



Practical steps to reduce Serious Injuries & Fatalities (SIFs)

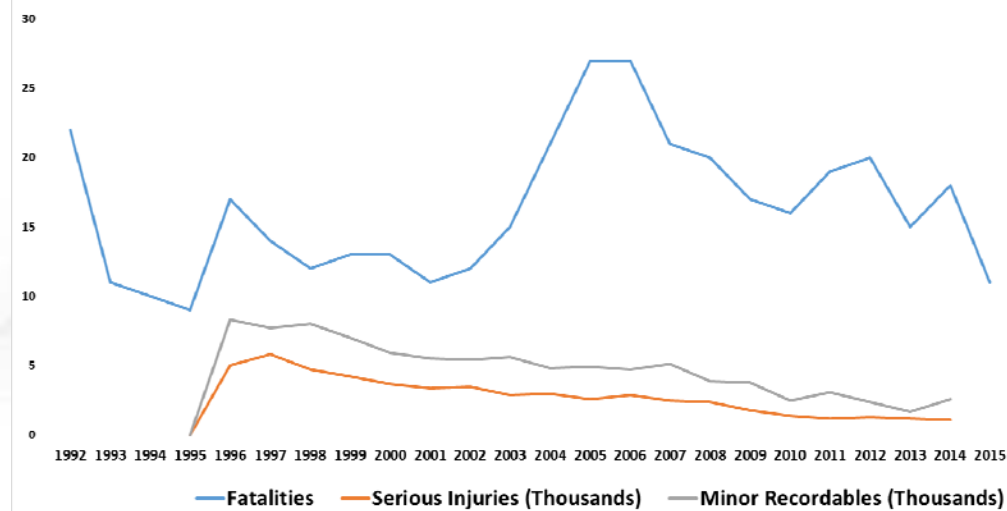
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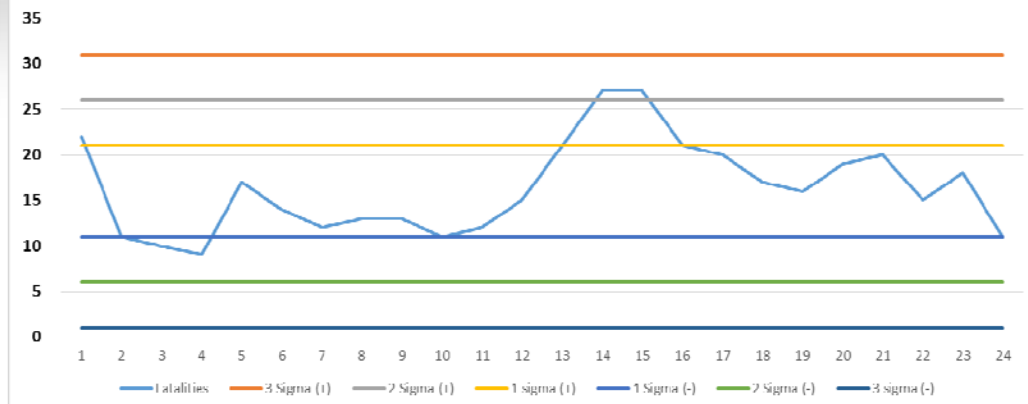


