NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Analysis of Human vs Organizational Performance in the ERO Event Analysis Process

Human and Organizational Performance Webinar
November 9, 2023

RELIABILITY | RESILIENCE | SECURITY



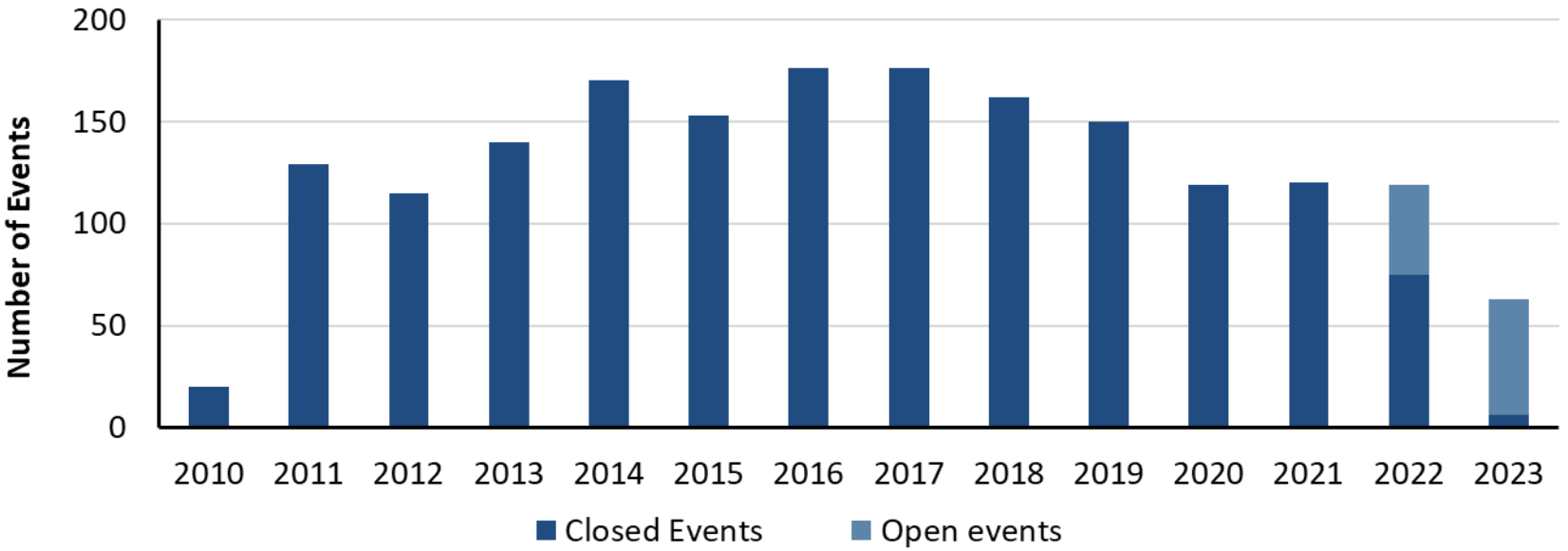

Data Source

- ERO Event Analysis Program (EAP)
  - A program that reviews a subset of incidents (categorized events) that occur on the bulk power system.
  - Requires industry participation and support to be effective.
  - Used to develop Lessons Learned, which are published on the NERC website.
  - Data is used to identify trends of how and why events occur and identify common themes
  - Trends are identified by cause codes that include the following:

A1 – Engineering and Design	A2 – Equipment and Material
A3 – Human Performance	A4 – Management and Organization
A5 – Communication	A6 – Training
A7 – Other	AX – Overall Configuration
AN – No cause found	AZ – Information to determine cause LTA

