made possible by the CSRA's unique community, which combines academic rigor with industry expertise.

HIGHLIGHTS INCLUDE:

What is Safety?

- Analyzed practitioner responses to uncover how safety is defined across industries.
- Framed safety as a continuum that connects past performance, present controls, and future safety activities to guide how safety systems are designed, measured, and improved.

What Works in Safety? ROI of Key Practices

- Demonstrated that high-quality pre-job briefs and targeted energy-based training reduce SIF risk and improve business outcomes.
- Provided a measurable link between safety investments and operational value.

Decluttering Safety

- Identified two families of clutter and their impact on frontline operations: pure and conditional clutter.
- Delivered a diagnostic tool to remove low-value tasks (i.e., clutter) and refocus resources on controls that prevent SIFs.

Managing Last-Minute Change

- Showed the limits of human attention in detecting unexpected hazards caused by last-minute change.
- Introduced a "What-If" planning tool to help crews anticipate high-risk changes before work begins.

Training & Technology

- Revealed that hands-on and video-based formats outperformed traditional lectures, improving hazard recognition and knowledge retention.
- Presented mixed results for the use of Virtual Reality (VR) in training and Augmented Reality (AR) during work. Their impact on hazard recognition depends on context and careful application.

THANK YOU TO:



Academic Teams: Drive research with field-tested science.

Communities of Practice: Open forum spreading knowledge.

Partners: Amplify our reach across industries.

Collaborators: Bring diverse academic expertise and add rigor.

Member Companies: Co-create research and bring applied safety expertise.

LETTER FROM THE CHAIR

CSRA COMMUNITY,

As we celebrate another year of development, innovation, and growth, I remain in awe of the engagement and enthusiasm of our members and community. The scientifically rigorous, data-driven research and actionable field resources we publish each year are the direct result of your commitment to research projects, new ideas, data collection efforts, and Community of Practice events. Our membership is the engine that drives evidence-based safety forward and brings us closer to our vision of eliminating serious injuries and fatalities (SIFs) in the construction industry.

In February, seventy-five Environment, Health and Safety leaders from across our membership came together in Boulder to set the strategy and direction for three new projects: *Safety Starts with Design, Talking Safety: Words that Work*, and *Energy-Based Risk Assessment*. At the kickoff meetings, I was struck by the enthusiasm and excitement team members had from the moment they walked in. As the teams discussed, debated, and came together, that enthusiasm only grew.

In August, two other project teams realized the accomplishments of the work they put in over the last two years: *Managing Last-Minute Change* and *Decluttering Safety*. These projects, through their incredible membership and leadership, uncovered valuable learning opportunities and developed some of our most practical tools to date.

It is my honor to begin my service as your Chair of the Board of Advisors. Thank you to our members, research teams, collaborators, partners, and all the professionals who implement our work in the field. Your efforts are the reason the CSRA exists and why our work continues to have real-world impact. Finally, thank you to the CSRA academic team for ensuring we uphold the highest standards of scientific research.

As we look ahead to 2026, let's continue building momentum and setting new standards in safety together.



Mike Quashne

Senior Manager, Health Safety Security & Environmental

Luminace



WHAT IS SAFETY?

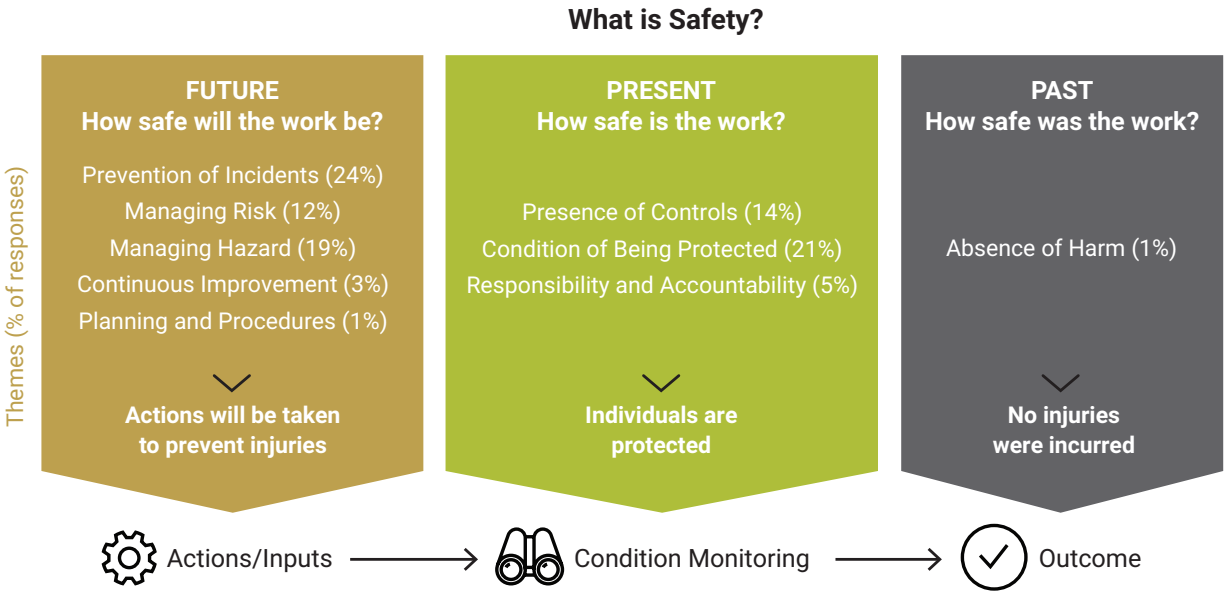
The term safety is used in a wide variety of contexts, creating the impression that there is a shared definition and understanding of its meaning. Although many definitions exist, none are inherently correct or superior. The differing viewpoints in our profession cloud our understanding of shared goals, limit our capacity to communicate clearly, and stifle collaboration. For safety to progress as a scientific field, we must first agree on our definition of safety, our most foundational term.

