Severity Based Index (SBI)

Presented by:

Jonathan Briley, CSP

Background

The SBI concept was developed by a team of EHS professionals representing 20 electric power utilities across the United States and Canada

The goal of the team was to create a metric that define incident severity categories and assign a weight to incident types using pooled historical data from the 20 participating utilities.

To avoid differing opinions on things like “how many first aid case are the equivalent of a fatality”, etc… the team decided to use used data and research to quantify the amount of physical energy that corresponds to injury severity.

To be 100% clear, I did not invent this. I saw an article about it in the PSJ and adapted it for use.

Severity-Based Lagging Indicator: An Alternative Measure of Safety Performance
Matthew R. Hallowell;
Elif Deniz Oguz Erkal
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Article history

"Our incident rate is low. Our audits have minimal findings. We have a good Safety program. But then, after years of good performance, we have an accident that puts someone in the hospital. I don't understand it."

– Leadership Teams Everywhere

Why do we have SIF/pSIF events?

- It's complicated…

- Factors Include:
  - Regs stopped driving incident reductions in the 1980/1990s
  - TRIR is everyone's primary metric, and it isn't statistically significant
  - Long term occupancy facilities with designs not optimized for SIF reduction and decades of ad hoc and incremental changes
  - Current safety systems usually focused on reducing incident counts
  - Serious consequence/low occurrence risks with weak controls

How Do We Reduce SIF Potential

- Incorporate SIF analysis into root cause analysis and risk assessments including Management of Change
- Prioritize SIF/pSIF fixes

- Design beyond the regulations
- Discard outdated benchmarks
- Make risk visible with metrics other than TRIR

Agenda

01 What is a Severity Based Index

Explanation of the metric and how it works

02 How Will it Enhance Safety?

Benefits of SBI

03 Deployment Plan

Introduction to the business, deployment and use

04 Discussion and Questions

We want to hear your thoughts

Safety Metrics

Metrics can be placed into 2 broad categories, lagging metrics and leading metrics.

Metrics in general are tools for comparison, measuring performance, setting goals, making decisions and influencing responses to change

Lagging Metric

Metrics that are historical and tell you what has already happened

- Pros – relatively easy to identify, measure and compare
- Cons – limited use as predictors of future performance

Leading Metrics

Metrics that provide insights into future performance and predictability

- Pros – Can predict future performance
- Cons - Difficult to get right, very dependent on data quality, and surprises still happen

Most Common Safety Metric is Total Recordable Incident Rate (TRIR)

TRIR became the standard EHS metric as it was the primary metric of the United States Occupational Safety and Health Administration (OSHA) in 1970

- This was not the intended use of the metric
- It was meant for large data sets, i.e. use in benchmarking across all US industries
- To report with a precision of 2 decimal places, you need around 300 million worked hours. Our largest LCs run around 300k hours on average
- Program driver often become "how do fewer recordable injuries?", not "how do improve Safety?".

Pros

- Good for analyzing large data sets
- Massive amount of historical data available
- Good for benchmarking past performance
- Trends can be an indicator of progression/regression
- Helped drive improvements for 25+ years

Cons

- Not good for small data sets
- As a lagging metric, it has limited predictive value
- Does not account for severity
- Safety becomes all about the lack of injuries rather than the presence of effective controls
- Reported a number but is actually a distribution

Incident Rates & Statistics

- TRIR is missing context.
  - Incident severity matters – tells more of the story
  - There is a big difference between a paper cut and a fatality
- As a single data point reported monthly, TRIR is often statistically meaningless.
  - We need to look at trends over time with something that adds context

TRIR alone has extremely limited value and a score to look at monthly .
We are mostly looking at statistical noise at the site level.

