



NSC's Serious Incident & Fatality (SIF) Prevention Model

**NSC Labor Meeting
September 17, 2024**

Acknowledgements

Thank you to our champion donor for funding the NSC
SIF Prevention Project



Disclaimer: The SIF Project is funded by US Steel. The contents of this session reflect the contributions of individual speakers and are solely their responsibility, and do not necessarily represent the views of US Steel.

Thank You!

Have our injury rates gotten better?

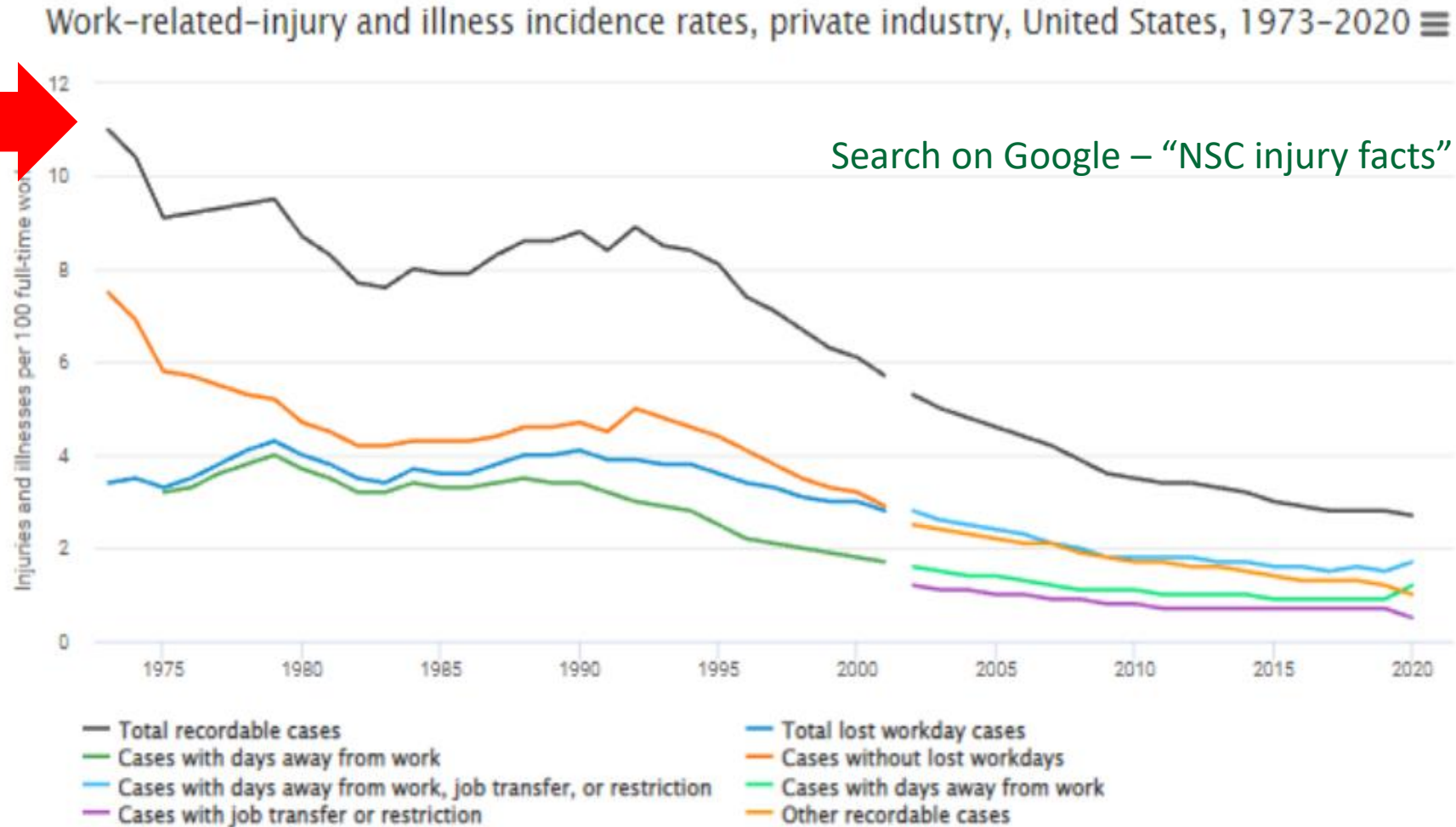
Have our injury rates gotten better?

Recordable rate over past 10 years?

Fatality rate over past 10 years?

