Transformative Safety: AI-Powered High-Risk Injury Prevention for Electrical Contractors
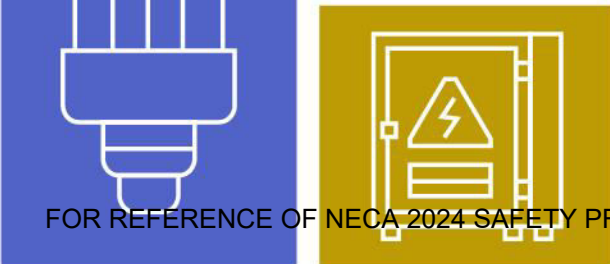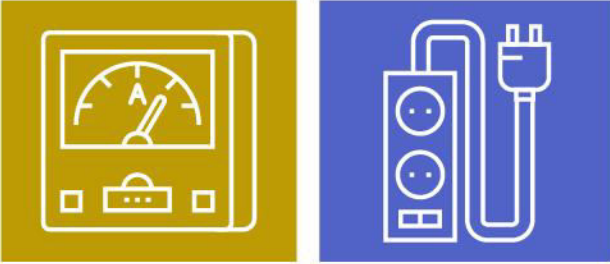
Brent Bowers and Barry Nelson

Agenda

- Introductions and Background

- Balancing Field Engagement Observation Quality

- AI/NLP Provides A New Lens to Think About Observation Quality

- Examples and Discussion

Brent Bowers
## Corporate Safety Manager
Cupertino Electric, Inc (CEI)

- 16 years of experience in electrical safety

- Passionate about transforming workplace safety through education and technology.

- Centered on engaging teams at all levels, enhancing communication, and empowering their people to anticipate and mitigate risks before they occur.

- Manage the development, maintenance, implementation, and continuous improvement of Safety Policies and Procedures throughout the organization.

Barry Nelson
FactorLab
CEO
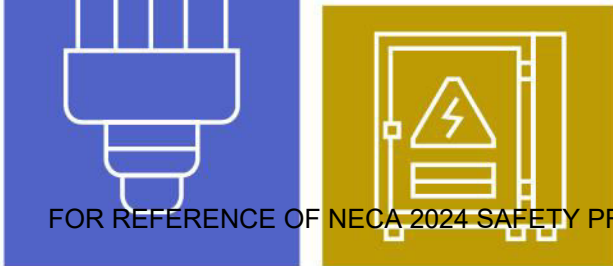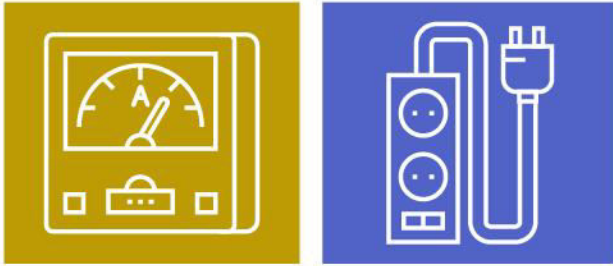
- >20 years of experience at the intersection of incident prevention and technology

- Helped hundreds of organizations significantly reduce accidents and injuries in the workplace.

- SmartTagIt - used by craft employees over a million times on the past twelve months

Cupertino Electric, Inc (CEI)

- >3400 Craft Employees

- 79+ Safety Professionals across the nation

- Complex projects- commercial, biotech, data center, education, hospitality, solar, transmission and distribution…

- Award Winning Safety Team

What is an At- Risk Observation?

Brent's Challenges

- Maintaining High Impact Engagement With Highly Distributed Workforce

- Maximize Insights From 70,000 Field Observations

- Find New Ways to Better Align Safety and Operations

Total Engagement Report
Cumulative Activity Trend- Line Chart

⚙ ⋮

Total: 73,799

73,799 at Risk Observations

80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0

Apr   Jul   Oct   2019   Apr   Jul   Oct   2020   Apr   Jul   Oct   2021   Apr   Jul   Oct   2022   Apr   Jul   Oct   2023   Apr   Jul   Oct   2024

NSPC
NECA SAFETY PROFESSIONALS CONFERENCE

8
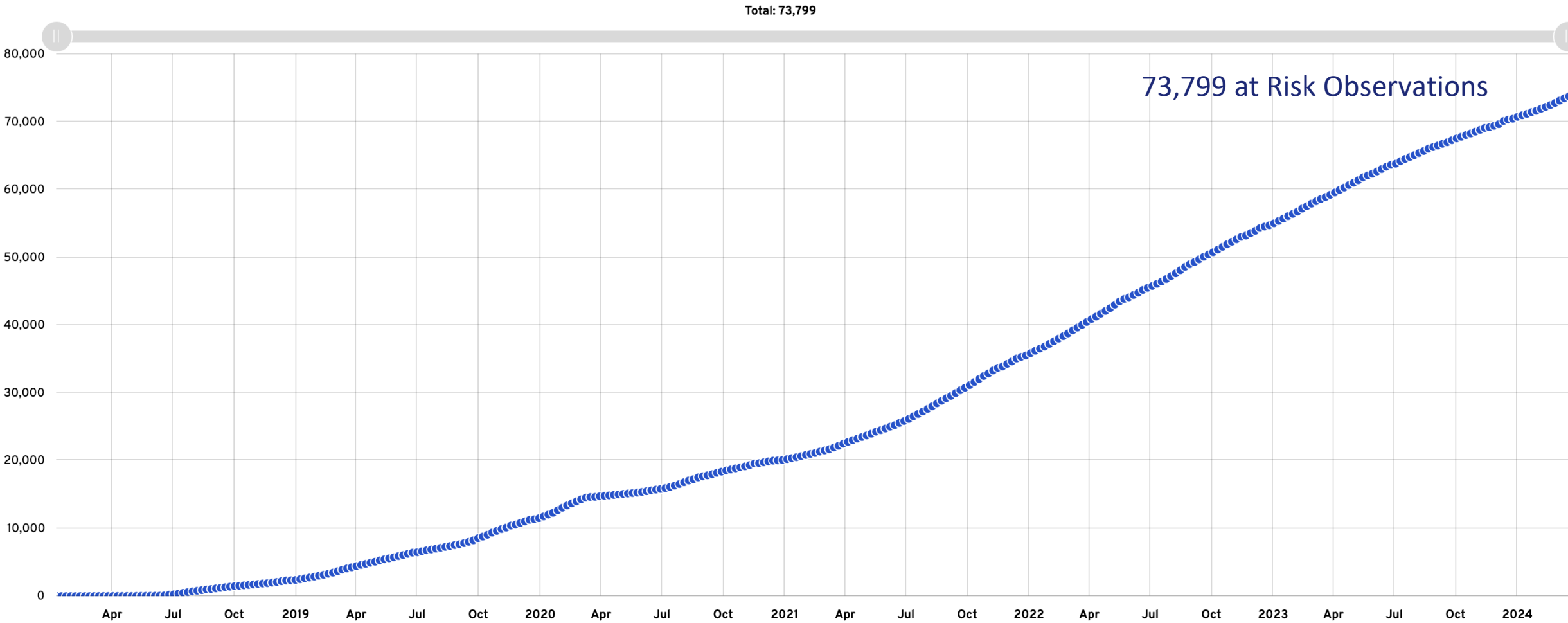
What Exactly Is the Purpose of an At-Risk Observation?

