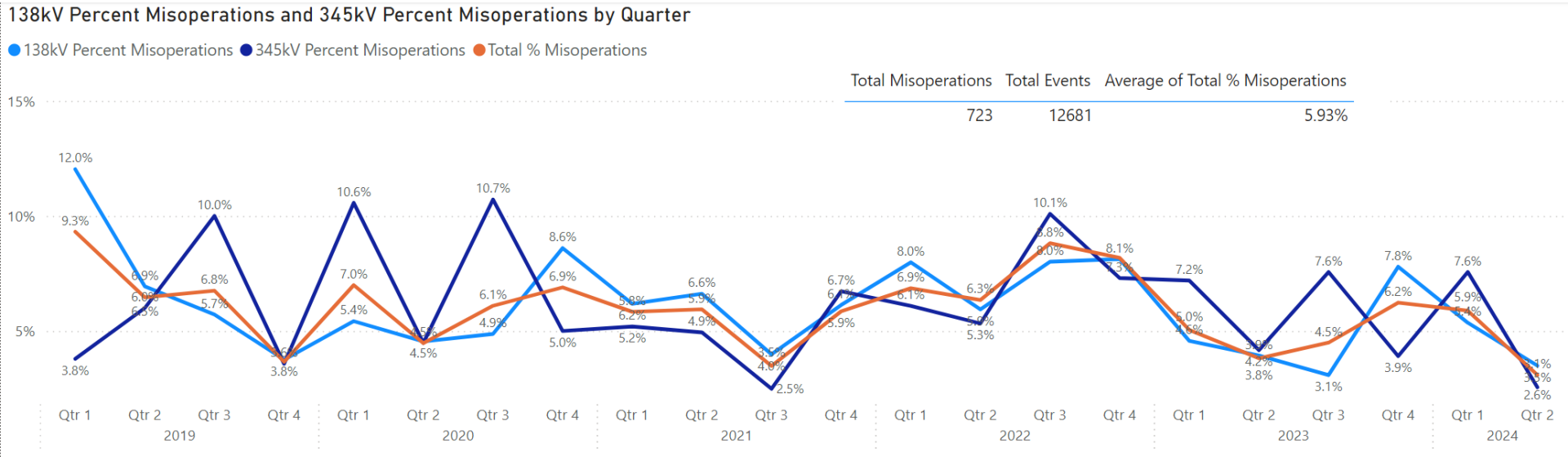
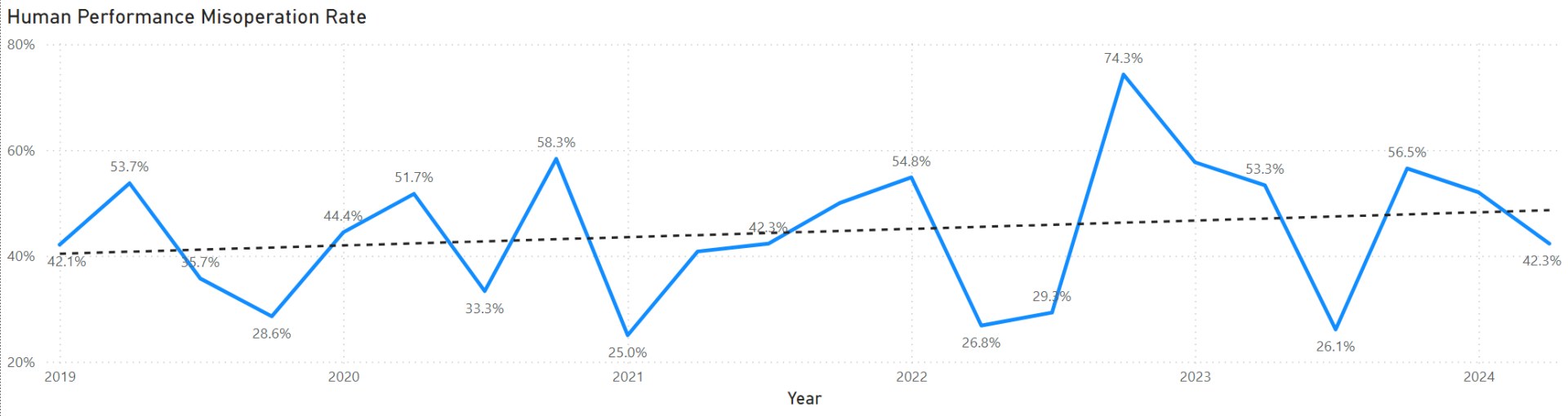
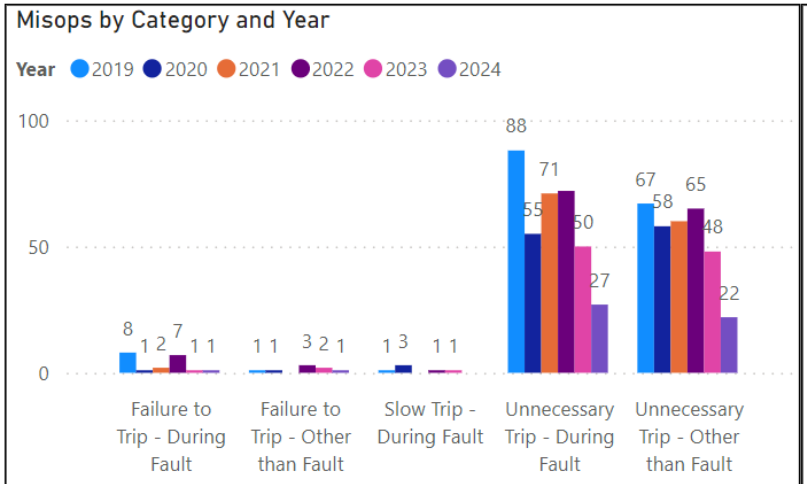
