Guidance for Serious Injury and Fatality Prevention

Document	Revision	Date
CS-G-9	1	11/18/2024

1.0. PURPOSE / BACKGROUND

1.1. According to BLS statistics, overall injury rates have declined steadily over recent years; however, the frequency of Serious Injuries and Fatalities (SIF) has remained relatively unchanged. Traditional approaches to injury reduction have not been effective at reducing SIF incidents. As a result, safety systems are now adapting to address this gap by placing a stronger emphasis on SIF prevention.

1.2. These guidelines identify the key elements to prevent serious injuries and fatalities in the workplace by applying proven Serious Injury and Fatality (SIF) revention methodologies and systems improvement strategies. Member companies can use the information as a roadmap for developing or enhancing their own SIF prevention programs.

1.3. These guidelines are not meant to supersede or replace regulatory requirements, nor are they intended to be all inclusive of the applicable regulatory requirements. Instead, view this data as supportive and complementary to any operating requirements.

2.0. SCOPE

The scope of this guideline is to provide consistent methods for identifying and controlling SIF to support the prevention of serious injuries and fatalities. Definitions and implementation recommendations for leading, monitoring and lagging methods for SIF prevention are presented including High Energy Control Assessments (HECA), Field Verification of Critical Controls (FVCC), and an incident classification and learning model.

3.0. DEFINITIONS

Term / Acronym	Definition
Capacity	Incident with a release of high energy in the presence of a Direct Control where a serious injury is not sustained.
Critical Controls	The critical behaviors and conditions (~10) that must be in place and functioning 100% of the time, without fail, to protect people when working in situations prone to SIF.
Direct Control	A barrier that is specifically targeted to the high-energy source; effectively mitigates exposure to the high-energy source when installed, verified, and used properly; and is effective even if there is unintentional human error during work that is unrelated to the installation of the control.
Energy Contact	Instance when high energy is transmitted to the human body.

Term / Acronym	Definition
Energy Proximity	A circumstance where a high-energy source may be within 6 feet of a worker before being contained or any distance when there is restricted egress from the energy source.
Energy Release	An instance where energy source changes state and is exposed to the environment.
Exposure	Condition where high energy is present in the absence of a Direct Control; a state of vulnerability.
Field Verification of Critical Controls	A Front-Line Leadership led process that utilizes SIF critical control checklists to conduct field observations and interviews during jobs with SIF risk to verify that critical controls are in place and functioning as designed.
High Energy	A hazard that exceeds 1500 Joules (approx. 500 foot-pounds) of physical energy and is most likely to cause a SIF if an employee contacts the energy.
High Energy Control Assessments	An observation-based assessment method that measures the proportion of high-energy hazards that have corresponding Direct Controls in place.
High-Energy Incident	An instance where the high-energy source was released and where the worker came in contact with or proximity to the high-energy source.
HSIF – High-Energy Serious Injury or Fatality	Incident with a release of high energy in the absence of a Direct Control where a serious injury is sustained.
Low Severity	Incident with a release of low energy where no serious injury is sustained.
LSIF – Low-Energy Serious Injury or Fatality	Incident with a release of low energy in the absence of a Direct Control where a serious injury is sustained.
PSIF – Potential Serious Injury or Fatality	Incident with a release of high energy in the absence of a Direct Control where a serious injury is not sustained.
Proximity	• A hazardous circumstance where the boundary of the high energy exposure is within 6 feet of a worker who has unrestricted egress. • Any distance to a high energy source when there is a confined space or situation with restricted egress where a worker potentially cannot escape the energy source.

Term / Acronym	Definition
Released	Instance where energy source changes state while exposed to the environment.
Safety Management Controls	The entire system of controls designed to protect people in situations with SIF risk includes equipment, training, operating procedures, signs and labels, Personal Protective Equipment (PPE), etc.
SIF – Serious Injury and Fatality	A work-related injury or illness that was life-threatening, life-altering, or fatal. SIF focuses on acute injury exposure only and does not include chronic injury exposure, e.g., Muscular-Skeletal Disorders (MSDs) of ergonomic origin, hearing loss, etc.
SIF Decision Logic	A structured set of decision-making rules or parameters for reliably classifying incidents and determining SIF potential.
SIF Decision Tree	A validated framework to consistently and reliably classify safety incidents based on concepts of High Energy and Direct Controls in high-risk task(s).
SIF Precursor	A high-risk situation in which management controls or systems are either absent, ineffective, or not complied with and which will result in a serious or fatal injury if allowed to continue.
Success	Condition where high energy is present but is not released because of the presence of a Direct Control.