SIF reduction depends on visibility

Indiana Construction Injury Statistics

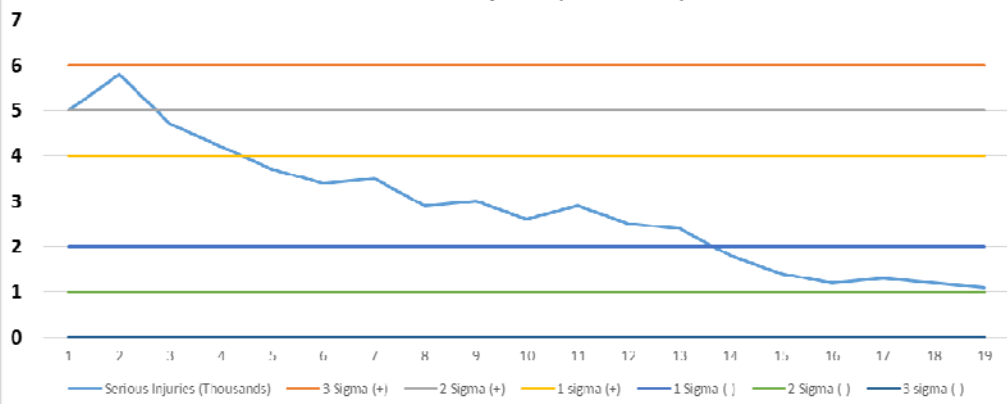


Fatalities (Actual Numbers) - SPC Chart

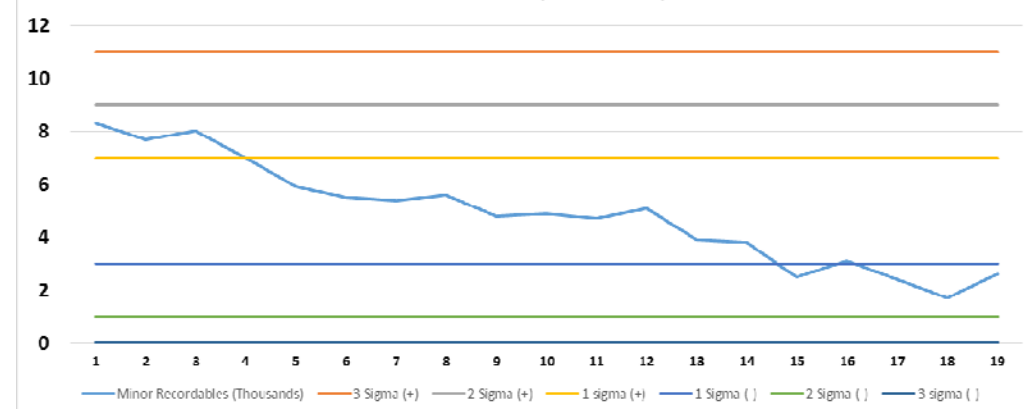


The number of fatalities is stable over time. This means the number of fatalities is being driven by common causes in our systems. What are these? It will take concerted action by management and the industry to identify and affect them!