Find and Fix

Prevent Problems

Raise Awareness

Proxy Indicator of Culture and System Health

How CEI Collected 70K+ At Risk Observations

- Communicated Value of Observations

- Admitted We Could Not Do It Ourselves

- Started with Safety and Then Moved To Production

- Trained in Hazard ID

- Showing Production Value of Engagement

Questions You May Be Considering?

- Is All of the Work To Get People Engaged in Providing Observations Worth It?

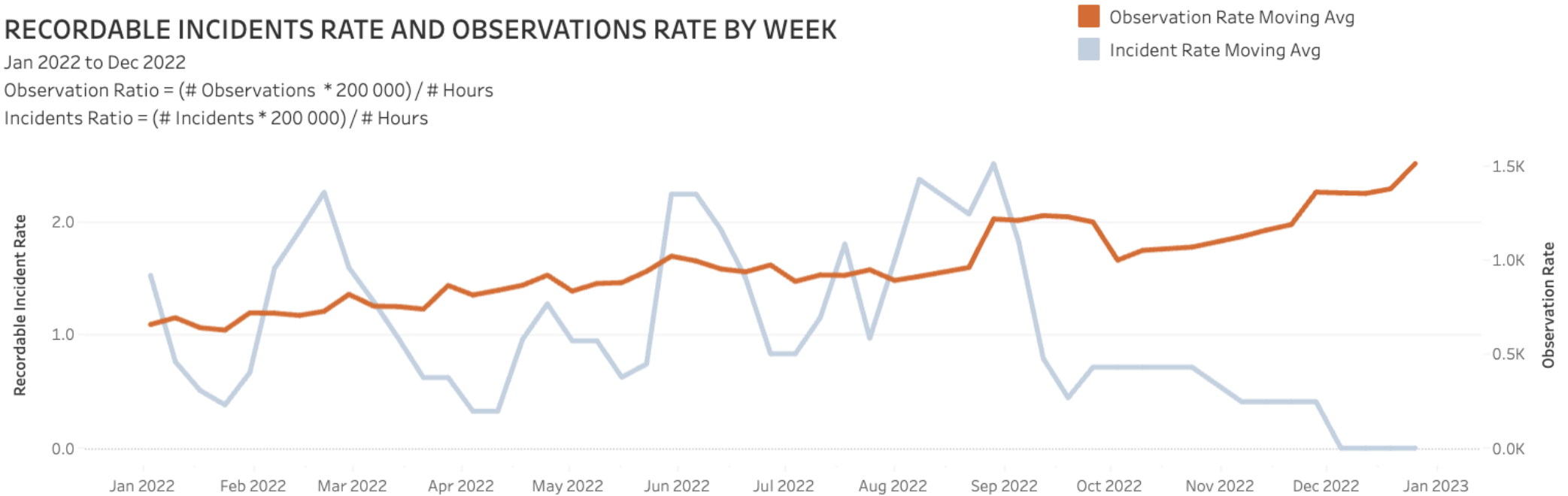- How Important is the Quality an Observation?

Engagement Can Be a Good Proxy Indicator of Leadership and Cultural State

RECORDABLE INCIDENTS RATE AND OBSERVATIONS RATE BY WEEK
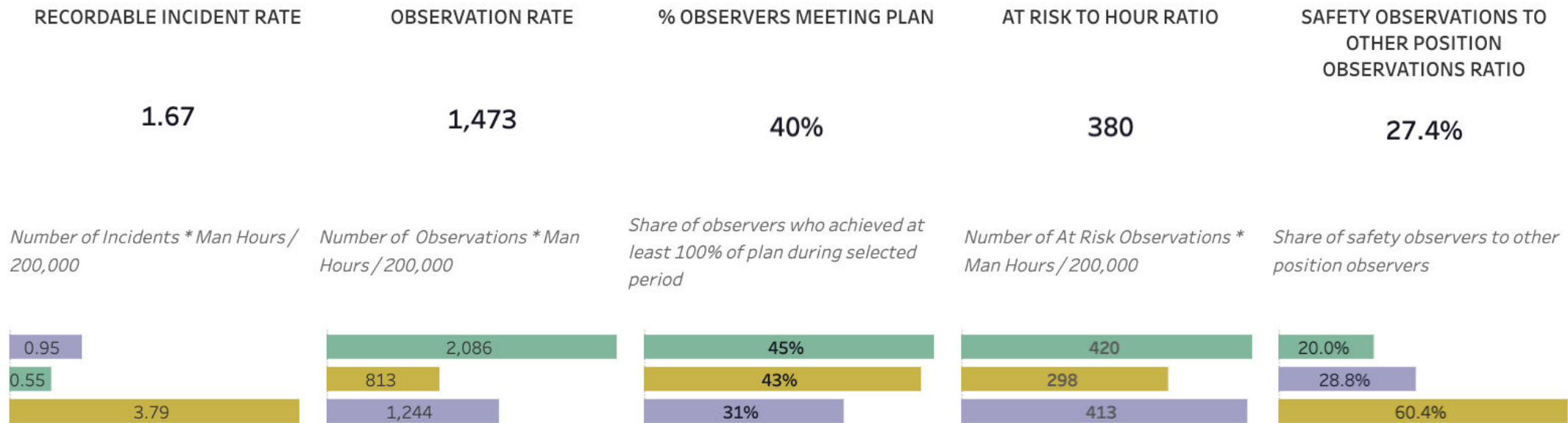
Jan 2022 to Dec 2022

Observation Ratio = (# Observations * 200 000) / # Hours

Incidents Ratio = (# Incidents * 200 000) / # Hours

Legend:
- Observation Rate Moving Avg
- Incident Rate Moving Avg

Frequency and Quality Over Time

27 Mar 2023 - 11 Mar 2024

RECORDABLE INCIDENT RATE	OBSERVATION RATE	% OBSERVERS MEETING PLAN	AT RISK TO HOUR RATIO	SAFETY OBSERVATIONS TO OTHER POSITION OBSERVATIONS RATIO
1.67	1,473	40%	380	27.4%
Number of Incidents * Man Hours / 200,000	Number of Observations * Man Hours / 200,000	Share of observers who achieved at least 100% of plan during selected period	Number of At Risk Observations * Man Hours / 200,000	Share of safety observers to other position observers

0.95	2,086	45%	420	20.0%
0.55	813	43%	298	28.8%
3.79	1,244	31%	413	60.4%

NSPC
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What is More Important Frequency or Quality?