4.0. RESPONSIBILITIES

4.1. Management Responsibilities

4.1.1. Establish a formal governance and oversight structure for SIF prevention.

4.1.2. Provide resources to ensure that all SIF/PSIF incidents are identified and assessed, and that corrective actions are identified and implemented based on the hierarchy of controls.

4.1.3. Establish and maintain a system of proactive SIF Risk Mitigation (field verification) for validating that SIF critical controls are in place and functioning.

4.1.4. Establish and maintain continuous monitoring of SIF risks through High Energy Control Assessments (HECA).

4.1.5. Establish leading, monitoring, and lagging SIF risk metrics.

4.1.6. Ensure employees and contractors are educated on SIF prevention definitions and practices.

4.1.7. Establish robust sharing and communication of learnings from events with SIF risk including both external and internal sources.

4.2. **Supervisor Responsibilities** (includes all personnel on site with a supervisory role)

4.2.1. Utilize resources to ensure that all SIF/PSIF incidents are identified, and assessed, and that corrective actions are identified and implemented based on the hierarchy of controls.

4.2.2. Participate in and promote proactive SIF Risk Mitigation (field verification) for validating that SIF critical controls are in place and functioning.

4.2.3. Participate in and promote continuous HECA observations and coach based on High Energy and Direct Control concepts on site to improve SIF hazard recognition and risk prevention.

4.2.4. Respond promptly and positively to reported incidents, near misses, concerns, etc.

4.2.5. Promptly report SIF level events / near-misses to Management.

4.3. **Worker Responsibilities**

4.3.1. Identify, assess, monitor, and control SIF risks in their work area.

4.3.2. Participate in field verifications of Direct and Critical Controls to identify hazardous situations with the potential for serious injury or fatality.

4.3.3. Report all incidents and near misses to Supervision and participate in incident investigations.

4.3.4. Follow SIF controls recommendations and procedures.

5.0. SIF FOCUSED INCIDENT CLASSIFICATION AND LEARNING

5.1. Identifying and Classifying SIF Incidents

5.1.1. Reported incidents – including injuries and close calls/near misses – are evaluated to determine if they meet the criteria for a SIF or PSIF event.

5.1.2. To enable the consistent and reliable evaluation and classification of incidents, a reliable and valid SIF incident classification methodology (e.g., APPENDIX D – SIF PROCESS FLOW) is used. A customized decision tree, based on an organization's SIF incident history, is developed and used to drive classification of all incidents based on SIF risk, and facilitates decisions based on the objective criteria of the decision logic, ensuring consistency.

5.1.3. For each SIF/PSIF event, further analysis (i.e., SIF precursor identification) is conducted and results in the determination of:

