



# Misoperations Severity Index

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# Misoperations Rate

- Area of great interest and focus of stakeholder outreach to improve (reduce) the number of misoperations
- Simple misoperations rate developed for use as an aggregate performance measure applied to NERC and regional entities to evaluate whether outreach was resulting in reducing the misoperations rate

$$\frac{\sum \text{misoperations}}{\sum \text{protection system operations}}$$

- Designed for a very specific purpose—to evaluate whether there was a reduction in the number of misoperations over time at the regional and NERC levels. Interpreted as catch-all for whether relay reliability is improving

# Concerns with Current Misoperation Rate

- Concerns with current Misoperation Rate
  - Susceptible to changes not indicative of reliability
  - All Misoperations aren't equal
    - “Unnecessary Trip—Other than fault” has a near 100% rate, despite being arguably one of the less impactful categories
    - “Failure to Trip—During Fault” likely has a relatively low rate due to additional equipment operating to clear the fault, despite being very impactful
  - Can fluctuate wildly for small entities with fewer than 10 PSOps/quarter
- New metric purpose
  - Determine whether Misoperations are becoming more or less impactful to reliability
  - Determine whether there are “common” high-impact Misoperations with similar causes
  - Be scalable for any granularity
  - Present information in a concise, easy to understand way at a high level

# Inputs to Severity Index

Misoperation Impact Factors			
Field	Weight	Sub-field	Factor
Voltage Class	30%	0–99 kV	0.4
		100–199 kV	0.5
		200–299 kV	0.65
		300–499 kV	0.85
		500–765 kV	1
Equipment Type	20%	BES UFLS, BES UVLS	0.333
		Shunt Capacitor, Shunt Reactor/Inductor	0.5
		HVdc, Line, Series Capacitor, Series Reactor/Inductor, Transformer, Breaker	0.667
		Bus, Other	0.833
		Dynamic VAR Systems, Generator	1
Cause	10%	Equipment Errors (and Other)	0.5
		Human Errors	0.85
		Unknown	1
Category	40%	Slow Trip–Other than Fault	0.167
		Unnecessary Trip–Other than Fault	0.333
		Failure to Trip–Other than Fault, Unnecessary Trip–During Fault	0.667
		Failure to Trip–During Fault, Slow Trip–During Fault 1	1

