
Severe Injury & Fatality Prevention
Working on Solutions
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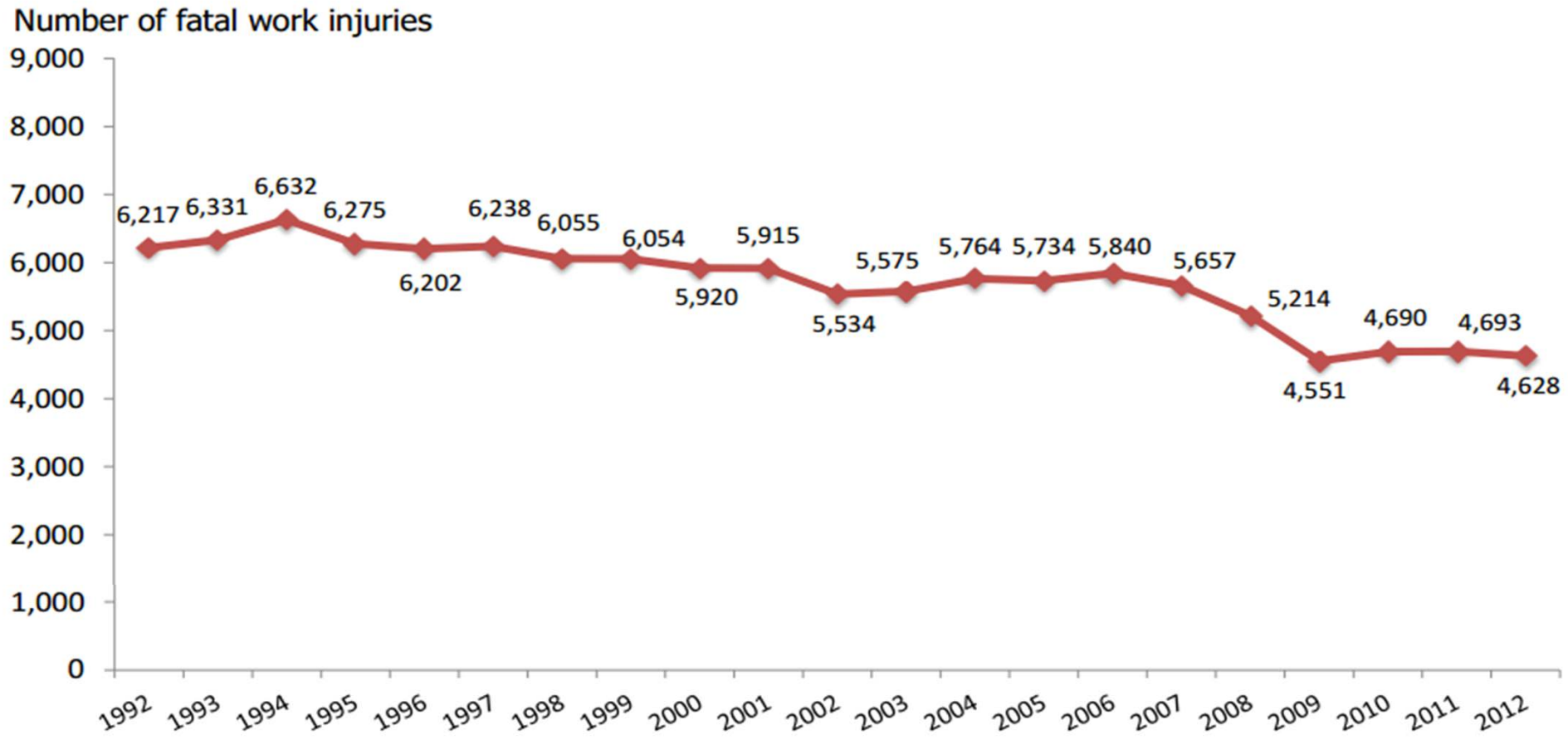
Severe Injuries & Fatalities: What are the Facts?

