Leading Indicators for Serious Injury and Fatality Prevention

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NSC Mission

Eliminate Preventable Deaths and Injuries at Work, in our Homes & Communities, and on the Road

Leadership | Research | Education | Training

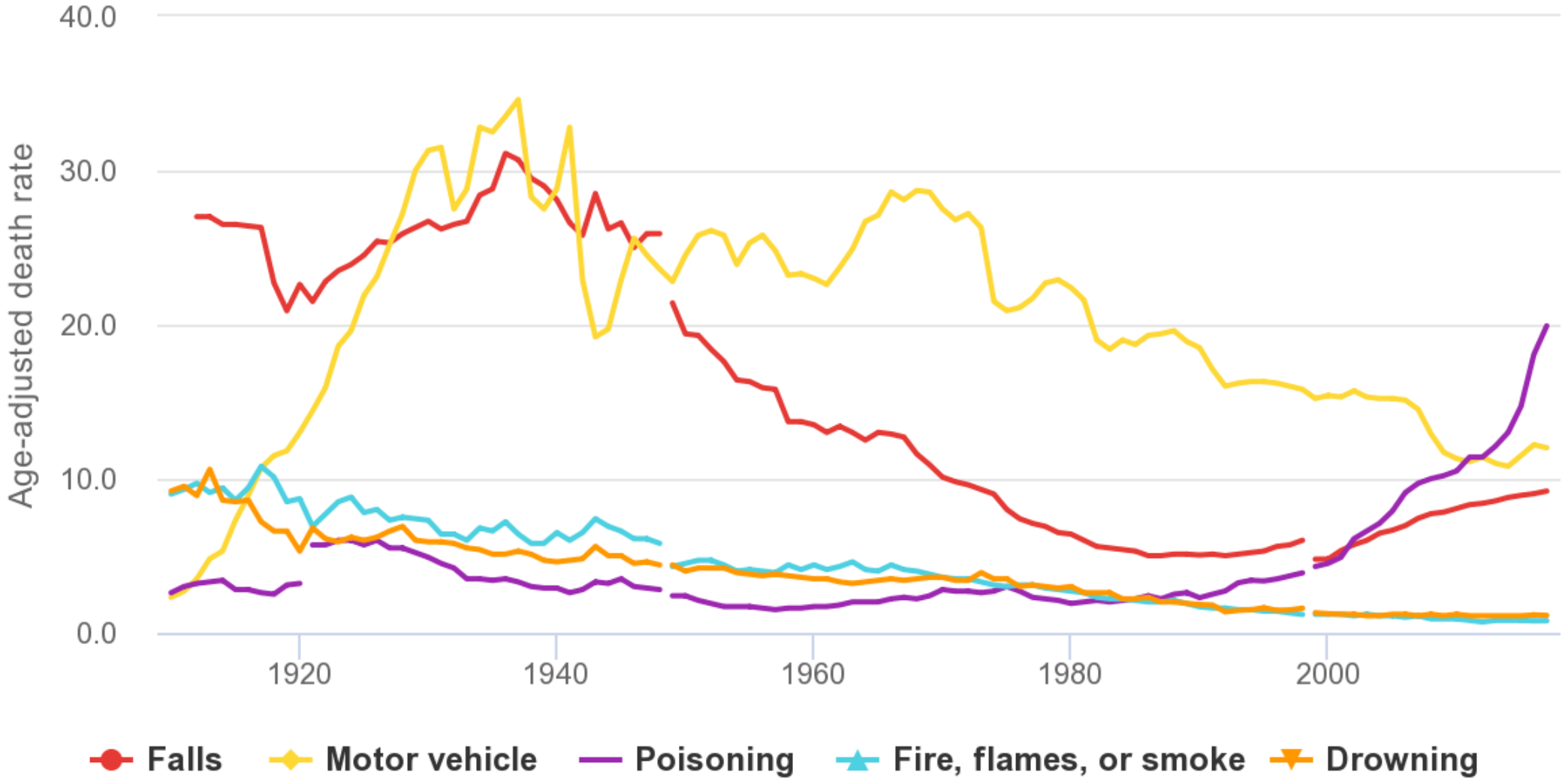
The Data

Leading Causes of Death

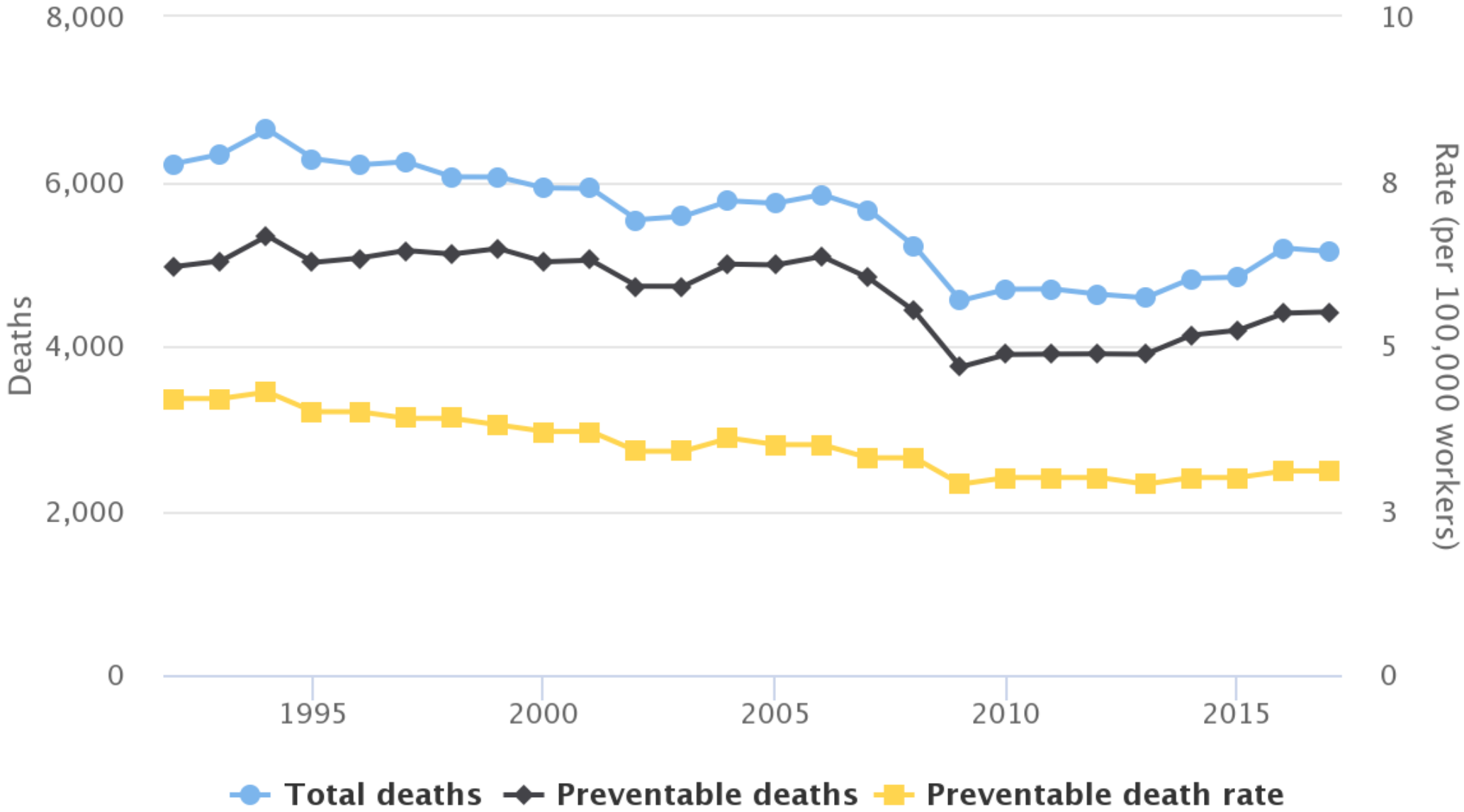
Heart disease	647,457
Cancer	599,108
Unintentional injuries	169,936
Chronic lower respiratory disease	160,201
Stroke	146,383
Alzheimer’s disease	121,404
Influenza and pneumonia	55,672
Nephritis	50,633
Suicide	47,173

Age-adjusted death rates by leading cause of preventable injury, United States, 1910-2017

Deaths per 100,000 population adjusted to the year 2000 standard population. Breaks in graph lines signify changes in fatal injury coding.