Event numbers

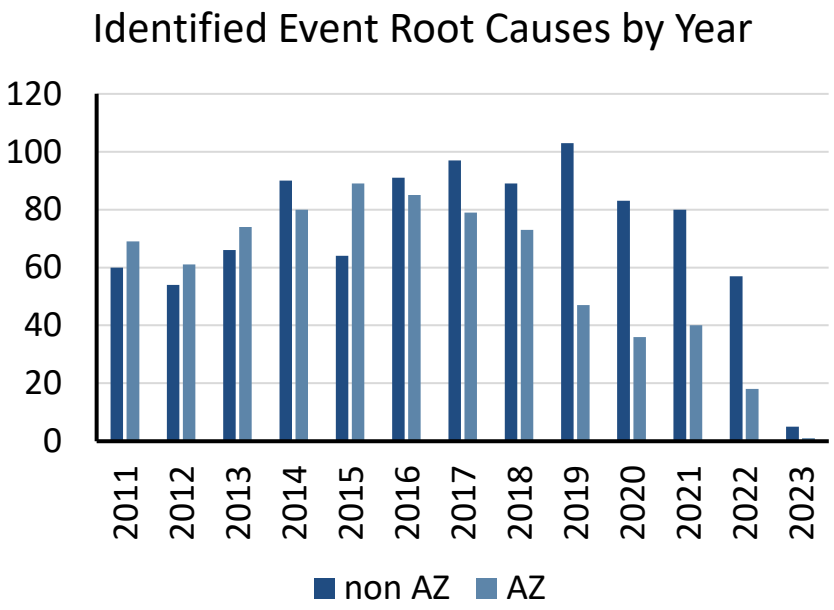
- 1,812 unique qualified events
- 1,711 have been reviewed and closed (have codes applied to them) 948 of them have a root cause identified.
- Recent trend is 115–140 events per year or approx. 2.3 per week

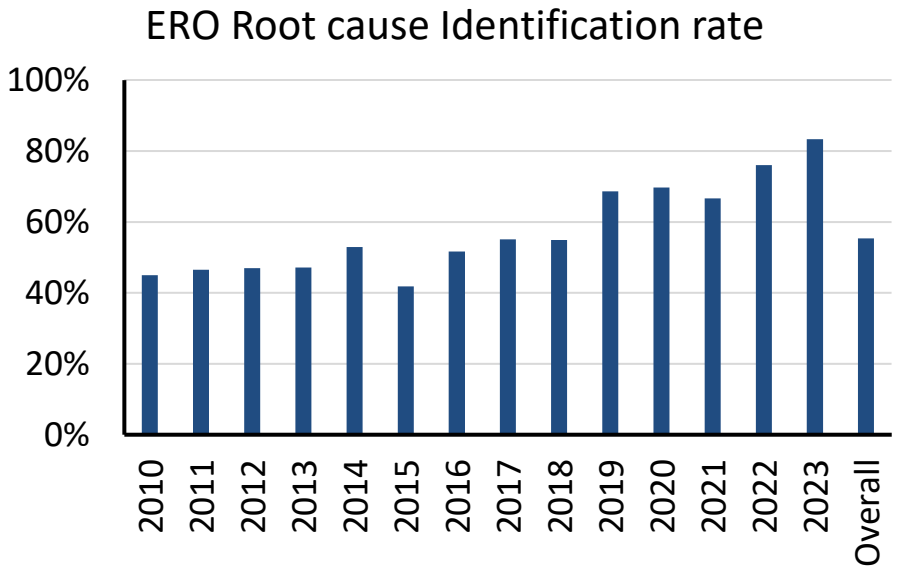


*Data as of 8/14/2023

Root Cause Identification Rate

- Root cause identification continues to improve
- Overall average is 55.4%
- 2017–2021 (rolling average of last 5 completed years) is 62.2%