National Stats (BLS)

National Fatality Statistics

www.bls.gov

Number of fatal work injuries, 1992–2012

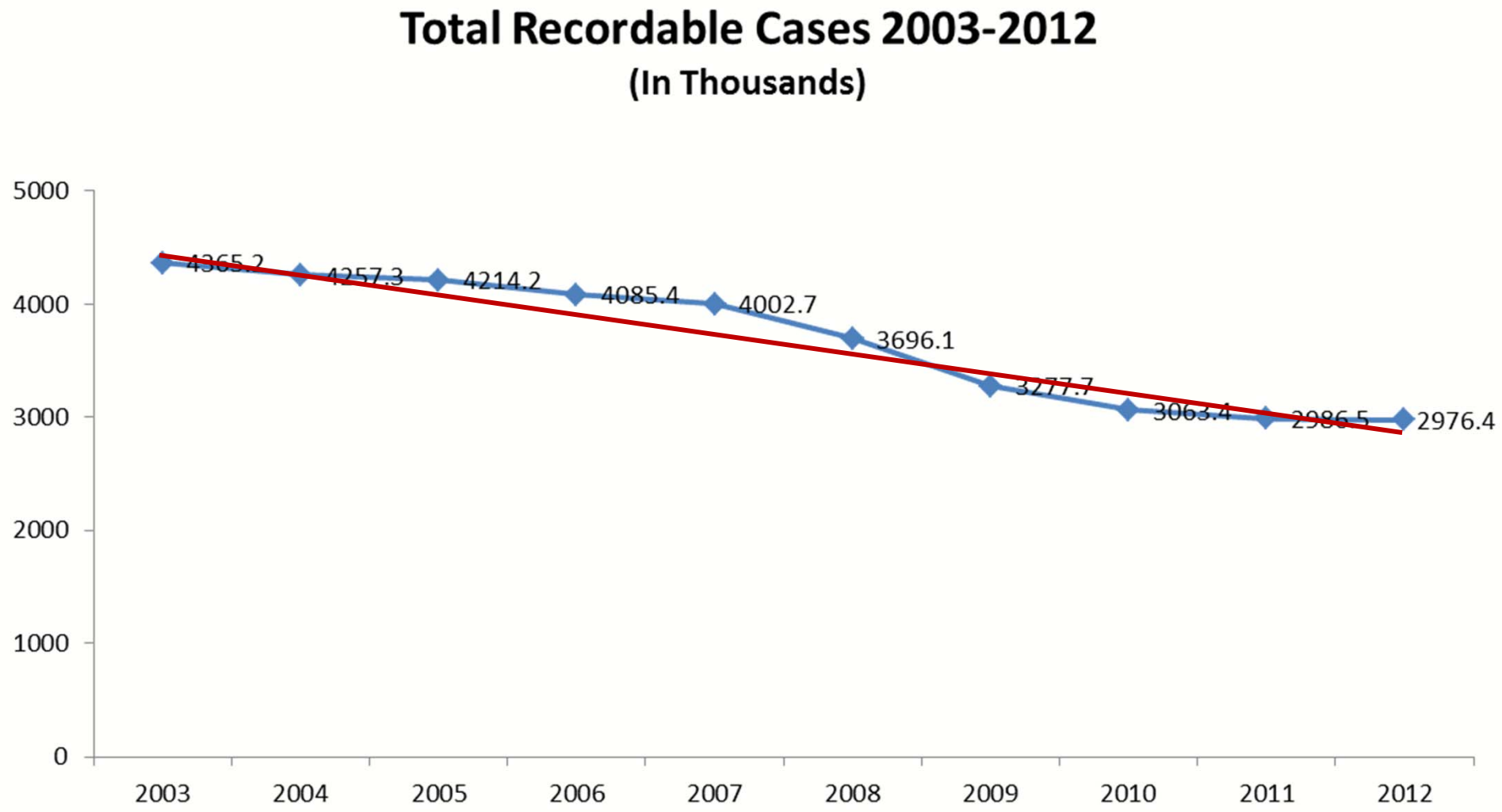


The 2012 total of 4,628 fatal work injuries decreased slightly from the 4,693 fatal work injuries reported for 2011.

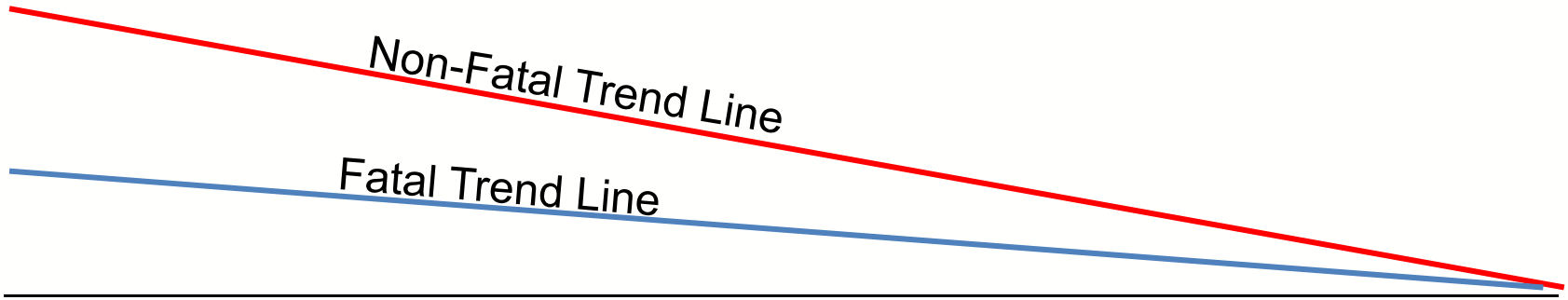
NOTE: Data from 2001 exclude fatal work injuries resulting from the September 11 terrorist attacks.
SOURCE: U.S. Bureau of Labor Statistics, U.S. Department of Labor, 2013.