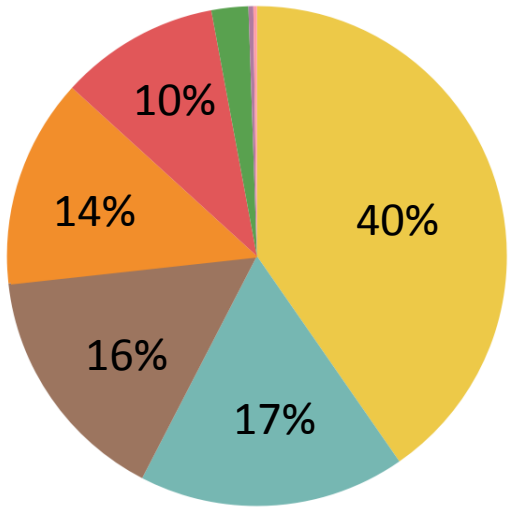
Work-related-injury deaths and death rates, United States, 1992-2017



Work-related deaths and injuries by event or exposure, United States, 2017

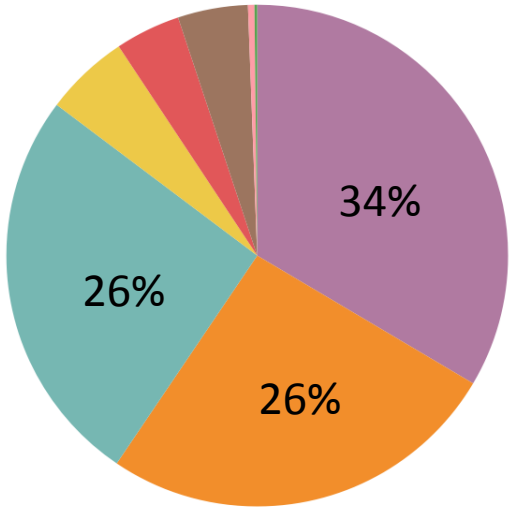
(Hover over on the pie chart to see subcategories)

Deaths



- Transportation incidents
- Falls, slips, trips
- Violence and other injuries by persons or animals
- Contact with objects and equipment
- Exposure to harmful substances or environments
- Fires and explosions
- Overexertion and bodily reaction
- Nonclassifiable

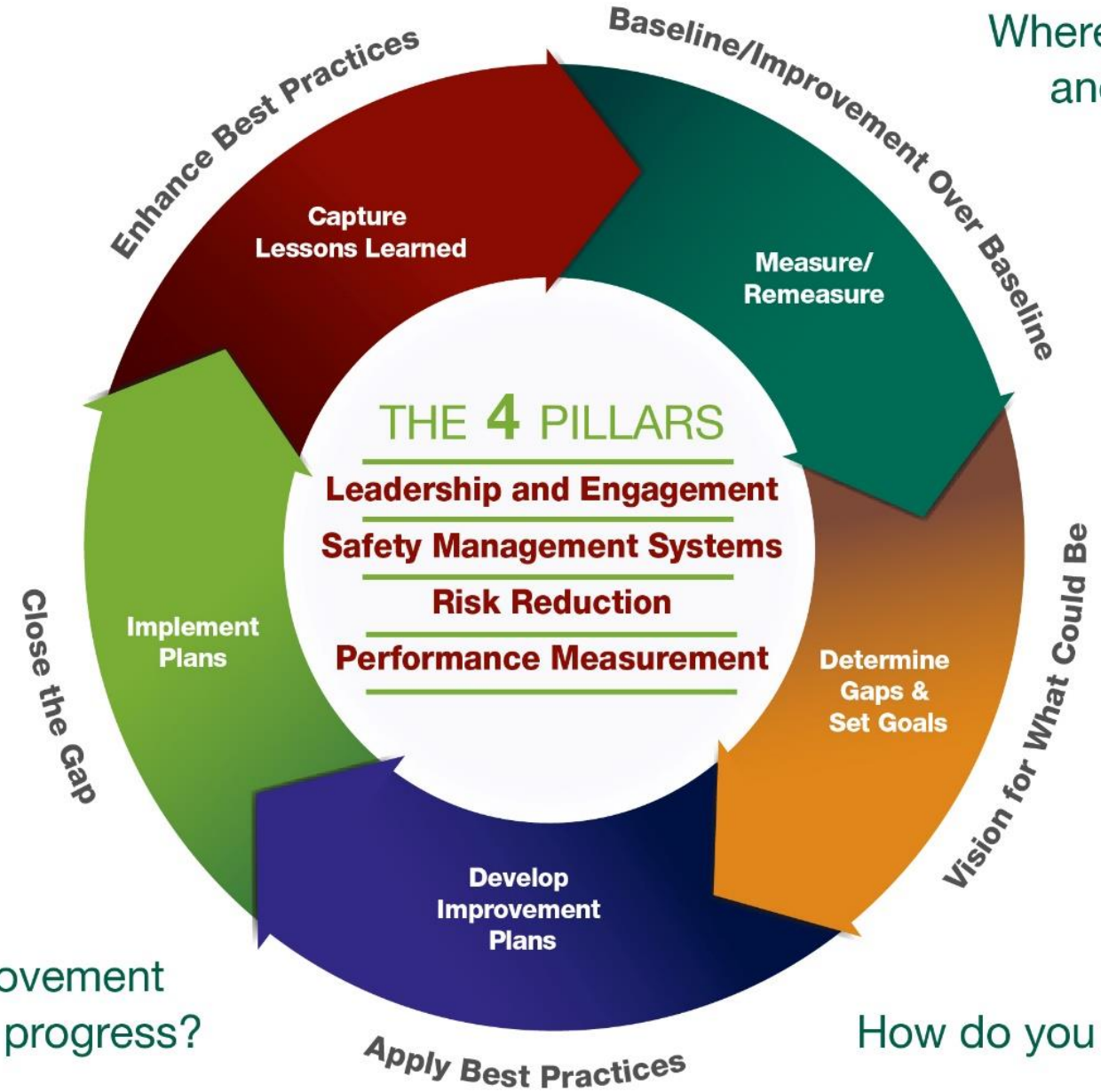
Nonfatal injuries involving days away from work



- Overexertion and bodily reaction
- Contact with objects and equipment
- Falls, slips, trips
- Transportation incidents
- Exposure to harmful substances or environments
- Violence and other injuries by persons or animals
- Nonclassifiable
- Fires and explosions

Source: Bureau of Labor Statistics.

Where are you now – and where do you want to be?



How do you manage your improvement and measure your progress?

How do you move forward?