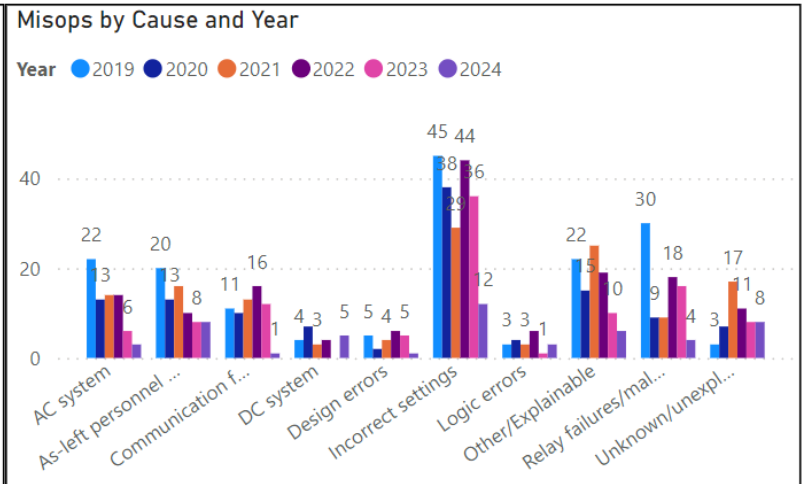
Protection System Misoperations: 2019-2024 Q2