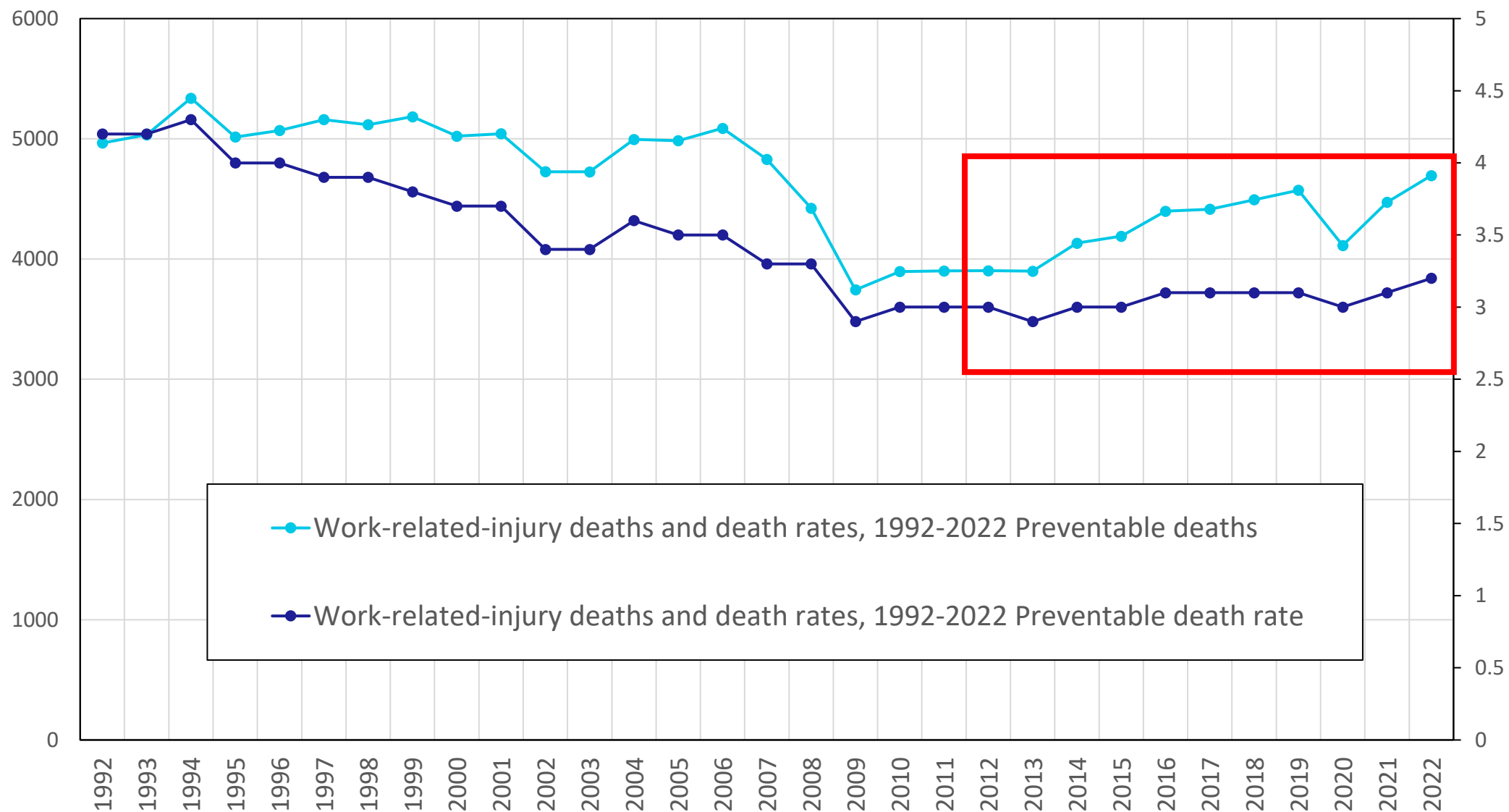
Macro View – Progress Over Time

OSHA
Total
Recordable
Cases

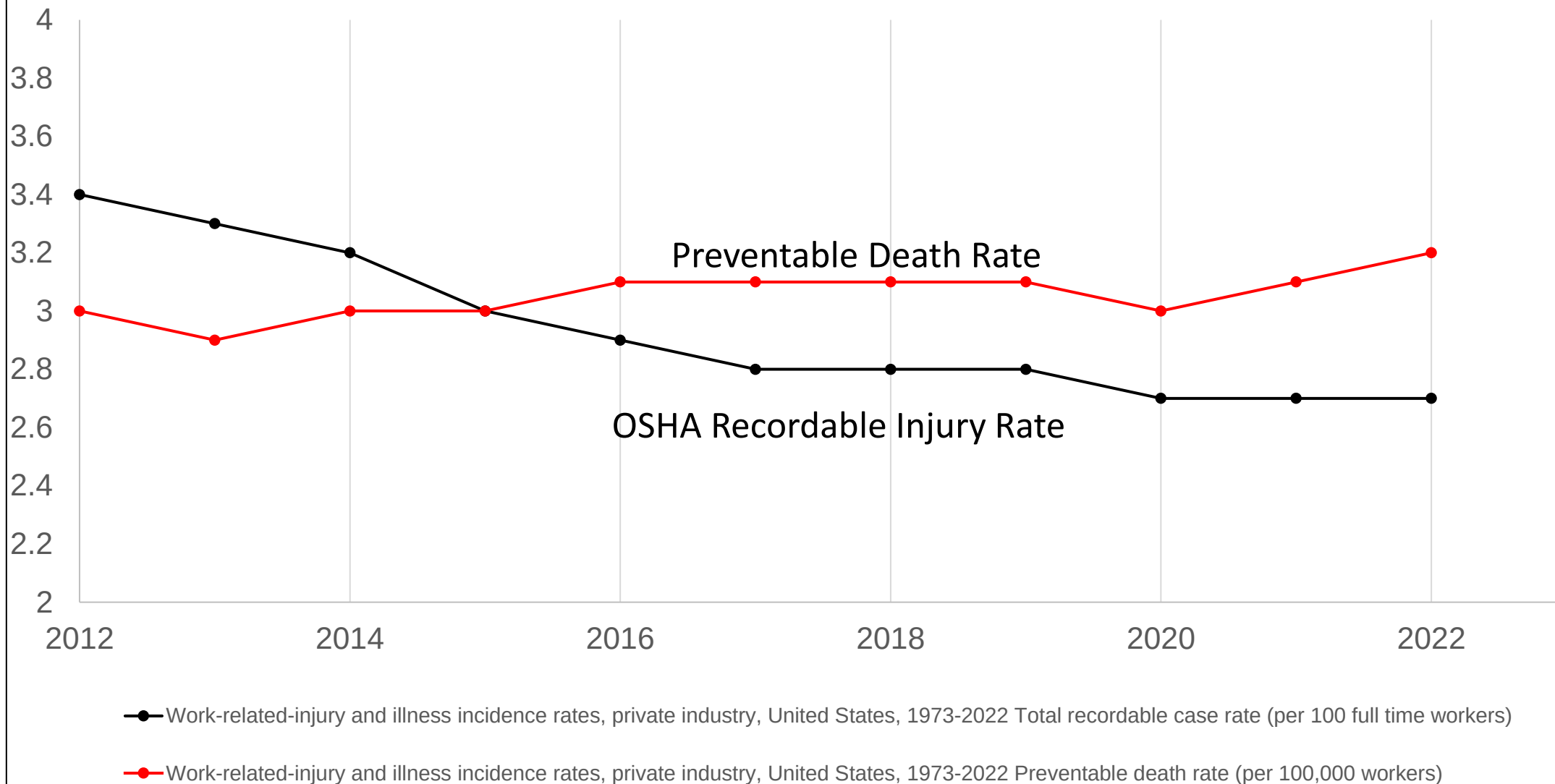


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Work-related-injury deaths, death rates, 1992-2022



US Total Recordable Rate (per 100 workers) US Fatality Rate (per 100,000 workers)



The Things That Hurt People Are Not the Same as the Things That Kill People: Key Differences in the Proximal Causes of Low- and High-Severity Construction Injuries (ascelibrary.org)