National Non-Fatal Statistics

www.bls.gov

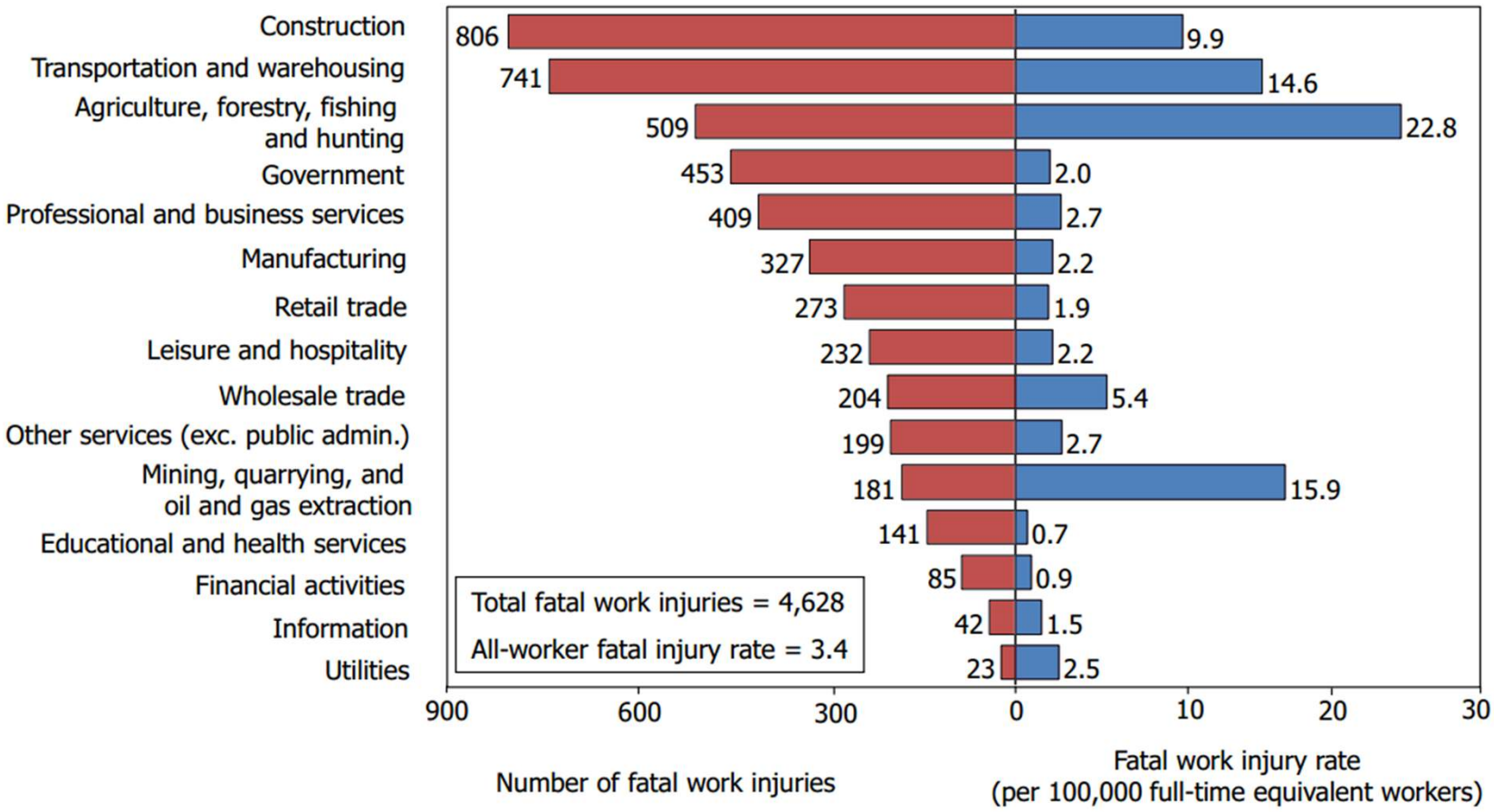


Comparison Fatality vs Non-Fatal
www.bls.gov



Fatalities are not decreasing at the same rate!