# Weights of Inputs

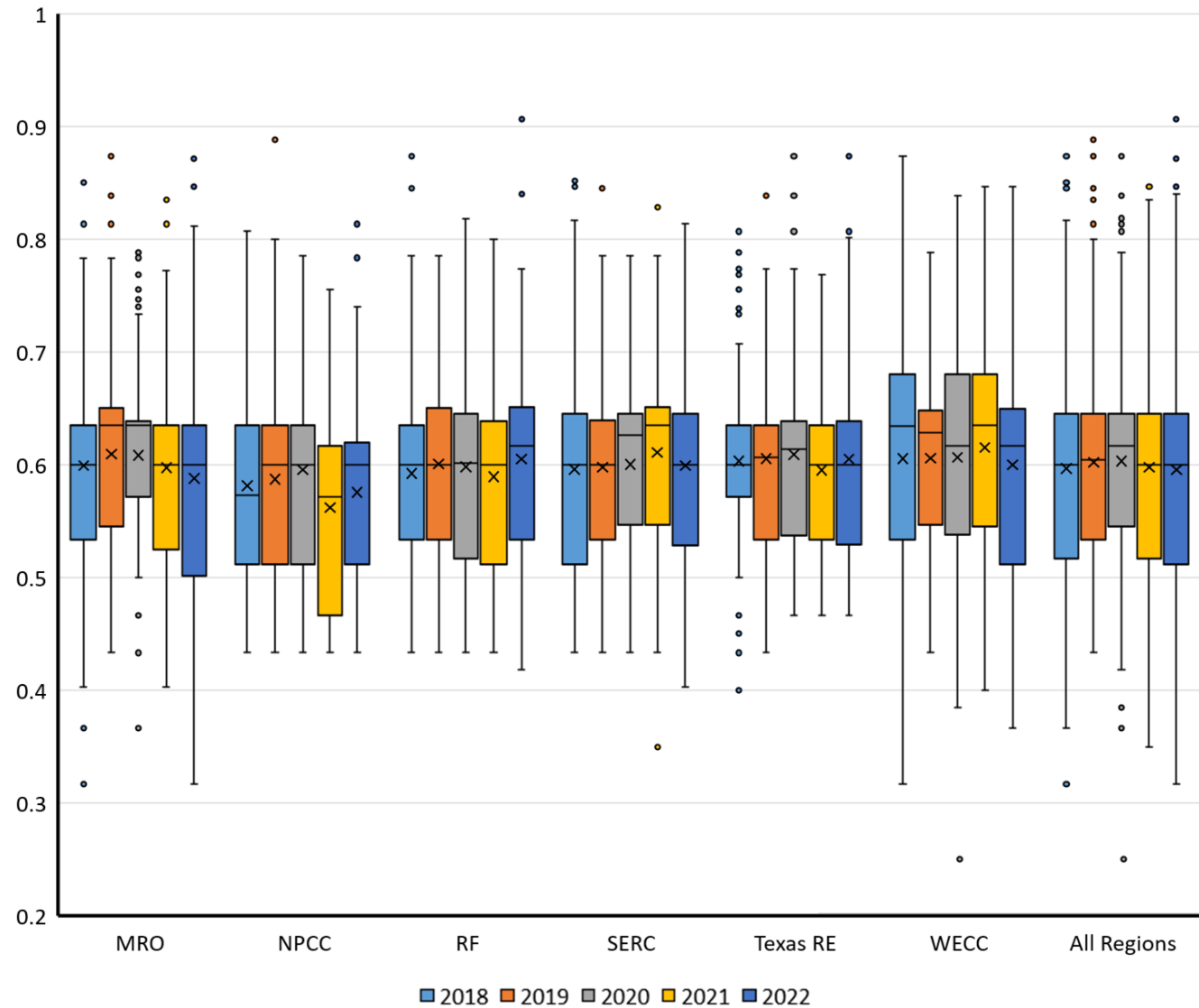
Fields	Impact
Voltage Class	30%
Equipment Type	20%
Cause	10%
Category	40%
Misoperation Rate	

# Entity Misoperation Impact Score Equation

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$$\frac{([\text{Voltage Class Factor}] * 0.3 + [\text{Equipment Type Factor}] * 0.2 + [\text{Cause Factor}] * 0.1 + [\text{Category Factor}] * 0.4)}{\text{Total Misoperation Count}}$$