In pursuit of a shared understanding of "**safety**," we set out to examine how the term is used in our profession. We asked one simple question: "What is safety?" in an open-ended survey circulated across North America. 518 practitioners responded from construction, utilities, oil and gas, and other industries, most of whom had over two decades of field experience. Their responses were analyzed through content analysis so that we could compare, summarize, and interpret each major theme.

The findings revealed diverse viewpoints with no single dominant definition. Three strong themes emerged, framed by time:

1. **FUTURE SAFETY: activities performed to prevent injuries**
2. **PRESENT SAFETY: ensuring individuals are protected from harm as they work**
3. **PAST SAFETY: how safe the work was, indicated by injury counts**

Integrating these themes, safety is a holistic concept: activities that promote safety, the extent to which controls are in place during work, and their long-term impact on injuries. These themes together frame safety as a continuum, informing the design of safety systems, daily practices, and the ways we measure and monitor performance.



WHAT WORKS IN SAFETY?

Measuring the ROI of Key Safety Practices



While it's widely assumed that safety programs contribute to business success, proving this connection has been difficult. This study helps address that gap by identifying the specific safety practices that drive better outcomes and by quantifying the extent of their impact.

Drawing on empirical data from field experiments, the research reveals a clear chain of influence: quality training improves pre-job briefs, better briefs lead to stronger energy control, and stronger energy control predicts a reduction in the expected number of serious injuries. In short, better planning leads to better protection.

The quality of pre-job briefs emerged as a particularly strong predictor of both safety outcomes and business performance. When crews consistently identified hazards, discussed controls, and engaged in thoughtful planning, they were far more likely to control high energy and avoid incidents. These findings do more than confirm long-standing field beliefs; they provide a measurable basis for evaluating return on investment (ROI). For example, organizations that invested in targeted Energy Based Safety (EBS) training saw improved pre-job briefings and measurable gains in energy control. These gains signal links to reductions in long-term injury rates.

The quality of pre-job briefs emerged as a particularly strong predictor of both safety outcomes and business performance.

Taken together, this research confirms that we can measure whether a safety initiative is effective and draw reliable links between safety activities and future performance. Combined with financial analysis, the study reinforces that safety and business performance are not separate goals. They are part of the same system. By investing in practices that strengthen hazard recognition and control, companies can protect workers and improve long-term operational value.

"When controls are built into the systems before setup, crews spend less time managing background high-energy hazards and more time focusing on the ones tied directly to the task."

– Orion Field Engineer





DECLUTTERING SAFETY

Safety systems grow and grow, but we rarely take anything away. Each incident, audit finding, or new initiative adds yet another form, meeting, dashboard, or rule to the already crowded safety plate. The result is an ever-thickening layer of activities and paperwork carried out under the guise of safety, consuming resources without adding value to frontline operations. This is safety clutter.

Clutter diverts attention from high-value work, breeds bureaucracy, and hinders innovation. For example, while safety processes have doubled over recent decades, the rate of SIFs in high-risk industries remains unchanged. Clearly, increasing the number of safety activities does not automatically result in improved safety performance.

In this project, we set out to systematically examine safety clutter and help organizations lift unnecessary burdens while sharpening their focus on preventing SIFs. Our objectives were to:

- **clearly define what clutter is,**
- **uncover its types and real-world examples,**
- **understand the causes behind it, and**
- **provide safety professionals with science-backed tools to help identify and address clutter in their organizations.**

To this end, we conducted focus groups with safety professionals, in-depth interviews with construction professionals, and ran field experiments on 11 construction sites.

The findings show that safety clutter is far more than the mere accumulation of things over time. It is not simply a buildup of old forms or forgotten rules gathering dust in the system. There is so much more: Clutter emerges from the way safety systems evolve and interact with work, gradually disconnecting from their original purpose.

At its core, safety clutter is an adjective, not a noun. In other words, clutter is not the activity itself but how the activity is executed. For example, it is not the safety orientation, near miss program, or a dashboard, but the way these activities are performed and used. They become clutter when they are carried out in a way that adds effort without adding value. Activities that lose their purpose and create only burden ultimately turn into waste.

Our research uncovered two families of clutter: Pure and Conditional.

FROM THE FIELD:

"Half the stuff we read out doesn't even happen on our job, but we still have to read it."

"We log a near miss in our format, copy it into the client form, and repeat it in the daily and weekly reports, so the same near miss is reported four times."



Pure clutter is irredeemable by design. Within it lies things that are incorrect, dead ends, and obsolete artefacts. Removing pure clutter is the only remedy.

Conditional clutter, by contrast, is wasteful in its design or execution, branching into three types:

- **Excessive clutter** arises when work becomes overcomplicated, overdone, or repetitive.
- **Irrelevant clutter** occurs when tasks are misplaced, meaning they no longer align with the work being done or the risks being managed.
- **Inaccessible clutter** appears when information or tools become unreachable, buried, or noisy.

Building on this taxonomy, the project delivered a diagnostic tool to help practitioners tackle safety clutter. The tool provides guidance in identifying each type of clutter, determining whether refinement or removal is reasonable, and sparking conversations to keep safety systems lean. Ultimately, it empowers organizations to direct safety efforts toward high-value activities that can effectively prevent SIFs.