Serious Injuries (Thousands) -SPC Chart



No Lost-DAY Recordables (Thousands) - SPC Chart

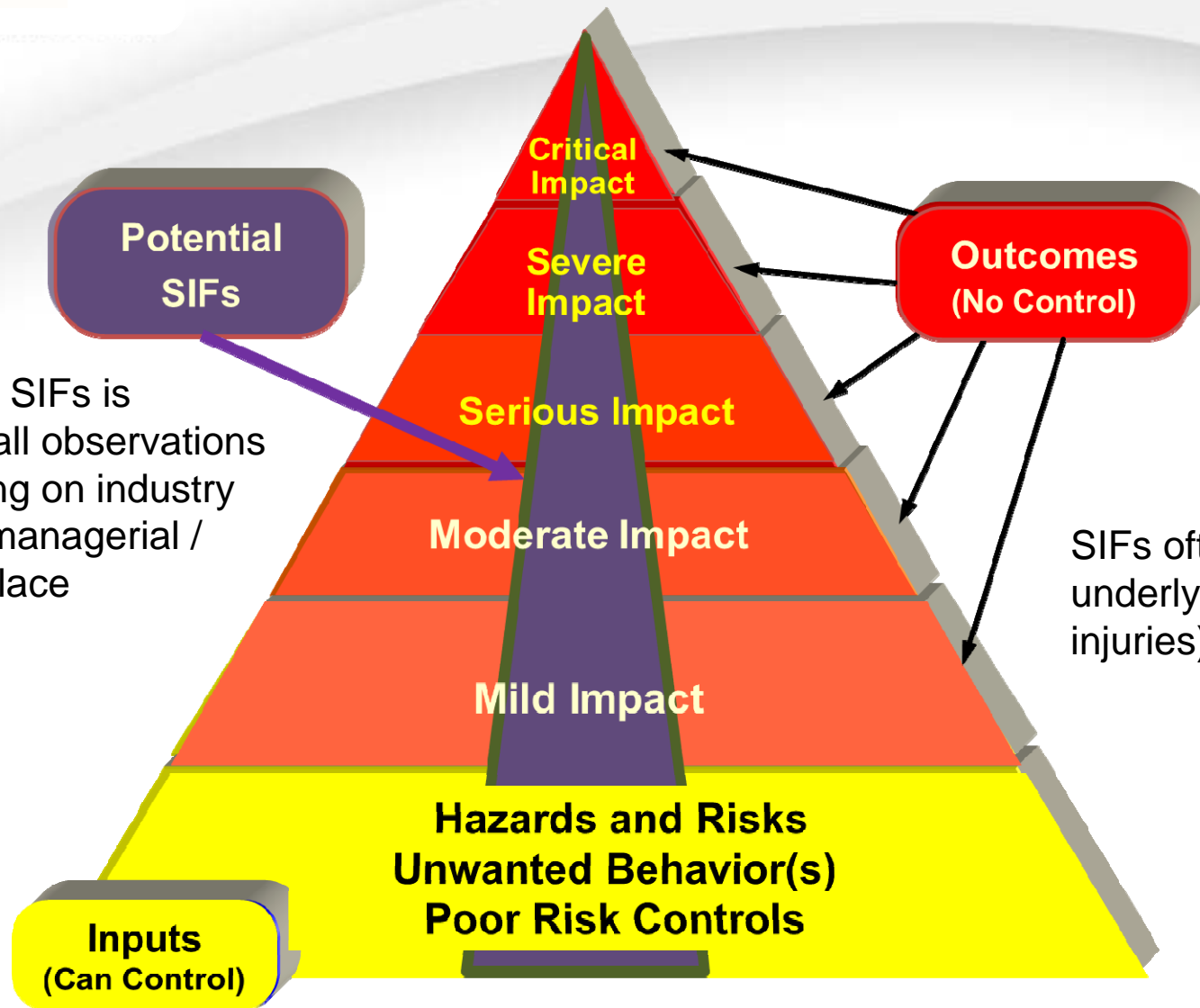


N.B. Statistics retrieved from <http://www.in.gov/dol/stats.htm>

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The hazard triangle



SIFs often have different underlying causes to minor injuries)

Avg. # of Potential SIFs is approx. 6-20% of all observations recorded depending on industry (Based on 12.5K managerial / supervisory workplace observations)



Principles for reducing SIFs

- Focus on both the top and bottom of the pyramid, not just the bottom of the pyramid alone (*the causes and correlation are different*).
- ACTIVE senior leadership attention and involvement is necessary (*SIF reduction demands a different focus*)
- Potential SIFs can be made visible (*identify and measure*)
- Act on causes leading to potential SIFs
- Actively monitor progress of potential/actual SIF reduction
(*# of Potential SIFs x 200,000 / total man-hours worked*)
(*# of actual SIFs x 200,000 / total man-hours worked*)
- Issue safety bulletins/alerts as necessary about actual/potential SIFs



Step 1: Define / adopt SIF types

Potential SIF	Severity Level	Event Category	Definition
Yes	Critical	Life-Threatening	Injury or illness which could lead to the death of the affected individual.
Yes	Severe	Life-Altering	Permanent or long-term impairment or loss of use of an internal organ, body function, or body part.
Yes	Serious	Temporary Disability	Traumatic injury causing limited or no use of fingers, hands, extremities, fractures, burns or major lacerations (Out of action for 30 days or more).

Restricted Work Cases and First-Aids are not considered to be potential SIFs

1. Adopt and use a Severity Scale that can be consistently understood by anyone.
Consistency is KEY
- 2. Define what you mean by each level**
3. Decide on which of the levels your company will focus upon (i.e. Life Threatening, Life-Altering, and Temporary Disabilities?)



Illustrative definitional issues

Before the event definition (Proactive)

- A Potential SIF is an “at-risk” behavior that could feasibly and reasonably have resulted in a life-threatening or life-altering injury or long-term temporary disability to the person or others.