The Tension Between Frequency and Quality

- Is There Such a Thing as A Bad Observation?

- More Field = Lower "Quality'

- More Safety Pro = Higher Quality But Lower Field Engagement

Started With Organizing By Hazard/Risks

Total: 508

■ PPE	166	■ Falls - Above 6 Feet	92	■ Contact with Electricity	89	■ Slip Trips	79	■ Housekeeping	64	■ Falling/Dropped Object	18
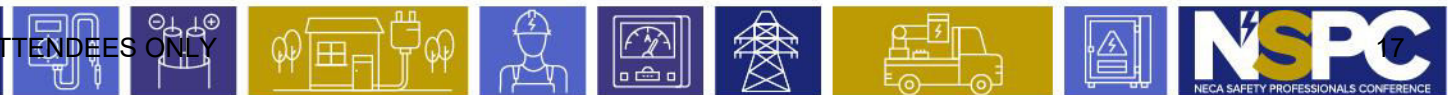
CEI Model Design- Guiding Principles

- No Such Thing as a Bad Observation

- Observations Are Different and Some Are More Useful Helpful Than Others

- Think Systems and Cultures Not Events

- This is The Beginning of Our Learning and Not the End

The Energy Wheel- University of Colorado/ Dr. Matt Hallowell
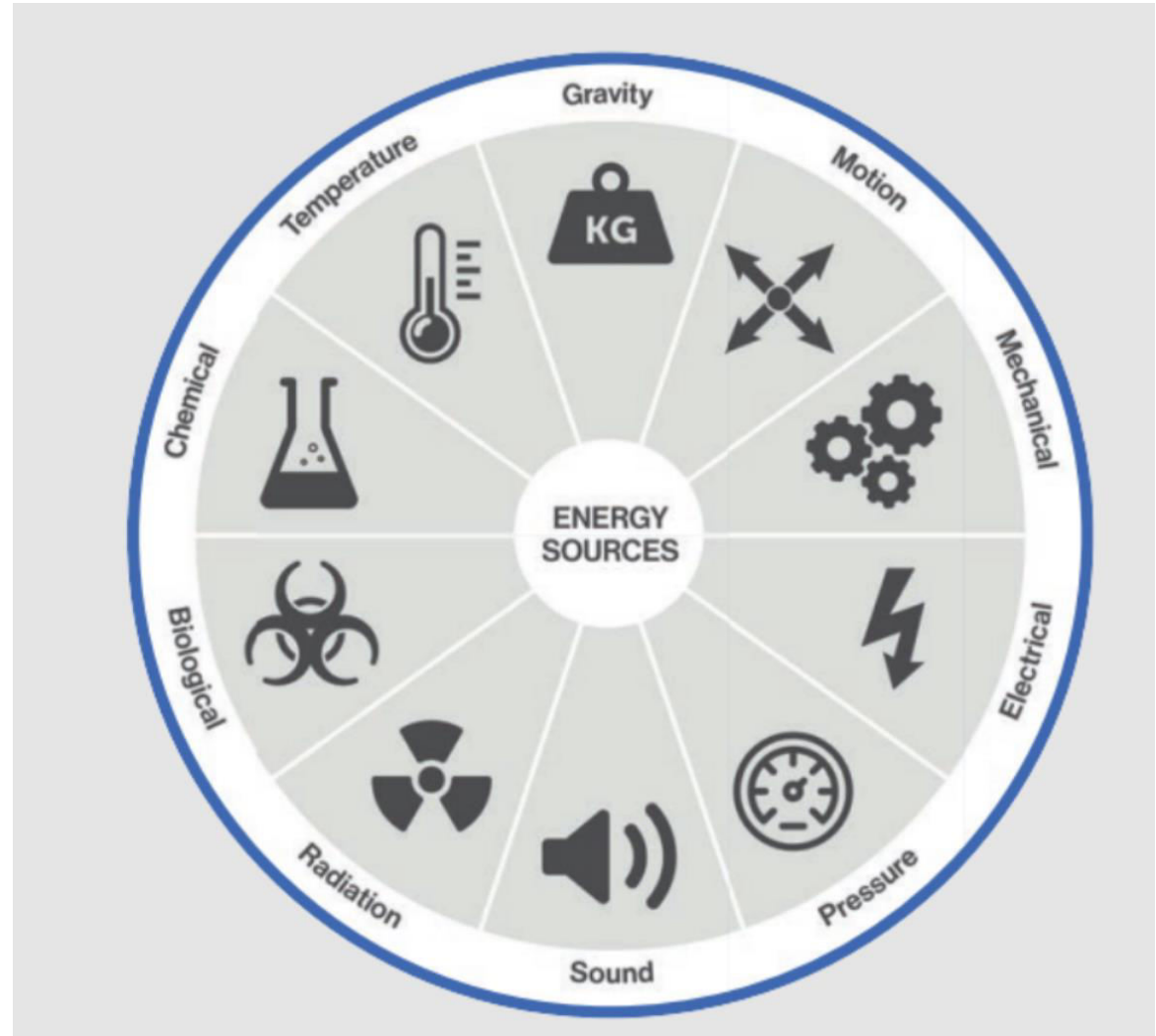
STCKY Wheel
-
Brasfield & Gorie
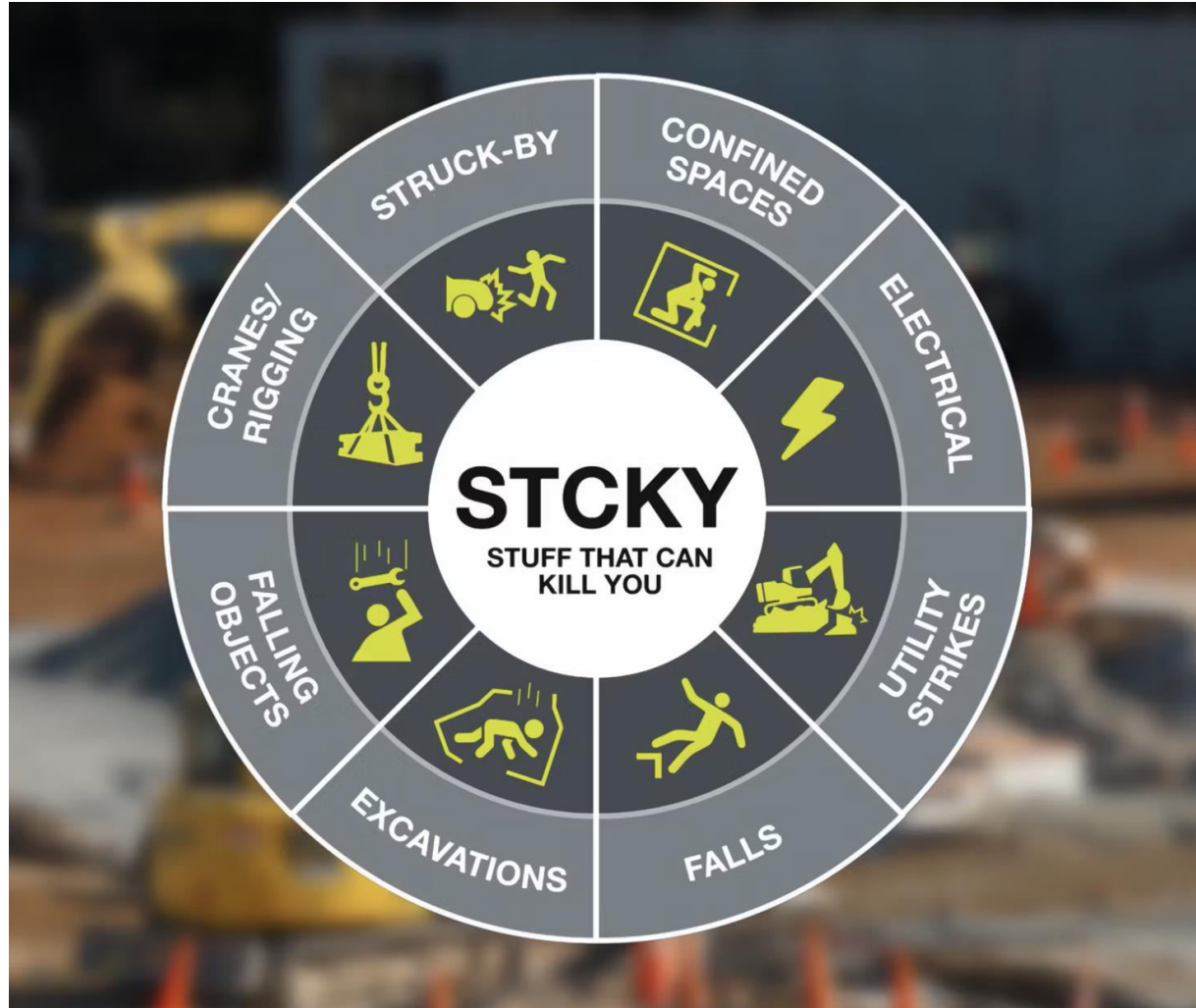
Overview of Applied AI/ML for the Natural Language of Incident Prevention