MANAGING LAST-MINUTE CHANGE

Changes on the jobsite are frequent and rarely predictable. We often expect workers to detect these changes in real time, adjust their actions, and make safe decisions — all based on the assumption that they can identify risk as it happens. But is this realistic? Research in applied psychology shows that people often miss even major changes in their surroundings. But if workers can't recognize what has changed, safer decision-making becomes impossible. This led us to asking three fundamental questions:

- Which type of changes are commonly missed?
- What factors influence a worker's ability to detect change?
- How can we create and test a pre-task meeting tool to anticipate high-risk changes during work?

To focus on changes most likely to cause SIFs, we defined **last-minute change** as any unexpected shift that:

Introduces a new STKY (Stuff That Kills You) hazard,

Increases exposure to an existing STKY hazard, or

Weakens or removes a Direct Control.

With this clear focus, three experiments were designed to explore change detection across different senses and workers' responses in real-world settings.

Experiment 1: Hearing the Change



GOAL

Test whether inexperienced workers can detect auditory warnings in a busy, construction-like environment.

EXPERIMENT

Construction engineering students assembled a scaled piping and conduit system in a lab simulating real jobsite conditions via continuous background noise. Two warning sounds, a hissing noise (task-relevant) and an air horn (task-irrelevant), were played at low, normal, and high volumes. Participants were instructed to stop work and step into a safety zone if they heard anything dangerous. Observers recorded which sounds were detected, measuring how often participants recognized auditory hazard cues while actively working.

Experiment 2: Seeing the Change

GOAL

Test how well participants noticed visual changes in construction scenes.

EXPERIMENT

A total of 614 participants completed a one-hour online flicker task, a well-established method in applied psychology that presents two alternating images separated by a brief blank screen, making visual changes more difficult to detect. Some of the simulated changes reflected serious safety risks, such as missing barriers, while others were minor, like repositioned signs or equipment. This approach enabled us to investigate what influences the detectability of change in a risk-free construction setting, including the type of change, its risk level, and individual factors such as fatigue and emotional state.



Experiment 3: Responding to the Change

GOAL

Test whether structured pre-task conversations improve how well crews anticipate and respond to change.

EXPERIMENT

The team developed a "What-If" planning tool to guide crews in discussing potential changes before work starts to help workers prepare for the unexpected. Prompts included questions such as: What could become a life-threatening hazard today? Using a multiple-baseline experiment design, the team observed nine crews from various sectors, assessing the quality of their conversations and whether the tool improved their ability to anticipate changes before work began.



Ultimately, this project aimed to shift the industry's approach to last-minute change. It is no longer about simply telling workers to "keep your head on a swivel" but about designing systems that guide safer responses. This requires understanding the limits of human attention and designing interventions to close those gaps, all with the goal of preventing SIFs.

Roughly 30% of all SIFs involve a last-minute change in the work process or environment.



SCIENCE OF SAFETY TRAINING

Strengthening Impact Through Better Delivery

The construction industry invests millions each year in safety training, yet there's limited evidence on what actually works.

To address this gap, the Science of Safety Training project tested five delivery formats to measure improvements in hazard recognition and knowledge retention. The same energy-based hazard content was delivered as pre-recorded video, lecture (with reflection and Q&A), interactive lecture (with group discussions), flipped classroom (video plus live discussion), and hands-on training (with realistic practice). Over 590 craft workers across 17 jobsites completed pre- and post-training tests, including a retest after one month to measure retention.

What We Learned

- **Video and hands-on training consistently outperformed traditional lectures.**
- **Hands-on training produced the strongest gains, both immediately and one month later.**
- **Flipped and interactive lectures showed poor retention, suggesting structure matters as much as participation.**
- **Training combining visuals, personal reflection, and discussion supported longer-term retention.**



Practical Implications

This isn't a call to chase trends; it's about strengthening what you already do and making every training dollar count.



1. **Stop defaulting to lectures. Not all "interactive" sessions are effective.**
2. **Use hands-on training when addressing high-risk/STKY work; it's worth the investment for SIF prevention.**
3. **Use video when logistics are tight. It works surprisingly well and scales.**
4. **Match delivery format to the material complexity and message.**

The CSRA also conducted a large-scale qualitative study surveying 143 workers and 190 trainers on effective and ineffective training. Their insights shaped the CSRA Safety Training Guide, outlining eight key attributes with practical steps. Access the guide on our website to improve the quality of what you're already doing.

IMMERSIVE TRAINING FORMATS

What the Evidence Actually Shows



New technologies like Virtual Reality (VR) and Augmented Reality (AR) promise to revolutionize construction safety training through immersive, realistic experiences. But does higher immersion always mean better learning and safer outcomes? Recent findings suggest modest gains, though not to the degree originally hoped for.

VIRTUAL REALITY (VR)

High Immersion, Debatable Gains

A field experiment involving 221 frontline construction workers examined the effectiveness of VR in enhancing hazard recognition. All participants received validated and video-based instruction focused on energy-based safety hazards. In addition, participants experienced an immersive VR simulation (a subset even received haptic feedback) that allowed them to interact with hazards, witness hyper-realistic accidents, and verbally reflect within the environment how the incident could have been prevented.

While emotional engagement increased with the combined training, hazard recognition improved only after the video instruction and declined slightly following the VR component. These findings do not invalidate the value of VR but emphasize that its effectiveness depends on the context and that not all training approaches yield the same results.

