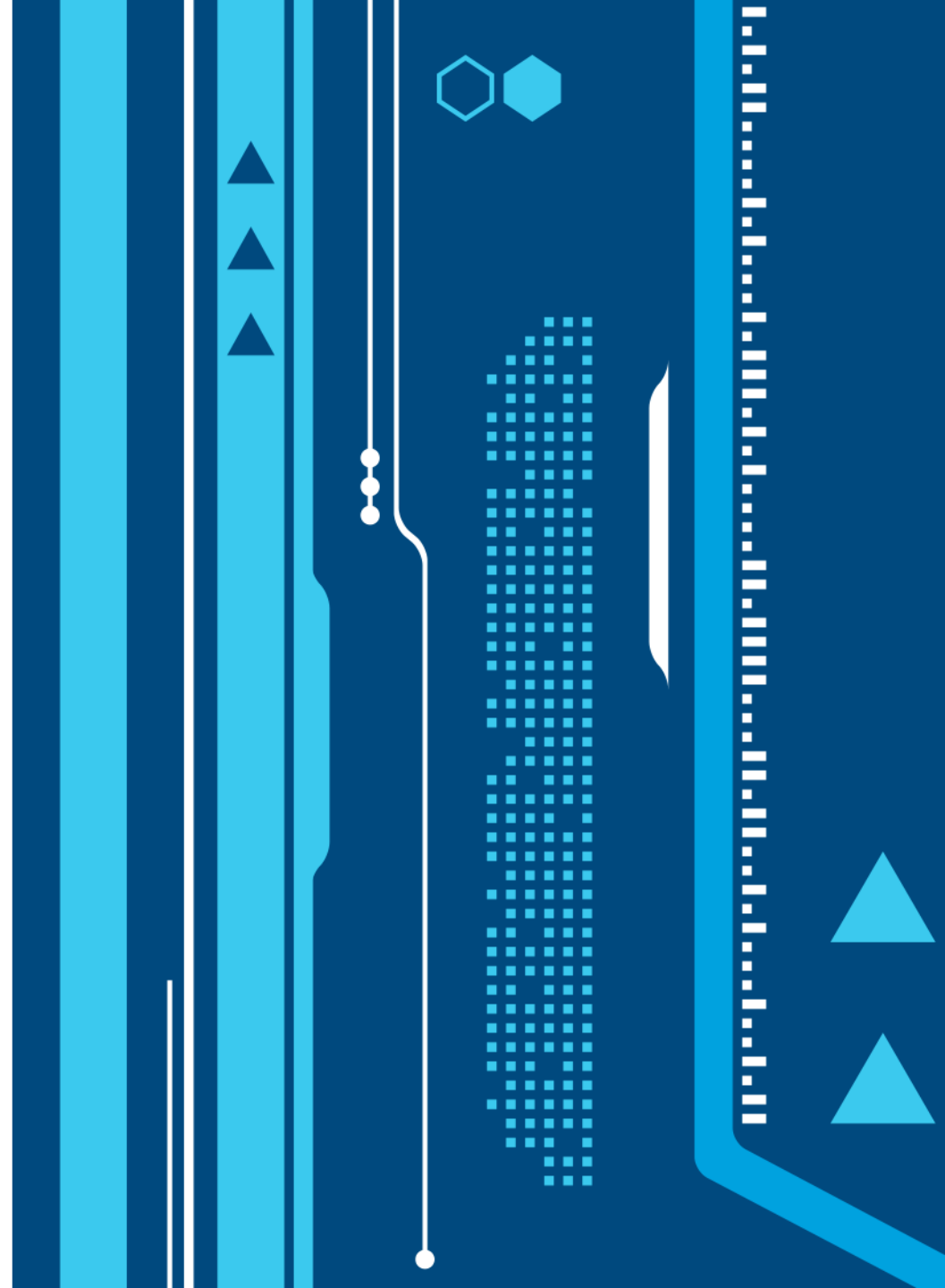


Misoperations Summit 2016



Helping our members
work together to
keep the lights on...
today and in the future



Background



Misoperations: A Definition

The failure of 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. The failure of a Protection System component is not a Misoperation as long as the performance of the Composite Protection System is correct.**
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. The failure of a Protection System component is not a Misoperation as long as the performance of the Composite Protection System is correct.**

Misoperations: A Definition (cont.)