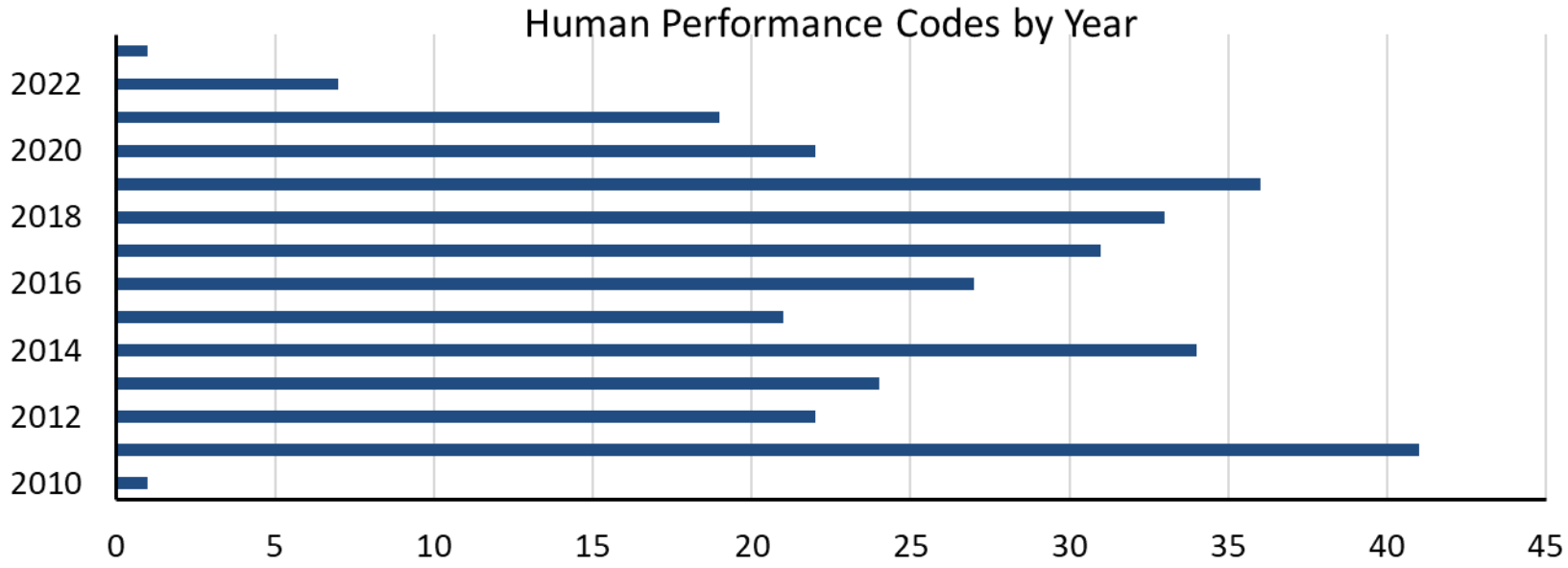
**AZ Codes represent when a specific correctable/actionable root cause cannot be determined for an event*

Human Performance vs Organizational Performance

- Human Performance refers to individual human performance
  - A substitution test would show different results, excluding the operating environment from influencing individual action
- Organizational Performance refers to practices, policies, team work, and procedures, management decisions, etc.
  - Substitution test would show similar result indicting the operating environment leading the individual to action

Human Performance Issues

- Human Performance has been identified as a contributing factor 319 times
- Average of ~28 events per year
- So more than once every other week, someone is making a mistake with consequences for the grid



Types of Human Error*

- Skill-Based Mode
- Rule-Based Mode
- Knowledge-Based mode
- Work Practices Error** (This is when a person can't perform the task or deliberately causes an error.)

* Based on Rasmussen's model

** Not Based on Rasmussen's model

Skill Based Mode

- Skill-Based Mode–associated with highly practiced actions in a familiar situation
- Examples:
  - Making your daily commute on a nice day
  - Cooking your favorite weekday meal
  - Changing a lightbulb in your ceiling fan
  - Calling your children by name
  - Reciting the Alphabet
  - Tiger Woods playing golf
- Main error driver–Distraction
- Error Rate 1:10,000

Rule Based Mode

- Rule Based Mode – based on selection of stored rules derived from one's recognition of the situation.
- Examples:
  - Using a GPS system to direct you to your sister's new house in another state
  - Changing the lightbulb in your microwave
  - Using Order of Operations in math $(\frac{(2+6)*\frac{4^2}{2}}{8})$
  - Reciting the alphabet backwards
- Main error driver – incorrectly identified the problem
- Error Rate 1:1,000