AI Transcribes and Translates Text from Audio File

Spanish to English
Speakers, Turns, Simple Features- Word Counts, Averages and Distributions

AI/ML Converts Unstructured Text Into Topics

Limited
NonSTCKY
STCKY
Better
...

Topics Are Used as Is or Merged by ML and AI into Meta Topics

STCKY Ratio
TAV Ratio

Topics and Meta Topics Are Used as Indicators or Organizing Entities

Projects
Leaders
Business Units
High Performing
Teams
Benchmarks

"Better" Examples

More Detail and Context,
Addressed either STCKY or
Non STCKY Hazard or
Behavior. The Observer
Typically Shares Some
Information That Would
Indicate Controls How This Can
Be Prevented in the Future.

Project	Position	Observer
(All)	(All)	(All)

	A three step yellow step box being used in a scissor lift. PCI working six to eight foot away and twenty foot above CEI employees. We removed ourselves from area.
RELWOOD	#siteconditionsThis is the worst I have seen this site underwater. There are areas in our work area that are under feet of water, not inches. It appears that all the water ..
RELWOOD	#scaffold #inspectionsSubcontractor crew installing CMU wall scaffold is in an area where wa..
	#carbonmonoxidedetector@Building is being closed in and unnecessary equipment still being run inside. Worse is the fact that someone from the GC mounted monitor..
NUT - VCN	#materialstorage #egressblockSevere congestion of WPI materials on penthouse 2 loading dock area forced a stop work situation for CEI receiver. Safety intervention ..
NUT - VCN	#scissorliftsafetyCEI operator using a scissor lift without chain in position. Coached and corrected in DH C of VCN 2.
ORKS-SCOPE 3	#grinding paint off of pipe by a non-CEI worker was creating dust in our work area. I asked the worker to get a vacuum and he said he would get a fan with an exhaust du..
	#impalementBESS trailer removed and impalement hazards left behind. Insolent haza..
	#fall ... fall p...
R	#SP... good job clearing a small walking path and identifying it with markers.
R	#speedlimitsignThe wind blew over the speed limit sign . I put it back up.
ESS	#damagetotrailerOne of our pony trailers showed up with a damaged landing jack. New jack is on order and will be installed.
GISTICENTER	#stuck in mudYou thought he could take a shortcut to get to where he needed to be. Still, there was a giant mud puddle in between him and the area he was trying to wo..
GISTICENTER	#mudThe job site was not prepared for the heavy rain. There's a huge mud pit on each side of the building. If you're not careful, you'll get stuck in the mud. My crew has be..
V	#theft #jobsite_breakin #thieves #tweekersNoticed this morning the GC trailer was

Project: PROXIMA BESS
Observer: George Alves
Answer: **#impalementBESS trailer removed and impalement hazards left behind. Insolent hazards covered with delineation and plastic barrier.**

Limited Examples

Limited Detail. The Observer Did Not Share Much Information That Would Indicate Controls How This Can Be Prevent in the Future

	Project	Position	Observer
▼	(All) ▼	(All) ▼	(All) ▼

CRODUCT	#triphazard
CRODUCT	#contamination
CONUT - VCN	#unsafe #access/egress
CONUT - VCN	#handasclamp #coached
MUDA	#muddy #pathoftravel
1	#weatherRain today H 60 L 53
JV – PROJ	#cordsranacrosswalkpath
JV – PROJ	#cordoutofdate
	#CordCord not inspected
CONUT - VCN	#no grommet
CONUT - VCN	#home made tool
L	#water fallingIn core vcn 5
CONUT - VCN	#missinggroundprong
CONUT - VCN	#abandonedladder#liability
CONUT - VCN	#unsecuredpropane

STCKY Examples

Addressed STCKY
Hazard or Behavior.
Observer Shared Limited
Information That Would
Indicate Controls For
How This Can Be
Prevented in the Future.