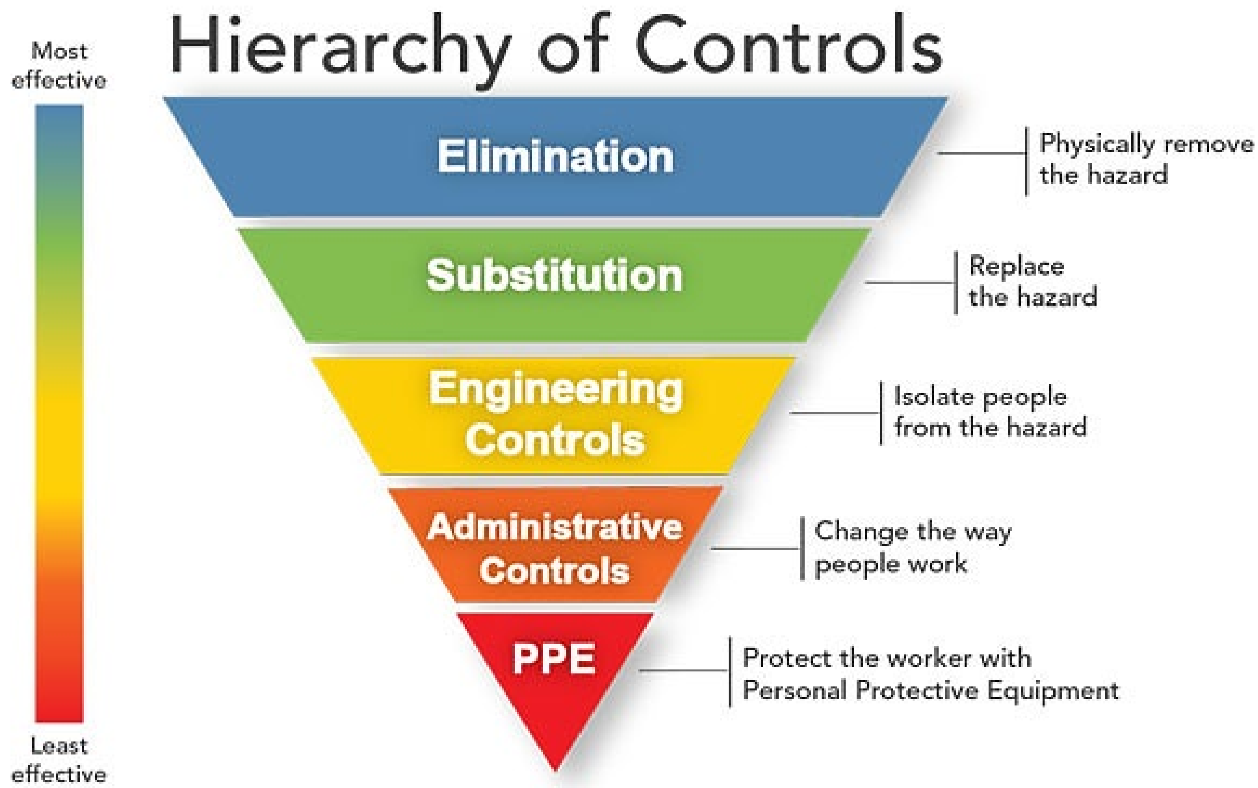
(1) the high-risk situation under which the event occurred,

(2) the management systems that were either absent, ineffective, or not complied with, and

(3) the leadership and cultural contributing factors that if allowed to continue would result in a SIF.

Additionally, an extent of condition analysis is completed to determine the potential for the SIF risk to exist or to have occurred in other activities, processes, programs, divisions, or systems elsewhere in the organization.

5.1.4. Systematically use results from the SIF precursor analysis to build SIF prevention tools (e.g., the SIF Classification Table categories are based on the high-risk situations identified in paragraph 5.1.3 (above) and are correlated with Life Saving Rules/Processes, and strategies to improve and fill gaps in existing management or safety systems).



During or after the incident investigation, causal analysis is undertaken to identify corrective actions and preventive actions (CAPA) to address the causes and contributing factors. Integral to the identification of effective CAPAs in SIF prevention is the use of the Hierarchy of Controls (HOC). The identification of CAPAs that utilize controls in the top half of the HOC (i.e., engineering, substitution, or elimination) are more effective those in the bottom half (i.e., administrative or PPE) for controlling SIF risks. Each CAPA is tracked for completion and monitored for effectiveness.

Source: NIOSH

5.1.5. Learnings from SIF/PSIF incident investigations should be shared across the organization after the incident investigation is complete.

6.0. SIF RISK MITIGATION

6.1. SIF Critical Controls

6.1.1. SIF critical controls (i.e., critical behaviors and conditions (up to 10) that must be in place and functioning 100% of the time, without fail, to protect people when working in situations with SIF risk) are determined for each high-risk exposure category identified from the SIF precursor analysis and included on the SIF Classification Table (see APPENDIX A – SIF CLASSIFICATION TABLE).

6.1.2. The identification of SIF critical controls should be done by a group of internal Subject Matter Experts (SMEs) with knowledge and experience relevant to the situations with SIF risk.