Knowledge Based Mode

- Knowledge-Based Mode–Behavior based on unfamiliarity, so individuals must rely on experience, perceptions, and perspectives
- Examples:
  - Playing a musical instrument for the first time.
  - Driving for the first time
  - Cooking Thanksgiving dinner for the first time
  - Reciting the Greek alphabet
- Main Error Driver–Lack of a good mental model
- Error Rate 1:2

HP codes – Top 5

Out of 319 times a human performance code was identified, the top five codes were:

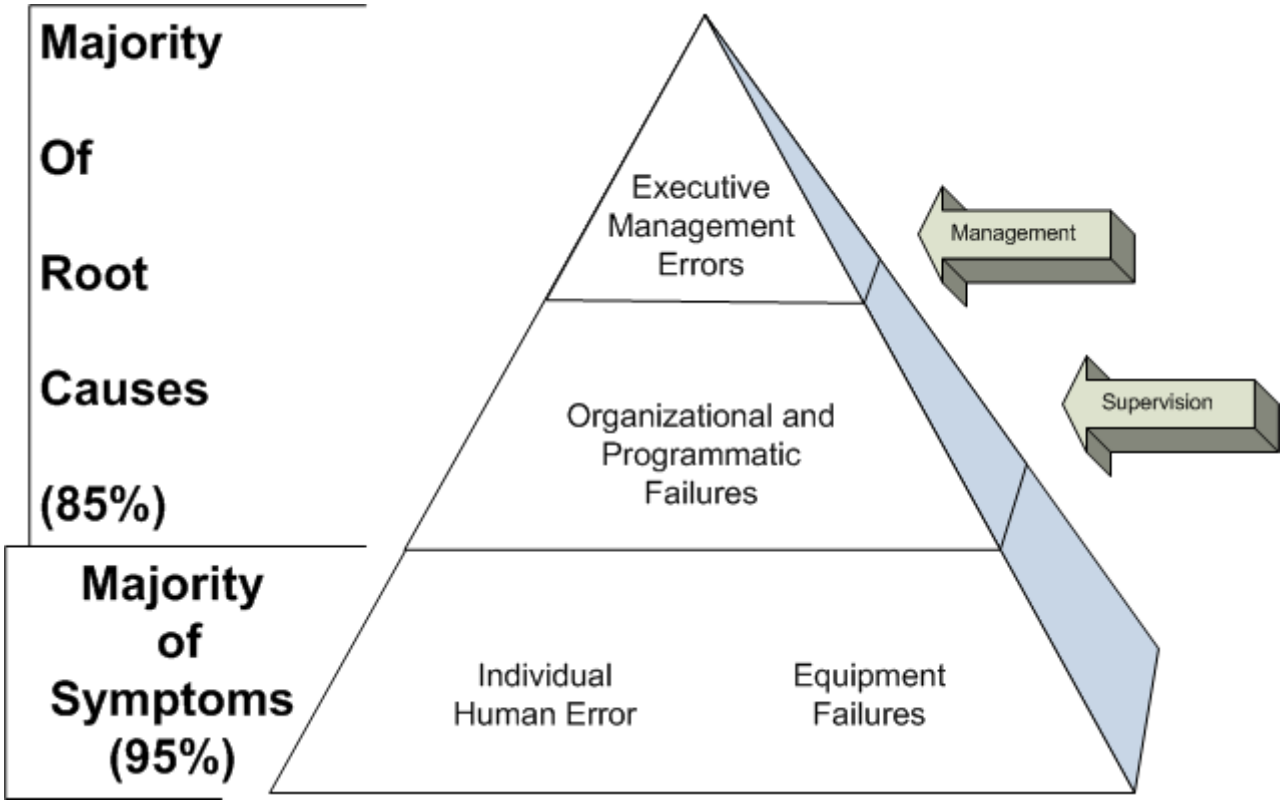
- A3B1C01–Check of work Less than Adequate (LTA) (70 times)
- A3–Individual Human Performance (33 times)
- A3B1C03–Incorrect performance due to mental lapse (26 times)
- A3B2C05–Situation incorrectly identified or represented resulting in wrong rule used (24 times)
- A3B1–Skill Based Error (23 times)

Where are the problems

- Skill-Based Error (175 times)
- Rule-Based Error (67 times)
- Knowledge-Based Error (41 times)
- Unknown mode (33 times)
- Work Practices Error (3 times)

So, is it just the Human?

