# WOLFCREEK

#### SAFETY SOLUTIONS

From Safety Philosophy to Safety Science

#### The Industrial Revolution to WWI



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#### WWI to WWII





ENVIRONMENT



Industrial Accident Prevention: H. W. Heinrich

I D E

ACC











# WWII to the birth of OSHA









#### The Ascension of Modern Safety



SUCCESSIVE LAYERS OF DEFENCES, BARRIERS & SAFEGUARDS



Figure 6: Reason's 'Swiss Cheese' Model (modified from Reason, 2008 p.102)

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# Where we are today....The Good



2

# Where we are today....The Bad



Occupational Fatalities and Nonfatalities

#### **Lagging Indicators**

#### **TRIR Calculation**

(Number of recordable injuries and illnesses x 200,000)

Employee total hours worked





#### Safety-as-Philosophy



#### **Injury Prevention Hierarchy**

#### Hierarchy of Controls







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#### Safety Science – What does it look like... Today?

#### Precursors Analysis

Poor Work Planning	Factor Presence	Weight	Weighted Score
Crew Members are Unaware of Work Procedure		x1	
No/Poor Plan to Address Work Changes		x1	
No/Poor Pre-Task Plan or Discussion Specific to Work		x1	
Productivity Dominated Culture	Factor Presence	Weight	Weighted Score
Crew Members are NOT Active in Safety		x2	
Fatigue		x2	
Schedule/Productivity Pressure		x2	
Significant Overtime		x2	
Prior Safety Performance is Poor		x2	
Vulnerability to High Energy	Factor Presence	Weight	Weighted Score
Lack of Control Barrier and/or Visual Warning		x2	
Line of Fire is Uncontrolled		x2	
Improvisation		x2	
Outside Safety Influences	Factor Presence	Weight	Weighted Score
Congested Workspace/Crowding		x1	
Distracted Workers		x1	
Limited Safety Supervision		x1	
Poor Quality or Inexperienced Foreman		x1	
Working Alone		x1	
Total Score (if score equal to or greater than 4, HILF is Predicted)			

 $e^{(-1+0.20*X_1+0.56*X_2+0.46*X_3+0.24*X_4)}$ 

 $Probability = \frac{1}{e^{(-1+0.20 \times X_1 + 0.56 \times X_2 + 0.46 \times X_3 + 0.24 \times X_4)} + 1}$ 

#### Safety Science – What does it look like... Today?



# So, where is this kind of work being done?



### Vision and Objectives

# Prevent serious injuries and fatalities in the construction industry via transformative research and defendable science.

#### **Objectives:**

- Create and disseminate new knowledge
- Connect industry and academia
- Develop robust professional networks
- Train the next generation of safety

scientists and professionals who intuitively work together



### **CSRA** Vision and Objectives





## Transformative interventions that can only be achieved together

# Project 1: Predicting SIFs

*Goal: Create a research-validated dashboard that forecasts SIF risks based upon observable and measurable predictors.* 

Input



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#### Project 2: Quality-Based Safety Leading Indicators



We are building quality standards, scorecards, and guides for pre-job safety meetings, leadership engagements, and safety observations (critical controls assessments)



#### What science supports the change in narrative from TRIR to SIF?

#### When, if ever:

- Can TRIR be a metric that can be used to compare performance?
- Is it valid to compare the TRIR of two organizations?
- Is TRIR from the past predictive of TRIR in the future?
- Can we attribute changes in TRIR to changes in the company?

#### **Bottom Line**

- We can't make any of these statements with confidence.
  - The probability of a recordable injury at any given time is so small that the margin of error becomes very wide.
  - For example, if a company has 10,000,000 hours and 40 Recordable injuries (TRIR of 0.8), we can only say with confidence that their system performance was actually between a TRIR of 0.59 and 1.09.

The Verdict: Without an extremely large number of hours (100M-1B), an observed TRIR is a poor indicator of system performance, and a poor basis for comparison.

#### A Picture is Worth a 1000 Words

Company C has a TRIR of 0.8 over 6,000,000 worker-hours. Company D has a TRIR of 1.4 over 980,000 worker-hours.



#### Why is this important?

If an organization is rewarding or penalizing based on TRIR as a performance measure, they are doing so most likely based upon normal variation rather than any systematic change, effort, or behavior.

### Upcoming Project: Safety ROI

#### **Two critical questions:**

- How do we measure the impact of a safety intervention?
- How do we estimate the return on investment?



### **CSRA Current Member Companies**

- 1. Consolidated Edison
- 2. Southern Company
- 3. Chevron
- 4. Quanta Services
- 5. Tennessee Valley Authority
- 6. The Otis Elevator Company
- 7. California Resources Corporation
- 8. Wolfcreek Group
- 9. TechnipFMC
- 10. Enbridge Pipelines
- 11. Graham Construction
- 12. Mastec
- 13. Xcel Energy

#### **Executive Director:**

Dr Matt Hallowell

- 14. SabicIP
- 15. ConocoPhillips
- 16. Caterpillar
- 17. Laney Group
- 18. Enable Midstream
- 19. Southern California Edison
- 20. Exelon
- 21. Remote Medical International
- 22. CenterPoint Energy
- 23. Portland General Electric
- 24. Marsh
- 25. Cheniere
- 26. Price Gregory International
- 27. TC Energy
- 28. Honeywell
- 29. Eversource
- 30. Entergy
- 31. PLH Group



#### What can you as a leader do?

• Support the research.



- Ask the right questions.
  - Is this intervention supported by peer-reviewed research?
- Operationalize the research.
- Don't wait for the clients to drive the conversation.

## **Questions and Discussion**