6.1.3. The initial set of SIF critical controls are field-tested and reviewed for accuracy, and completeness. Going forward, the SIF critical controls should be reviewed at least annually and updated as needed.

6.2. SIF Critical Controls Use and Implementation

6.2.1. **Pre-Task / Pre-Job Planning:** Prior to commencing and executing the work in the field, the Pre-Task Risk Assessment (PTRA), Field Level Hazard / Risk Assessment (FLHA / FLRA) or equivalent process should include a review of SIF critical controls relevant to the upcoming scope of work.

6.2.2. **Pre-Job Briefs:** Prior to commencing on-site/field work, Pre-Job Briefs (PJBs) or an equivalent process should include a review of all site and activity hazards, potential SIF risks (High Energy Hazards), Direct Controls and SIF critical controls.

6.2.3. **Field Verification of Critical Controls (FVCC)**: Front-Line Leaders use SIF critical control checklists to conduct field verifications (observations and interviews) of jobs with SIF risk. If a critical control is exposed (i.e., not functioning as intended), the work is paused and only resumes once the control is in place. Data from FVCCs is collected, tracked, and used to identify SIF prevention priorities.

6.2.4. **Incident Investigation**: Actual and Potential SIF incidents are reviewed to determine what SIF critical controls could have helped prevent it. If none of the existing SIFcritical controls would have prevented the event, additional ones are developed to protect workers from the exposure situation.

6.3. **High Energy Control Assessments (HECA) Use and Implementation**

6.3.1. HECA is a monitoring method that measures safety performance by evaluating the extent to which front-line workers are protected against life-threatening hazards. It is calculated as the percentage of high-energy hazards with a corresponding Direct Control.

6.3.2. HECA requires observers that are trained on concepts of High Energy and Direct Controls. These observers are required to be calibrated for monitoring using HECA Rulebook, standard Calibration Scenarios, and a sampling strategy.

6.3.3. During on-site/field work, observe ongoing normal work for existence of High Energy hazards and presence (Success) or absence (Exposure) of relevant Direct Controls continuously.

6.3.4. During on-site/field work, use High Energy Hazard icons (see APPENDIX A – SIF CLASSIFICATION TABLE) to coach for High Energy Hazard identification and importance of Direct Controls.

6.3.5. Use continuous HECA trends, findings, and benchmarks for executive communication, management and decision-making related to SIF Risk Mitigation.

7.0. METRICS

7.1. SIF metrics are established to drive continuous improvement.

7.2. Key leading, monitoring, and lagging SIF metrics and trends are tracked, analyzed, and communicated with the same frequency as other EHS performance metrics (see APPENDIX C – SIF METRICS EXAMPLES). Refer to *Leading Safety Indicator Program Guidance* (CS-G-08) for more information.

8.0. REFERENCES

- U.S. Bureau of Labor Statistics – Injuries, Illnesses, and Fatalities (https://www.bls.gov/iif/news.htm)
- Edison Electric Institute – *Safety Classification and Learning (SCL) Model* (SCL Model Report), March 2020 (eeiSCLmodel.pdf (esafetyline.net))
- Edison Electric Institute – *The Power to Prevent Serious Injuries and Fatalities* (Presentation), April 2020 (Microsoft PowerPoint – EEI SIF Prevention_SCL Webinar_4-29-20_Final (esafetyline.net))
- Edison Electric Institute – *High Energy Control Assessments Rulebook, Calibration Scenarios, and Sampling Strategy*, August 2023 (Power to Prevent SIF | (eei.org)).
- INGAA Foundation – *Leading Safety Indicator Program Guidance* (CS-G-08)

- INGAA Foundation – *Construction Safety Guideline Job Safety Analysis* (CS-G-2)

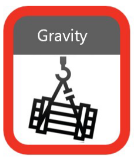
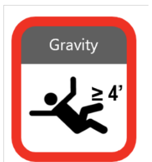
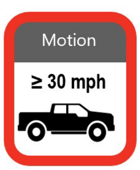
8.1. Attribution Notice

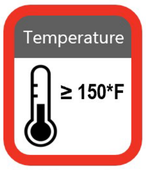
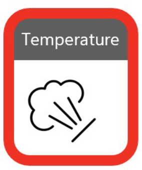
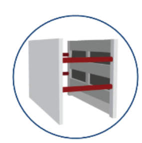
Some Definitions (Subsection 3.0), Icons and Descriptions found in APPENDIX A – SIF CLASSIFICATION TABLE, and APPENDIX D – SIF PROCESS FLOW provided by, and used with the express permission of, the Edison Electric Institute (EEI).