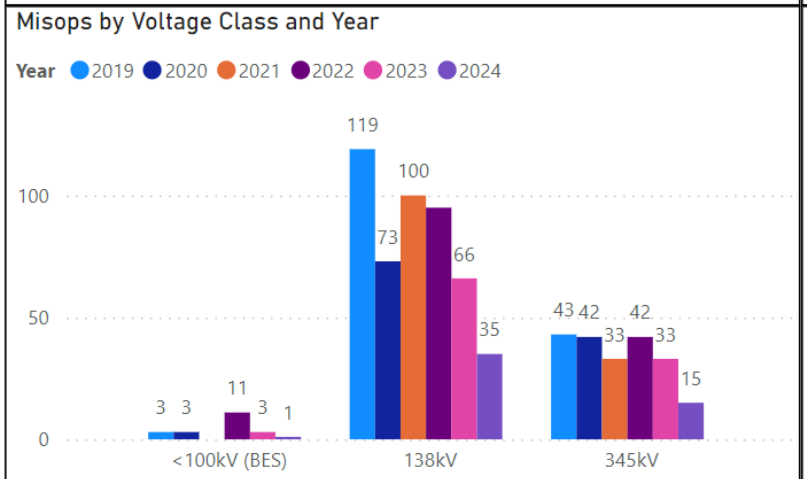


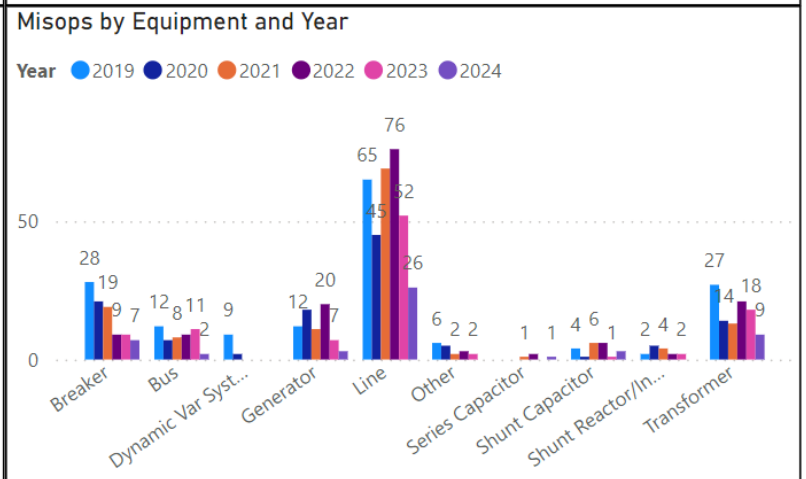


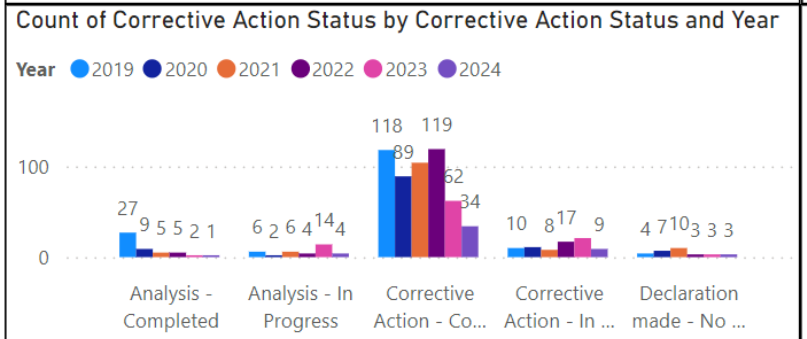
Protection System Misoperations: 2019-2024 Q2