Leading indicators framework

1. **Define**
   - Characteristics
   - Taxonomy

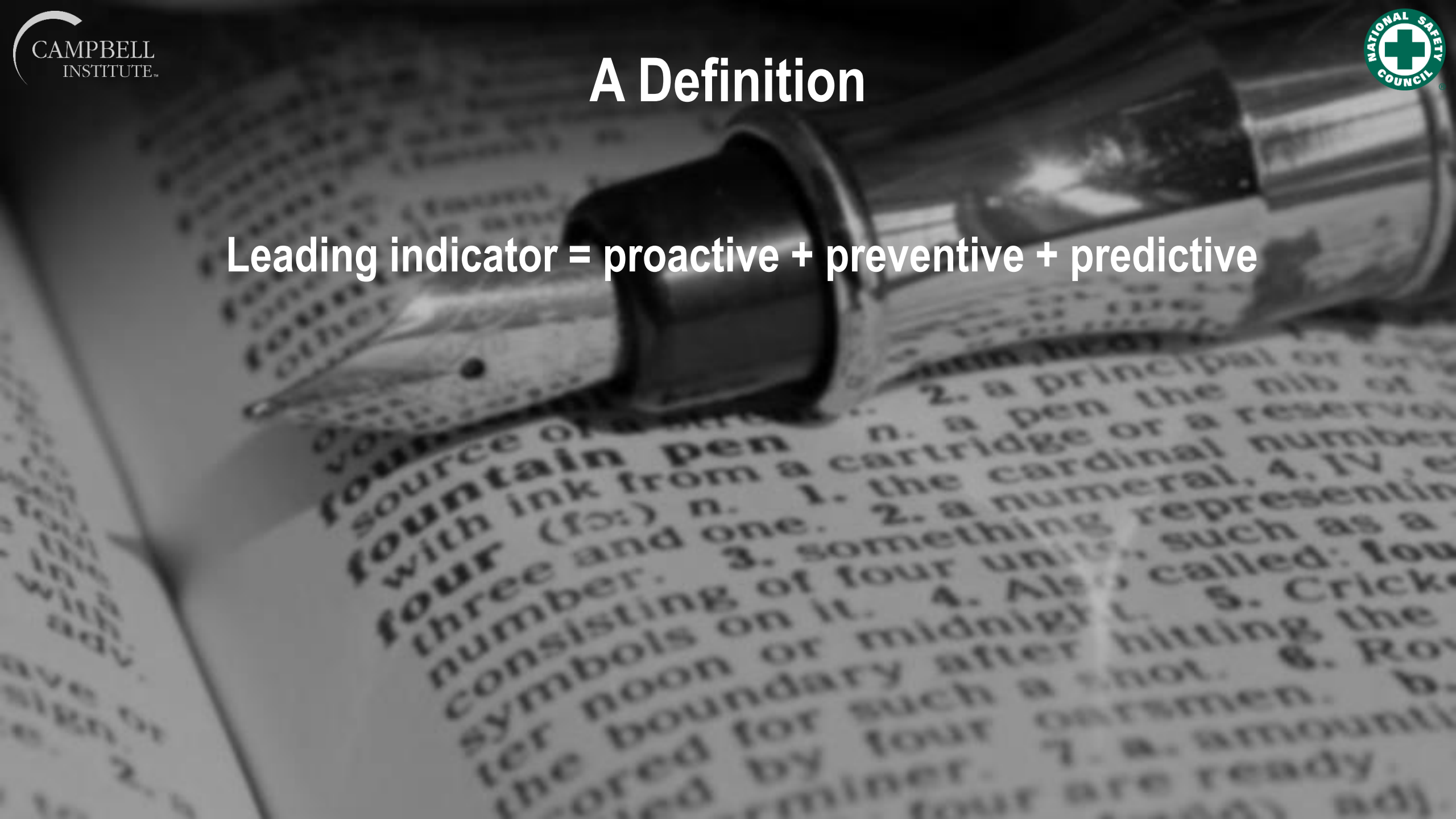
2. **Align**
   - Enablers & Barriers
   - Current state

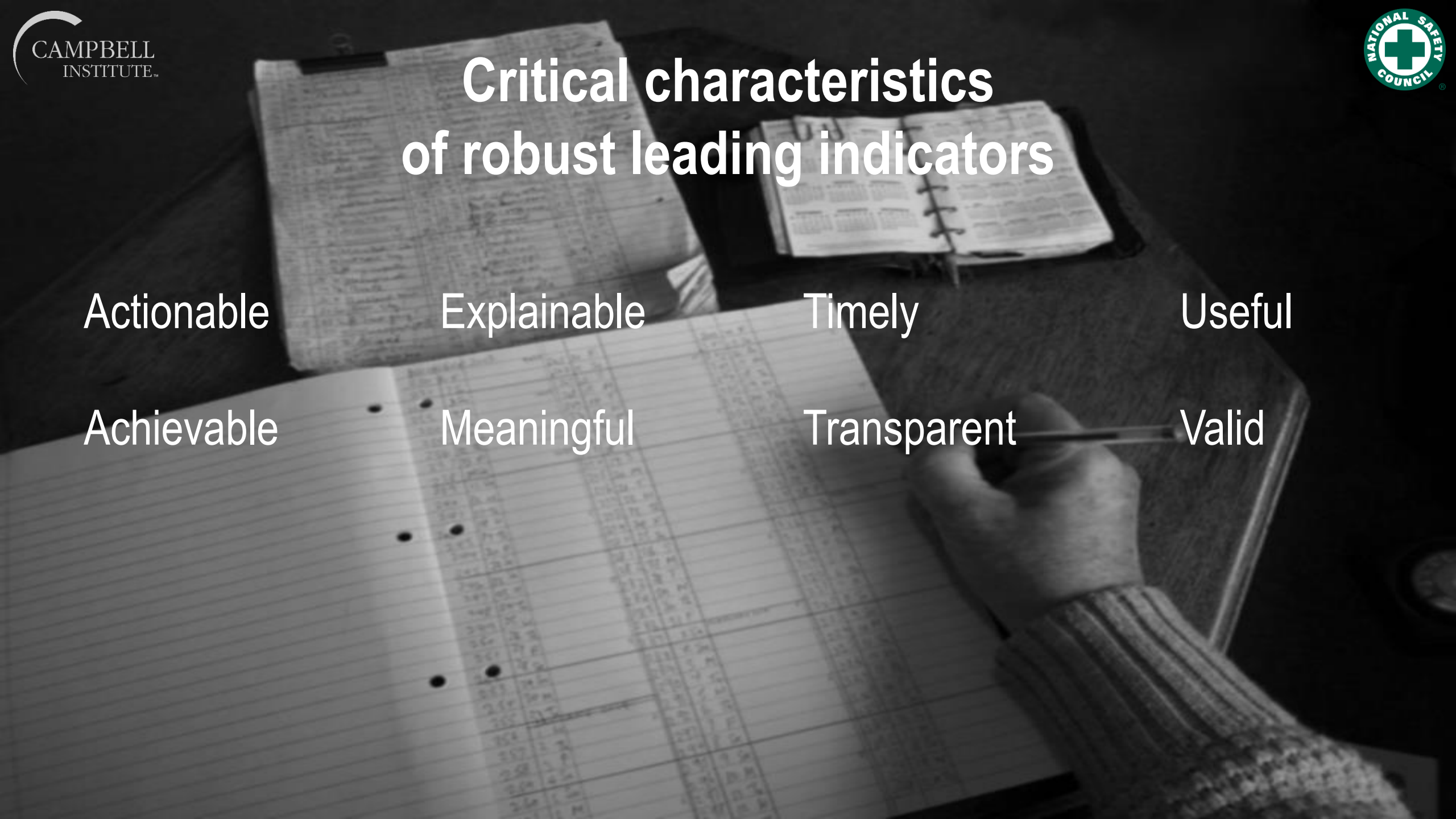
3. **Refine**
   - Categories
   - Metrics