Number and rate of fatal occupational injuries, by industry sector, 2012



Construction had the highest count of fatal injuries in 2012, but the agriculture, forestry, fishing and hunting sector had the highest fatal work injury rate.

Note: All industries shown are private with the exception of government, which includes fatal injuries to workers employed by governmental organizations regardless of industry. Fatal injury rates exclude workers under the age of 16 years, volunteers, and resident military. The number of fatal work injuries represents total published fatal injuries before the exclusions. For additional information on the fatal work injury rate methodology, please see http://www.bls.gov/iif/oshnotice10.htm.
Source: U.S. Bureau of Labor Statistics, U.S. Department of Labor, 2014.

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Definition of Serious Injuries?

- Traumatic Brain Injury
- Spinal Cord Injury
- Amputations
- Significant Permanent Disability
- Disfigurement
- ???

Work Operations/Tasks Associated With Severe Injury & Fatality Risk

- Working from heights
- Driving exposures
- Lockout/Tagout
- Confined spaces
- Machine guarding
- Crane operations
- Trenching and shoring/Excavation
- Bulk quantities of acutely hazardous chemicals
- Any situation involving upset conditions, non-routine work, or a change in plans.

Measuring Safety Using OSHA Lagging Indicators

- OSHA incident rate

  $$\frac{\text{\# of OSHA recordables (200,000)}}{\text{\# of employee hours worked}}$$

  Does a severe injury or fatality count more than a minor recordable?
  Is the OSHA incident rate a good predictor of future SIF?

- OSHA DART Rate (Days Away Restriction Transfer)

  $$\frac{\text{\# of OSHA cases involving days away, restrictions or job transfer (200,000)}}{\text{\# of employee hours worked}}$$

  Does a severe injury or fatality count more than a minor recordable with restrictions?
  Is the DART Rate a good predictor of future SIF?

- Using OSHA compliance/inspections as the gold standard
  - Leading or Lagging indicator?
  - Are OSHA standards cutting edge best industry practices or minimum standards?
  - Do OSHA standards address all unsafe situations or employee behaviors?
  - Is OSHA compliance a good predictor of future SIF?

2007 RAND Injury Study

- No relationship between Cal-OSHA IIPP compliance and fatality rates
- Absence of minor injuries is not a predictor of the *absence* future fatalities
- Presence of minor injuries is not a predictor of the *presence* of fatalities in the future
- Positive correlations were found between IIPP compliance and general injury reduction

Fred Manuele –ASSE Fellow

* A large proportion of incidents resulting in serious injury occur in unusual and non-routine work, in non-production activities, and where sources of high energy are present. Also, they occur in what can be called at-plant construction operations.

* Many accidents resulting in severe injury are unique and singular incidents, having multiple, complex, cascading causal factors.

* Causal factors for low probability/high consequence events are seldom represented in the analytical data on accidents that occur frequently.

Dan Petersen – S&H Icon

"If we study any mass data, we can readily see that the types of accidents that result in temporary total disabilities are different from the types of accidents resulting in permanent partial disabilities or in permanent total disabilities or fatalities.

The causes are different. There are different sets of circumstances surrounding severity. Thus if we want to control serious injuries, we should try to predict where they will happen"

Clearly we have two separate problems that require different solutions – perhaps using old tools in new ways

We should not stop what we have been doing for many years – it has produced an improving and safer working environment – it may just not be enough to impact SI/F reduction effectively

ASSE Symposium – “Avoiding the Worst”

Program Themes, Insights and Applications

Trenching Case Study (Handout Activity)

Keynote – Dr. Tinsley

- We look at safety outcomes in a binary way (success or failure)
- Near misses are “perceived and valued” as successes in the research even though they may be due to luck
- Challenger/Columbia/BP-Macondo all disasters where warning signs were ignored

Solid Rocket O-Ring seals faulty from start ; many near misses; due to weather engineers a no go for launch; mgmnt chose to launch

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Foam shedding and strikes were not unusual, even common before Columbia

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Near Misses

- Evidence that the system is vulnerable OR
- Evidence the system is resilient
- Her research showed that people tend to believe the latter

We have the ***blow up*** how people think about this

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How do we prevent this?