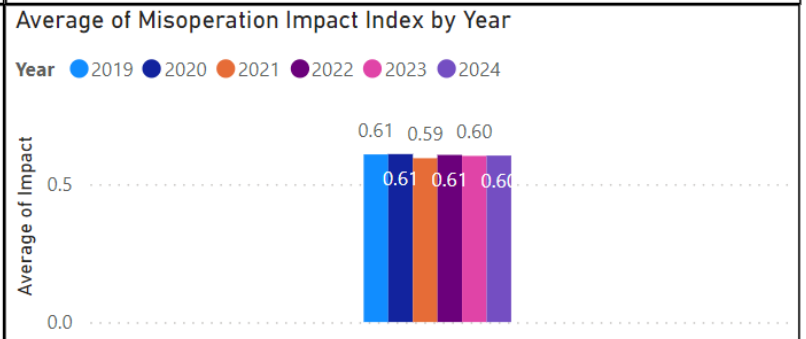




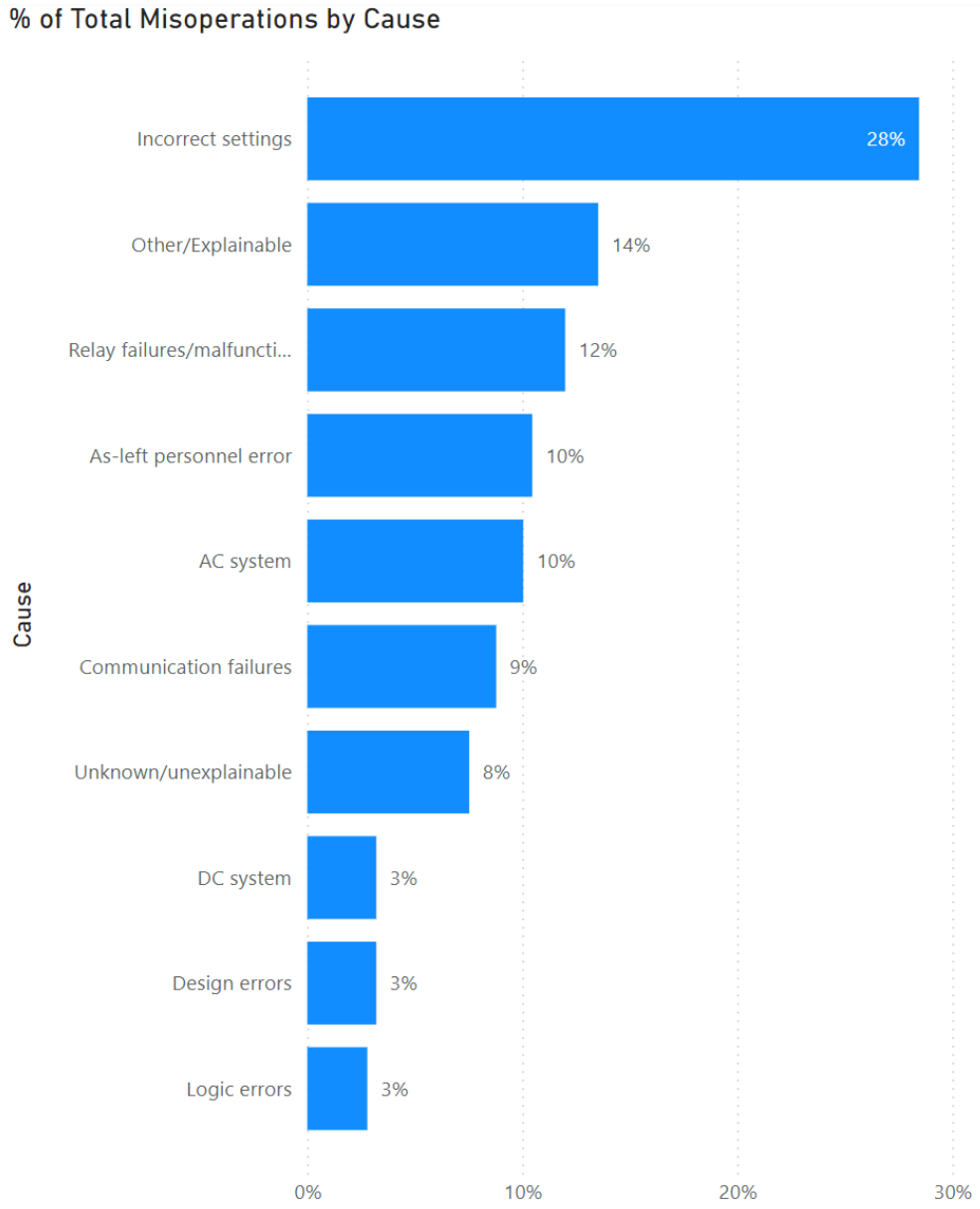