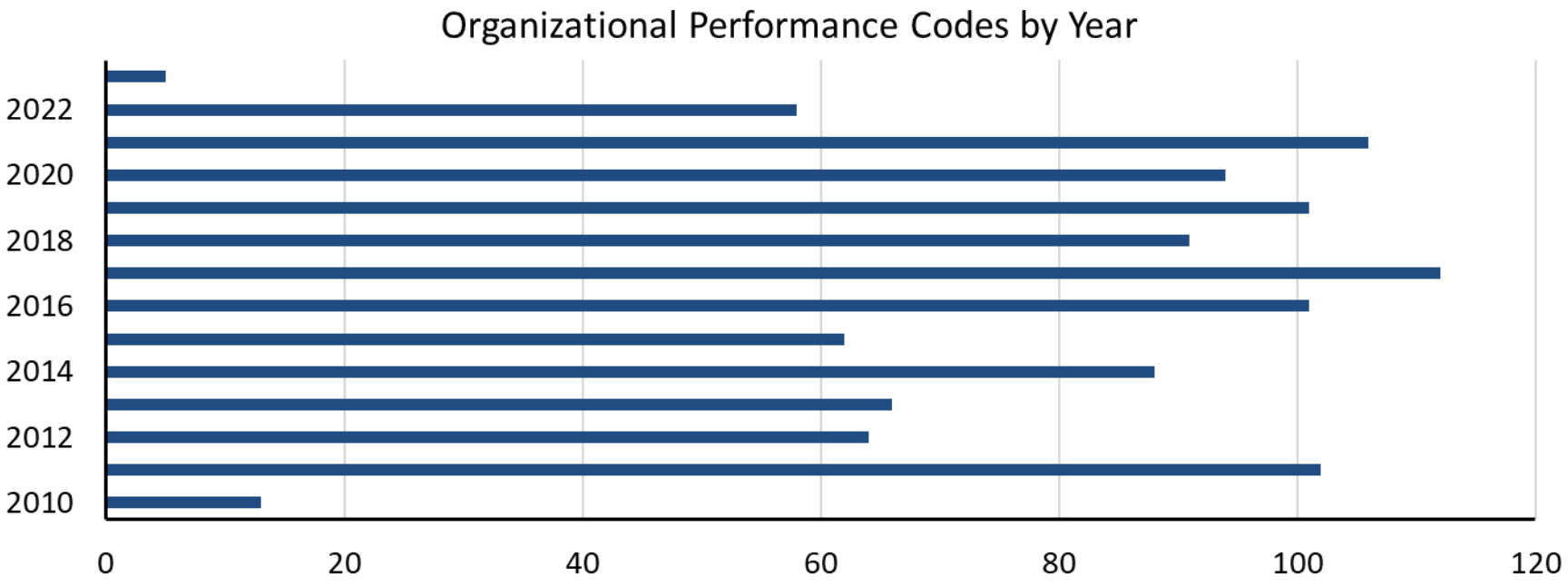
What do others see?



The PII Performance Pyramid ™

Organizational Performance Issues

- Organizational Performance has been identified as a contributing factor 1,063 times
- Average of ~90 events per year
- This is over 3x the rate of Individual Human Performance issues