4. **Design**
   - Implementation & improvement plans

A Definition

Leading indicator = proactive + preventive + predictive





Critical characteristics of robust leading indicators

Actionable

Achievable

Explainable

Meaningful

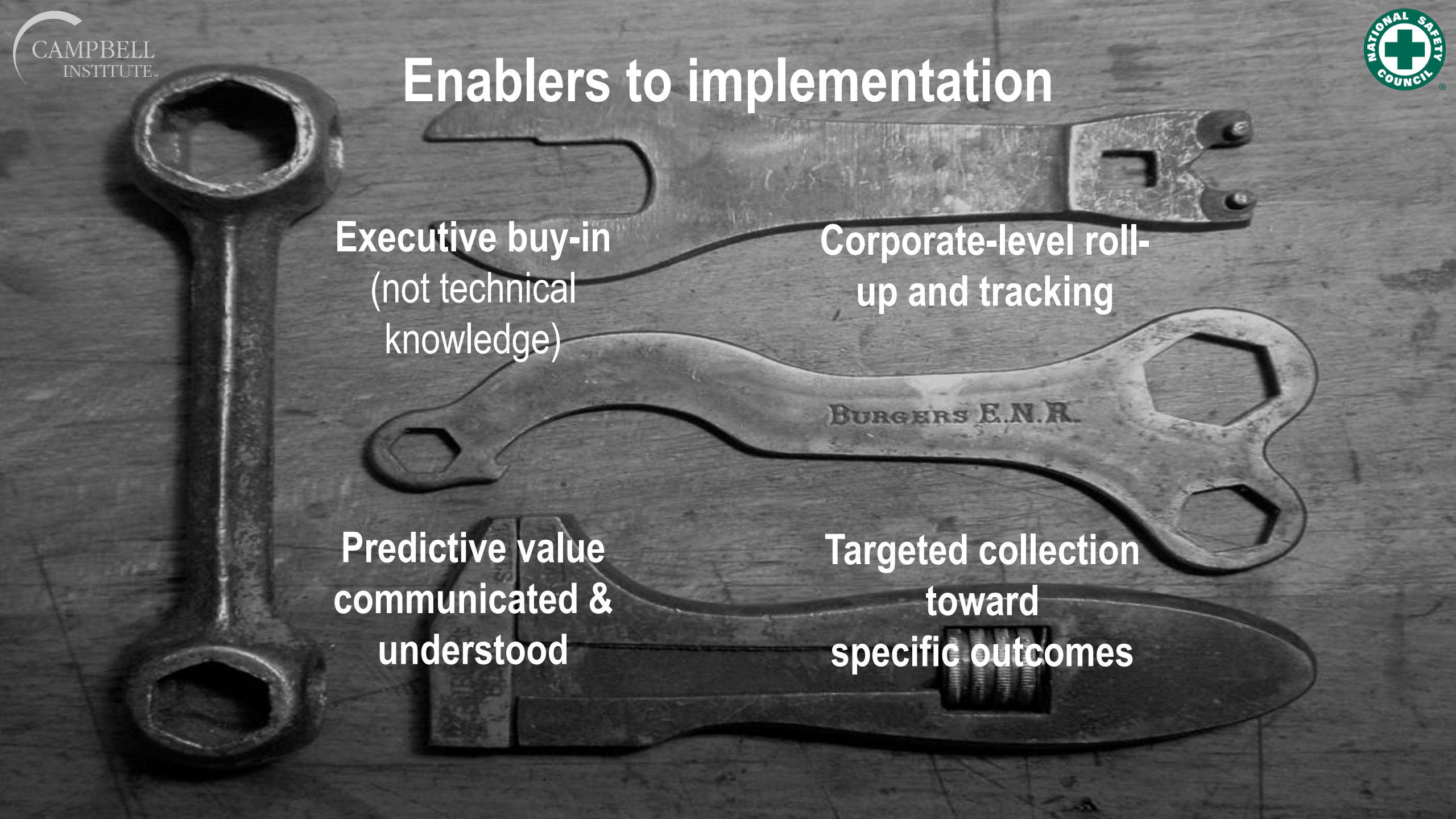
Timely

Transparent

Useful

Valid

Enablers to implementation



Executive buy-in (not technical knowledge)

Corporate-level roll-up and tracking

Predictive value communicated & understood

Targeted collection toward specific outcomes

Barriers to implementation

Inability to develop consistently actionable metrics

Lack of reliable, consistent relationship

Continued C-suite reliance on lagging indicators

Sporadic, infrequent, non-standard benchmarking

Leading indicator taxonomy

Cultural/Behavioral

- Activities
- Thoughts
- Perceptions

Operational/Technical

- Work processes
- Equipment

Administrative/Systems

- Functions of system

Leading Indicator Matrix

Operational/ Technical

- Compliance
- Risk assessment
- Preventive and corrective actions
- Equipment and preventive maintenance
- Prevention through design
- Training
- Management of change process

Systems/ Administrative

- Hazard identification and recognition
- Leading indicator component evaluation
- Learning system
- Permit-to-work system
- Safety perception survey
- Communication of safety
- Recognition, disciplinary and reinforcement system
- Hazard analysis
- EHS system component evaluation
- Risk assessment
- Preventive and corrective actions

Behavior based

- Leadership engagement
- Employee engagement and participation
- At-risk behaviors and safe behaviors
- Area observations and walkarounds
- Off-the-job safety

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DESIGN

DESIGNING AND DEVELOPING A LEADING INDICATOR SUITE

TIPS FOR GETTING STARTED

- Look at what is already being measured; could it be a leading indicator?
- Just get started; don't spend too much time deliberating
- Make sure indicators communicate meaningful and actionable information
- Obtain leadership support
- Integrate leading indicators into the overall safety management system

Complexity ranking

Low: Minimal time and effort; minimal coordination across teams

Medium: Moderate time and effort; more coordination to collect, track, and analyze data

High: High amounts of time and effort; deep coordination and communication to collect, track, and analyze data

1. Leading indicator: Hazard reports / unsafe condition reports / proactive observations

Formula for Calculation	Organizational Maturity Level	Complexity Level	Explanation
# of each coded hazard type per site or per site headcount	Reactive	Medium	Basic information that can be gathered easily.
# of observations per month	Reactive	Low	
Frequency of 100% safe BBS observations	Reactive	Low	
# of employees trained in hazard identification	Reactive	Low	
# of checklists filled out	Reactive	Low	
Ratio of proactive observations to near misses and incidents	Dependent	High	This metric may require more data collection to calculate.
Ratio of safe to unsafe observations	Dependent	Medium	An organization that implements BBS is already at a certain level of maturity. This metric may require more data collection to calculate.
% of employees actively participating in BBS	Dependent	Medium	
% of supervisors meeting observation goals	Dependent	Medium	
# and % of previously unknown or uncategorized hazards discovered	Dependent	High	This metric implies an organization that has been tracking leading indicators for some time; requires the tracking and categorization of hazards.

2. Leading indicator: Personnel trained / system training completed

Formula for Calculation	Organizational Maturity Level	Complexity Level	Explanation
# and % of employees trained in Six Sigma	Dependent	Low	The organization needs to be sufficiently advanced to implement programs like Six Sigma or BBS. Counts/ percentages of employees is simple to calculate.
# and % of employees trained in BBS	Dependent	Low	
% of trainings completed	Reactive	Low	Regulatory compliance training is basic.
% of new hires who have completed safety orientation training	Reactive	Low	
# of S&H regulatory compliance training hours per employee	Reactive	Low	
% compliance versus program requirements	Dependent	Medium	This is an audit of the major elements of all programs to check for compliance.
# of incidents with a root cause that includes lack of training	Dependent	Medium	Incident investigations would have to include lack of training as a factor to consider.
# of certified trainers in critical safety courses	Dependent	Low	Critical safety areas may include confined space, elevated work, electrical work, etc.

3. Leading indicator: Completed corrective actions / safety work order resolution

Formula for Calculation	Organizational Maturity Level	Complexity Level	Explanation
# and % of completed corrective actions by due date	Reactive	Medium	Basic information that can be gathered easily.
Average time to work order resolution, average time to complete corrective action	Reactive	Medium	
# of open action items in corrective and preventative action database	Reactive	Medium	
# of open issues without a corrective action assigned	Reactive	Medium	
# of corrective actions prioritized by risk (e.g. High severity, Low severity, life-threatening, etc.)	Dependent	Medium	This is more mature than counting a number, but the definition of risk should be easy to categorize.
% of preventive and corrective actions communicated	Dependent	Medium	An organization is going beyond merely counting corrective actions; making sure they're communicated to a larger group.
# of effective corrective actions verified by managers	Dependent	Medium	This requires more investigation on part of safety manager to verify and evaluate corrective actions.

Name/Description of Indicator	Formula for Calculation
Hazard reports / Unsafe condition reports / Proactive observations	# of observations per month
	# of employees trained in hazard identification
	# of checklists filled out
	# of unsafe observations per inspection
	# of inspections
Personnel trained / System training completed	% of trainings completed
	% of new hires who have completed safety orientation training
	# of S&H regulatory compliance training hours per employee
	# of safety talks and safety training sessions
Employee engagement and participation	% attendance at safety committee meetings
	% attendance at safety events
	# of on-the-job observations from employees
	% job turnover
Risk assessment	# of assessments conducted per plan/target/strategy
	# and % of risks mitigated with control measures put in place
	% of routine tasks identified
	% of tasks identified
Risk profiling	# of assessments deemed unacceptable
	# of repeat findings
Communication of safety	# and frequency of employee meetings
	# of tailgates/pre-shift safety talks completed

Metrics for organizations looking to get started

Name/Description of Indicator	Formula for Calculation
Communication of safety	# and frequency of employee meetings
	# of tailgates/pre-shift safety talks completed
EHS management system component evaluation	# and frequency of audits performed
	# of findings (instances of non-conformance)
	# of corrective actions
Safety recognition	# of disciplinary actions
	# of incident root causes tied to disciplinary actions
Change management	# of new trainings for operators
	% of tasks completed
Safety perception survey	% of employees polled
	Response rate
Near misses / Close calls reported	# of near misses reported
	# of near miss injuries