ASCE

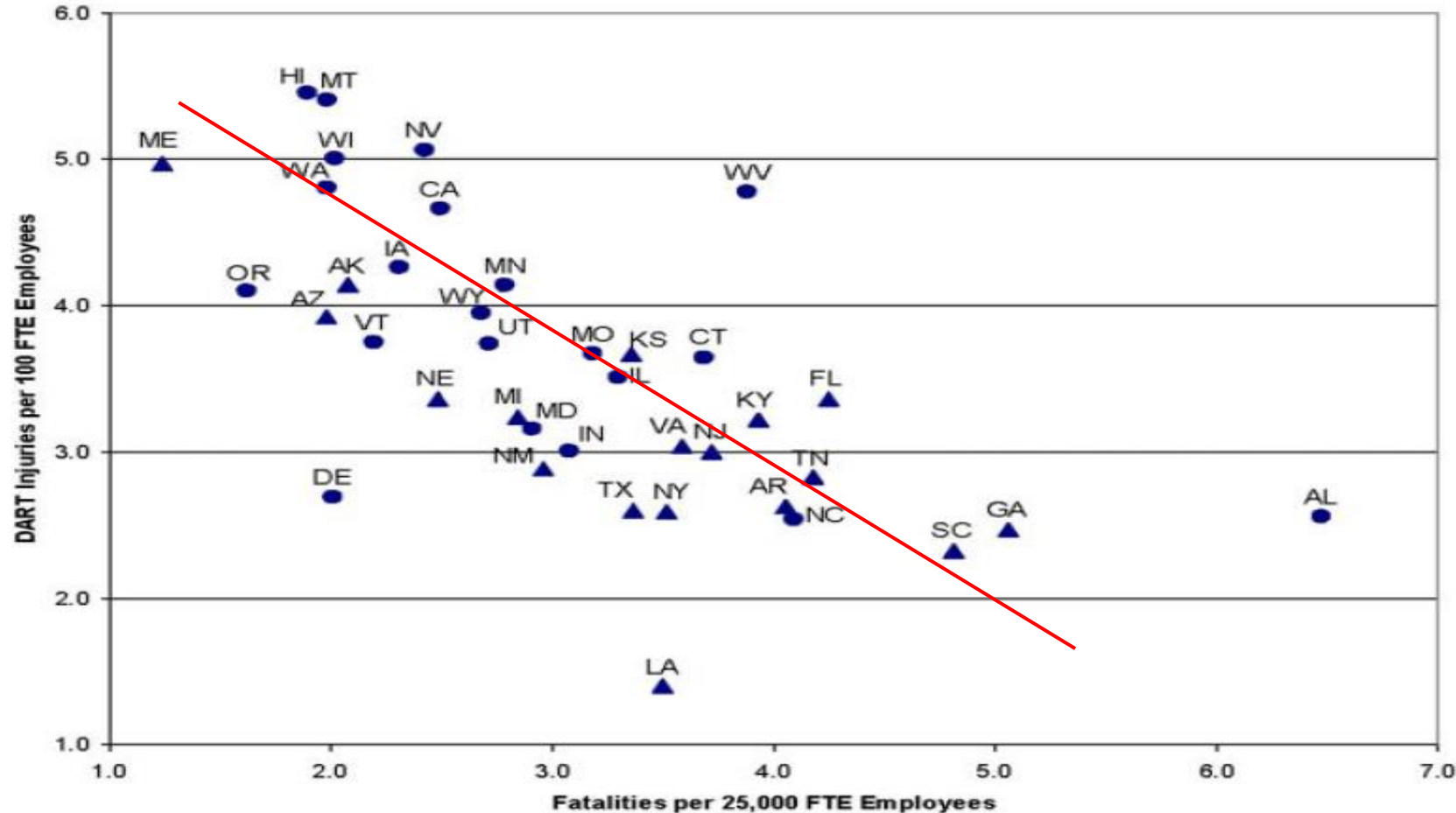
The Things That Hurt People Are Not the Same as the Things That Kill People: Key Differences in the Proximal Causes of Low- and High-Severity Construction Injuries

Arnaldo Bayona, S.M.ASCE¹; Matthew R. Hallowell, A.M.ASCE²;
and Siddharth Bhandari, A.M.ASCE³

Abstract: The safety profession has been shaped by the assumption that there is a fixed ratio of low- to high-severity injuries and the notion that injuries of all severity levels share the same general causes. There is now very strong empirical evidence that this ratio is not fixed, which has led to a new hypothesis that serious injuries and fatalities (SIFs) happen for different reasons than lower-severity injuries and the idea that a targeted approach is needed for SIF prevention. To better understand this phenomenon, this study explored the question: *what, if anything, is different about the causes of SIFs?* To answer this question, a research team of construction safety experts and academics hypothesized seven factors that may be unique to high-severity injuries. Concurrently, details of serious injuries and fatalities (SIF, $n = 13$), potential serious injuries and fatalities (PSIF, $n = 12$), and low-severity injuries (LSI, $n = 13$) were collected from utility, oil and gas, commercial, pipeline, and specialized construction trades. Blind to each injury outcome, the team assessed the presence or absence of the seven potential differentiators. The samples were then compared using Fisher's exact test to determine if any factors explained the differences among the injury types. Although there were no differences between SIF and PSIF cases, two factors differentiated LSI and PSIF/SIF: (1) absent direct controls; and (2) absent or not followed work plan. Surprisingly, no human factors were significant. The results indicate that the control of high-energy hazards through effective work planning, discipline, and execution is vital for targeting SIFs, supporting the theory that a differentiated approach is needed to avoid the concerning plateau in the rate of construction fatal injuries. DOI: [10.1061/JCEMD4.COENG-14545](https://doi.org/10.1061/JCEMD4.COENG-14545). This work is made available under the terms of the Creative Commons Attribution 4.0 International license, <https://creativecommons.org/licenses/by/4.0/>.

Is the Heinrich Pyramid correct?

The lower the incident rate, the higher the fatality rate? ...Not useful for SIFs anymore



- State DART rate vs. fatalities graphic
 - 2013 RAND Study Am J Ind Med
- Corroborating Studies
 - Finnish Construction and manufacturing study 1977-1991
 - Aviation passenger mortality risk 2000
 - Occupational Injury Statistics in Korea 2011
 - Injury rate 1/5 EU rate
 - fatality rate 5 x's EU's

“Disasters don’t happen because someone drops a pipe on his foot or bumps his head.
They result from flawed ways of doing business that allow risks to accumulate.”