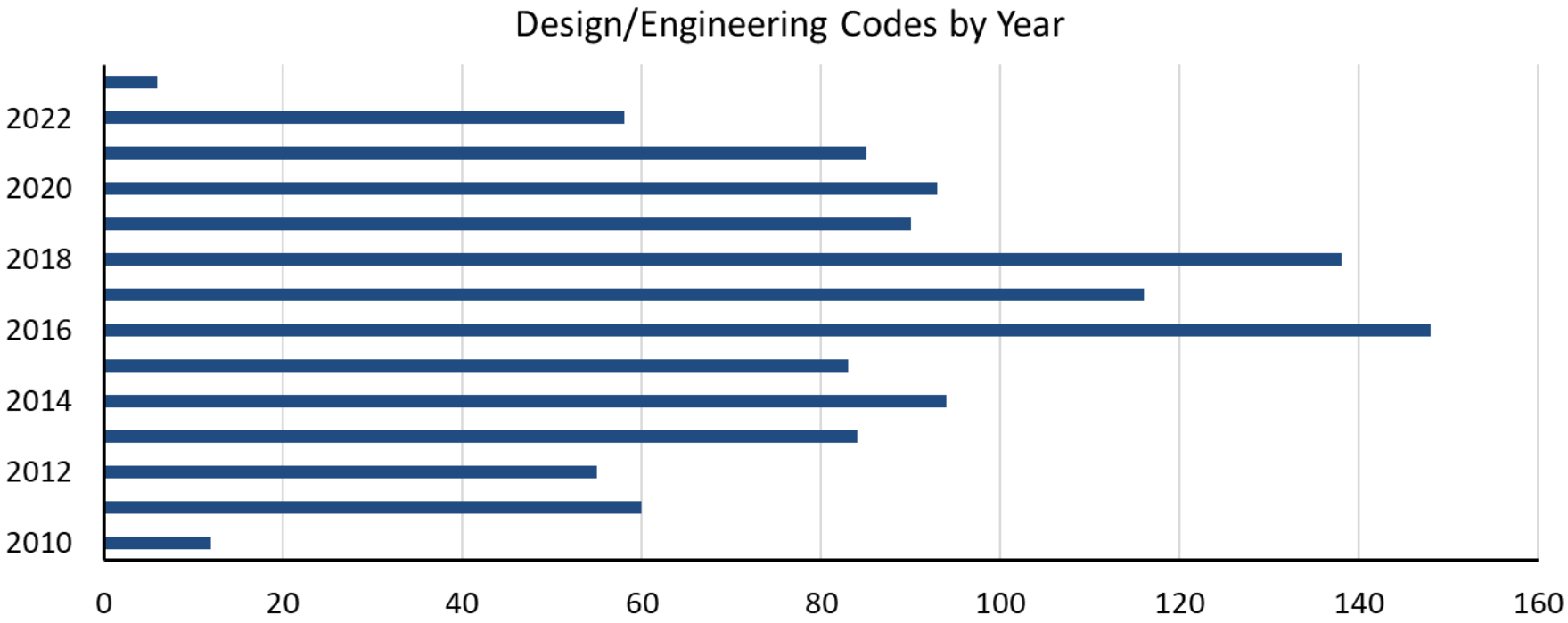
Organizational Performance Issues – Top 5

Out of the 1,063 times organization performance has been indicated as factor, the top five are the following:

- A4B3C08–Job scoping did not identify special circumstances and/or conditions (124 times)
- A4B5B05–System interactions not considered or identified (95 times)
- A4B1C08–Corrective action responses to a known or repetitive problem was untimely (86 times)
- A4B5C04–Risks/consequences associated with change not adequately reviewed/assessed (71 times)
- A4B1C06–Previous industry or in-house experience was not effectively used to prevent recurrence (59 times)

Design/Engineering Issues

- Design/Engineering has been identified as a contributing factor 1,122 times
- Average of ~95 events per year
- This is over 3x the rate of Individual Human Performance issues