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What action should the race organizer take now?

Traditional Safety Efforts
Do We Accept/Reward Risk Taking?

- It Often Depends on the **Outcome**.
- Poor decisions that result in bad outcomes are generally not accepted.
- Poor decisions that still result in success are often accepted and sometimes rewarded.
- How are good decisions that may result in delays, increased costs, or smaller losses viewed in your organization?(Discussion)

Near Miss Incidents

- What is the definition of a Near Miss?
- Are near misses a leading or lagging indicator?
- What makes the difference between a near miss and a severe accident?
- Why do we ignore near misses?
  - Frequent near misses can lead to:
    - False sense of security--its not going to happen to me
    - Normalization of deviations

Normalization of Deviance

- Getting away with bad behavior
- We get used to it if there is no bad consequence
- Abnormalities without consequence become the “new normal” leading to:
  - Not following procedures all the time
  - Relying on “common sense” of employees

The New Paradigm – Thomas Krause

- More focus on the prevention of serious injuries
- Institutionalize the SIF Rate (# of serious, fatal and recordable injuries with ***high potential*** divided by hours worked)
- Longitudinal analysis of injury and near miss root causes
- Development of Safety Culture and high-reliability mindset
- More engagement at the ***worker level***

Effects of the “Old Paradigm”

- Elevation of the trivial
- Creative classification of injuries
- Loss of credibility with labor
- Cynicism in organizational culture
- Lack of effectiveness in fatality prevention

Focusing on Safety Outcomes can lead to a false sense of security

- "All is Well" at our company because we haven't had the bad outcome yet
- Most Fatalities/SI are low probability
  - "Potential" explosions, falls, crashes don't make news
  - "It has never happened before" syndrome
- Unsafe behaviors may be ignored or even rewarded based on a good outcome
- A balanced approach ***identifies critical operations*** and measures leading and lagging indicators