(Elkind and Whitford 2011, p. 7)

The Statistical Invalidity of TRIR as a Measure of Safety Performance

*Dr. Matthew Hallowell, Mike Quashne,
Dr. Rico Salas, Dr. Matt Jones, Brad MacLean,
Ellen Quinn*

November 2020

Parametric and non-parametric statistical analysis data revealed that:

01.

There is no discernible association between Total Recordable Incident Rate (TRIR) and fatalities;

02.

The occurrence of recordable injuries is almost entirely random;

03.

TRIR is not precise and should not be communicated to multiple decimal points of precision; and

04.

In nearly every practical circumstance, it is statistically invalid to use TRIR to compare companies, business units, projects, or teams.

“What gets measured gets managed—even when it's pointless to measure and manage it, and even if it harms the purpose of the organization to do so”

- Simon Caulkin, columnist

...in summarizing a 1956 paper by V.F. Ridgway that criticized popular measurement practices in management.

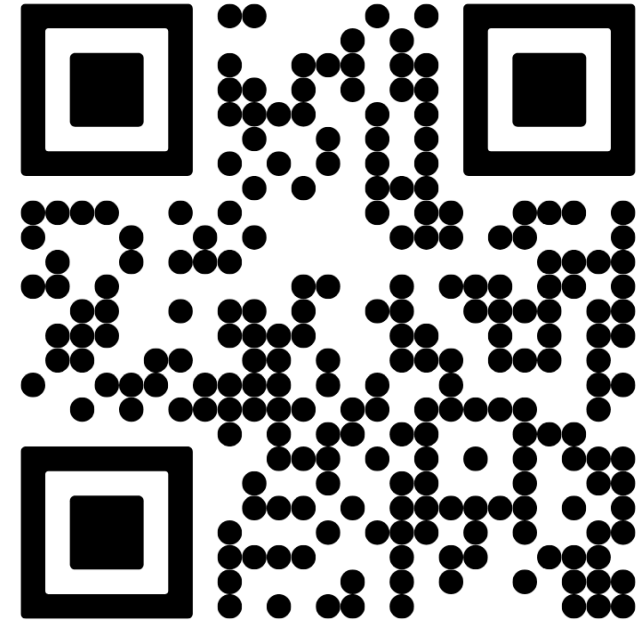
“Moving beyond OSHA Recordable Rates for Prevention of Serious Incidents and Fatalities Metrics”

Why did we need a New SIF Prevention Model?

NSC's SIF Prevention Model



NSC SIF Prevention Model



It is LIVE!



WORKPLACE SAFETY

Serious Incident and Fatality (SIF) Prevention Model

Helping employers identify SIF hazards, implement and verify controls and provide continuous control monitoring.



[HOME](#) / [WORKPLACE SAFETY](#)

Serious Incident and Fatality (SIF) Prevention Model

Helping employers identify SIF hazards, implement and verify controls and provide continuous control monitoring.



Plan: Leadership Commitment and Organizational Readiness

Step 1. Assess existing organizational capacity for SIF prevention and prepare organization for SIF prevention work.

Do: SIF Risk Understanding

Step 2. Conduct initial hazard identification and determine the risk
Step 3. Implement additional defenses/controls where needed

Check: Control Analysis and Verification

Step 4. Verify that defenses/controls are sufficient and working properly
Step 5. Monitor defenses and controls over time

Act: Continuous Improvement

Step 6. Drive continuous improvement in SIF prevention programs and strategies

About this Model

HOME / WORKPLACE SAFETY / SIF PREVENTION MODEL

PLAN - Leadership Commitment and Organizational Readiness



Step 1: Effective prevention of SIF requires thorough planning and preparation. Identifying and comprehending organizational strengths and weaknesses concerning SIF, involving key stakeholders (workers), and securing leadership support are crucial steps in the process.

The PLAN stage of this model contains four tools designed to complement each other.

Initial Documentation Review
This tool lists key organizational documents related to worker protection and SIF prevention that should be reviewed for accuracy and may be needed as the model is reviewed and implemented.
[Tool 1>](#)