AUGMENTED REALITY (VR)

Improved Performance, Reduced Awareness



In this study, 100 craft workers completed a complex piping assembly task using either traditional paper drawings or AR models. Midway, a simulated hazard was introduced, and participants were instructed to stop work upon noticing it.

Workers using traditional drawings detected the hazard fastest, while AR users were significantly slower. This suggests that increased immersion improved task focus but may have narrowed attention and raised cognitive load, particularly among older workers.

While AR can enhance task performance, it may suppress situational awareness that is critical for safety. As AR adoption grows in construction, its impact on broader awareness must be carefully considered.

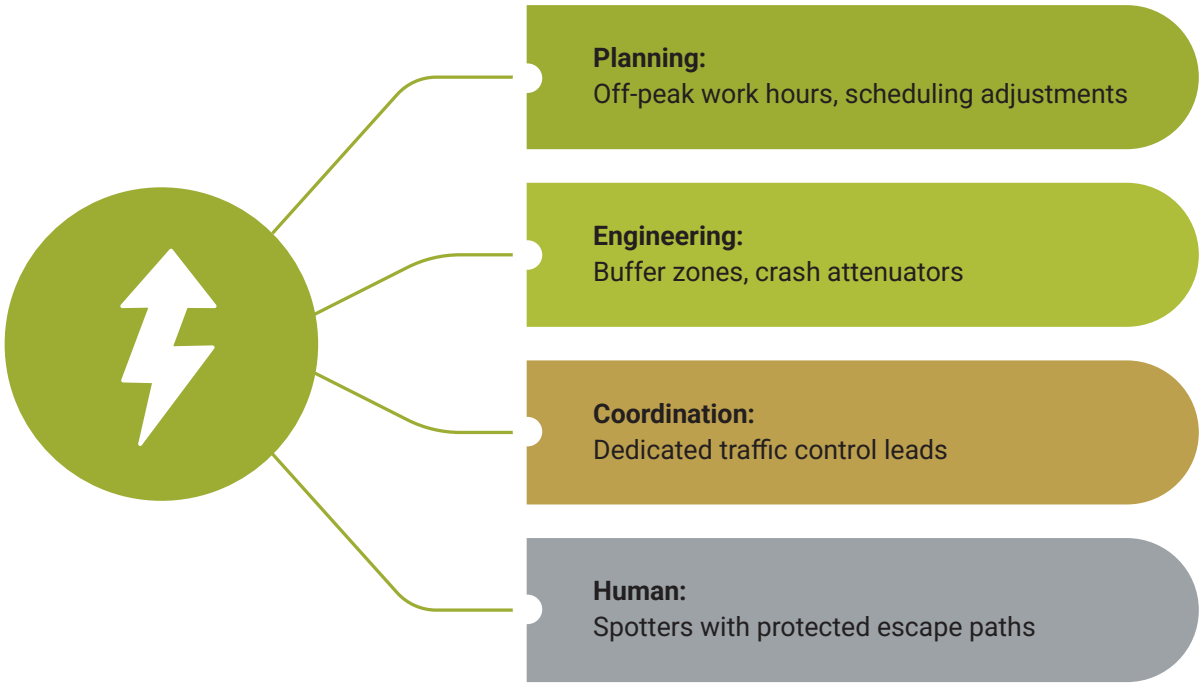


STKY CHALLENGE

Advancing Practical Solutions for Uncontrolled SIF Conditions

Some life-threatening hazards resist the straightforward use of Direct Controls (DCs); they are either impractical or do not yet exist. These high-energy "Stuff That Kills You" (STKY) situations force crews to rely on Alternative Controls (ACs), designed to mitigate or eliminate human error when DCs cannot be applied. The CSRA's work on ACs is gaining traction, most recently highlighted by Luke Bowley at the EEI Spring Conference (April 2025), where it sparked industry leaders to ask the critical question: *if there is no direct control, what is good enough?*

To enhance ACs and develop future DC solutions, the CSRA launched the STKY Challenge, a cross-sector learning effort involving clients, contractors, engineers, regulators, manufacturers, and frontline leaders. Two scenarios were prioritized for lacking reliable DCs and requiring stronger ACs: managing public traffic in live work zones and interactions between heavy equipment and workers on foot. Rather than a research study, the challenge was conducted through two workshops in a structured learning team format. It revealed the limits of current controls, produced a practical framework and recommended four types of ACs:



The resulting guide, *Managing Work Zone Risk: A Structured Approach to Alternative Controls*, offers practical direction and a model for cross-sector learning. Findings were released as a CSRA report, later adapted into a technical paper, and showcased at the ITS World Congress (August 2025), signaling broader influence beyond construction into transportation safety.

ONGOING RESEARCH PROJECTS



GOOD SAFETY, GOOD BUSINESS

This study examines nearly 10 years of injury and financial data from 83 firms to understand how injury rates affect business outcomes for client (i.e. utility) and contractor companies. The findings from this dataset suggest that client firms experiencing a significant increase in medical treatment injuries saw a market value decline, reflecting investor sensitivity to elevated TRIR. For contractors, lost-time injuries were especially damaging in firm revenue. Minor injuries often rose during busy periods that brought higher revenue, suggesting that pushing hard to meet demand can come at a safety cost. Fatalities, though rare, led to significant revenue losses months later. By treating injuries as predictors of business performance, the study provides compelling case that effective safety management isn't just ethical, it's financially prudent.



ENERGY-BASED RISK ASSESSMENT (EBRA)



Team members participating in the Delphi process.