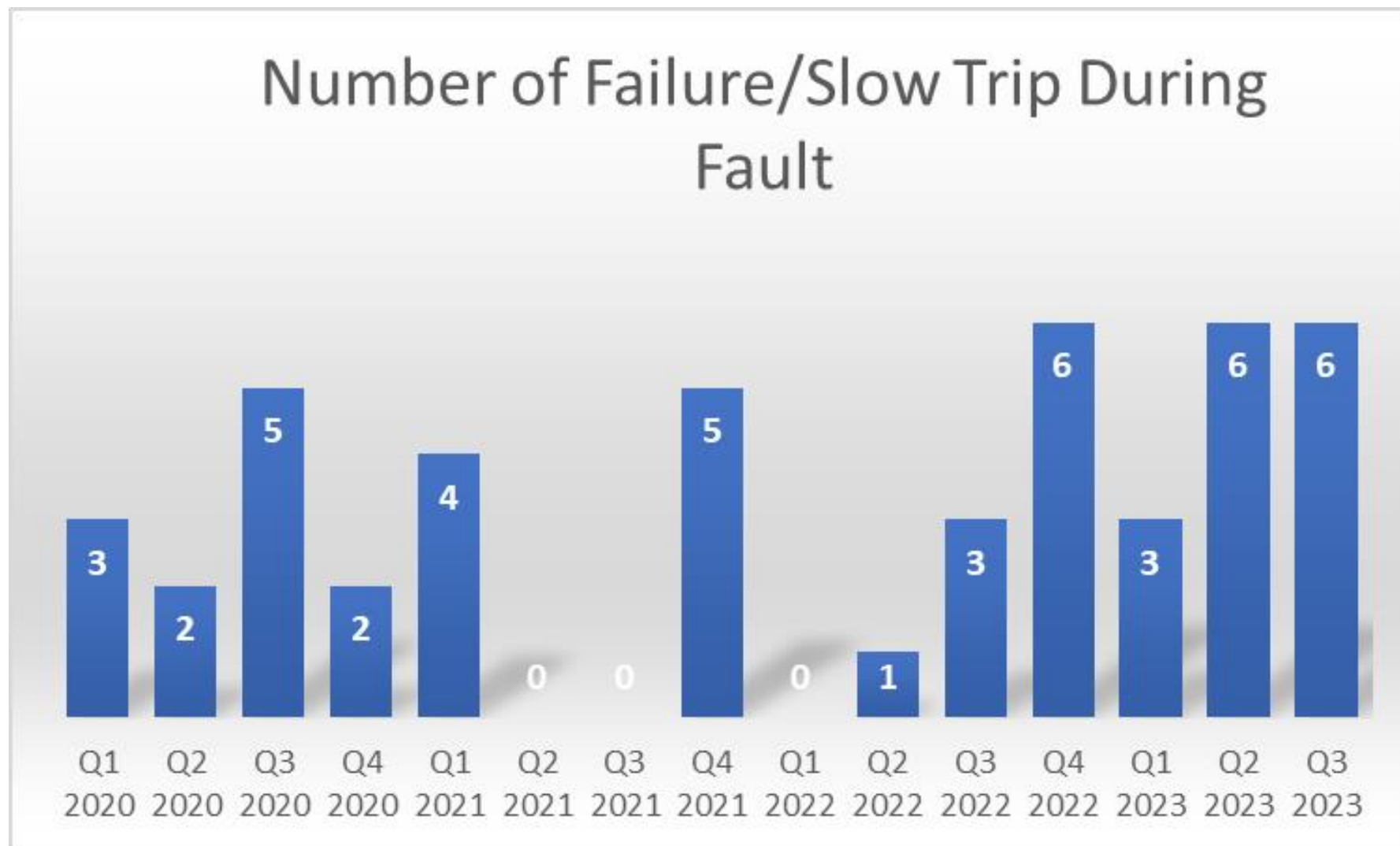
# Severity Index Comparisons



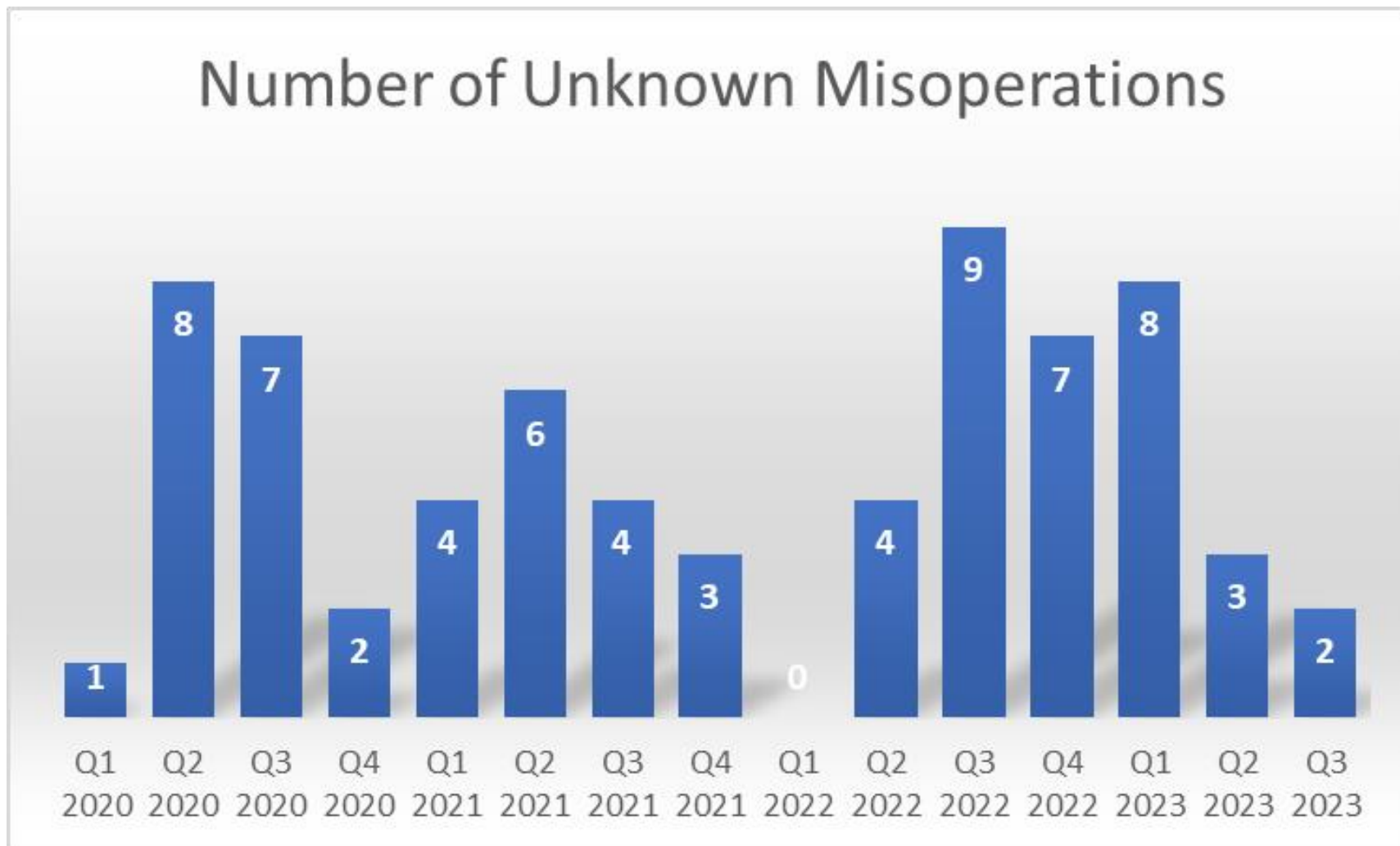
# Most Severe Misoperations in WI

Severity	Quarter of Misop	Equipment Type Factor (20%)	Voltage Class Factor (30%)	Category Factor (40%)	Cause Factor (10%)	Misoperation Impact Score
1	Q2 2023	0.833	0.65	1	0.85	0.8466
2	Q4 2022	0.833	0.65	1	0.85	0.8466
3	Q1 2021	0.833	0.65	1	0.85	0.8466
4	Q3 2020	0.667	0.85	1	0.5	0.8384
5	Q3 2023	1	0.5	1	0.85	0.835
6	Q2 2023	1	1	0.667	0.5	0.8168
7	Q1 2021	1	1	0.667	0.5	0.8168
8	Q1 2023	0.833	0.5	1	1	0.8166
9	Q4 2021	0.667	0.65	1	0.85	0.8134
10	Q4 2021	0.667	0.65	1	0.85	0.8134
11	Q4 2022	0.667	1	0.667	1	0.8002
12	Q1 2023	0.667	1	0.667	0.85	0.7852
13	Q4 2022	0.667	1	0.667	0.85	0.7852
14	Q4 2022	0.667	1	0.667	0.85	0.7852
15	Q3 2022	0.667	1	0.667	0.85	0.7852
16	Q2 2022	0.667	1	0.667	0.85	0.7852
17	Q4 2020	0.667	1	0.667	0.85	0.7852
18	Q2 2020	0.667	1	0.667	0.85	0.7852
19	Q3 2022	0.667	0.5	1	1	0.7834
20	Q3 2022	0.667	0.5	1	1	0.7834
21	Q4 2021	0.667	0.5	1	1	0.7834
22	Q4 2021	0.667	0.5	1	1	0.7834
23	Q2 2020	0.667	0.5	1	1	0.7834
24	Q3 2020	0.5	0.65	1	0.85	0.78
25	Q4 2022	0.667	0.65	1	0.5	0.7784

# Insights—Category



# Insights—Unknown





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