Project	Position	Observer
(All)	(All)	(All)

Project	
IMA SOLAR	#muddy #poorsiteconditions #extractionteamEE tried to turn around an empty module truck & trailer. The ground was to soft and truck and trailer were stuck.
IMA SOLAR	#muddy #poorsiteconditions #extractionteamEE was trying to pick up a BYD module pallet & forklift became stuck.
SELL BESS	Rain and windSite foreman was using a tent to provide coverage of fiber splice equipment and splice enclosure.
ALASKA AIRLINES T1 CTN	#dangerous #laddersafteyEmcor journeyman not using the right size ladder for the job. Should b..
ON ROCK - PARCEL F)	#unsafepatho @jarod_dimau
6	#windyWindy Mitigated by s
Y HILLS-SOLAR	#RedropeareaLet's try and keep these ropes up. If have a trucking evolution using the gate regularly and rope remains down we should post an attendant..
Y HILLS-SOLAR	#rederopeareaKeep rope up if area is designated as a red rope area. Safety will make signage indicating red rope area and indicate "Rope to be Reinstall..
ANKS SOLAR	Unsatisfactory = Fixed =SatisfactoryNoticed Forklift with No Drip pan but it was in Proximity
ANKS SOLAR	SafeNoticed Grade stake cap off and put back . Entrance 16
ANKS SOLAR	SafeNoticed T post cap off No Construction Traffic Beyond this point Sign . Near Entrance 16
6	#fireA fire was started at the PCI 6 C/D expansion joint, cause is unknown at this time, further investigation will be conducted.
IMA SOLAR	Impalement hazard of iron stake without capsAll rebar stakes must have caps covered
IMA SOLAR	Road way has sink hole development in 5A15 rear passage roadway near castle houseUse caution and avoid travel unless necessary
IMA SOLAR	EE HAS A STRUT BAR ATTACHED TO FRONT BACK SUPPORT OF THE FORKS ON THE

Project: SFO ALASKA AIRLINES T1 RELOCTN
Observer: Paul Bockenkamp
Answer: #dangerous
#laddersafteyEmcor journeyman not using the right size ladder for the job. Should be using a scissor lift
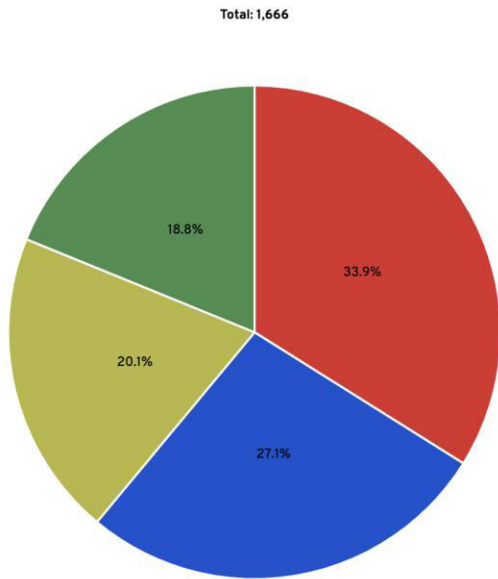
Non-STCKY

More Detail. Observer Did Not Address a STCKY Hazard, Indicate Resolution/Controls or How to Prevent in the Future

Project	Position	Observer
(All)	(All)	(All)

	Will be bringing this up to HP.
	Lack of house keeping
	Eye wash station needs resecured or repaired
AR	#JHAAlthough cal compaction did add items to their JHA for todays task, minor coaching was needed to include the addition of HOT WORK
NSAS	#exhaustBroken exhaust tube on a heater
1	#hazardmaterials #gasPainters has spilt paint on floor and solution was gasoline to clean it up, Notify safety and Ryan Company of gasoline spill on floor
AURELWOOD	#standingwaterWitnessed PGM employee walking through thigh high water. Immediately #correctedandcoached employee to take the time to walk around.
CK PRCL F-STDIO	#hanging cablesCables are hanging at eye level potentially causing someone an eye injury
CK PRCL F-STDIO	Cluttered with materialsCEI unable to work in this area due to building material clutter
	#Poorhousekeeping@Garbage cans need to be brought in where we can't get tippy dumpsters. It starts out small and then there will be an incredible mess.
ONUT - VCN	#electicalcordExtension cord missing a prong in DH C of VCN 2. Removed immediately.
ONUT - VCN	#hearing-protection #barricade&signage
AY	#walkingsurfaceThere is a great fix in one area but the rest of the walking areas are still substandard...
AY	#fireprotectionFE's still not inspected as required. @Mark_Sevieri ..
WORKS-SCOPE 3	#cords on the floor. I will speak to Foreman in charge and get cords out of the way.
	#concrete drilling without any dust mitigation. I have notified the GC safety

Simple Distribution of At-Risk Ratios With Details

TAV Ratio Definition

- Trust
- Ability
- Value

TAV Ratio = (STCKY + Better/ Total At Risk)

Benchmarking Known High Quality Experts

	Limited Detail	% Limited Detail	# Non-STCKY Hazard	% Non-STCKY Hazard	# STCKY Hazard	% STCKY Hazard	# Better Observation	% Better Observations	TAV Ratio
	1,778	4.1%	24,674	57.4%	7,445	17.3%	9,103	21.2%	38.5%

	# Observations	# Limited Detail	% Limited Detail	# Non-STCKY Hazard	% Non-STCKY Hazard	# STCKY Hazard	% STCKY Hazard	# Better Observation	% Better Observations	TAV Ratio
Painter, E..	1,027	0	0.0%	495	48.2%	120	11.7%	412	40.1%	51.8%
Detlor	1,026	7	0.7%	338	32.9%	210	20.5%	471	45.9%	66.4%
McCowen	932	0	0.0%	298	32.0%	140	15.0%	494	53.0%	68.0%
rtinez, CS..	921	0	0.0%	565	61.3%	241	26.2%	115	12.5%	38.7%
t Bringhur..	855	10	1.2%	415	48.5%	170	19.9%	260	30.4%	50.3%
earcy	832	3	0.4%	261	31.4%	126	15.1%	442	53.1%	68.3%
undberg	627	1	0.2%	427	68.1%	184	29.3%	15	2.4%	31.7%
Murray	550	171	31.1%	297	54.0%	74	13.5%	8	1.5%	14.9%
s Hinkle	543	5	0.9%	397	73.1%	105	19.3%	36	6.6%	26.0%
athews	523	0	0.0%	237	45.3%	203	38.8%	83	15.9%	54.7%
lcott	489	0	0.0%	269	55.0%	99	20.2%	121	24.7%	45.0%
tto	482	0	0.0%	152	31.5%	62	12.9%	268	55.6%	68.5%
es	454	4	0.9%	191	42.1%	104	22.9%	155	34.1%	57.0%
oberts	449	0	0.0%	329	73.3%	41	9.1%	79	17.6%	26.7%
Norris, CH..	428	0	0.0%	149	34.8%	87	20.3%	192	44.9%	65.2%
cCracken	390	11	2.8%	158	40.5%	53	13.6%	168	43.1%	56.7%
Dodson	386	30	7.8%	248	64.2%	72	18.7%	36	9.3%	28.0%
onzález-R..	382	1	0.3%	164	42.9%	60	15.7%	157	41.1%	56.8%
Loftus	379	1	0.3%	218	57.5%	98	25.9%	62	16.4%	42.2%