What if we could assess SIF risk with the same clarity as engineering forecasting? The Energy-Based Risk Assessment (EBRA) project aims to create a unified framework that brings together all known predictors of SIF risk across a project's lifecycle. The CSRA's past research shows SIF risk is shaped by business, design, operations, and crew-based conditions, which are often assessed in isolation. This year, the team set the direction to integrate these layers into a practical risk framework aligned with energy-based concepts. They also developed a SIF-focused safety climate tool to highlight upstream decisions and organizational conditions that introduce risk before work begins. By improving the precision and quality of SIF risk signals, EBRA will help organizations identify where to strengthen resources to better protect their workforce.

SAFETY STARTS WITH DESIGN

Physical energy and cognitive workload are critical for designing safer work operations. But how can we integrate them into design to drive meaningful change in the field? Supported by a team of experts from 22 companies, this project focuses on improving pre-construction planning by incorporating these concepts into Prevention through Design (PtD) strategies. It further integrates safety principles that influence work planning and logistics on construction projects. Research activities over the coming year include expert interviews, focus groups, experimental design and data collection. Findings will help guide the development of a practical field resource, which will be explored for feasibility and effectiveness in real projects. Ultimately, this work empowers project teams to make better planning decisions that help prevent SIFs and protect lives.



TALKING SAFETY: WORDS THAT WORK



Clear, actionable safety messages can save lives, but only if they land as intended. This project investigates how safety messages are understood and acted upon by frontline workers compared to management's intent. This year, the team held interactive workshops, analyzed campaign materials, and conducted site visits to study SIF prevention messaging in action. Interviews with workers focused on how they received and interpreted these messages, while management interviews captured the rationale and desired outcomes of the initiative. Artifacts like emails, posters, and training materials were reviewed to see how messages appeared in the field. Ultimately, this project identifies gaps between intended and received meanings and explores why they occur. Findings will guide clearer, more resonant safety communications to ensure SIF prevention messages drive lasting impact.

RESEARCH ON THE HORIZON

MANAGING SAFETY TRANSITIONS

Projects are full of transitions. Work is transferred from one contractor to another, responsibilities shift throughout design and execution, and assets change hands from construction to operations. Each transition creates uncertainty about the hazards that exist, what controls are required, who is responsible, and how risks are communicated. This project will define critical transition points and explore how they impact the risk of serious injuries and fatalities. We will examine how risk assessment, communication, technology, and systems can be used to decrease uncertainty when work changes hands. By studying real projects, we aim to develop practical guidance that strengthens continuity, reduces vulnerability, and ensures that safety is never lost in transition.

RECOGNITION AND EVALUATION OF LAST-MINUTE CHANGES

Over half of serious injuries and fatalities involve unexpected changes in the work process or environment. In our earlier project, we measured how well workers notice and assess change. This next project will explore what happens when attention is divided by other tasks and competing motivations. We'll examine what changes workers notice, which they miss, and why; how the risk associated with change is assessed; and what ultimately drives the decision to stop work. We'll also study crew dynamics and how the type of information about the change affects how we respond. Ultimately, this research will explore why high-risk changes are sometimes discounted and identify interventions that highlight them so people clearly recognize when a change is critical and could cause a SIF.





CSRA PEER-REVIEWED PUBLICATIONS

**Our peer-reviewed publications are the scientific backbone of the CSRA vision, advancing both industry impact and research credibility. Below, we highlight key findings from recent studies.
Full papers are freely accessible in our Knowledge Center for those interested in exploring the details.**

Raheemy, Y., Sherratt, F. and Hallowell, M.R. (2025) What is safety? Contemporary definitions and interpretations across North America, Safety Science, https://doi.org/10.1016/j.ssci.2025.106798

Definitions form the foundation of every scientific discipline. Although the term 'safety' is widely used, it does not have an agreed scientific definition. Drawing on 518 qualitative responses from safety professionals across United States, simply asking them 'what is safety?', the analysis reveals we are still far from consensus. No single precise definition of safety emerged, and a shared definition remains elusive. Yet, safety can be considered in past, present and future terms, each with their own associated constructs. Rather than adding another definition, the study synthesized existing definitions to clarify the field and lay the groundwork for a shared definition. Further work is needed to drive consensus to better underpin comparable and consistent safety research.

Lopez, J., Bhandari, S., Perry, L., Ayer, S. K., Hallowell, M. R., & Jones, M. (2025). Analyzing the Impact of Virtual Reality and Haptic Feedback on the Safety Skills of Construction Workers. Journal of Construction Engineering and Management, 151(8), 04025110.

Can Virtual Reality (VR) truly improve safety training for construction workers? As a part of the data collection, 221 workers experienced VR after prerecorded video-based safety training. While the training paired with VR showed potential to improve hazard recognition together, the specific VR application tested here negatively impacted recognition skills. No significant impact was found on workers' risk perception, tolerance, or safety-related decision-making. Although VR remains a promising tool, these results suggest we need more research to understand when and how VR best supports adult learning and safety performance in the field.

Bayona, A., Hallowell, M. R., Bhandari, S., Moyen, N., & Lien, A. (2025). Impact of Energy-Based Safety Training on Quality of Prejob Safety Meetings and Control of Hazardous Energy in Construction: Multiple Baseline Experiment. Journal of Construction Engineering and Management, 151(7), 04025086.