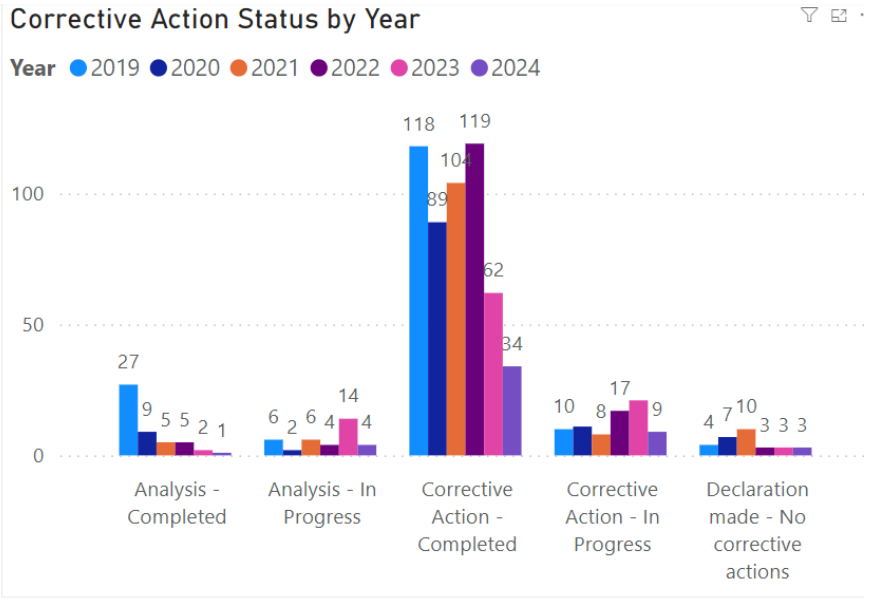


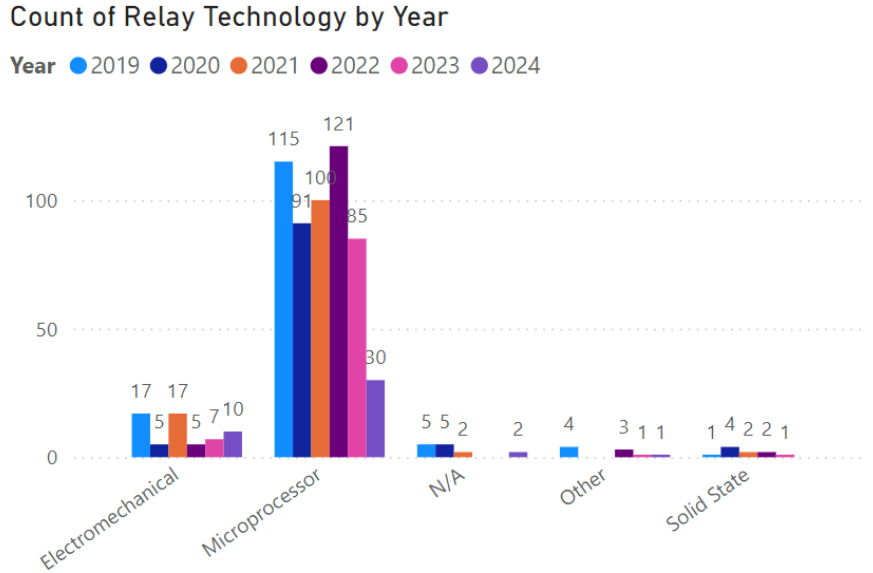