Benchmarking Ratios Across Business Units

	# Limited Detail	% Limited Detail	# Non-STCKY Hazard	% Non-STCKY Hazard	# STCKY Hazard	% STCKY Hazard	# Better Observation	% Better Observations	TAV Ratio
0	2,670	4.6%	33,323	57.3%	10,151	17.5%	11,976	20.6%	38.1%

	# Observations	# Limited Detail	% Limited Detail	# Non-STCKY Hazard	% Non-STCKY Hazard	# STCKY Hazard	% STCKY Hazard	# Better Observation	% Better Observations	TAV Ratio
	35,602	2,038	5.7%	20,877	58.6%	6,092	17.1%	6,595	18.5%	35.6%
	7,035	93	1.3%	4,170	59.3%	1,062	15.1%	1,710	24.3%	39.4%
	5,393	169	3.1%	2,792	51.8%	1,098	20.4%	1,334	24.7%	45.1%
	4,207	85	2.0%	2,257	53.6%	919	21.8%	946	22.5%	44.3%
G	2,438	101	4.1%	1,143	46.9%	351	14.4%	843	34.6%	49.0%
ll	2,208	94	4.3%	1,358	61.5%	350	15.9%	406	18.4%	34.2%
A	981	80	8.2%	571	58.2%	227	23.1%	103	10.5%	33.6%
OD	256	10	3.9%	155	60.5%	52	20.3%	39	15.2%	35.5%

Using Outcomes and Known Experience To Understand Expectations Over the Life of A Project
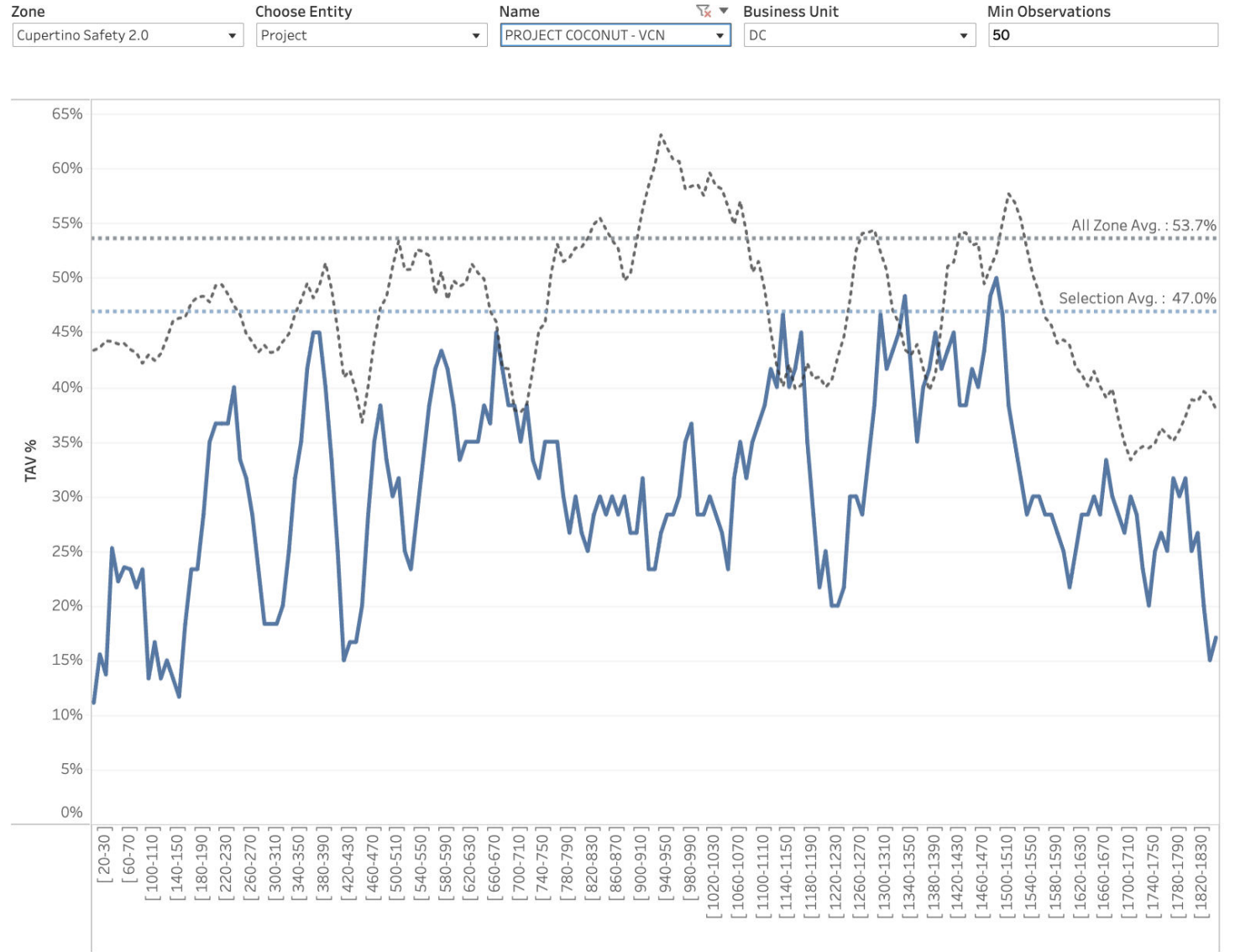
Frequency and Ratios of Classifications Over Time
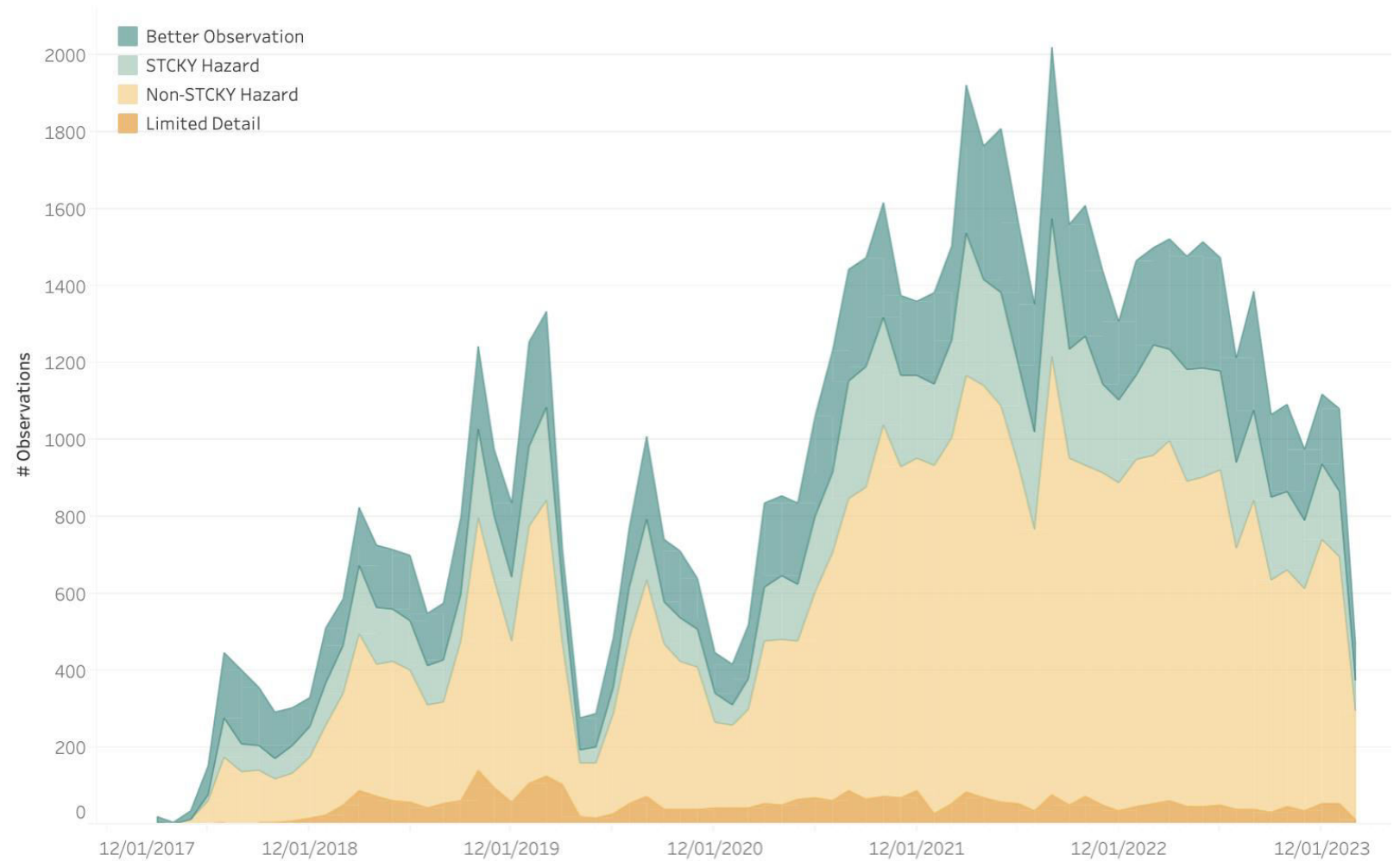
Focus on Outliers Above and Below Type of Work Benchmark