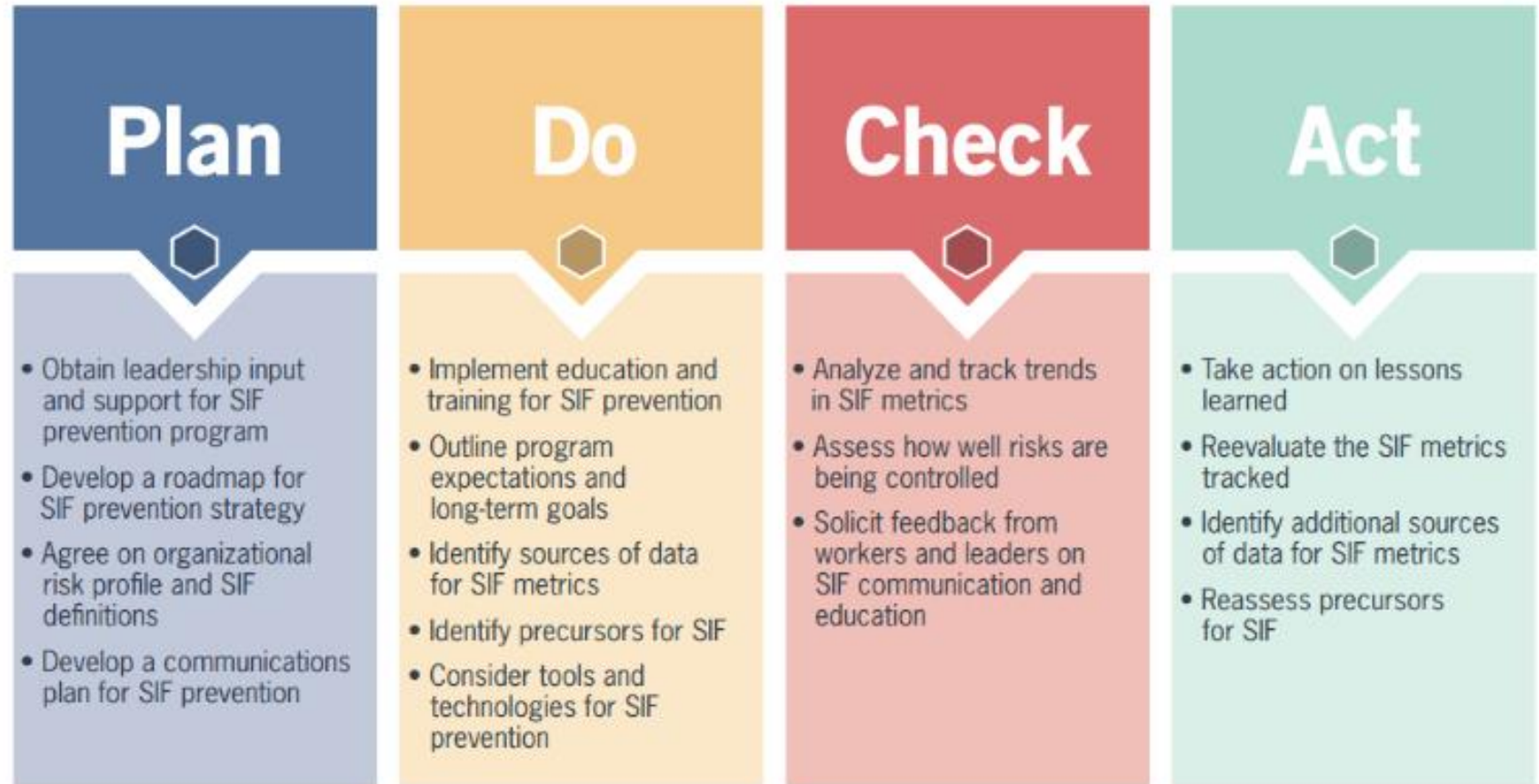
SIF-related Organizational Gap Analysis
Identify and assess key elements to SIF prevention, including management commitment and worker involvement.
[Tool 2>](#)

SIF-related Safety & Health Perception Survey
Confidential, blinded surveys promote candor and provide an unbiased look at the status of worker protection policies, practices and programs.
[Tool 3>](#)

Key Stakeholder Discussion Points
Discussion points to guide interviews and get a better understanding of SIF risks. Includes criteria for leadership to ensure engagement and buy-in from the top and examples for worker engagement.
[Tool 4>](#)

Insights from Research & Best Practice

- Campbell Institute
- Work to Zero
- BST
- ORC-HSE
- Z10 Guidance
- DEKRA
- ISN
- And more...



The NSC SIF Model Basis- PDCA



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Critical SIF Prevention Metrics

- OSHA Recordable Injury Rate (Lagging) **...Continue doing**
- Severity Based Metrics (Lagging/Leading) **NEW!**
 - ✓ ASTM 2920, SIF, pSIF, pSIF controlled/uncontrolled,
- High Risk Reduction Footprint (Leading) **NEW!**
 - ✓ Critical Controls Verification, MS Systems, CIRCLE, Risk Footprint Reduction
- Employee & Leadership Engagement (Leading) **NEW!**
 - ✓ “Take Charge”, “Boots on the Ground”, “See & Act”, ...

Critical SIF Prevention Metrics

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- Severity Based Metrics (Lagging/Leading) **Brad Kline**
 - ✓ ASTM 2920, SIF, pSIF, pSIF controlled/uncontrolled,
- High Risk Reduction Footprint (Leading) **Scott DeBow**
 - ✓ Critical Controls Verification, MS Systems, CIRCLE, Risk Footprint Reduction
- Employee & Leadership Engagement (Leading)
 - ✓ “Take Charge”, “Boots on the Ground”, “See & Act”, ... **Jason Kunz**

**New ASTM
Standards
Proposed**

Questions / Comments?