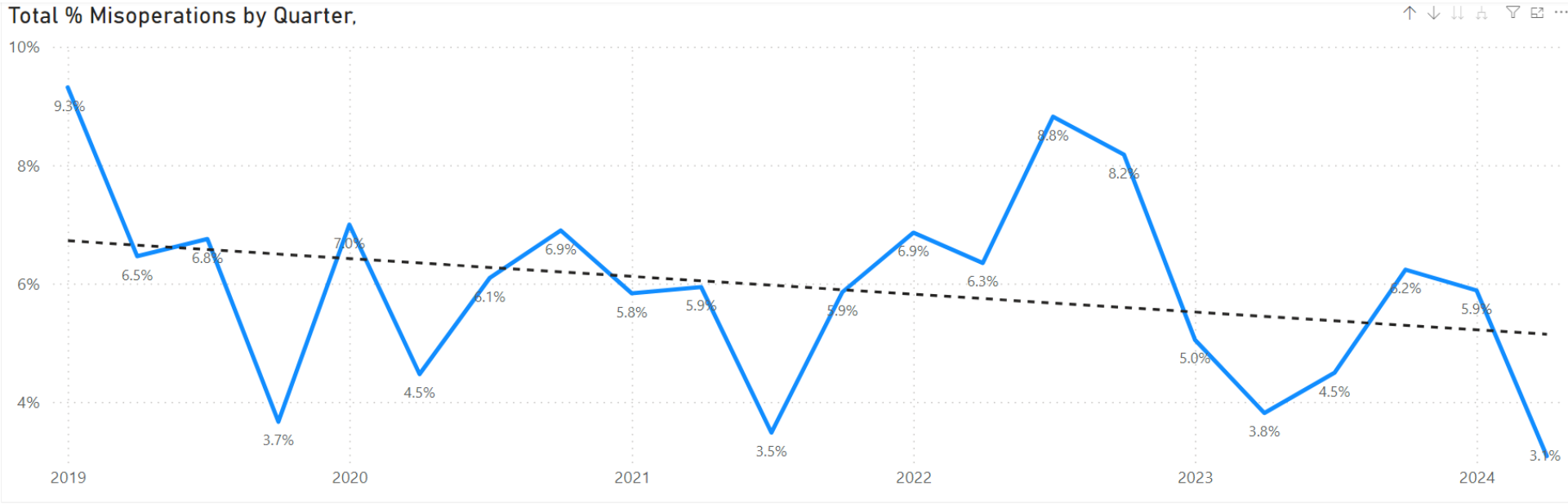
Protection System Misoperations: 2019-2024 Q2