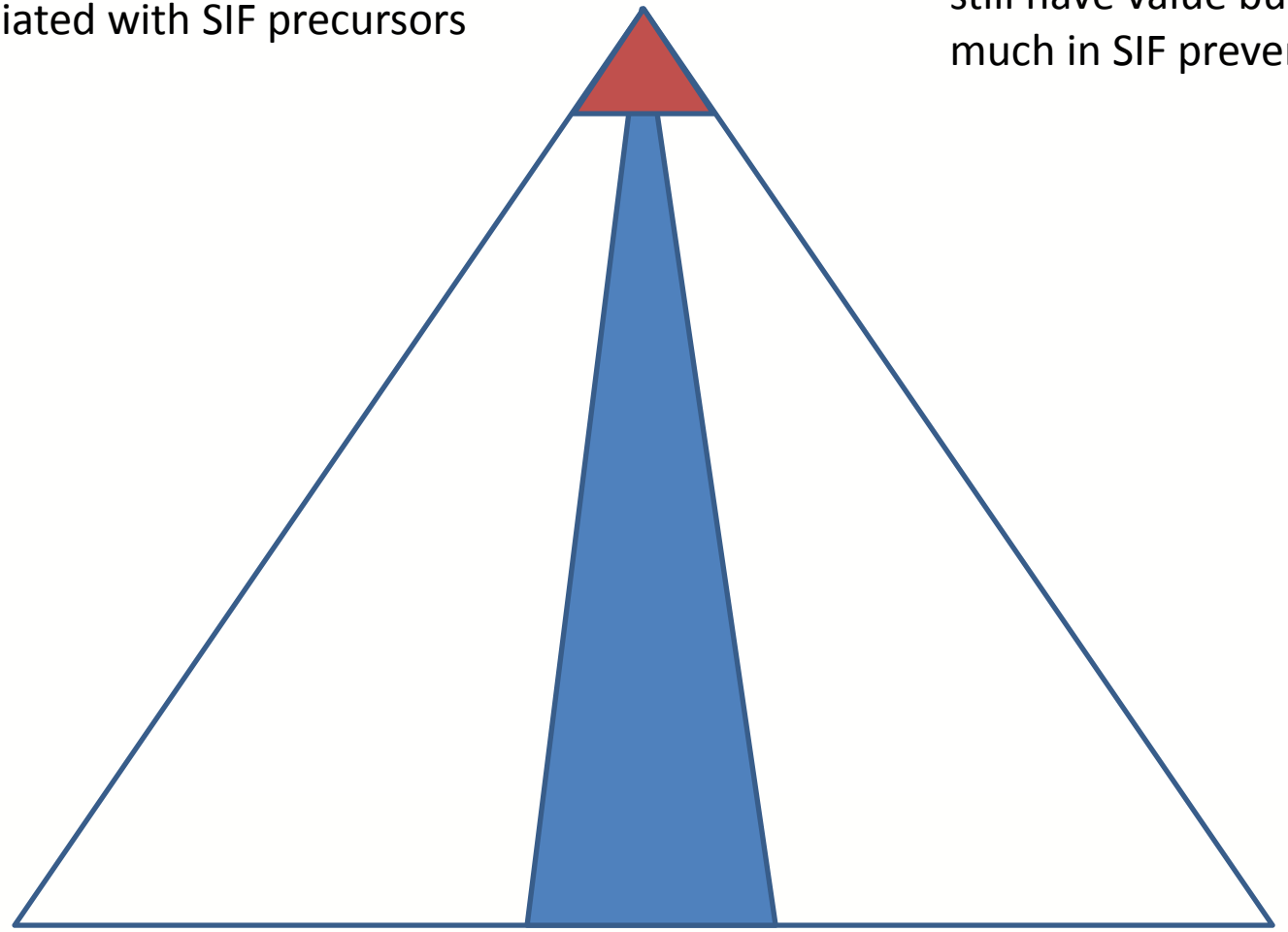
SIF Precursor

Precursor: something that comes before something else and that often leads to or influences its development

"A ***SIF precursor*** is an unmitigated high risk situation which will result in a serious or fatal injury if allowed to continue" (Krause)

All minor injuries are not the same:
A subset of low severity injuries are
Associated with SIF precursors

Heinrich's pyramid may still have value but not as much in SIF prevention



Remember Heinrich's 300-30-1 pyramid

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Activities With High Proportions of Precursors

- Confined space entry
- LOTO exposures
- Lifting operations (cranes)
- Working at heights
- Mobile equipment exposures

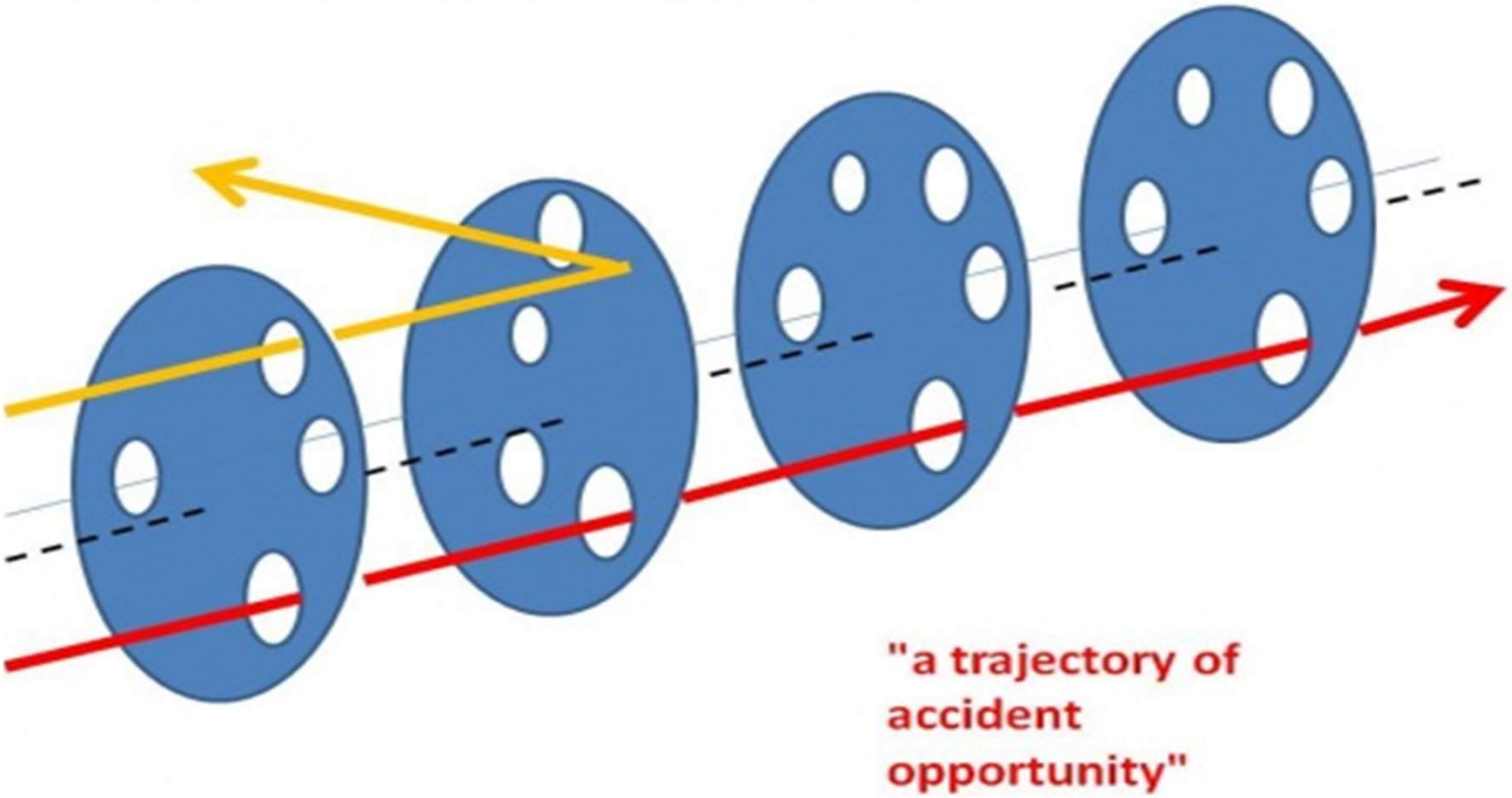
Situations That May Have High Proportions of Precursor Events