Metrics for organizations looking to get started

Additional advice for getting started

Balance leading indicators with lagging metrics

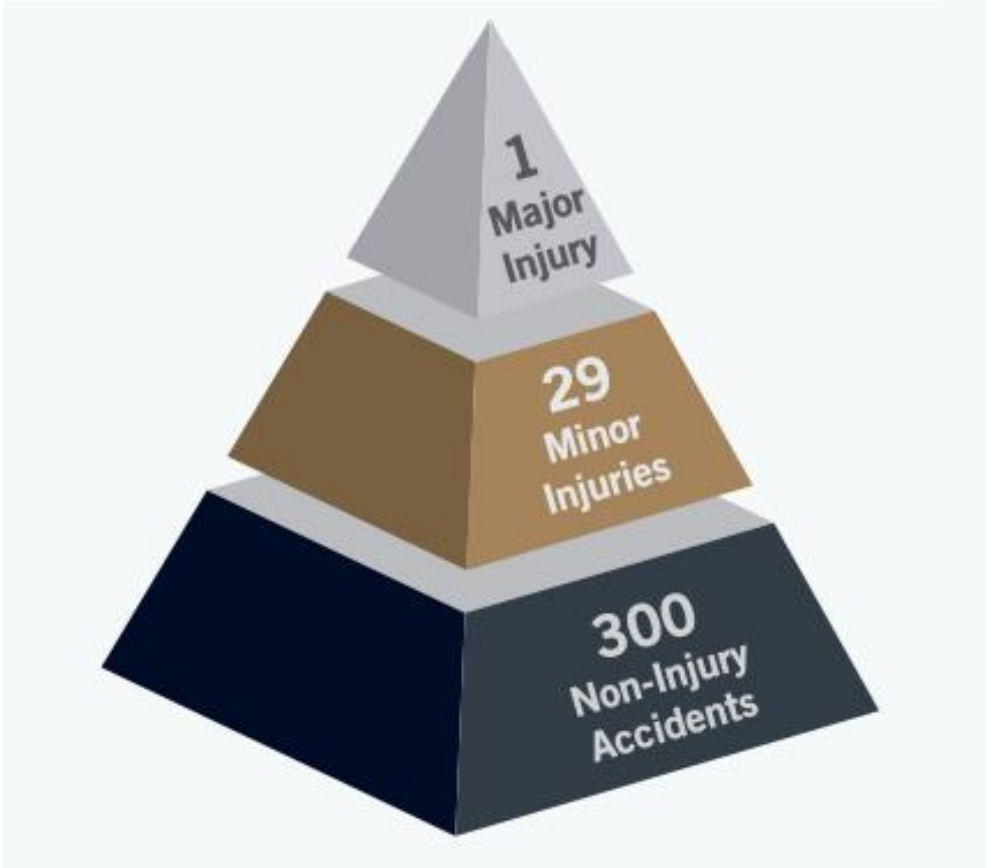
Communicate to workers the rationale for tracking leading indicators

Regularly communicate how the organization is performing on leading metrics

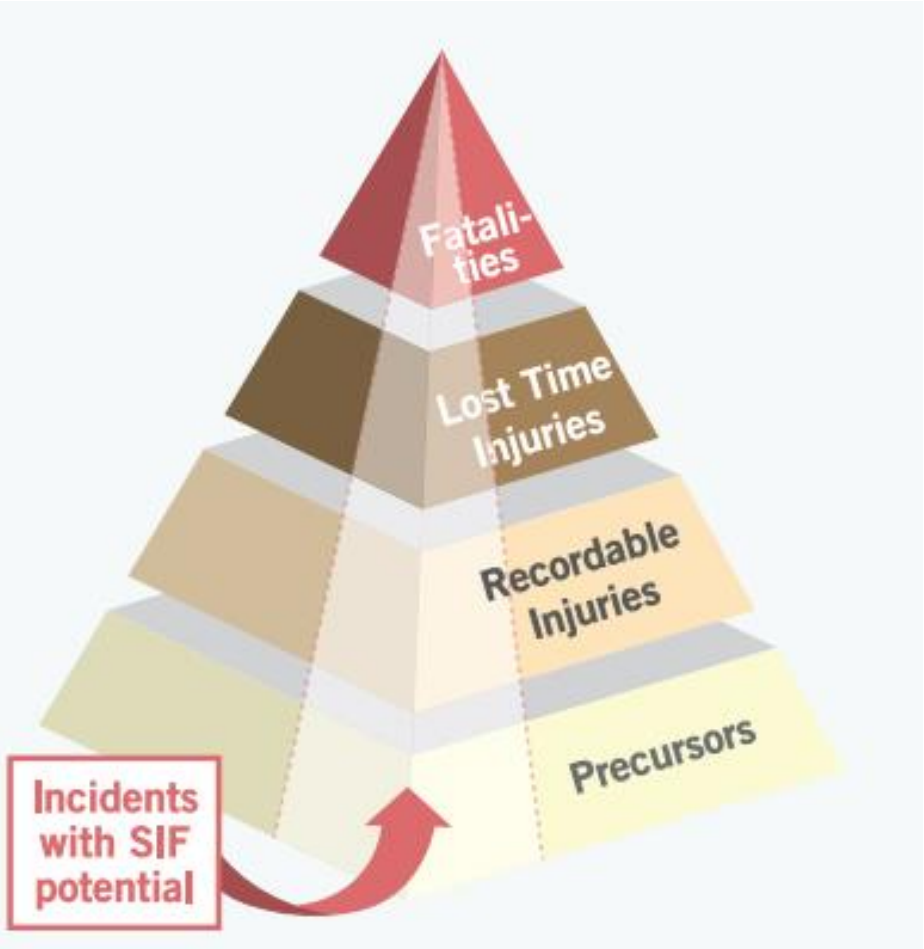

We’re preventing the “**bee stings**,”
but what about the **life-altering events**?