After the event definitions – (Reactive)

- A Potential SIF is an incident that resulted in a minor injury that could reasonably have resulted in a life-threatening, life-altering or long-term temporary disability.
- A Potential SIF is a near-miss incident that resulted in human exposure and a release of some type of stored energy that could reasonably have resulted in a life-threatening, life-altering or long-term temporary disability.
 - *What is human exposure? What is the definition? Is it any exposure even when not in close proximity of the incident or is it direct or close exposure to the incident?*
 - *What is a near-miss? What is the definition?*
 - *What is an energy release? How are the various types defined?*

Both types of potential SIFs are valid



Step 2: Examine company incident database(s)

1. Develop SIF structure in Incident database(s)

Event	SIF Classification	SIF Precursor Situation	SIF Exposure Category	SIF Main Root Cause	Severity Level	Severity Scale	Potential Injury Type
Failing to use gas detector during confined space entry into gas storage tanks	TRUE	Unusual / Non-routine Work	Confined Space Entry	Failure in Job Planning	Level 5	Life Threatening	Gas Inhalation

2. Using adopted Severity Scale

- Identify all incidents that resulted in an actual SIF
- Identify all incidents that had the potential to be an SIF

3. Identify the precursors, exposure categories and underlying contributors (root causes) associated with each incident

4. Identify & record the type of injury that *feasibly and reasonably* could have been experienced – get agreement among the team to ensure consistency



Identify SIF precursor situations

“A combination of hazard(s) and underlying human factors and organizational or managerial deficiencies that if left unaddressed can result in a fatal or serious injury” (Wachter & Ferguson, 2013).

Typical NON-ROUTINE (Abnormal) SITUATIONS

“a situation not generally encountered during the course of normal operations”.

- Deviation from Normal Operations (Upset)
- Emergency Shutdown
- Potential High-Energy Release
- Loss of Containment
- Personal Health (e.g. Heart Attack)
- Process Instability
- Unexpected Changes
- Unexpected Maintenance
- Unusual/Non-routine Work

Typical ROUTINE SITUATIONS

(“a situation which is repeated on a regular basis during the course of normal operations”.)

- Equipment Use
- Access/Egress
- Driving

Every company has its own unique SIF precursor profile



Identify key SIF exposure categories

“Work activities that would reasonably be expected to be controlled by a key procedure to prevent risk of injury”

Mobile equipment (operation and interaction with pedestrians)