- Process instability
- Significant process upsets
- Unexpected maintenance
- Unexpected changes in job conditions
- High energy potential jobs (elec,chem,kinetic)
- Emergency shutdown procedures

Cognitive Biases Make Swiss Cheese Look Like Cheddar

James Reason's Accident Causation Model

Reason's Swiss Cheese Model



In the Swiss Cheese model, an organization's defenses against failure are modeled as a series of barriers, represented as slices of cheese. The holes in the slices represent weaknesses in individual parts of the system and are continually varying in size and position across the slices. The system produces failures when a hole in each slice momentarily aligns, permitting (in Reason's words) "a trajectory of accident opportunity", so that a hazard passes through holes in all of the slices, leading to a failure

Slices = training, hazard inspections, management oversight, accident investigations

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1. Consider Alternate States

- How could this have been worse?
- How much would have to change to make this a bad outcome?
- How bad of an outcome would it be?
- What danger was/is present?
- Where are the holes in our OSH systems?

2. Investigate Deviations

- Something different than the norm or standard
- As we ignore it we become less aware of it
- Have we always been comfortable with this level of risk?
- Has our policy toward this changed over time?
- Search for ***root causes***

Sakichi Toyoda's Five Whys

Here's an example. A worker looses the tip of his finger when it's pinched between a drive belt and an unguarded pulley. The first step is to identify the problem. In our case it's self-evident. Continue to ask WHY about each response to a question and when you are no longer able to answer the question you've likely arrived at a root cause.

1. Why was the worker's finger crushed?

His finger was caught between a moving pulley and belt.

2. Why was the finger caught between the pulley and the belt?

The guard on the pulley was missing.

3. Why was the guard missing?

A mechanic had overlooked replacing it.

4. Why was it overlooked?

There is no written equipment servicing checklist.

5. Why is there no checklist?

No hazard assessment has been completed.

While it's called the 5 WHYS, the exact number of WHYS are not cast in stone. In the above example we would have likely kept the questioning going to find out why no hazard assessment was completed. Whatever the answer was would be considered a root cause.

IHS Inc. – Joe Stough

- Data analytics only work in a data rich environment
- He gathers and sorts tremendous amounts of data from oilfield production
- Determine key metrics and factors
- Derive key leading indicators of SI/F
- Correlation coefficient level of .8 in final product
- **Operating discipline is the key component of mature organizations**

Exxon – Blackbeard well in Gulf – walked away from $200M investment

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Overcoming Illogic – Mike Allocco ISSS Fellow

- System Safety – its not rocket science and it does work
- “common sense is bull**** in risk”
- Hypothesize potential system risks
- BBS won’t overcome a poor design

Fisher IT – Rob Fisher

- Watch out for people with MSU* degrees
- *"Look at the system before human error, that is the only way to turn Swiss into Cheddar"*
- Fix the system first and you fix it for good
- ***Error Traps*** include stress, distractions, time pressure, overconfidence, infrequent or first time task, 1st day back after 4+ days off

* Makes Stuff Up

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Fisher (con't)

- ***Triggers*** tell us we are approaching traps

  head scratching

  " I think..