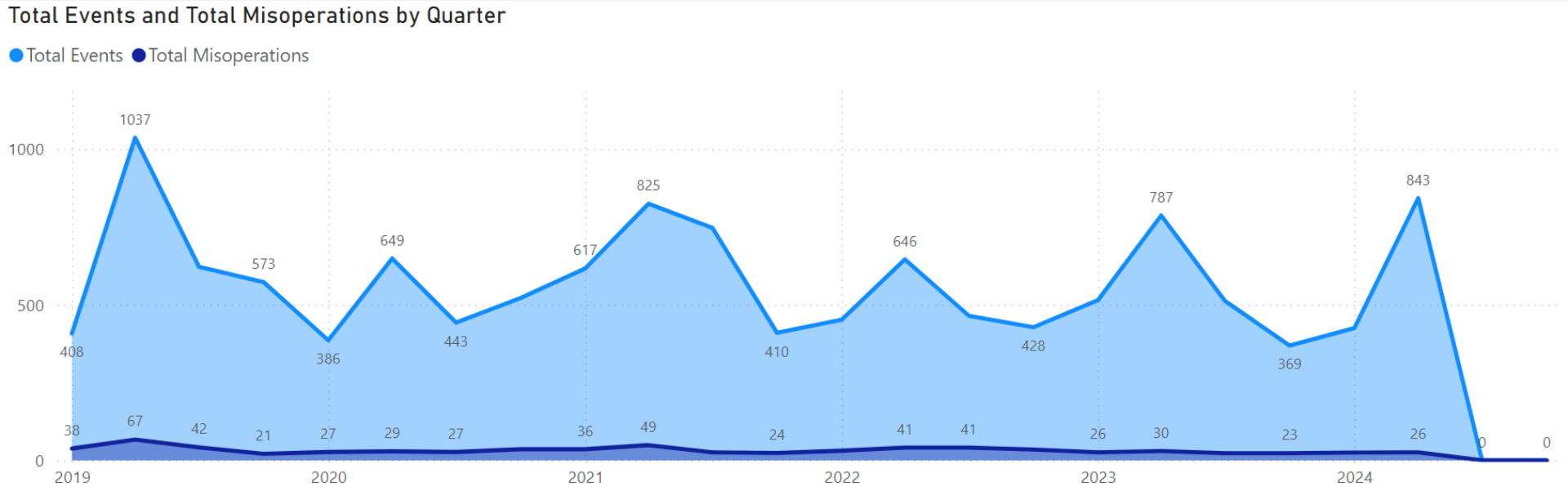






Protection System Misoperations: 2019-2024 Q2





Protection System Misoperations – 2024 YTD

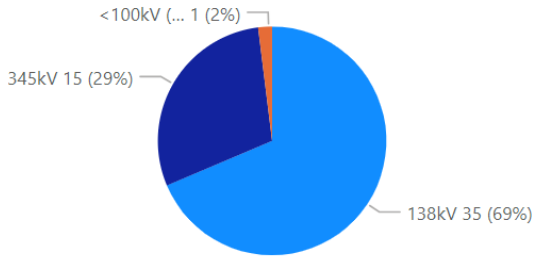
Facility Voltage	Count
<100kV (BES)	1
138kV	35
345kV	15

Category	Count
Failure to Trip - During Fault	1
Failure to Trip - Other than Fault	1
Unnecessary Trip - During Fault	27
Unnecessary Trip - Other than Fault	22

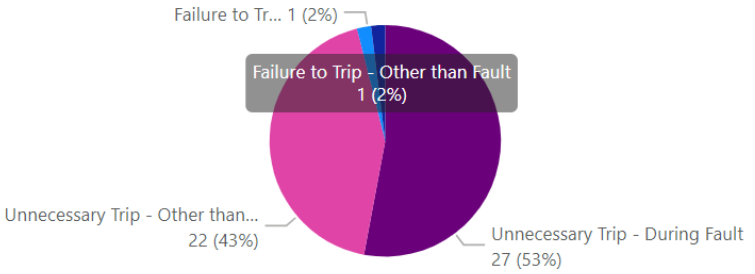
Relay Technology	Count
Electromechanical	10
Microprocessor	30
N/A	2
Other	1

Equipment Type	Count
Breaker	7
Bus	2
Generator	3
Line	26
Series Capacitor	1
Shunt Capacitor	3
Transformer	9