Confined space entry

Jobs that require lock-out tag-out

Lifting operations

Working at height

Manual handling

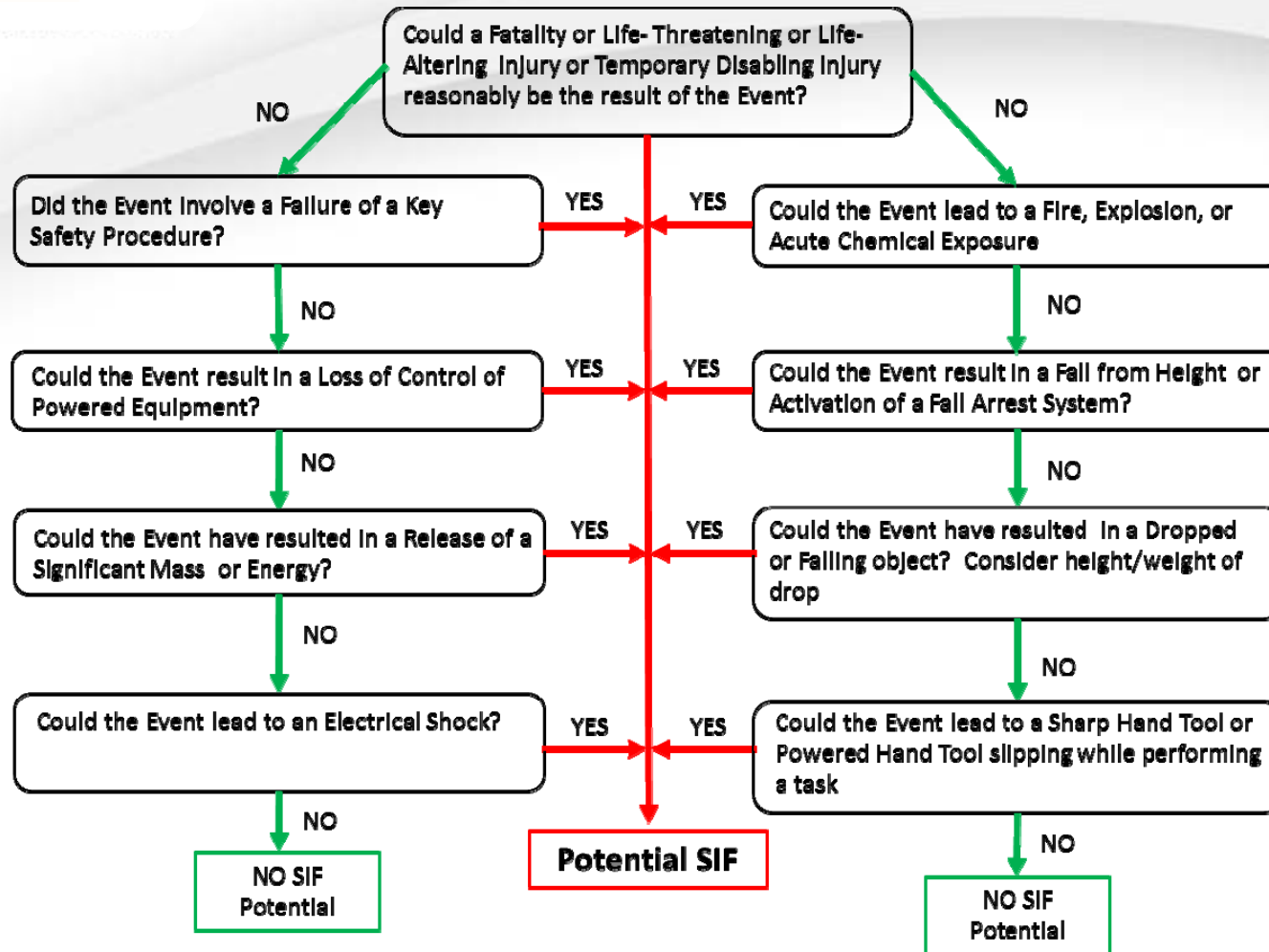
Chemical handling

Use of tools

These Exposure Categories are usually ‘managed’ by safety controls



Step 3: Create an SIF decision-aid



1. Should reflect the findings of your database analysis
2. Used to determine if future events / behaviors are *potential* SIFs or not



Step 4: Link the precursors to underlying safety culture attributes

- SIFs are the outcome of organizational failings that should previously have been identified and addressed (Reason, 1998).
- Precursor situations are linked to an organizations safety culture, but this aspect is usually overlooked within SIF programs.
- Focus on fixing safety culture related underlying contributors (i.e. root causes) to exert maximum impact



Underlying safety culture contributors

Under Management's Direct Control

People Factors (Personal)

Failures in Task Planning
Failures in Task Execution
Behavioural Choices
Inadequate Competency
Ineffective Team Leadership

*Human
Error*

System Factors (Organisational)

Extreme Job Pressures
Inadequate Job Methods
Inadequate Job Standards
Insufficient Manpower
Insufficient Resources
Lack of Managerial Support
Poor Job Planning
Poor Communications

Infrastructure Conditions (Environment)

Poor Work Environment
Sub-standard Equipment

Underlying contributors' should reflect Safety Culture factors



Main causes of process safety disasters

No.	Management Behaviours	No.	Workforce Behaviours	No.
273	<i>Loss of containment incidents related to normal operations</i>			
	Failing to fully consider potential hazards or causes of component failure	155	Operators not following procedures correctly	44
	Managerial failure to provide adequate plans / or implement a system of operating procedures	74		
99	<i>Loss of containment incidents related to planned maintenance</i>			
	Managerial failure to provide adequate maintenance procedures	45	Failure to follow planned maintenance procedures	12
	Failure to monitor Permit-to-Work standards	37		
	Failure to communicate	5		
72	<i>Loss of containment incidents from pipework</i>			
	Corrosion due to failures in planned maintenance procedures	12	Inadequate isolation	30
	Stress/ Fatigue/ Vibration	10		
	Defective Equipment	15		
	Corrosion from inadequate plant inspection plan	5		