95% CONFIDENCE INTERVALS FOR A SERIES OF TRIR SCENARIOS

	TRIR 95% confidence interval								
Work hours	**0.1**	**0.2**	**0.5**	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**
100,000	0.00 to 7.68	0.00 to 7.68	0.00 to 7.68	0.00 to 7.68	0.00 to 7.68	0.35 to 11.33	0.35 to 11.33	1.10 to 14.59	1.10 to 14.59
250,000	0.00 to 3.07	0.00 to 3.07	0.00 to 3.07	0.14 to 4.53	0.14 to 4.53	0.44 to 5.83	0.82 to 7.06	1.71 to 9.36	2.20 to 10.47
500,000	0.00 to 1.54	0.00 to 1.54	0.07 to 2.27	0.22 to 2.92	0.41 to 3.53	0.85 to 4.68	1.36 to 5.78	2.17 to 7.36	2.75 to 8.39
1 million	0.00 to 0.77	0.04 to 1.13	0.11 to 1.46	0.43 to 2.34	0.68 to 2.89	1.09 to 3.68	1.82 to 4.95	2.59 to 6.18	3.39 to 7.38
2.5 million	0.01 to 0.45	0.04 to 0.58	0.22 to 1.05	0.55 to 1.68	0.91 to 2.28	1.35 to 2.95	2.15 to 4.08	3.03 to 5.27	3.87 to 6.36
5 million	0.02 to 0.29	0.09 to 0.47	0.27 to 0.84	0.68 to 1.48	1.07 to 2.04	1.52 to 2.64	2.39 to 3.76	3.29 to 4.86	4.20 to 5.96
10 million	0.04 to 0.23	0.11 to 0.37	0.34 to 0.74	0.76 to 1.32	1.20 to 1.88	1.64 to 2.43	2.56 to 3.52	3.48 to 4.59	4.42 to 5.66
20 million	0.05 to 0.18	0.13 to 0.31	0.38 to 0.66	0.82 to 1.22	1.28 to 1.76	1.74 to 2.30	2.68 to 3.36	3.63 to 4.41	4.58 to 5.46
50 million	0.07 to 0.15	0.15 to 0.26	0.42 to 0.60	0.88 to 1.13	1.36 to 1.66	1.83 to 2.18	2.79 to 3.22	3.76 to 4.26	4.73 to 5.28

Hallowell, M. et al. (2024) 'The Statistical Invalidity of TRIR as a Measure of Safety Performance', Journal of the American Society of Safety Professionals, 69 (April 2021), pp. 28–34.

What about D.A.R.T?

D.A.R.T

- Days Away, Restricted, Transferred
- Like TRIR but only counts injury/illness that resulted in outcomes where a person can't perform all duties or work at all

Still just a count

- A step in the right direction, but still just counting events
- Same benefits and limitations as TRIR

Severity Based Index

Like any metric, SBI has both benefits and drawbacks

Pros

- Consistent with common incident classifications
- Based on real world data
- Pulls in more incident types
- Weights Severity
- Tells more of the story in a way relatable to workers and Leadership
- Works well with SIF/pSIF reporting concepts

Cons

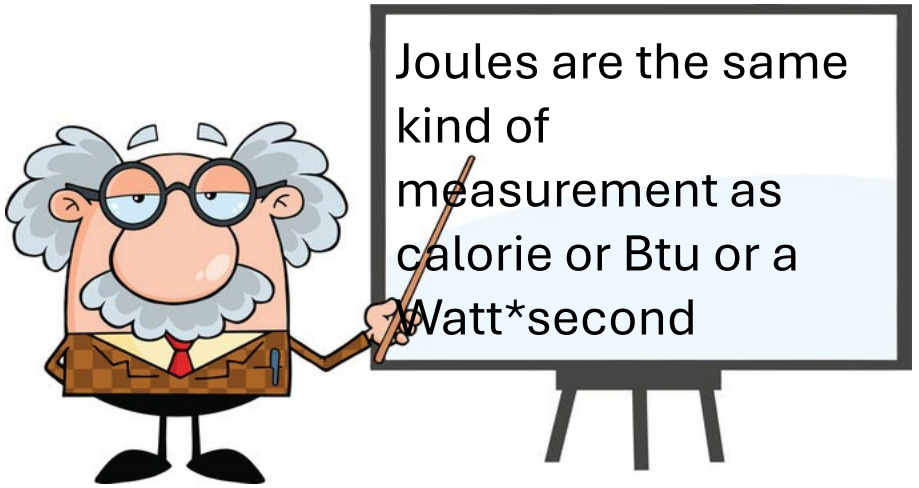
- Lagging Metric
- Not necessarily predictive
- Like all metrics, dependent on accurate reporting
- Good performance = no incidents

SBI isn’t a cure-all or the end of a path.