Workshop

Step 1: Effective prevention of SIF requires thorough planning and preparation. Identifying and comprehending organizational strengths and weaknesses concerning SIF, involving key stakeholders (workers), and securing leadership support are crucial steps in the process.

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Workshop #1 – Perception Surveys

- Does your organization use employee engagement surveys?
- Do you see the outcomes of the surveys?
- Do they include “Serious Incident & Fatality” Prevention?

Workshop #1 – Perception Surveys



SIF Prevention Model Tool 3: Perception Survey

Company: _____

Location: _____

Date: _____

QUESTIONS:

1. **Awareness:** Are you aware of the serious incident, and fatality (SIF) program implemented within our organization?

☐ YES
☐ NO

Workshop #1 – Perception Surveys

3. **Attitudes:** How important do you believe it is to prioritize the prevention of serious injuries, illnesses, and fatalities in our workplace?

- ☐ Not important
- ☐ Somewhat important
- ☐ Important
- ☐ Very Important
- ☐ Extremely Important

On a scale of 1 to 10, how confident are you in the effectiveness of our SIF program in mitigating risks and ensuring safety?

1 2 3 4 5 6 7 8 9 10

4. **Behaviors:** Do you feel empowered to report near misses and potential serious hazards in the workplace?

- ☐ YES
- ☐ NO

Have you received adequate training on how to identify and address risks that could lead to serious injuries, illnesses, or fatalities?

- ☐ YES
- ☐ NO

SIF Prevention Model

Tool No. 2. SIF-Related Organizational Gap Analysis

This model allows the user to assess their “Maturity” with regards to SIF prevention. The modified Maturity Model is relatively simple to follow. Key elements are grouped into seven major elements:

1. Safety and health operating environment
2. Management leadership
3. Worker engagement
4. Hazard identification and prioritization
5. Hazard abatement and control
6. Implementation and operation
7. Continuous improvement

Each of those categories has **Key Criteria** designated as important to SIF identification and management that can be used to assess the site/organization’s status with that element.

Each criterion under each element is straight forward, and can be characterized as either:

- **Red**: There is little or no evidence the criteria have been met (the journey is beginning)
- **Yellow**: The criterion is partially met (the organization is improving)
- **Green**: The criterion is fully met (the organization is sustaining and continually improving)

Organizational Gap Analysis

	G	Y	R	Comments
1. S&H Operating Environment				
Organizational culture – A culture exists that recognizes and promotes worker Demonstrated protection and the safety and health mission				
○ Leadership at all levels of the organization contribute to a positive safety and health culture				
○ Safety and health remain a core value even during labor shortages, production challenges, and business pressures.				
2. Management Leadership				
Demonstrated leadership commitment to safety and health – Leaders and managers at all levels of the organization continually demonstrate that safety and health is a core value and ensure that it is integrated into all aspects of the business.				
○ There are visible metrics for safety and health at the corporate level, business unit, and individual site levels.				

3 Worker Engagement				
The organization has demonstrated a process for worker engagement to ensure labor and management collaboration on safety and health issues.				
Input from workers and front-line supervisors is sought and they are encouraged to offer opinions.				
Formal safety and health orientation – new, inexperienced, and transferred workers are prepared to address safety and health aspects of their job				
○ A formal safety and health orientation program has been developed and includes all workers, contractors, and temporary workers and is provided prior to starting a new job assignment and after changes in procedures or processes.				
4. Hazard Identification and Prioritization				
Safety and Health hazards are identified.				

Workshop #2 – Risk Understanding

- Does your organization have processes / tools focused on “High Hazard Activities”?
- Are the Risks from High Hazard Activities assessed for all types of operations (i.e., normal, upset, maintenance,...)?