A new **safety triangle** for SIF prevention

Heinrich's Safety Triangle



The New SIF Prevention Model

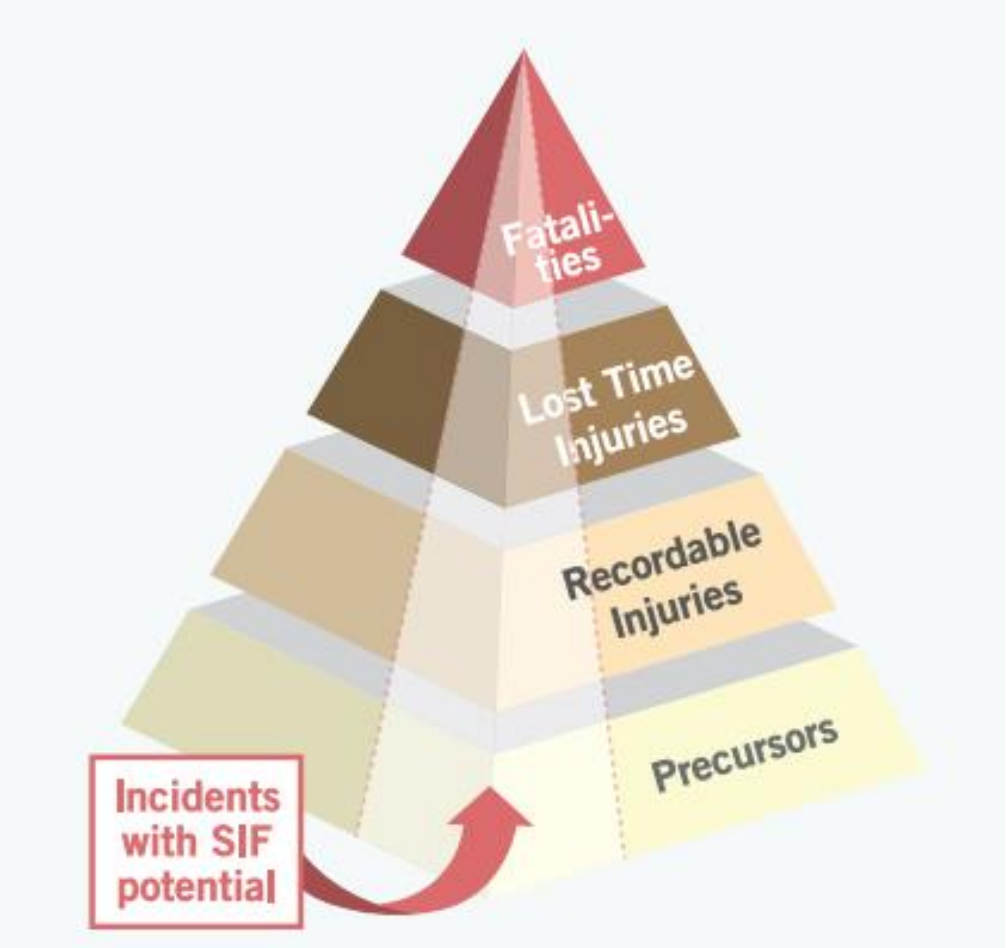


A new **safety triangle** for SIF prevention

different **severity**
different **causes**

different strategy

The New SIF Prevention Model



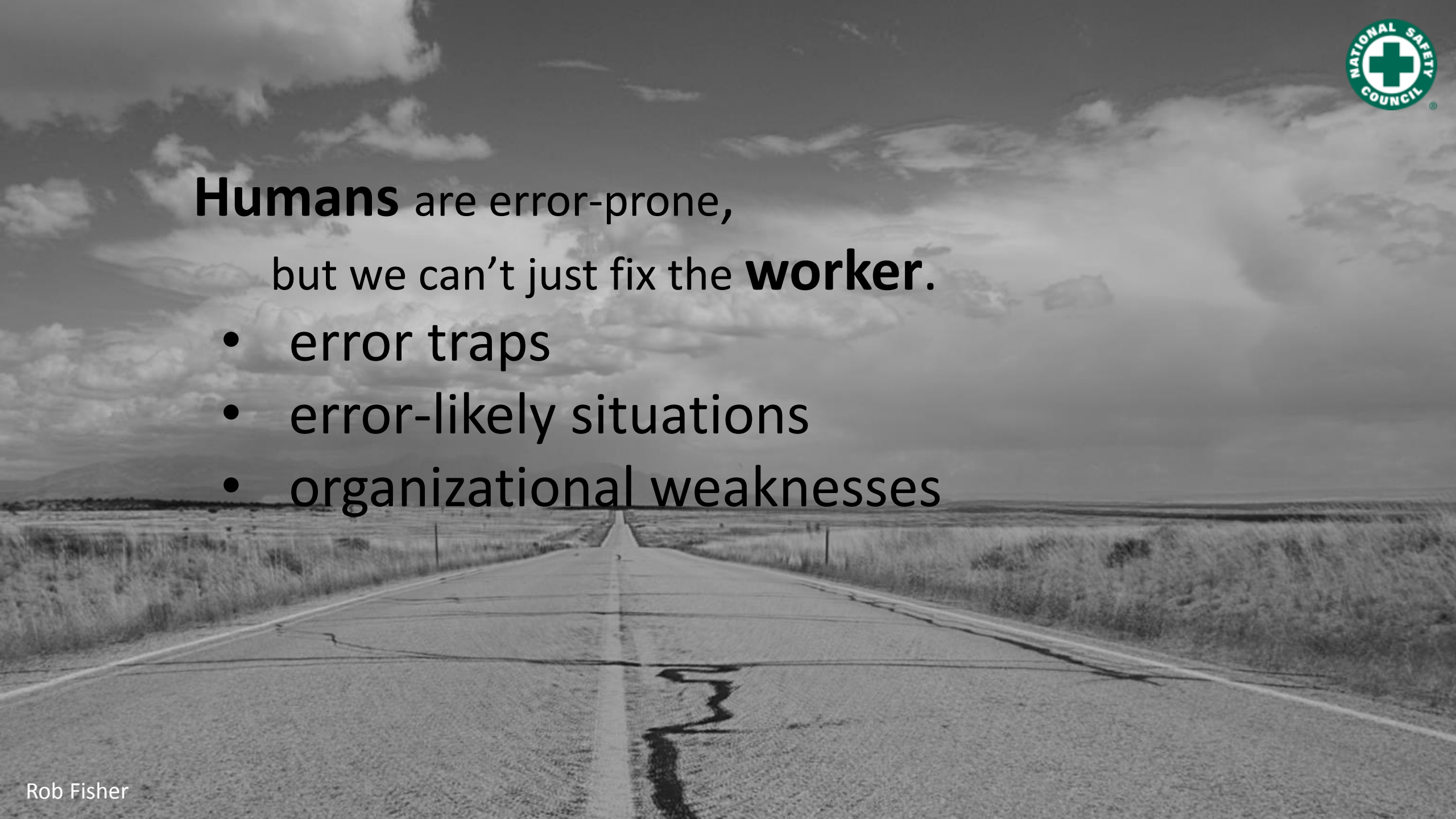
Tom Krause

Humans are error-prone,

but we can't just fix the **worker**.

- design of work
- management system
- corrective actions
- management expectations

Todd Conklin



Humans are error-prone,

but we can't just fix the **worker**.

- error traps
- error-likely situations
- organizational weaknesses

Rob Fisher

New thinking

- Heinrich's triangle doesn't **capture SIF**.
- Events with **SIF potential** are **different**.
- Humans will commit errors.
- Organizations should **repair the SMS** instead of the worker.

What is a **serious injury?**

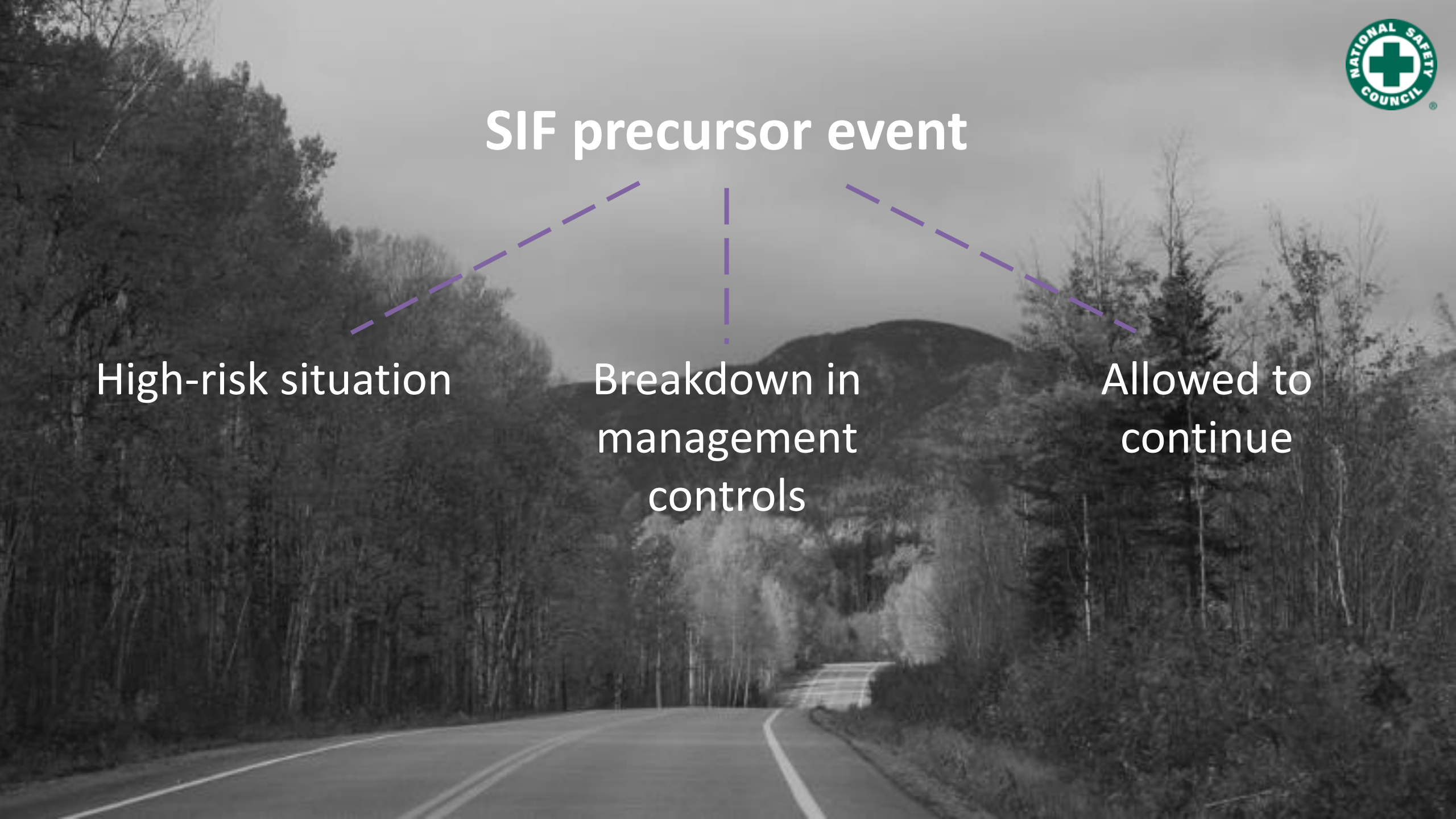
A **life-threatening** or

life-altering work-related injury or illness

What does it mean to have **SIF potential**?