Serious injuries and fatalities (SIFs) continue to plague the construction industry. Preventing them depends on identifying, assessing, and controlling hazardous energy. In this study, we tested energy-based safety training with 10 construction crews in the US and Canada, delivered in English and Spanish. The training immediately improved the quality of prejob safety meetings and had a smaller, more varied effect on High-Energy Control Assessment (HECA) scores. While prejob safety meeting scores improved consistently and quickly, HECA results varied widely, suggesting that improved direct controls may require more time and data to achieve conclusive results. This approach also offers a practical way to measure the impact of any intervention on safety performance to support return on safety investment calculations.

Raeisinafchi, R., Bhandari, S., Perry, L., Hallowell, M. R., Albert, A., & Correll, J. (2025). Comparing training delivery methods: Impact on learning outcomes and engagement among construction workers. Safety Science, 187, 106870.

This study aimed to identify the most effective safety training delivery methods to improve engagement and short-term learning (i.e., high-energy hazard recognition). Five approaches were tested, from least to most learner-centered: pre-recorded video, lecture, interactive lecture, flipped lecture (video plus hands-on activity), and interactive lecture with hands-on activity. A field experiment showed that engagement rose steadily with more learner-centered methods. Interestingly, hazard recognition improvements were highest at the least and most learner-centered ends, with decreasing gains in the middle methods, and lowest in the interactive lecture group. All groups except the interactive lecture group perceived high-energy hazards as riskier after training, while risk tolerance did not change.

Sherratt, F., Szabo, E., & Hallowell, M. R. (2025). Seeking a scientific and pragmatic approach to safety culture in the North American construction industry. Safety Science, 181, 106658.

In the construction industry, regulators are growing increasingly interested in safety culture as phenomenon, requiring a demonstrable 'good safety culture' for a license to operate. However, safety culture remains undefined, and safety science around it is fragmented and incoherent, limiting theory building and the generation of universal knowledge through practice. Many models and methods combine individual safety components and claim to measure "culture," a logical fallacy further complicated by issues of external validity and scientific proof. This study unpacks these challenges and calls for more coherence and scientific rigor. Ultimately, we argue for eliminating "safety culture" as a blanket term and instead focusing research on its distinct parts and their links to safety performance.

Chaudhari, R., Goodrum, P., Bhandari, S., Hallowell, M., Jones, M., Brady, N., & Yeh, T. (2025). How does augmented reality head-mounted display impact the ability to detect safety hazards while performing piping assembly?. International Journal of Industrial Ergonomics, 107, 103751.

Augmented Reality (AR) Head-Mounted Display Devices (HMDDs) offer new possibilities for delivering information during construction, but concerns remain about their impact on situational awareness. In a controlled experiment, 100 craft workers completed an assembly task on a full-scale MEP model using either paper drawings or AR models at two levels of detail (LOD 300 and 400). A safety hazard was introduced, and response time to detect the change was measured. Workers using paper drawings detected changes significantly faster than those using AR HMDDs. Notably, higher levels of AR detail further reduced change detection performance. In AR environments, older workers were slower to detect change, while spatial cognition had no measurable effect. This study is among the first in construction to examine how AR affects hazard recognition through change detection.

Stoddard, E., Bhandari, S., Sherratt, F., Bone, L., & Russell, S. (2024). Exploring the Perceptions of Construction Workers and Senior Management Towards Mental Wellness Interventions Using Q-Methodology. International Journal of Environmental Research and Public Health, 22(1), 52.

The construction industry is facing a mental health crisis, with rising suicide rates and psychological distress among workers. Addressing these issues requires systemic changes in work practices and better access to wellness resources. Yet, little research has explored how both workers and senior managers perceive proposed solutions. This study used Q-Methodology to examine preferences for validated wellness interventions among 12 senior managers and 15 frontline workers. Frontline workers favored personalized interventions, while notable differences emerged between the groups regarding policies to reduce workload pressures and improve accountability and communication. Findings also suggest that current contracting practices may limit the adoption of interventions seen as most beneficial. These insights can guide the design and delivery of more effective workplace wellness strategies.



CSRA COMMUNITIES OF PRACTICE

In 2025, the CSRA Communities of Practice (CoP) continued to grow into a vital forum for industry professionals to engage with cutting-edge safety research. Now streamed live on our website, each session includes a research spotlight, a dynamic panel discussion with industry leaders, and an interactive live chat with approximately 300 participants to foster real-time exchange.

Each conversation brings forward practical insights and peer-driven solutions, making research implementation approachable, visible, and actionable.

We are honored to offer this free, open-access platform for sharing and learning to support safety professionals all over the world in translating research into practice. Together, we are building a community committed to eliminating SIFs through science, dialogue, and collective action.

By the numbers:

30
panelists

1,000+
unique viewers

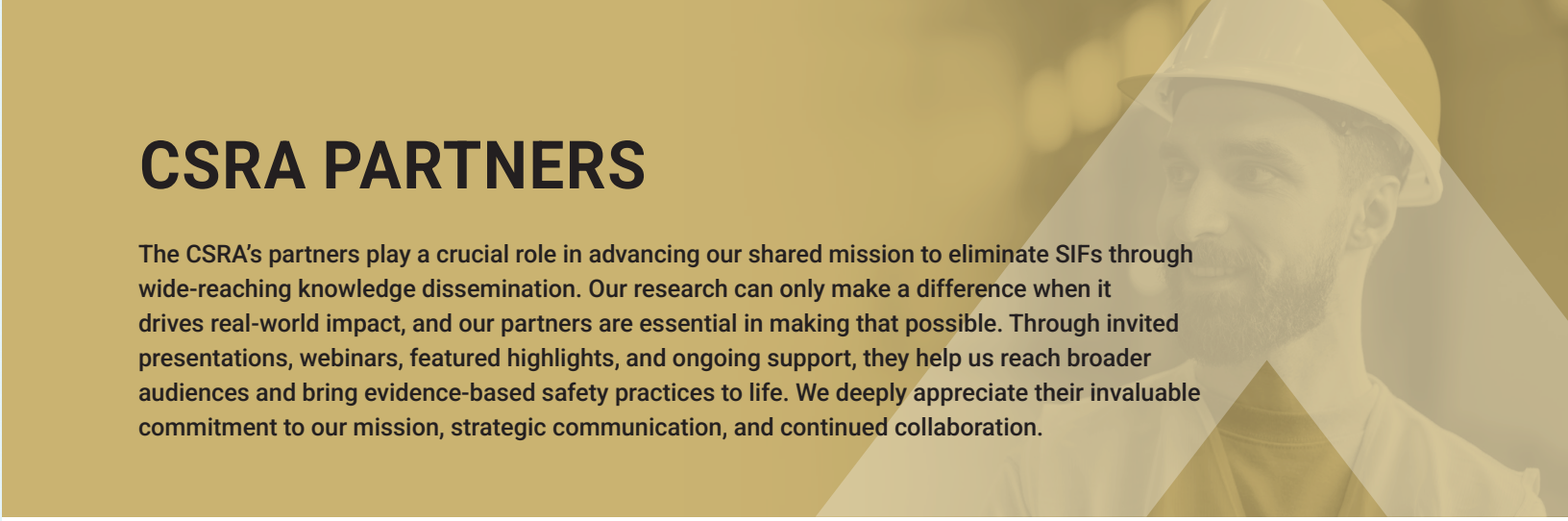
3,000+
hours of content watched

Topics covered:

- **Principles of Energy-Based Safety**
- **Tyranny of TRIR**
- **HECA in Practice**
- **Alternative Controls**
- **Incident Investigations and Learning**
- **What is a SIF and Life Model**
- **Quality of Pre-job Briefs**
- **Finding STKY**
- **Safety Analytics**

Scan the QR code to register for future CoPs or access recorded content.

CSRA PARTNERS



The CSRA's partners play a crucial role in advancing our shared mission to eliminate SIFs through wide-reaching knowledge dissemination. Our research can only make a difference when it drives real-world impact, and our partners are essential in making that possible. Through invited presentations, webinars, featured highlights, and ongoing support, they help us reach broader audiences and bring evidence-based safety practices to life. We deeply appreciate their invaluable commitment to our mission, strategic communication, and continued collaboration.

ABC Associated Builders and Contractors Rocky Mountain

ASSP

EEI Edison Electric INSTITUTE

INGAA FOUNDATION

NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

NUCA COLORADO CHAPTER REPRESENTING UTILITY & EXCAVATION CONTRACTORS

nsc National Safety Council

CSRA GRADUATES

The CSRA's students are truly at the heart of our research. They bring fresh ideas, creative problem-solving, and contagious energy. Their curiosity and drive to learn push our work in exciting new directions and help us tackle the toughest challenges in the field. What makes them stand out isn't just their brainpower, but their collaborative mindset and willingness to jump in, ask big questions, and explore possibilities. They're not just shaping the future of safety research — they're driving it forward and inspiring others along the way. As core members of our team, their contributions reflect the best of who we are. We congratulate our recent graduates and wish them continued success in their next chapters.



ARNALDO BAYONA

PhD Graduate in 2025

Arnaldo completed his PhD in Spring 2025 and will join Central Washington University as an Assistant Professor in Fall 2025. His research blends evidence-based methods with real-world application, aiming to reduce SIFs across the construction industry. During his time with CSRA, Arnaldo led experimental studies to evaluate the effectiveness of a key safety intervention, drawing causal insights from field-based data. His work also built on CSRA's earlier efforts to connect leading, monitoring, and lagging metrics, providing statistical evidence of their relationships. He served as the graduate student lead on the *Unique Precursors of SIFs* and *Safety Return on Investment (ROI)* projects, delivering training and facilitating calibration workshops for hundreds of frontline workers and safety practitioners. In his upcoming role, Arnaldo is eager to continue advancing construction safety and preparing the next generation of industry leaders.



ROYA RAEISINAFCHI

PhD Graduate in 2024

Dr. Roya Raeisinafchi earned her PhD in Civil Engineering from the University of Colorado Boulder in December 2024. As the graduate lead of the Science of Safety Training project at the CSRA, her research explored how to enhance adult learning in the construction industry while navigating real-world cost and time constraints. Her work focused on optimizing safety training delivery methods to improve knowledge retention, engagement, and practical application in the field. Roya currently serves as an HSE Manager I at Sundt Construction, where she applies the knowledge gained during her PhD to support safety compliance, incident management, and jobsite performance improvement. Her responsibilities include communicating safety standards effectively across diverse teams, analyzing on-site risks, developing and implementing practical solutions, and leading efforts to learn from incidents to prevent future occurrences.



EVAN STODDARD

Masters Graduate in 2025

Evan Stoddard earned his B.S. in Civil Engineering from the University of Colorado Boulder and completed his M.S. with the CSRA in 2025. His research focused on mental health in construction, surveying nearly 500 field workers to identify key stressors and conducting focus groups with over 60 frontline workers to explore their experiences. He also worked with managers and field workers to assess potential solutions. His efforts led to CSRA's first mental health guide and a new survey tool to measure program impact. Evan now serves as a Civil Engineering Officer in the U.S. Air Force, overseeing infrastructure at Joint Base Andrews in Washington, D.C.