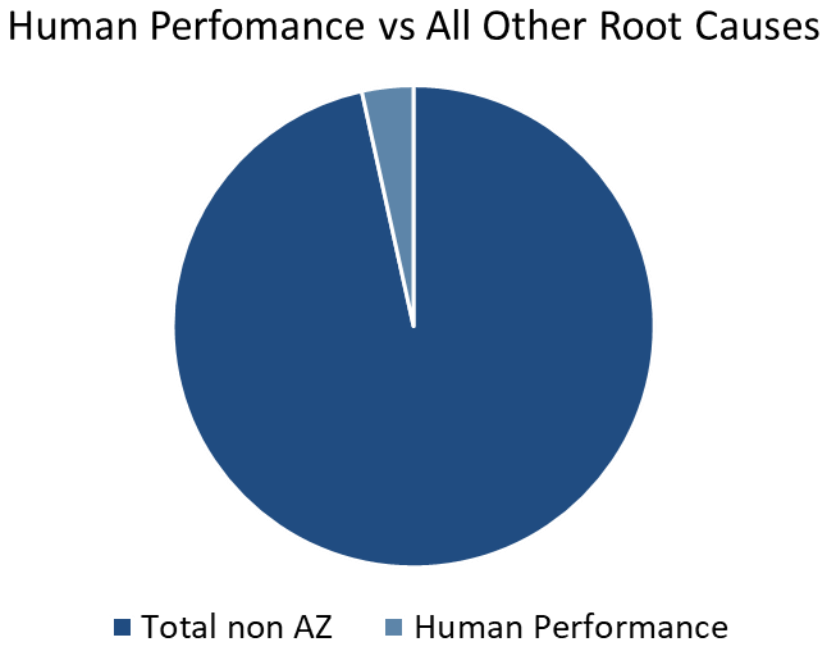
Design/Engineering Issues – Top 5

Out of the 1,122 times Design and Engineering has been indicated as factor, the top five are the following:

- A1B2C01–Design output scope LTA (487 times)
- A1B2C08–Errors not detectable (118 times)
- A1B4C01–Independent review of design/documentation LTA (110 times)
- A1B2C03–Design output not correct (103 times)
- A1B4C02–Testing of design/installation LTA (64 times)

So is it the Human?

- Only 3.6% of identified event root causes indicate that the event is due to an Individual Human Performance issue

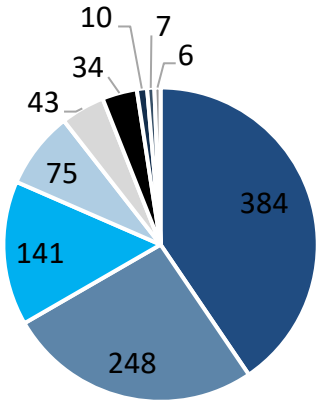


Where are our issues?

- 40.5% Organizational Performance (45.5% past 5 years)
- 26.1% Design and Engineering (26.0% past 5 years)
- 3.6% Human Performance (3.5% past 5 years)

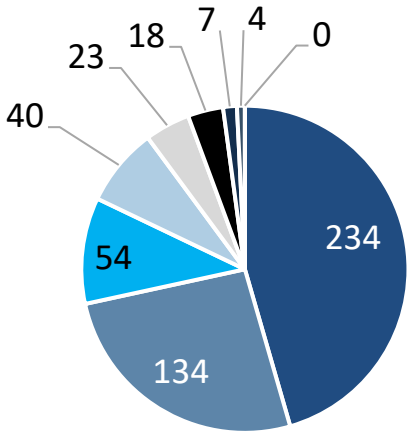
Current Identified Root Causes All Time

- Organizational Performance 40.5%
- Design and Engineering 26.1%
- Equipment 14.8%
- Other 7.91%
- Communications 4.53%
- Human Performance 3.58%
- Training 1.05%
- Overall Configuration 0.73%
- No Cause Found 0.63%