Situations that **could have been worse** if not for one factor

Rank high regarding **potential severity** and **probability**

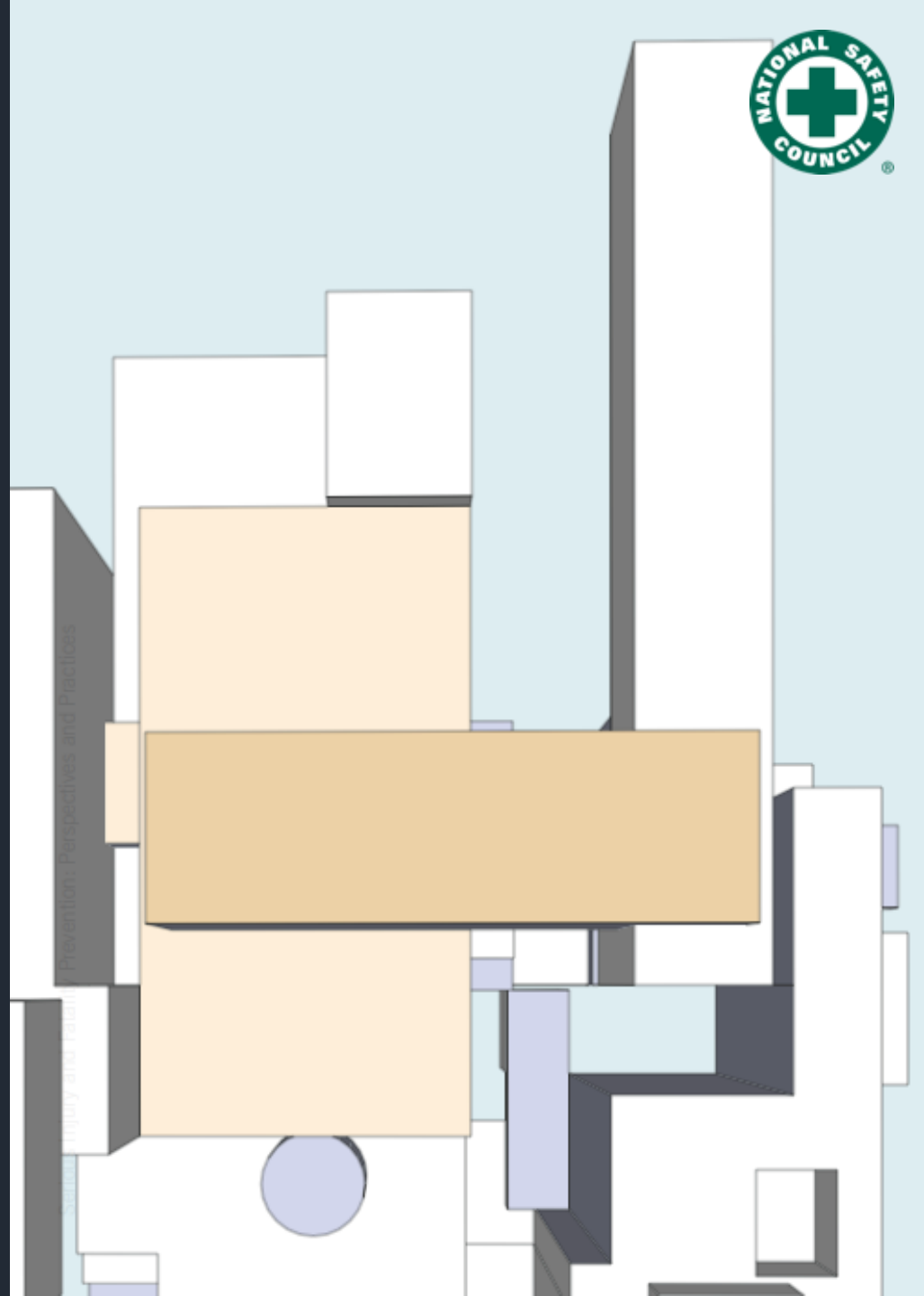

SIF precursor event
High-risk situation
Breakdown in management controls
Allowed to continue