80% Managerial behaviours Vs. 20% Operator behaviours



Analyses of Potential SIF underlying contributors*

SIF Severity Level	SIF Severity Label	Total Number In Sample	Main Underlying Contributors	# of potential SIF's	Percentage
5	Life-Threatening	272	Behavioural Choices Failure in Task Execution Failure in Task Planning	120 37 23	66%
4	Life-Altering	183	Behavioural Choices Inadequate Job Methods Failure in Task Execution Provision of sub-standard equipment	84 15 13 13	68%
3	Temporary Disability	187	Behavioural Choices Failure in Task Execution Inadequate Job Methods Poor Work Environment	66 26 20 16	68%
		642		432	67%

The table shows 6 underlying contributors account for 67% of all potential serious injuries and fatalities (SIFs) in the sample. Much easier to tackle a few root issues than all the numerous precursors and exposure categories at the same time (e.g. using a BBS Process and a Procedural Review)

**Recorded in PEER® Software 2016*



Step 5: Identify potential SIFs on the go

87% of potential SIF's can be identified from safety observations / conversations





of PSIFs identified via behavioral observations

Rank	Behavioral Category	# of PSIFs Observed*
1	Access & Egress	101
2	Driving	79
3	Equipment Use	74
4	PPE	68
5	Body Positioning	55
6	Work Processes	49
7	Barriers	47
8	Housekeeping	37
9	Use of Tools	35
10	Heavy Materials Handling	22
11	Mechanical Lifting Operations	20
12	Mobile Machinery	12
13	Manual Handling	11
14	Health	11
15	Environment	11
16	Isolations/Purging	10
Total		642

**Recorded in PEER® Software 2016*



Underlying contributors for all PSIFs recorded

Rank	Safety Culture Element	Underlying Contributors	# of PSIFs
1	Person	Behavioural Choice	269
2	Person	Failure in Task Execution	76
3	Person	Failure in Task Planning	45
4	System	Inadequate Job Methods	40
5	Infrastructure	Poor Work Environment	40
6	Infrastructure	Provision of Sub-Standard Equipment	38
7	Person	Inadequate Task Competency	36
8	System	Inadequate Job Planning	25
9	System	Inadequate Job Standards	22
10	System	Poor Communications	12
11	System	Extreme Job Pressure	15
12	Person	Lack of Task Leadership	14
13	System	Lack of Managerial Leadership Support	5
14	System	Lack of Resources	4
15	System	Insufficient Manpower levels	1
Total			642



Problems to overcome with an SIF program

- **Who decides upon the SIF categorization of processes and events that have the potential for serious injury and fatality?**
 - How should this categorization be done?
 - How do we define everything to eliminate errors in interpretation?
 - Is it possible to provide a clear exclusive list of defined injuries to eliminate data massaging during implementation of an SIF program?
- **How can people reliably assess the potential for an SIF without the assessment becoming arbitrary and subjective?**
 - What does feasible and reasonable mean?
 - Can we use severity x likelihood of impact? – i.e. Risk Ratings
- **Could an SIF program lead to under-reporting?**
 - Safety Vs. Productivity issue
 - Identified SIFs/PSIFs will generate actions and people may avoid reporting to keep the action list shorter.
 - Also, how do we know we are focusing on the right corrective actions to eliminate future SIFs?
- **If a low probability/serious injury event occurs, should all such prior and future events be re-categorized into SIFs?**
 - How much effort does this take, and are people willing to do it?



The way forward

To develop a robust and sustainable SIF program, it is recommended that

- High quality SIF Data Management processes are put in place
- Integrate SIF program with other safety systems (e.g. JSA's. Tailgate Talks, etc.)
- Educate everyone about the SIF program
- Develop managerial safety leadership practices to test, question and manage tasks with high-risk SIF exposures.
- Engage everyone in safety observations/conversations to identify potential SIFs in real-time.
- Develop SIF feedback channels (e.g. calculate SIF rates, share Lessons Learned)
- Conduct periodic SIF program effectiveness reviews