Multiple Data Center Projects with >100 Observations

TAV Ratio

Label	TAV Ratio
NAO 5/6	46.9%
E	39.3%
T PCI 1&2	36.0%
ON EAST	34.5%
HASE	34.2%
1-5 EC	32.8%
VCN	32.8%
OJ MORGAN	29.9%

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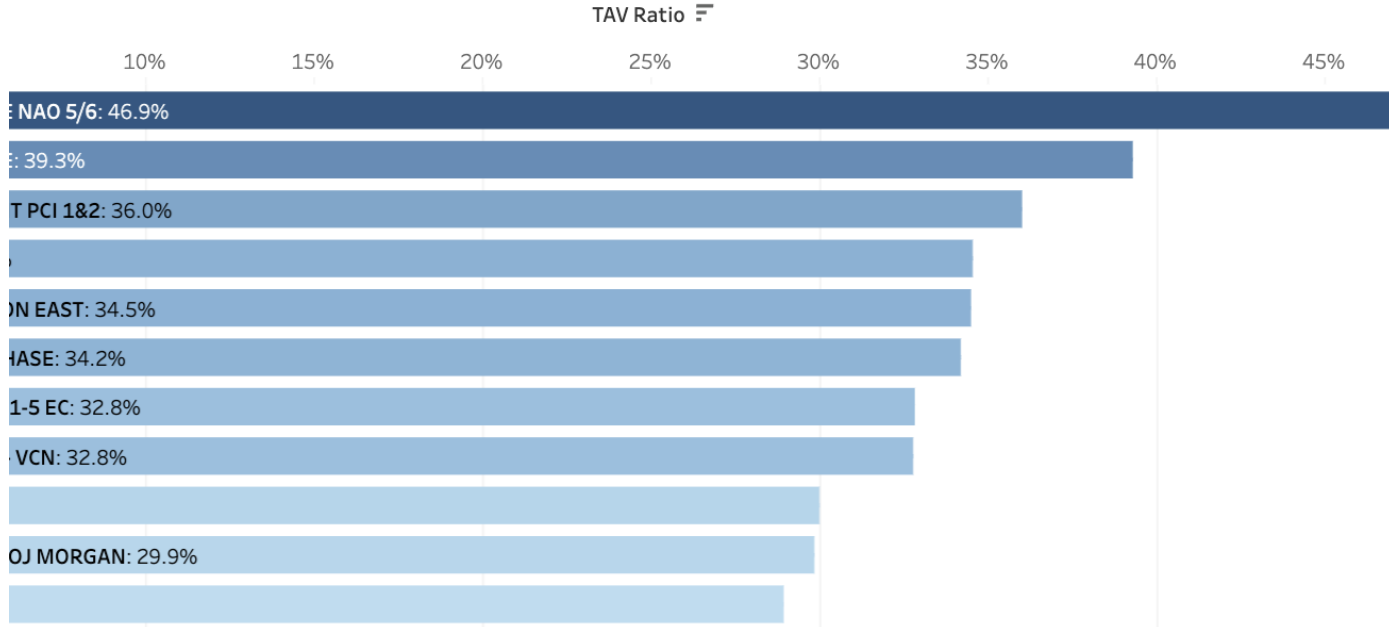
Focus on Outliers Above and Below Type of Work Benchmark