It is a much-needed incremental improvement, with a path to future improvement, that will be used to identify trends of increased risk, measure the effectiveness of interventions and aid in ensuring the health and wellbeing of our colleagues.

How Does It Work

- We report a quantifiable magnitude of energy (SBI) as a companion metric to TRIR and present both as trends vs data points
- By using historical data, researchers were able to quantify the typical amount of physical energy involved in different categories of injury in Joules (J)



Energy Magnitude Comparison

First Aid – 100 J

Does not require professional medical intervention. The person can immediately return to work with minor treatment.

Energy Equivalent

Apple falling from a tree and hitting you in the head

Recordable – 500 J

Requires professional medical intervention or prescription medication but the person can perform normal work duties

Energy Equivalent

A medium sized pumpkin falling from a tree and landing on you

Restricted – 750 J

Requires professional medical intervention or prescription medication, the person can work, but cannot perform all of their usual duties

Energy Equivalent

A large watermelon falling from a tree and landing on you

Lost Time – 1500 J

Requires professional medical intervention or prescription medication, the person cannot perform any of their usual duties

Energy Equivalent

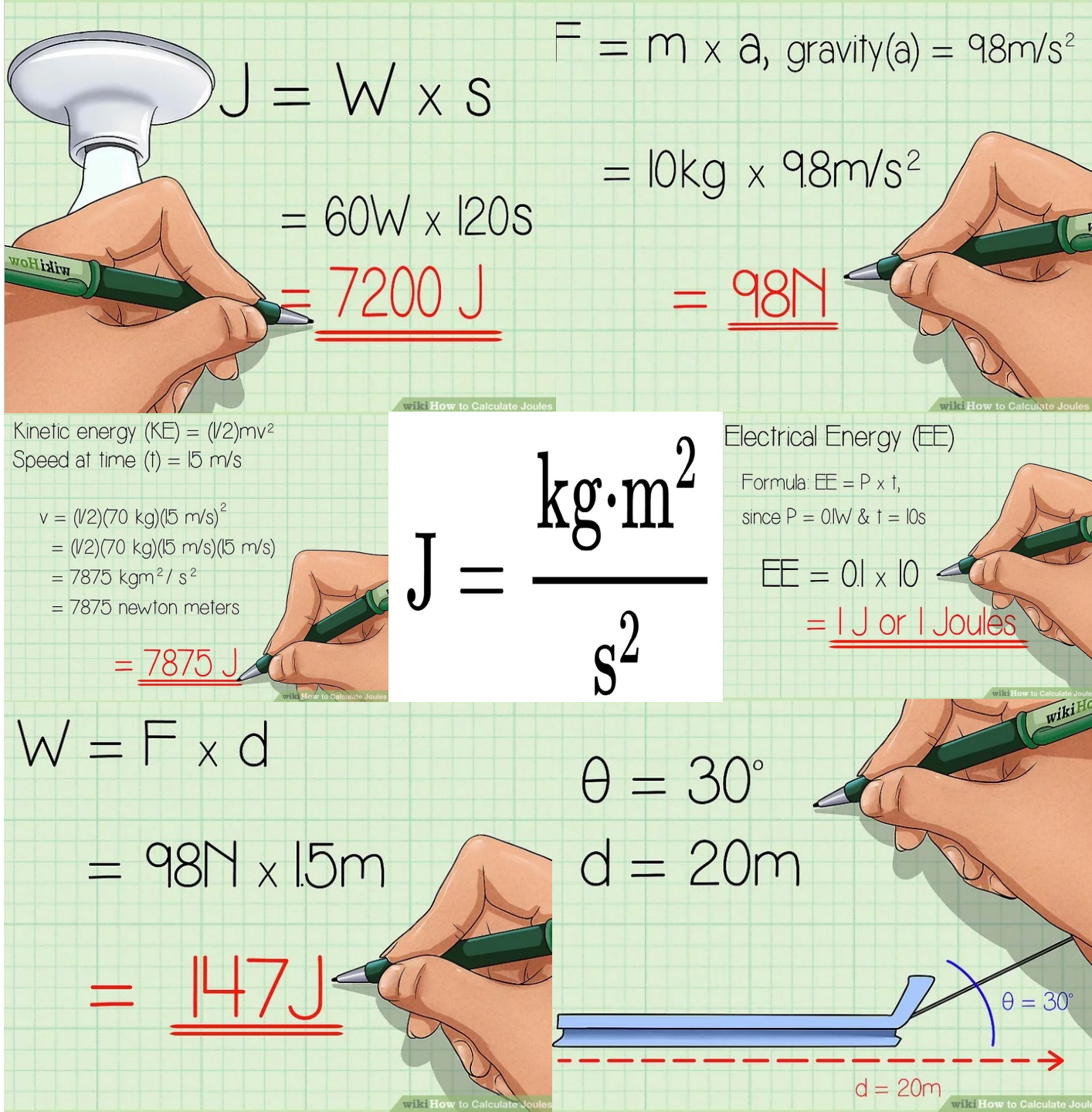
A honey badger falling from a tree and landing on you