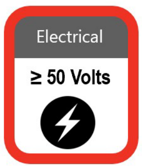
9.0. HISTORY OF REVISIONS

Revision	Date	Description
0	9/27/2021	Initial Issue
1	11/18/2024	Updated with High Energy Control Assessments (HECA)

APPENDIX A – SIF CLASSIFICATION TABLE

High-Energy Hazard (Icon)	Description	Example Life-Saving Rules
 Suspended Load	Most suspended loads require specialty equipment to lift more than 500 lbs of load higher than 1 foot off the ground. In such a case, the suspended load would be more than the high-energy threshold.	
 Fall from Elevation	Considering the average weight of a human is over 150 lbs, 4 feet of elevation (measured from the ground surface to the bottom of the feet) exceeds the high-energy threshold.	
 Mobile Equipment and Workers on Foot	Because of the mass, most mobile equipment exceeds the high-energy threshold when the equipment is moving more than 1 mile per hour. The energy exposure is taken from the point of view of the worker on foot and not the equipment operator.	
 Motor vehicle incident (occupant)	Estimates of the motor vehicle speed typically involved in serious or fatal crashes vary greatly from the National Transportation Safety Board, National Highway Transportation Safety Association, and the U.S. Department of Transportation. The team selected a conservative estimate of 30 miles per hour as the high-energy threshold. This energy exposure is taken from the point of view of the vehicle occupants, including the driver.	
 Heavy Rotating Equipment	Computing mechanical energy can be complex, as it requires estimates of the moment of inertia and angular velocity for rotating objects and stiffness and displacement for tension or compression. Thus, all heavy rotating equipment beyond powered hand tools typically exceed the high-energy threshold and any rotating equipment or tools exceeding 100 rotations per minute (rpm) should be considered high energy.	

High-Energy Hazard (Icon)	Description	Example Life-Saving Rules
 High Temperature	According to the American Burn Association, exposure to any substance greater than or equal to 150 degrees Fahrenheit typically cause third degree burns when contacted for 2 seconds or more.	
 Steam	According to the American Burn Association, any circumstance with the release of steam exceeds the high-energy threshold.	
 Fire with Sustained Fuel Source	According to the North American Combustion Handbook, a lightly combustible material like paper burns at approximately 700 degrees Fahrenheit, far exceeding the temperature threshold. Fire with a sustained source of fuel exceeds the high-energy threshold.	
 Explosion	Most incidents described as an explosion exceed the high-energy threshold.	
 Excavation or Trench	An exposure to unsupported soil in a trench or excavation that exceeds 5 feet of height exceeds the high-energy threshold. Typically, for each foot of depth, soil pressure increases by about 40 pounds per square foot. Thus, at 5 feet of depth, the pressure is approximately 200 psf.	

High-Energy Hazard (Icon)	Description	Example Life-Saving Rules
 Electrical Contact with Source	Electricity equal to or exceeding 50 volts is sufficient to result in serious injury or death according to the NFPA 70E.	
 Arc Flash	Any arc flash exceeds the high-energy threshold because of the voltage exposure, according to the NFPA 70E. Also, permissible distances are covered in OSHA Standard 1910.333 and section 1910.333(c)(3)(ii)(C) in particular.	
 High Dose of Toxic Chemical or Radiation	Exposure to toxic chemicals, radiation, or biological agents. An industrial hygienist, chemist, or toxicologist should be involved in the assessment of toxicity and acceptable exposure limits.	 