Multiple Non-Data Center Projects with >100 Observations

TAV Ratio

Project	TAV Ratio
SCHOOL-BID 1069	100.0%
GMP 3	60.7%
KS-SCOPE 3	58.3%
STRUCTION	56.6%
EY FAIR EXPANSN	53.7%
ROLLUP-LV	51.2%
OUT	50.0%
CAL CAMPUS	50.0%
STON EAST	44.4%
RICAL	35.3%
UNION	27.3%
TRCTN PWR-W BAY	9.1%
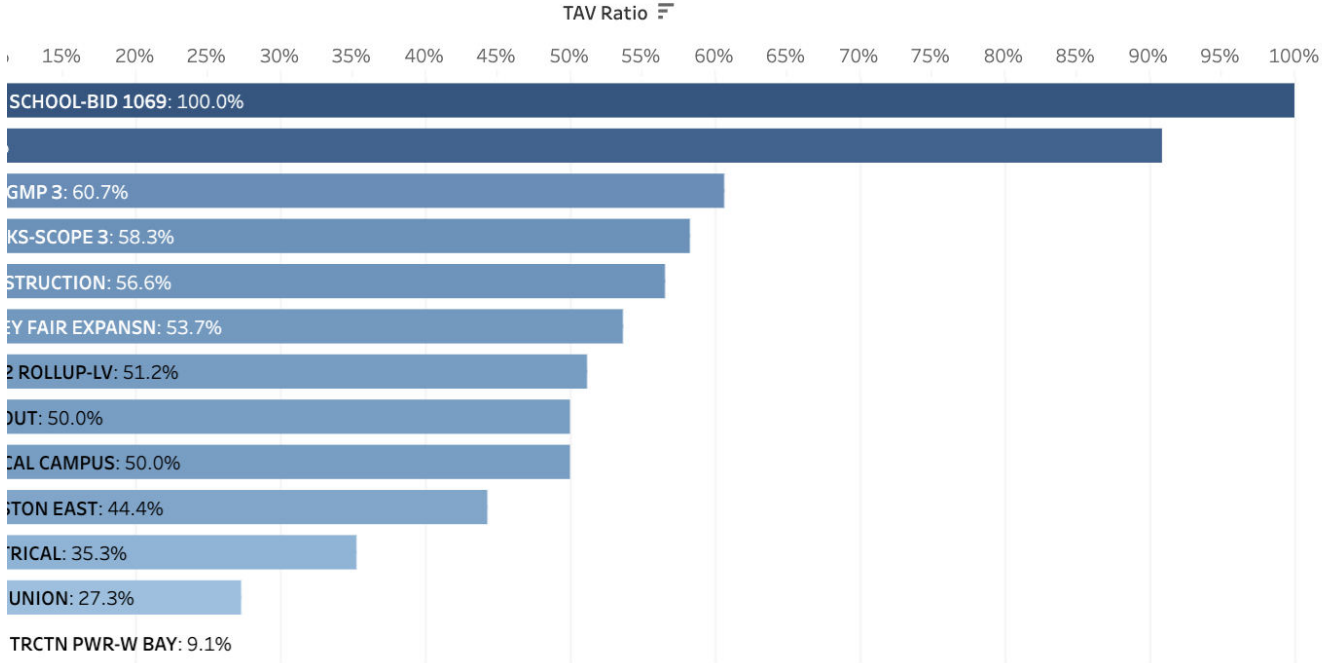
Conclusion and Discussion

- Frequency and Engagement Do Matter

- AI/ML Are Giving us a New Way to Look at Quality and Leaders

- Use These New Metrics to Understand What "Good" Means to You and Focus Your Efforts

Let's Continue the Conversation

LinkedIn

FactorLab.com

Thank You

brent_bowers@cei.com

barryn@factorlab.com

Please complete the Online Evaluation

https://www.surveymonkey.com/r/2024NationalSafetyProfessionalsConference

Back Up- Benchmark- Anecdote

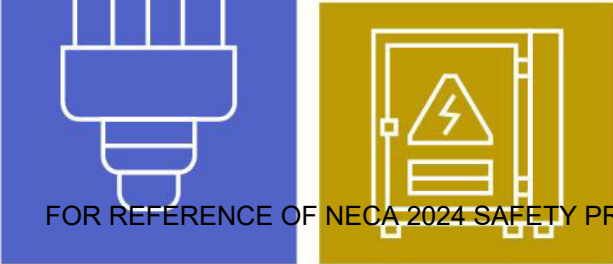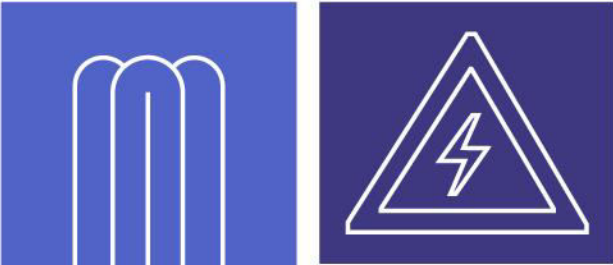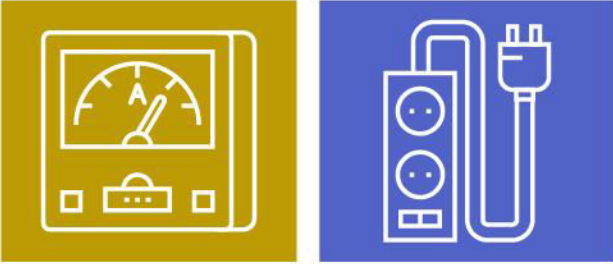| RECORDABLE INCIDENT RATE	OBSERVATION RATE	% OBSERVERS MEETING PLAN	AT RISK TO HOUR RATIO	SAFETY PROS AT RISK OBSERVATIONS TO OPERATIONAL TEAMS AT RISK..
0.94	703.8	60%	325	10.7%
Number of Incidents * Man Hours / 200,000	Number of Observations * Man Hours / 200,000	Share of observers who achieved at least 100% of plan during selected period	Number of At Risk Observations * Man Hours / 200,000	Percentage of At Risk Observations Collected by Safety Professionals vs Operational Teams

0.80	938	60%	471	10.7%
0.92	295	54%	85	17.1%
1.70	448	67%	364	31.7%
1.33	558	63%	165	14.0%
0.56	837	62%	438	5.1%

27 Mar 2023 - 11 Mar 2024

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