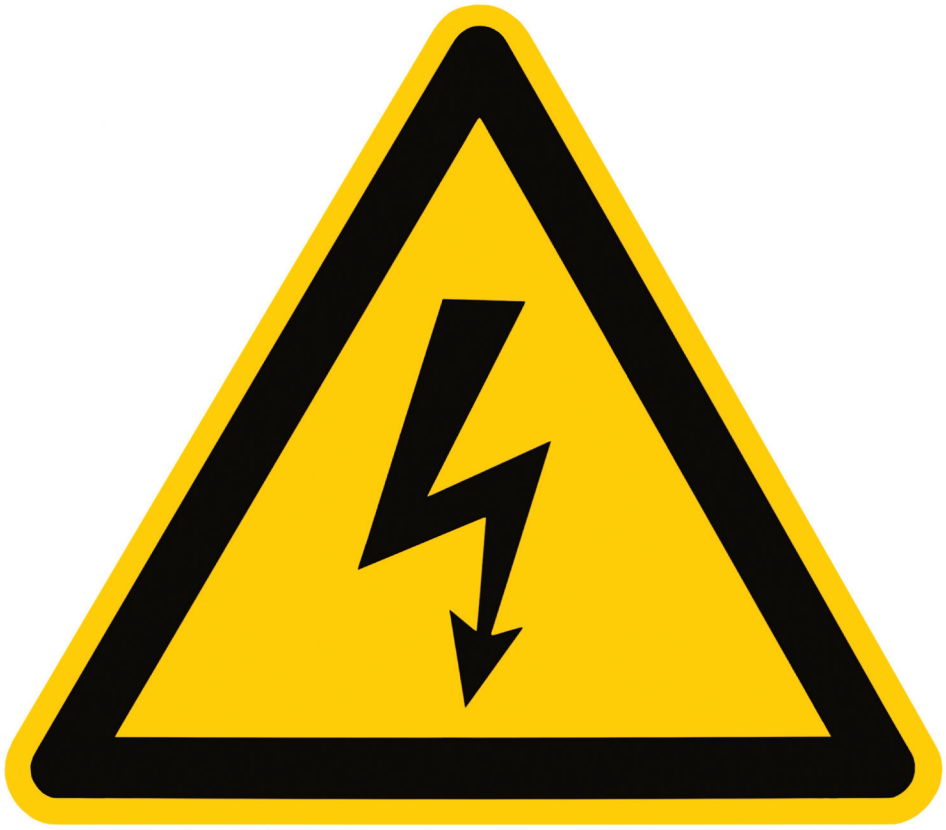
Workplace Safety
ACADEMY



Breaking the SIF Plateau with Energy-Based Safety

Most SIFs result from the uncontrolled release of high energy.

by Dr. Matthew Hallowell

For decades, we have made remarkable progress in reducing workplace injuries. Total Recordable Incident Rates (TRIR) have plummeted, and minor injuries are far less common than they once were.

Yet, despite these gains, the rate of serious injuries and fatalities (SIFs) has remained stubbornly unchanged for nearly 20 years.

The disconnect between declining injury rates and stagnant fatality rates is one of the most pressing challenges facing environmental, health, and safety (EHS) professionals today.

Why? Because the management approaches, field tactics, and metrics that successfully reduced minor injuries are not working equally well to address SIFs. Research has shown that the factors that cause minor injuries are not the same as those that lead to SIFs. Therefore, to make meaningful progress in preventing SIFs, we need a new approach that directly addresses the types of hazards that cause them.

That is where Energy-Based Safety (EBS) comes in. Over the past two decades, my time and I at the **Construction** Safety Research Alliance (CSRA) have focused on building a scientific framework for SIF prevention.

EBS is grounded in four key principles:

- **Energy causes harm**. Every injury results from an undesirable transfer of energy to the human body.
- **More energy causes more harm**. Contact with high-energy hazards containing more than approximately 1500 joules of physical energy is far more likely to result in a SIF.
- **Controls save lives**. High-energy hazards require Direct Controls that are targeted, mitigate energy, and remain effective even when people make mistakes.
- **People drive performance**. Since every control is designed, installed, used, and verified by people, systems must be designed to set workers up for success.

EBS is already influencing how major organizations approach workplace safety. It is attractive because it adds focus and clarity to existing safety activities and aligns safety systems around a single objective: preventing SIFs.

Why Traditional Approaches Fall Short

For decades, misinterpretations of the “safety pyramid” have led many to believe that preventing low-severity injuries will ultimately prevent SIFs. Although repeated studies have disproven this assumption, it continues to underpin many safety programs. Building

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on a stronger evidence base, it is becoming increasingly clear that while all hazards matter, they are not equally important.

The focus must shift from safety in general to a more targeted approach to SIF prevention.

Safety metrics reinforce this imbalance. Measures such as TRIR largely reflect minor injuries like cuts, sprains, and strains that occur frequently but are rarely fatal. Along with their well-documented philosophical, structural, and statistical limitations, these metrics unintentionally incentivize organizations to focus on managing minor cases.

This diverts attention and resources away from the hazards most likely to seriously injure or kill workers.