APPENDIX B – CRITICAL CONTROL CHECKLIST EXAMPLE

SIF Risk Category: Mobile Equipment
SIF Risk: Head-on or rear end collision, sideswipe, or equipment rollover. Lack or loss of control of mobile or moving equipment. Lack or Loss of control of separation between pedestrians and mobile equipment.
Critical Controls: Behaviors and conditions that must be in place and functioning 100% of the time, without fail, to protect people when working in situations with SIF risk. **Instructions**: For each Critical Control, place an “X” whether it is observed as ‘Protected’, ‘Exposed’, or ‘NA’ (Not Applicable) / ‘NO’ (Not Observed). See Assessment below for definitions. If something is marked ‘Exposed’, immediately pause the work until the missing critical controls are put in place and write the corrective action taken in the notes box below.

Critical Controls		ASSESSMENT		
		Protected	**Exposed**	**NA / NO**
1)	Pre-task risk plan identifies exposures to be encountered, control mechanisms, and includes each member of the entire team. Stop-work authority understood by employees.			
2)	Operator is authorized to drive the mobile equipment.			
3)	Operator inspects vehicle prior to use to ensure that it meets established operating conditions.			
4)	Load is secured, balanced, and within rated capacity of vehicle.			
5)	Seat belt is adjusted tight enough to keep operator in seat in the event of a rollover/collision. Operator keeps body inside vehicle at all times.			
6)	Pedestrian routes are clearly marked, and free of potential obstacles (pallets, parked vehicles, and equipment) and pedestrians remain in marked routes.			
7)	Operator utilizes a Spotter to signal safe back-up operations.			

Critical Controls		ASSESSMENT		
		Protected	Exposed	NA / NO
8)	Operator slows speed, makes eye contact with pedestrians, and honks horn when delivery/removal of load requires entry in pedestrian aisle or work area.			
9)	Operator maintains clear line of sight in all directions or is able to see via spotters, ground guides, mirrors. Operator scans area when driving, looking for hazards or other nearby operating equipment.			
10)	Back-up lights and alarms are operating and used.			

ASSESSMENT

PROTECTED: The presence of this critical control is verified and effective.
EXPOSED: This control is missing or ineffective, resulting in potential exposure to high energy sources.
NA / NO: Not Applicable to this exposure situation or Not Observed.

Notes:

APPENDIX C – SIF METRICS EXAMPLES

Lagging Metrics

Indicator	Metric	Why is this Important?
1) SIF/PSIF Percentage	(# SIF potential + SIF actual recordable cases) / Total incidents X 100	Overall progress and effectiveness on SIF exposure prevention
2) SIF/PSIF Rate	(# SIF potential + SIF actual recordable cases) X 200,000 / Exposure hours	
3) SIF Exposure Total Percentage	(# SIF potential + actual cases) / Total incidents X 100	
4) Strength of Corrective Actions (SIF/PSIF incidents)	% of SIF investigations that have at least one corrective action in the upper half of Hierarchy of Controls (Engineering and above)	Measure effectiveness of corrective actions and that the corrective actions are as rigorous as possible

Monitoring Metrics

Indicator	Metric	Why is this Important?
1) HECA	(# Success / # Total Observed High Energy) Measured overall and for each High Energy Hazard and Broken down by Task, Location, Workstream, etc.	Monitors actual Exposure to existing High Energy Hazards proactively

Leading Metrics

Indicator	Metric	Why is this Important?
1) % Completed Corrective Actions (SIF incidents)	(# Completed corrective actions / Total corrective actions) X 100	Drives SIF risk reduction and corrective action implementation
2) Overdue SIF Corrective Actions	# Overdue corrective actions on SIF potential incidents	
3) Near Misses with SIF potential	# Near misses with SIF potential	Early intervention and encourages reporting
4) % of FVCC completed vs. Target	(Total FVCC / Target FVCC) X 100	Measures leader engagement in SIF Prevention efforts
5) Supervisors use of Field Verification of Critical Controls (FVCC)	Total number of supervisors FVCC / Total number of jobs with SIF/PSIF	Shapes the culture via field interaction to reduce SIF risk and improve critical controls
6) SIF Critical Controls Protected Percentage	# Protected critical controls / Total critical controls observed (protected + exposed)	Ensures that the critical controls are in place and functioning
7) HECA Data Collection Confidence	Confidence Level calculation based on actual worker-hours (see Sampling Strategy)	Ensures sufficient HECA data is collected to represent the organization
8) HECA Data Collection Size	# HECA	

APPENDIX D – SIF PROCESS FLOW