Risk Assessment Tool

Activity, Task or Operation Identify the tasks and high hazard or high energy activities identified in tool 5	Describe Maximum Credible Consequence (Worst consequence with reasonably probability, NOT worst case scenario)	MCC (1-100)	Describe FREQUENCY of Activity or Task	Frequency of Activity or task	Describe Intended Controls & Safeguards (List each control/safeguard with uncertainty leading to the strength of controls)	Control rating (0.5-10)	Total SCORE	Risk Level	Action Priority Describe additional controls and actions	Action Steps and follow-up
		Guidance	Dropdown	AutoFill		Guidance	AutoFill	AutoFill	AutoFill	
Example: Employees in the production office handle many	EXAMPLE-Paper cut	1	Very Rare (max of once per year)	1	No training or controls implemented	10	10	LEVEL I	Maintain and monitor the effectiveness of the existing safeguards and controls	
Example Production materials must be transported up 3 flights of stairs	Fall from Height: Without the harness secured, the employee is at risk of falling from the scissor lift.	15	Continuous daily or Repetitive (6 or more times per day)	8	Movable step is labeled for fall hazard and conforms to applicable regulations for such device, all employees have annual hazard awareness training that includes general information on recognizing fall hazards and work at	6	720	Level V	Immediately implement interim controls to reduce risks to a Level 3 or less. Establish an action plan to permanently reduce risks. Schedule periodic monitoring and reassessment.	
Example Work is done by maintenance using ladders to change bulbs in all work areas	Overreaching: The need to reach beyond the lift's platform can cause loss of balance, increasing the likelihood of a fall.	100	Occasional (at least once per week)	4	Ladder is labeled and conforms to ANSI and OSHA requirements for task, no procedure for use of ladder or specific training for employees who could perform task, no standard work or anchoring devices available.	5	2000	Level VI	Highest Priority - Shut down required, immediately stop this activity. Implement immediate risk reduction before continuing or resuming operations.	
Example A platform is used for overhead maintenance work	Lack of Supervision and Enforcement: Management's inaction may create a culture of neglect towards safety protocols.	100	Unusual (at least once per month)	3	Stair platform is labeled and conforms to ANSI and OSHA requirements for task, procedures for use of ladder and specific training is provided for employees who could perform task.	2	600	Level IV	Higher Priority - Additional Controls are Required - Implement interim controls and establish an action plan to permanently reduce risks to a Level 3 or below.	
Filter Change in the warehouse using sissor lift.	Fall from lift to ground, 20 feet	100	Rare (less than 12 times per year)	2	Use of fall protection harness	6	1200	Level V	Immediately implement interim controls to reduce risks to a Level 3 or less. Establish an action plan to permanently reduce risks. Schedule periodic monitoring and	
				#N/A		5	#N/A	#N/A	#N/A	
		0		#N/A		0	#N/A	#N/A	#N/A	

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		0		#N/A		0	#N/A	#N/A	

Workshop #3 – Learning Teams

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- Do you use “Learning Teams” to reduce risk and improve processes or jobs?

PLAN

DO

CHECK

ACT

The **DO** section of this model contains Step 2 and Step 3 for identifying potential SIF threats, assessing risk, and implementing needed controls. To get the most out of this model, complete the assessment in Step 2 then apply the information in Step 3.

Step 2. Conduct a General Site Assessment and Determine the Risk Factors

Conduct a general site assessment and determine the risk factors that are applicable to all employers, regardless of their size and regardless of the level and strength of their safety and health management system or program. The general site assessment provides employers a determination of their hazards, level of risk, and the strength of existing controls.

[Start Assessment>](#)

Step 3: Identify Hazards and Implement Defenses or Controls

Using the elements and criteria from the general site assessment (Step 2), create a baseline for the site/organization's safety and health "status" and begin the process of evaluating and classifying all the potential SIF hazards with these four tools.

Identification of Potential SIF High Hazards

This tool provides guidance in identifying the most critical hazards examples are provided below.

[Tool 5>](#)

Learning Teams

Facilitate a discussion among all individuals having knowledge and information about a process, procedure or piece of machinery to properly assess the strength of controls for given hazards.

[Tool 6>](#)

Risk Analysis and Strength of Current Controls

Enter your high hazards identified in Tool 5 to determine the level of risk to workers in this tool. You can adjust controls, add controls, or create new controls to lower the level of risk in the next step.

[Tool 7>](#)

Determine the Controls - SIF Hazard Control Matrix

Once you have prioritized SIF hazards and evaluated effectiveness of existing controls, you can determine what additional controls are needed. This tool provides instruction and tables to guide you.

[Tool 8>](#)

[Continue to Next Step >](#)

Workshop #3 – Learning Teams



SIF Prevention Model Tool No. 6: Learning Teams

Learning Teams are structured groups that come together to analyze events, identify system vulnerabilities, and develop strategies for improving performance and resilience. Key aspects of learning teams include - event analysis, systems thinking (identifying system issues rather than worker blame) and continuous improvement. Learning Teams are often triggered by an activity or by risk. They increase understanding and learning from both incidents and from everyday successful and safe work.

It is critical that one assemble a diverse Learning Team with a range of expertise, including members from various departments and job roles. Learning teams engage individuals having knowledge and information on a process, procedure, piece of machinery, maintenance, and so forth. The team, at a minimum, should include both frontline employees and management representatives, as well as maintenance personnel and staff from the safety and health group. The team should have a mix of experience levels, as newer employees who may offer a fresh perspective.

Workshop #3 – Learning Teams

Learning Teams are often utilized in the following situations:

- Before high-risk operations
- When confronted with difficult/challenging design problems
- After a serious injury, illness, quality, or operations event
- After a near miss, close call, or good catch

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Questions / Comments?