  " I believe…

  "I'm almost certain…

  a gut feeling that something is not right

  STOP

Star Wars Risk Management(not)

What did they do in all these situations ?

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Rob Fisher Nugget

- What is the highest risk task of the day?
- What is it?
- What could go wrong?
- What could happen?

"Teach people what these traps look and feel like"

Ron Pryor , CSP Pryor Experience Pre-Task Brief Form

An adaptation of JSA procedures to SIF exposures

Why?

- Identify and predict hazards specific to a task
- Develop countermeasures
- **Force a review of safe work instructions (100% compliance)**
- **Establish GO/No-Go decision criteria**
- Gets everyone focused on safe completion of the task

When?

- Performing a new task or something that hasn't been done in 6 months
- Task involves deviation from normal procedures
- Task in is response to "upset conditions" i.e non-normal operating conditions
- Tasks that involve high risk of injury, damage, schedule disruption
- Complex tasks – more than 7-15 discrete steps

Job Review Form

Date:	Dept/Location:	Leader:	Reviewed by:

What are you getting ready to do?

Is there a written procedure for this job? ☐ Yes ☐ No

List Procedure Name / Number:

Have you reviewed the current approved procedure? ☐ Yes ☐ No

Permits - check those that apply ☐ Confined Space ☐ Digging ☐ Hot Work ☐ Roof Work

Human Performance Error Traps - check all that apply

☐ **Stress, High Workload, Time Pressure** - tight time schedule, doing more than one task at a time, anxiety, impatience, lack of proper resources to do the job

☐ **Vague / Poor Work Guidance** - guidance conflicts with past experience, instructions out of date, errors in instructions

☐ **First Time / Infrequent Task** - first time YOU have done this task, or it has been longer than 6 months since YOU did it. Unfamiliar with details, no/low experience, implied experience, short duration task

☐ **Distractions** - feeling pulled in too many directions, getting pulled off another job, not completing original job, what's going on around you and in the workplace in general

Others

☐ **Overconfidence in abilities**
☐ **End of Shift or work cycle**
☐ **Poor or Unclear Communications**
☐ **First day back after > 4 days away**

Hazard Assessment - check all that apply

☐ Troubleshooting
☐ Different Level Fall
☐ Slips / Trips
☐ Truck / Crane Traffic
☐ Overload floor plates / roof
☐ Fluids & Chemicals
☐ Electrical / High Voltage
☐ Power Outage (fire protection, lighting, exit)
☐ Machine Guard bypassed/removed
☐ Body Placement / Stability
☐ Lifting / Pulling / Pushing
☐ Excessive Reaching, Bending, Twisting
☐ Repetitive motion / vibration
☐ High or Low Temperatures
☐ Air / Storm Water / other waste
☐ Other:
☐ Confined Spaces
☐ Difficult Access
☐ Close Clearance/Congestion
☐ Line of fire, struck by, struck against
☐ Pinch Points
☐ Hygiene - Gasses, Dust, Noise, Asbestos, Lead, O2 deficiency, etc

What should worker/supv do if he is checking a lot of error trap boxes?

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List the Critical Steps needed to complete this job		
Step	**What could go wrong?**	**Countermeasures**

What is the worst thing that could happen?

What are the conditions that would STOP this job?

Participating in the Review: (List all)

Post Review:	Did everything go safely as planned?	☐ Yes	☐ No
	Does this job need a detailed post job review?	☐ Yes	☐ No

Tools:	Slow down, Think methodically, take Action, Review results	**Step-by-Step**	**Stop & Seek Help if Unsure**

Nothing sacred about his form – we should develop our own/modifyable

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David Wilbanks, CSP, MPH

"Remember, the worker always pays the dearest price and must frequently make independent, real time decisions under pressure based on evolving data received during task performance. 'Workers are in the best position to identify conditions and precursors that could lead to error.'"

From, "Preventing Major Injuries", Professional Safety November 2013

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Implementing A SIF Process
Don Martin CIH,MPH,CSP

1. Educate senior leaders on SIF
2. Provide visibility to SIF exposure ,calculate and publish an SIF rate plus provide specific decision trees
3. Know your SIF precursors – high risk/exposure tasks-observe
4. Integrate SIF into your broader program
5. Accident investigations must become transformational – yours aren't as good as you think

Examples of Tools (Handouts)

- Employee Survey
- Severe Injury/Fatality (SIF) Employer Questionnaire
- Employee Incident Report
- SI/F Risk Potential Evaluation Checklist

Questions?