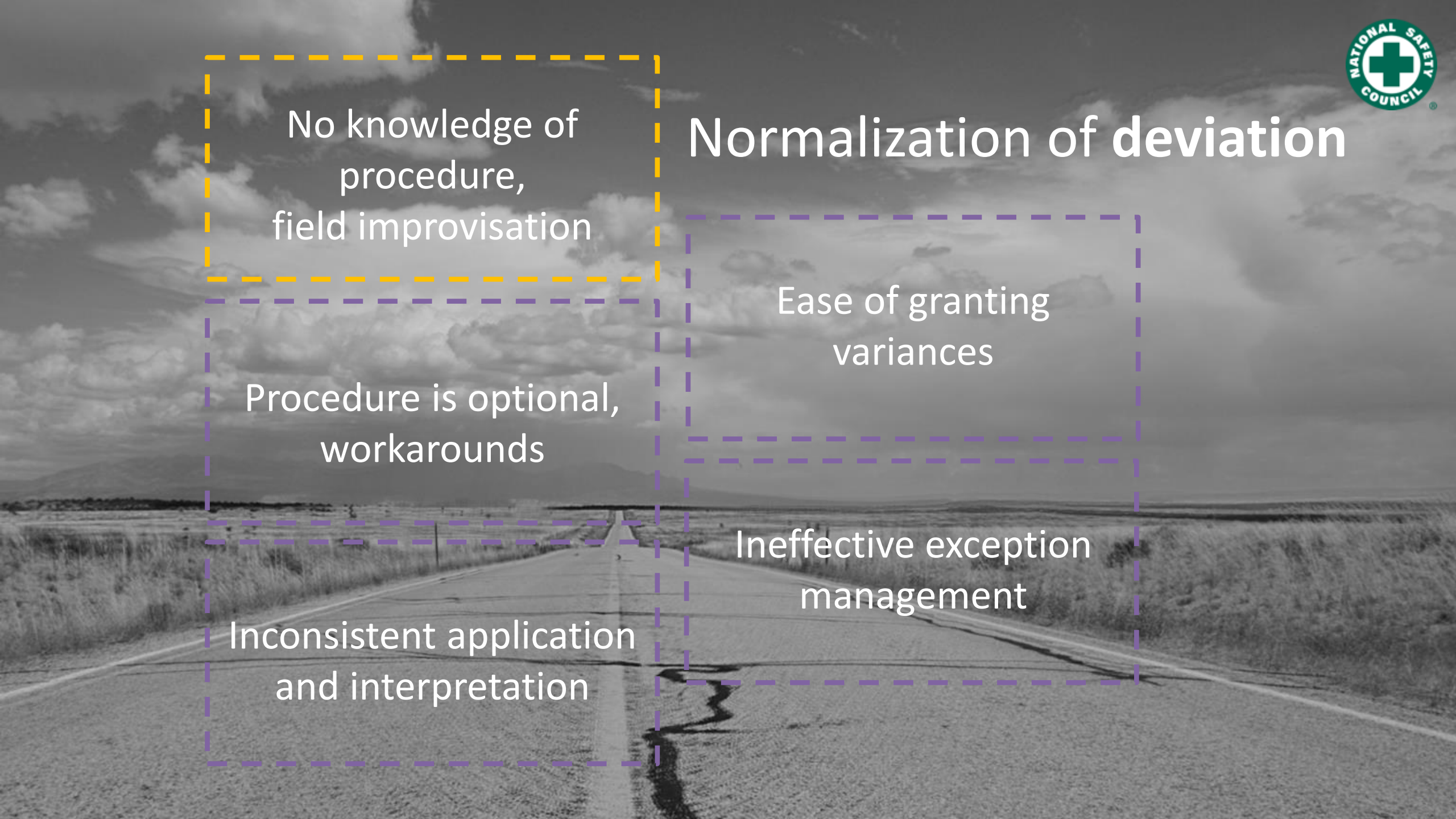
Three indicators of SIF

Normalization of **deviation**

Uncalibrated risk perception/tolerance

Decisions with safety consequences not **grounded in data**

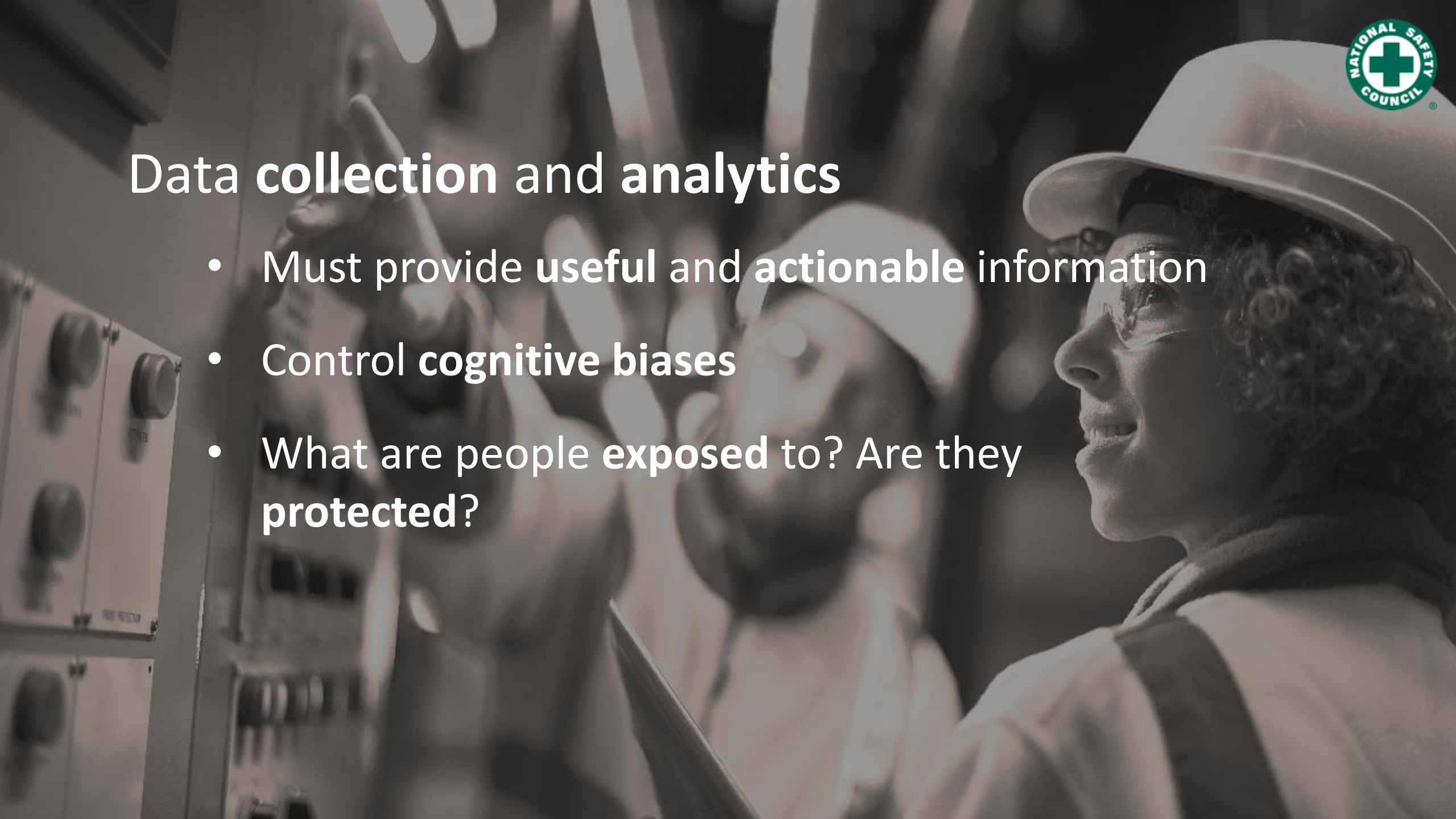



No knowledge of procedure, field improvisation
Normalization of **deviation**
Ease of granting variances
Procedure is optional, workarounds
Ineffective exception management
Inconsistent application and interpretation

Sample Risk Matrix

3 Certain	3	6	9
2 Possible	2	4	6
1 Unlikely	1	2	3
X	1 Minor Hurt	2 Recordable	3 Life Altering

Uncalibrated **perception** of **risk**



Data **collection** and **analytics**

- Must provide **useful** and **actionable** information
- Control **cognitive biases**
- What are people **exposed** to? Are they **protected**?

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Hierarchy of **controls**

Safety depends ***least*** on employee behavior

Safety depends ***most*** on employee behavior

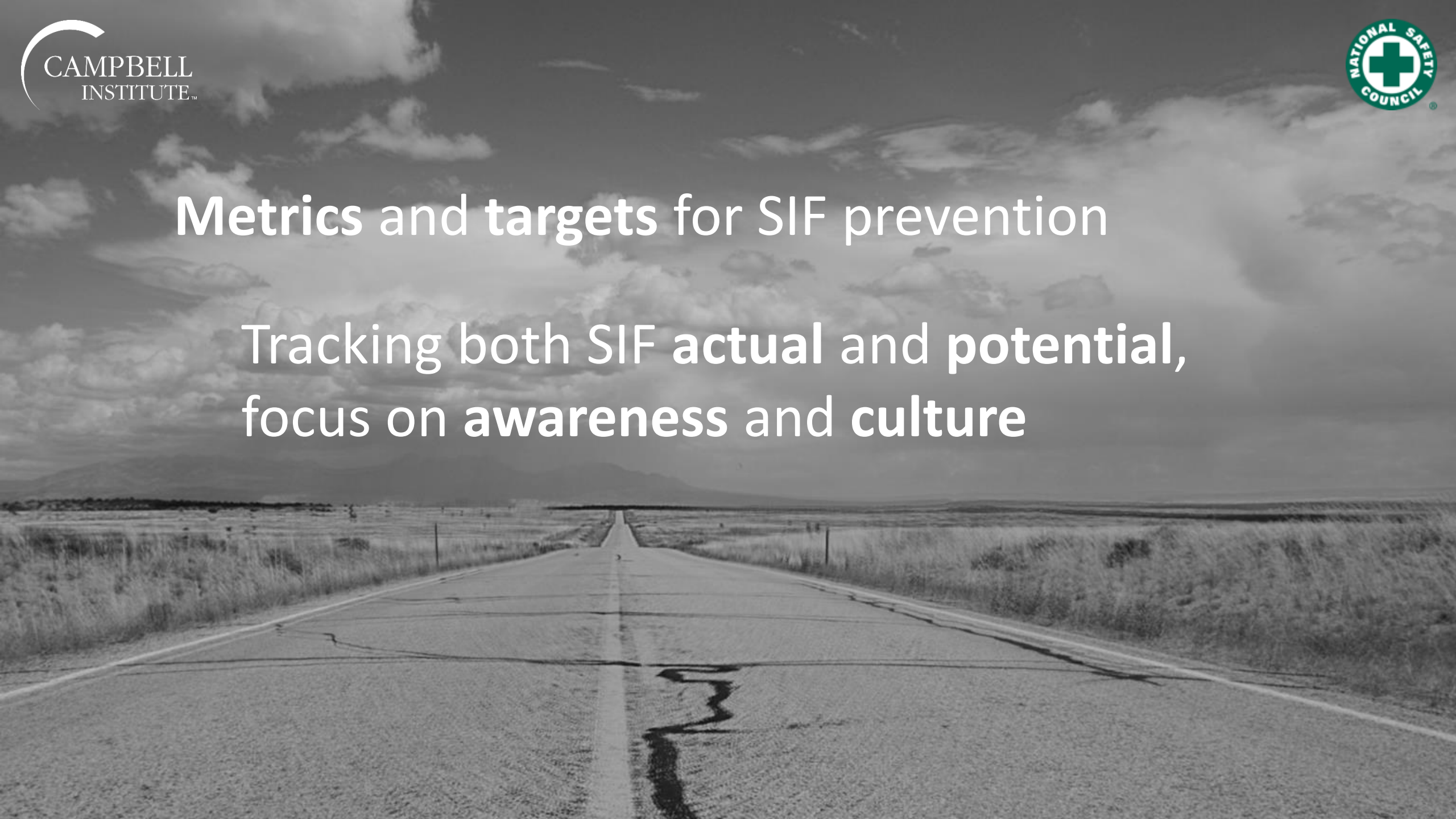

Determining **SIF-potential** events
through **risk** ranking, **review** teams,
analysis of past data

Coaching and **training** for SIF prevention

Safety training **modules**, tools/**strategies** to mitigate SIF, global safety **topics**

Communication of SIF and SIF prevention

Sharing of **lessons learned**, **bulletins**/emails, **recognition** programs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Metrics and **targets** for SIF prevention
Tracking both SIF **actual** and **potential**, focus on **awareness** and **culture**

Barriers to implementing **SIF prevention** program

Calibration of **risk** and **precursors**, different **priorities** among ranks

Future directions for SIF research

- Best practice and intervention research
- Intersection with human performance
- Workplace fatigue connection
- Connection to visual literacy

Find much more at

www.nsc.org

www.thecampbellinstitute.org

www.injuryfacts.nsc.org

Jonathan Thomas | Sr. Director, R&SS | National Safety Council