Actual Energy

- For many incident, including Serious Injury Fatality (SIF) or potential Serious Injury Fatality (SIF) incidents, an actual energy value can be calculated with simple physics equations.
- Energy Calculators can be easily built in Excel or found online.

- Examples include:

  - Falling Objects
  - Equipment Strikes/Collisions
  - Rotating Machinery
  - Slips/Trips/Falls
  - Fall Protection PPE Deployment
  - Struck-By
  - Electrical/Arc Flash

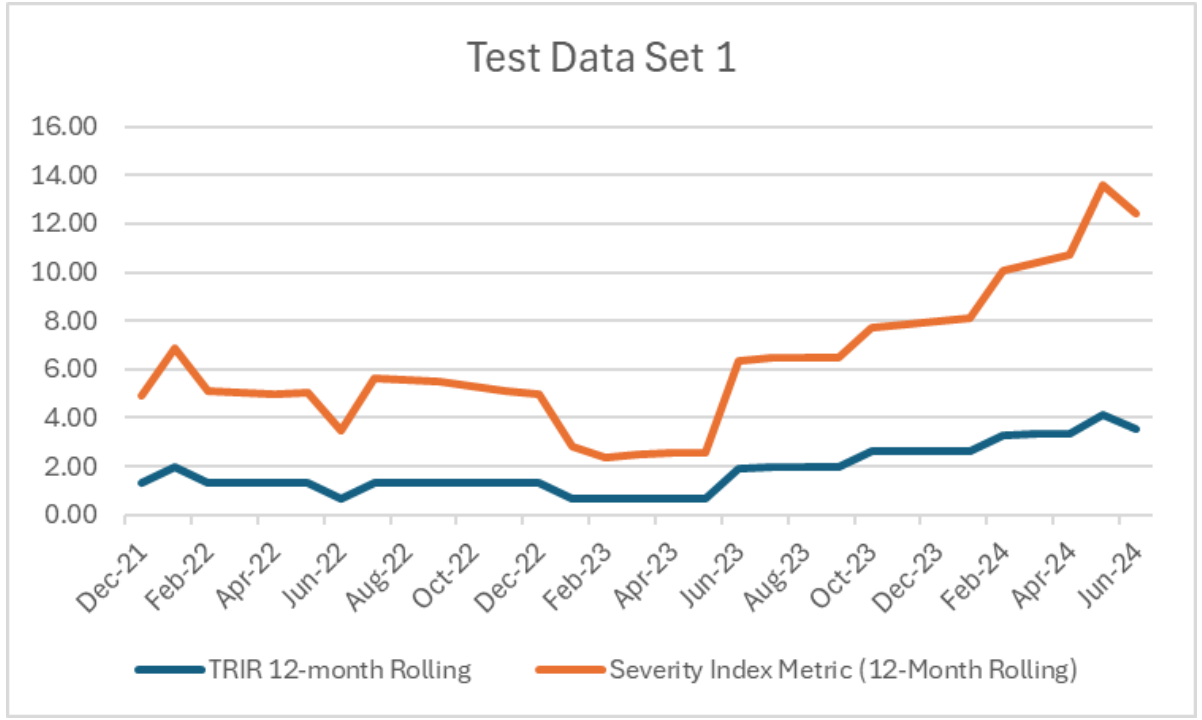


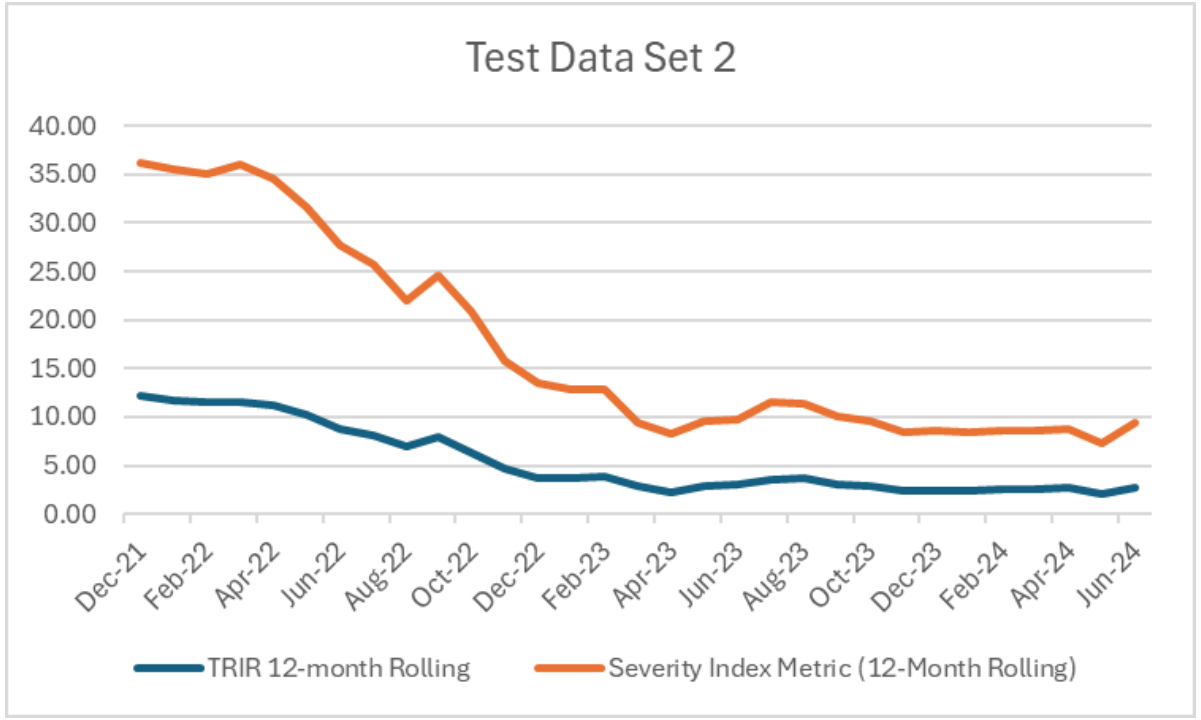
What does that look like in practice?

	Count	Severity Factor	Score			
First Aid	5	100	500			
Recordable	2	500	1000			
Restricted	1	750	750			
Lost Time	2	1500	3000			
pSIF	1	1500	1500	OR actual incident energy		
		SUM	6750			
Scalar Factor		Score Sum		Worked Hours		Severity Based Index (SBI)
200	X	6750	/	50000	=	27

Note: The severity factors are not arbitrarily selected values. The comes from analysis of a large data set of events that resulted in injuries

Sample Report





What does this tell us?