If we want to move beyond these outdated approaches, we must be able to consistently, reliably, and practically identify the hazards that cause SIFs. The concept of high energy provides a necessary step in that direction.

High Energy and the 1500-Joule Threshold

One of the central elements of Energy-Based Safety is that most SIFs result from the uncontrolled release of high energy. Research has shown that beyond a certain threshold, approximately 1500 joules, contact with energy becomes so severe that a SIF is no longer just a possible outcome, it becomes the likely outcome.

This threshold does not require practitioners to calculate energy values in the field. Instead, it provides an evidence-based boundary that helps distinguish everyday hazards from those that pose a genuine threat to life. In doing so, it reframes hazard prioritization by anchoring it to physics rather than intuition or injury history.

The practical challenge, of course, is translating this scientific insight into something that can be used reliably during everyday work. That translation is addressed through the tools described below, which make the control of high-energy hazards visible, recognizable, and actionable without requiring technical calculations.

Practical Tools for Immediate Implementation

EBS is not another task, checklist, or initiative. It is not an additional form to complete, or a new activity layered onto an already cluttered safety system. Instead, it is a set of scientific principles that, when embedded within a strong safety program, sharpen our ability to identify, prioritize, and control the hazards that matter most.

The following tools allow organizations to begin integrating EBS into existing safety activities:

The Energy Wheel

The first step in preventing SIFs is recognizing all sources of hazardous energy present in the work. While humans are biologically attuned to obvious threats like gravity and motion, we routinely overlook equally dangerous forms of energy such as mechanical, pressure, electrical, and chemical energy.

The Energy Wheel addresses these blind spots by prompting teams to systematically scan for the full range of hazardous energy. Field experiments across industries and geographies have consistently shown that use of the Energy Wheel improves hazard recognition by approximately 30 percent.

High-Energy Icons and "Stuff That Kills You" (STKY)

Once hazards are identified, the next step is prioritization. High-energy icons serve as visual markers for hazards that are most likely to cause SIFs. Each icon represents a category of high energy commonly involved in fatal and life-altering incidents, allowing teams to quickly recognize when elevated attention is required.

In everyday language, these hazards are often referred to as "Stuff That Kills You" (STKY). This phrase translates a scientific concept into terms the workforce readily understands. While the Energy Wheel supports comprehensive hazard identification, the high-energy icons narrow the focus to those hazards that demand deeper scrutiny and stronger controls.

Direct Controls for High-Energy Hazards

After high-energy hazards are identified, the next question is whether they are adequately controlled. In Energy-Based Safety, Direct Controls are the safeguards considered sufficient for high-energy hazards because they physically limit, contain, or isolate energy at its source.

To qualify as a Direct Control, a safeguard must be targeted to the specific energy, strong enough to mitigate the energy, and forgiving enough to remain effective even when people make mistakes.

Examples include self-retracting lifelines that arrest falls, de-energization and lock-out tag-out

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of electrical systems, and machine guarding that prevents access to hazardous heavy rotating equipment. A simple test helps distinguish Direct Controls from weaker safeguards: would this control still protect the worker if someone made a mistake once it is installed, verified, and being used properly? If the answer is no, the safeguard may reduce risk, but it is not sufficient for managing high-energy hazards.

SIF-Focused Safety Walks

Hazard identification and control definitions only matter if controls are present and functioning when work is actually performed. Energy-Based Observations (EBOs) provide a structured way to focus safety walks on hazardous energy and the verification of controls in real time.

Unlike traditional safety walks that often emphasize housekeeping or PPE compliance, EBOs center attention on high-energy hazards and whether effective safeguards are in place before energy is released. During an EBO, safety leaders observe work activities, identify energy sources, and verify the presence and effectiveness of Direct Controls.

High-Energy Control Assessment (HECA) builds on these observations by converting them into a measurable signal, defined as the proportion of high-energy hazards with a corresponding Direct Control. Together, EBOs and HECA shift safety walks from general oversight and compliance toward targeted learning and improvement.

A Shift That Is Gaining Momentum

Energy-Based Safety represents a fundamental shift in how workplace safety is understood and managed. It challenges organizations to move beyond traditional metrics and management approaches and focus squarely on the conditions that cause SIFs.

This shift is already gaining momentum across high-risk industries. Organizations that have adopted EBS report improvements in hazard recognition, clearer prioritization, and more effective controls. The most recent research has also empirically linked the control of hazardous energy to improved long-term SIF rates, an important step in breaking the SIF plateau.

Dr. Matthew Hallowell is the Founder and Executive Director of the Construction Safety Research Alliance and a leading researcher on serious injury and fatality prevention.

He is also a chaired professor at the University of Colorado Boulder.

Hallowell serves as the principal technical advisor to major industry organizations such as the Edison Electric Institute, helping companies align their safety systems to SIF prevention using evidence-based strategies. His approach is grounded in firsthand experience as a construction laborer, ensuring that scientific rigor remains firmly connected to the realities of daily work.

He is the author of Energy-Based Safety: A Scientific Approach to Preventing Serious Injuries and Fatalities (SIFs).