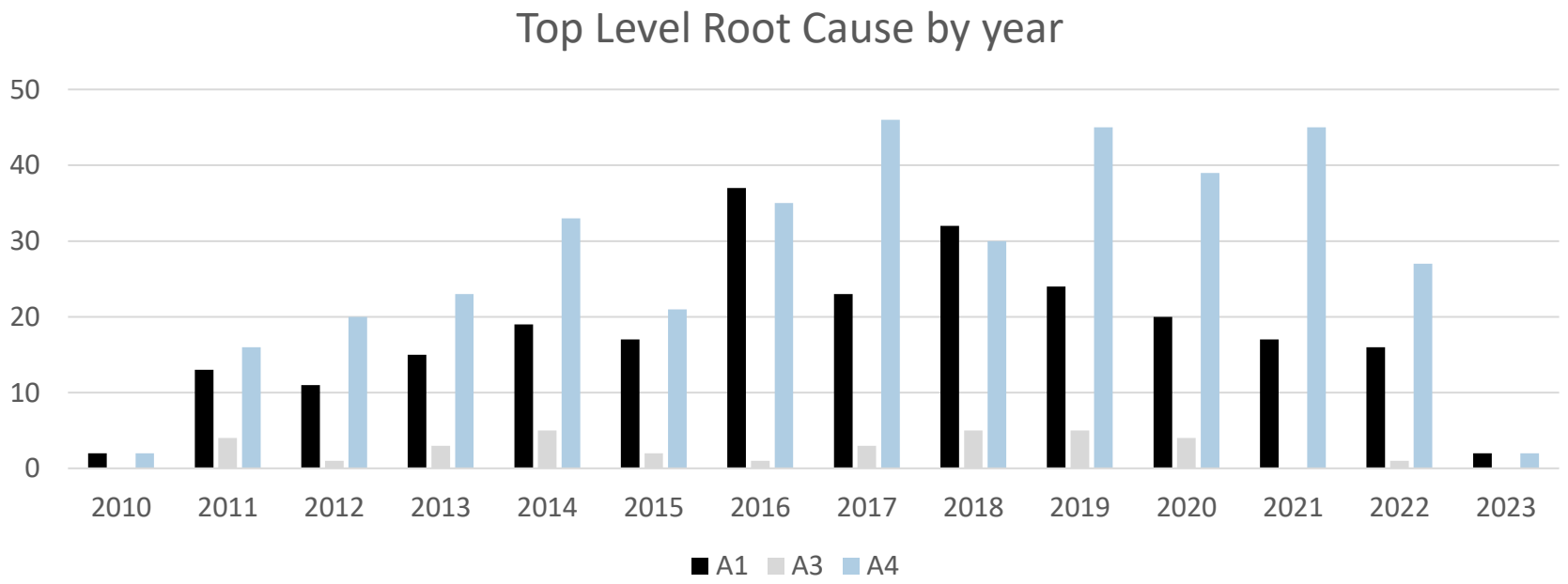
Current Identified Root Causes 2017–Present

- Organizational Performance 45.5%
- Design and Engineering 26.0%
- Equipment 10.5%
- Other 7.78%
- Communications 4.47%
- Human Performance 3.50%
- Training 1.36%
- Overall Configuration 0.77%
- No Cause Found 0%



Human Performance vs. Organization Performance

- Human performance remains fairly constant at a very low level
- Engineering has decreased over the past few years
- Organizational Performance issues remain a major driver of Categorized events



Top HP/OP Event Root Causes

- A1B2C01–Design output scope LTA (170 times)
- A4B3C08–Job scoping did not identify special circumstances and/or conditions (60 times)
- A4B5C05–System interactions not considered or identified (39 times)
- A4B5C04–Risks / consequences associated with change not adequately reviewed / assessed (30 times)
- A4B1C01–Management policy guidance or expectations not well-defined, understood, or enforced (26 times)

Conclusion

- "Human Performance issues" are usually a symptom of larger challenges within a company.
- Best ways to reduce events are by performing the following:
  - Working to improve engineering, especially improving the understanding of all the ways a design could fail
  - Working with supervisors and crews to improve job scoping and understanding how systems interact with each other
  - Ensuring that all potential impacts or dependencies are identified, reviewed, and (if needed) modified to accommodate changes when they are made
  - Ensure that policies and expectations are well defined and understood by your employees and contractors

Conclusion

- Doing what is easy vs doing what is hard
  - It is easy to blame the individual human, a failed component, or weather
  - It is harder to admit our processes, procedures, and policies need improvement
- Yet, It is by identifying and doing what is hard that results in significant improvement

"We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard." – President John F. Kennedy

References

- ERO Event Analysis Program Website
- ERO Event Analysis Process Document
- ERO Cause Code Assignment Process
- Lessons Learned Website

Questions and Answers

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