- Notice that SBI and TRIR track closely, though the scalar factor puts it higher on the scale for the purpose of visual clarity.
- What the SBI tells us is the severity of incidents that each site is experiencing and the trends in severity.
- SBI also accounts for First Aid and pSIF incidents that are not incorporated into the TRIR

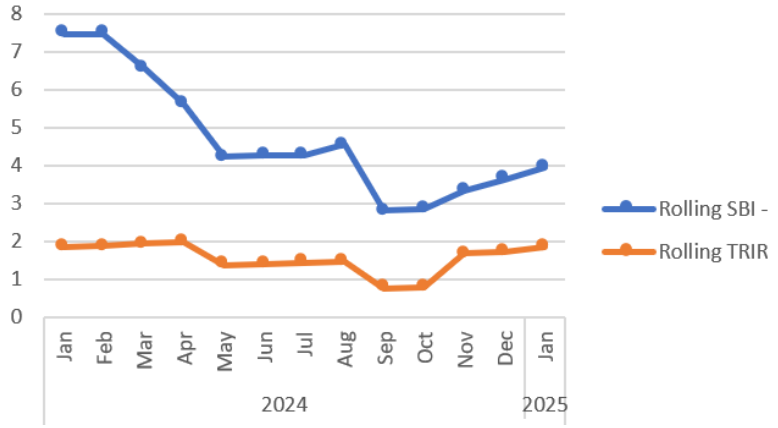
Lagging EHS Metrics Evolution

Past

YTD/Rolling Yr	Site A	Site B
First Aid Cases - YTD	15	5
Total Recordable Incidents - YTD	1	2
Lost Time Incidents - YTD	2	0
TRIR -YTD	7.2	2.4
Rolling 12 Month TRIR	2.6	0.9

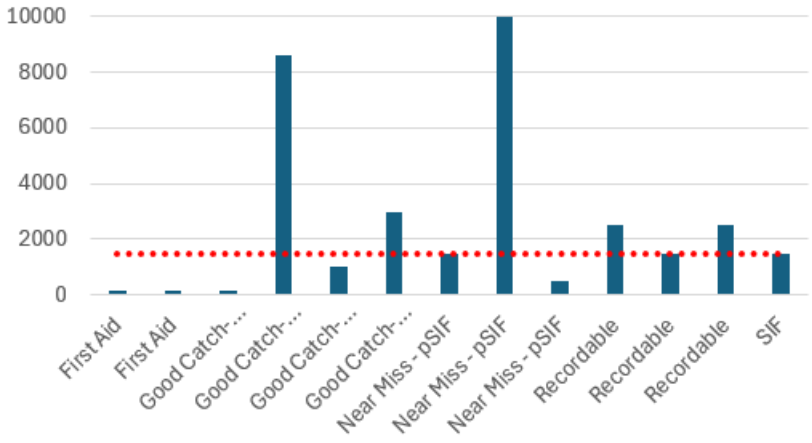
- Almost all counts, limited severity differentiation
- Data is only counts by incident type and weighted rates
- Rates are in statistical noise range
- YTD resets annually

Current



- Incident Severity is quantified
- Severity level based on typical incident energy by incident type
- Trending over time available
- All previous metrics still available

Current



- All previous metrics still available
- Precursor situations included
- Wherever possible, actual incident energy calculated
- Can identify SIF level precursors
- *Closing Precursors/Remaining

Telling a Safety Story

Some Past Systems

- "We had a near miss today. A fork truck hit a wall across a pedestrian walkway where we didn't have a guard rail. "
- Might be reported as a Near Miss and not investigated because no-one was injured.
- Hopefully, additional guardrail is installed.
- Hopefully, pedestrian/PIV interaction points get updated risk assessments.

With SBI and SIF/pSIF Concept

- "We had a pSIF today. A fork truck hit a wall across a pedestrian walkway where we didn't have a guard rail. "
- Energy (J) = ½ * PIV Mass (4000kg) * PIV Velocity (5mph or 2.2m/s) ^2=

9680J or over 6x our SIF threshold!!!

- Time for a thorough root cause analysis
- Mostly likely time to install more guard rail and update our risk assessments

Thank You

Questions?

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