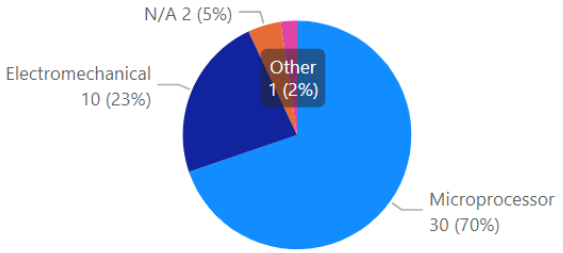
Facility Voltage



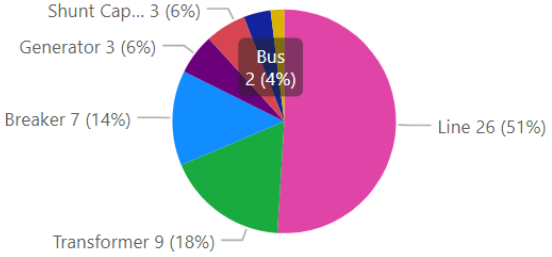
Category



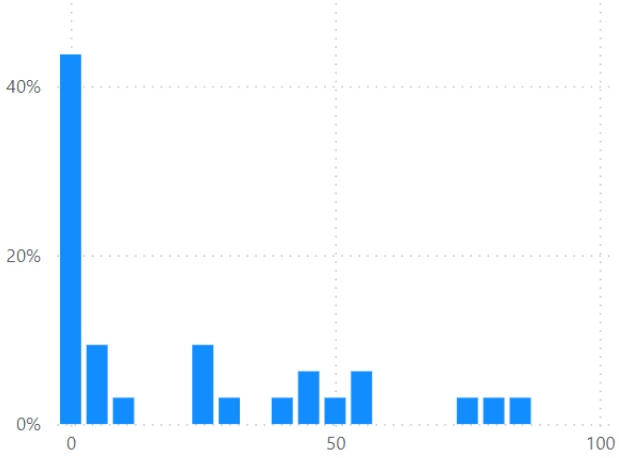
Relay Technology



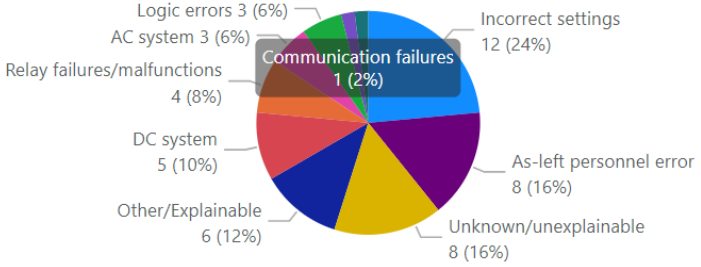
Equipment Type



CAP Duration



Cause



Human Performance - 2024 Q2

Summary of Human Performance Issues noted for 2024 Q2:

- 138kV breaker failure scheme misoperated due to logic errors in the breaker failure trip equation
- 138kV breaker overtripped due to incorrect ground instantaneous setting
- Generator tripped due to incorrect wiring of differential CT circuit following repair work on the GSU
- Generator breaker failure protection misoperated due to incorrect wiring of the breaker status input for the trip logic (wired 52a instead of 52b)
- 138kV line overtripped due to DCB element enabled in error
- 138kV line overtripped due to ground directional polarizing CT wired with incorrect polarity
- 138kV line overtripped due to line current differential protection enabled in error
- 345kV wind plant tripped off during an external fault due to incorrect setting of zero sequence elimination element
- 345kV battery facility GSU tripped due to incorrect time delay setting in backup differential protection

Failure to Trip/Slow Trip Misoperations in 2024 Q2:

- None

Definitions

- Protection System –
  - Protective relays which respond to electrical quantities,
  - Communications systems necessary for correct operation of protective functions
  - Voltage and current sensing devices providing inputs to protective relays,
  - Station dc supply associated with protective functions (including station batteries, battery chargers, and non-battery-based dc supply), and
  - Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices

Definitions

- Composite Protection System - *The total complement of Protection System(s) that function collectively to protect an Element. Backup protection provided by a different Element's Protection System(s) is excluded.*

- Misoperation – *The failure a Composite Protection System to operate as intended for protection purposes. Any of the following is a Misoperation:*
  1. Failure to Trip – During Fault – A failure of a Composite Protection system to operate for a Fault condition for which it is designed.
  2. Failure to Trip – Other than Fault - A failure of a Composite Protection system to operate for a non-Fault condition for which it is designed, such as a power swing, undervoltage, overexcitation, or loss of excitation.

Definitions

- Misoperation – *The failure a Composite Protection System to operate as intended for protection purposes. Any of the following is a Misoperation:*
  3. Slow Trip – During Fault – A Composite Protection system that is slower than required for a Fault condition if the duration of its operating time resulted in the operation of at least one other Element's Composite Protection System.
  4. Slow Trip – Other than Fault - A Composite Protection system that is slower than required for a non-Fault condition, such as a power swing, undervoltage, overexcitation, or loss of excitation, if the duration of its operating time resulted in the operation of at least one other Element's Composite Protection System.

Definitions

- Misoperation – *The failure a Composite Protection System to operate as intended for protection purposes. Any of the following is a Misoperation:*
  5. Unnecessary Trip – During Fault – An unnecessary Composite Protection system operation for a Fault condition on another Element.
  6. Unnecessary Trip – Other than Fault - An unnecessary Composite Protection system operation for a non-Fault condition. A Composite Protection System operation that is caused by personnel during on-site maintenance, testing, inspection, construction, or commissioning activities is not a Misoperation.