SNAPSHOTS FROM THE FIELD

Our work doesn't stay behind a desk. Field-based data and engagement is at the heart of what makes the CSRA's research different, relevant, and impactful. By spending time on actual job sites, our students get to observe, listen, and learn from the people who do the work to ground our research in reality.











CSRA COLLABORATORS

Bringing together researchers from a wide range of universities, backgrounds, and specialties is one of the CSRA's greatest strengths. These partnerships unite diverse expertise, ideas, and resources, creating a dynamic and collaborative academic environment where innovation thrives. By combining and exchanging different perspectives and areas of knowledge, CSRA can explore challenges more creatively and pursue research with greater depth and relevance. The results are far-reaching, producing insights and outcomes that resonate well beyond our own community.



DR. JOHN GAMBATESE

Professor, School of Civil and Construction Engineering

Oregon State University

Safety Starts with Design



DR. HELEN LINGARD

Distinguished Professor

RMIT / SHINe

Decluttering Safety



MATT MORRIS

Teaching Professor

University of Colorado

Managing Last-Minute Change



DR. LOGAN PERRY

Assistant Professor of Engineering Education

University of Nebraska-Lincoln

Talking Safety - Words that Work



LEAF VAN BOVEN

Professor and Chair of the Department of Psychology and Neuroscience

University of Colorado

Managing Last-Minute Change



DR. ZIYU JIN

Assistant Professor, Department of Construction Management

Colorado State University

Safety Starts with Design

CSRA TEAM

The CSRA's academic team at the University of Colorado Boulder is the driving force behind our mission. This diverse group of faculty, professionals, PhD candidates, graduate, and undergraduate students brings together deep expertise, curiosity, and a shared commitment to the CSRA's missions of eliminating SIFs in the construction industry. Beyond advancing cutting-edge research through industry collaboration, they foster an environment that cultivates future safety researchers and transforms data into practical solutions for the industry.



DR. MATTHEW HALLOWELL
Executive Director



DR. ELIF DENIZ OGUZ ERKAL
Associate Director of Research & Strategy



DR. SID BHANDARI
Associate Director of Research



AYLEEN PEREZ
Operations Manager



ALEX NOWAK
Administrative Assistant



YAQOOB RAHEEMY
Research Assistant, PhD Candidate



ABAYOMI OLADEJO
Research Assistant



EMI SZABO
Research Assistant



FRANK BENIN
PhD Student



OSMAN SAFFIA-DOE
PhD Student



STANLEY TWUMASI
PhD Student

CSRA BOARD OF ADVISORS

Our Board of Advisors is a distinguished group of seasoned industry professionals whose dedication, guidance, and expertise help drive our mission forward. Their decades of experience and strategic insight offer invaluable perspectives that strengthen our direction and reinforce our commitment to excellence. Guided by their diverse perspectives and thoughtful advice, we shape our research to achieve meaningful progress in eliminating SIFs, ensuring it remains grounded in real-world impact. We are sincerely grateful for their leadership, collaboration, and steadfast support.



2025 BoA Highlights

Alicia Edsen (Kiewit), Paul Leonard (Entergy), and Brad MacLean (Wolfcreek) stepped down from their roles as Board Members. We extend our gratitude for their dedicated service.

Dana Small (Exelon) and Seth Washington (Cheniere) joined the Board, bringing expertise and fresh perspectives to enrich our collective vision.

Mike Quashne (Luminace) has been elected as the new Chair of our Board of Advisors. Clint Harris (CRC) was elected as the new Vice Chair of our Board of Advisors.

Brad MacLean was unanimously chosen by his peers as Chair Emeritus, honoring his exemplary service.

How Does the Board Recommend Projects?

Every August, the Board of Advisors carefully evaluates all research ideas submitted by the CSRA community. Guided by our collective mission to eliminate SIFs, Board Members:

Review each proposal individually for relevance, feasibility, and potential impact.

Discuss and debate the merits of each idea.

Anonymously vote to recommend the two projects they believe should move forward.

These recommendations are then shared with the Executive Director, who makes the final determination.

This process ensures our research portfolio is both visionary and practical, addressing the most critical safety challenges while delivering measurable value to our members and the industry.



MIKE QUASHNE
Chair of the Board
Senior Manager, Health Safety Security & Environmental
Luminace



CLINT HARRIS
Vice Chair of the Board
Director of Compliance and Assessment
California Resources Corporation



BRAD MACLEAN
Board Emeritus
Senior Vice President
Wolfcreek Group



MATT COMPHER
Vice President, Safety Health Environmental & Quality
Quanta Serives



MIKE COURT
SVP HSEQ and Sustainability
Graham



NICK DIMARTINO
Vice President of Corporate Safety
MasTec



KEVIN DIX
Vice President, Global EHS
OTIS Elevator Company



ALICIA EDSON
Vice President, Corporate Safety Director
Kiewit Corporation



DR. JOHN GAMBATESE
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Tennessee Valley Authority



GREG KELLY
Manager Canadian, Global Business Development Projects and OffShore Wind Operations Health & Safety
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PAUL LEVIN
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Sundt



AL PAYTON
Vice President, Safety and Technical Training
CenterPoint Energy



DANA SMALL
Vice President Safety, Training & Environmental
Exelon Corp



SETH WASHINGTON
Manager, Health, Safety, and Environment
Cheniere

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