- 3. Slow Trip – During Fault – A Composite Protection System operation 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 operation 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.**

Misoperations: A Definition (cont.)

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.**

From this definition, is it clear what should be submitted into MIDAS as a misoperation?



Misoperations Examples



Example 1

Description of Misoperation/Failure

Entity was doing switching to isolate a section of the 138kV Bus to remove a switch that was to be replaced. While opening Switch 1234, which has a hand crank mechanism, the relay operated opening Breaker OCB 1235.

Misoperations Definition can be found on page 18 of the PRC-004-4 Standard.



Example 1

Investigation Results

The section of 138kV Bus being isolated had the relaying PT's for the Quadramho relay. Opening the switch by hand cranking caused arcing on all three phase which affected the voltage seen by the relaying PT's. This caused the relay to misoperate. Since all station load was being fed through that OCB, customer had a 30-minute outage.



Example 1

Corrective Action

Got together with personnel responsible for the switching procedure. Instructed them about how opening an air break switch slowly affects the voltage seen by the relay. In a case such as this, the relay needs to be disabled before de-energizing the relaying PT's.



Example 1

Is this an example of a misoperation? Please use Google to submit your response.

Yes

No



Example 1

Was MIDAS reporting necessary? Please use Google to submit your response.

Yes

No



Description of Misoperation/Failure

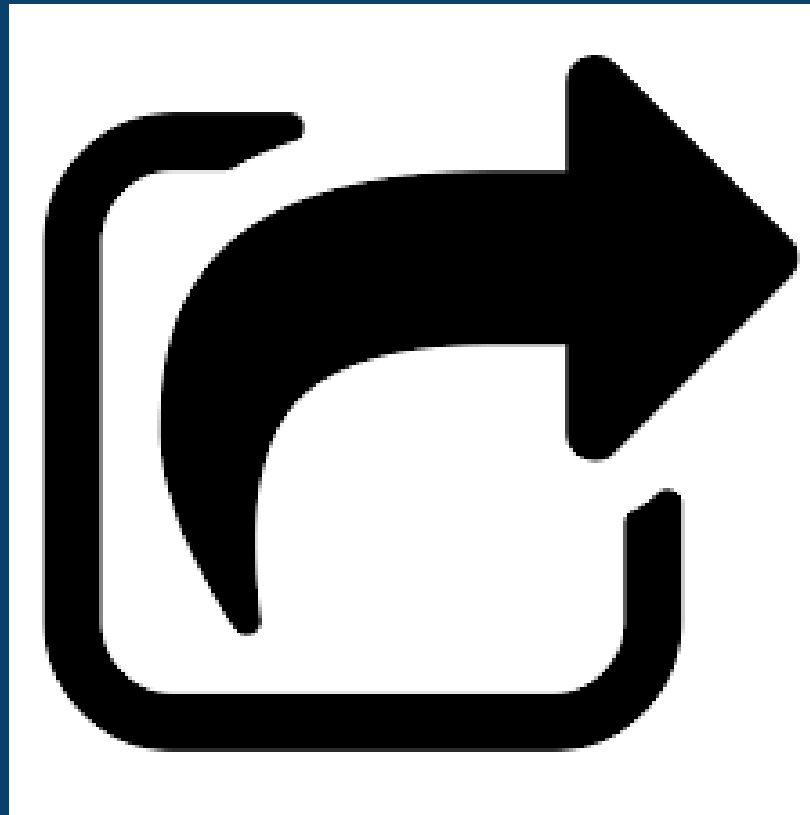
Entity was doing switching to isolate a section of the 138kV Bus to remove a switch that was to be replaced. While opening Switch 1234, which has a hand crank mechanism, the relay operated opening Breaker OCB 1235.

Misoperations Definition can be found on page 18 of the PRC-004-4 Standard.

Why?



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Example 2

Description of Misoperation/Failure

Breakers operated for line fault. Bkr Fail 86BF lockout relay operated clearing bus.

Misoperations Definition can be found on page 18 of the PRC-004-4 Standard.



Example 2

Investigation Results

Found the Breaker anti-pump 52Y relay seal in circuit was misoperating



Example 2

Corrective Action

Modify anti pump XY relay scheme to provide additional parallel Y contact to hold Y relay seal in



Example 2

Is this an example of a misoperation? Please use Google to submit your response.

Yes

No



Example 2

Was MIDAS reporting necessary? Please use Google to submit your response.

Yes

No



Description of Misoperation/Failure

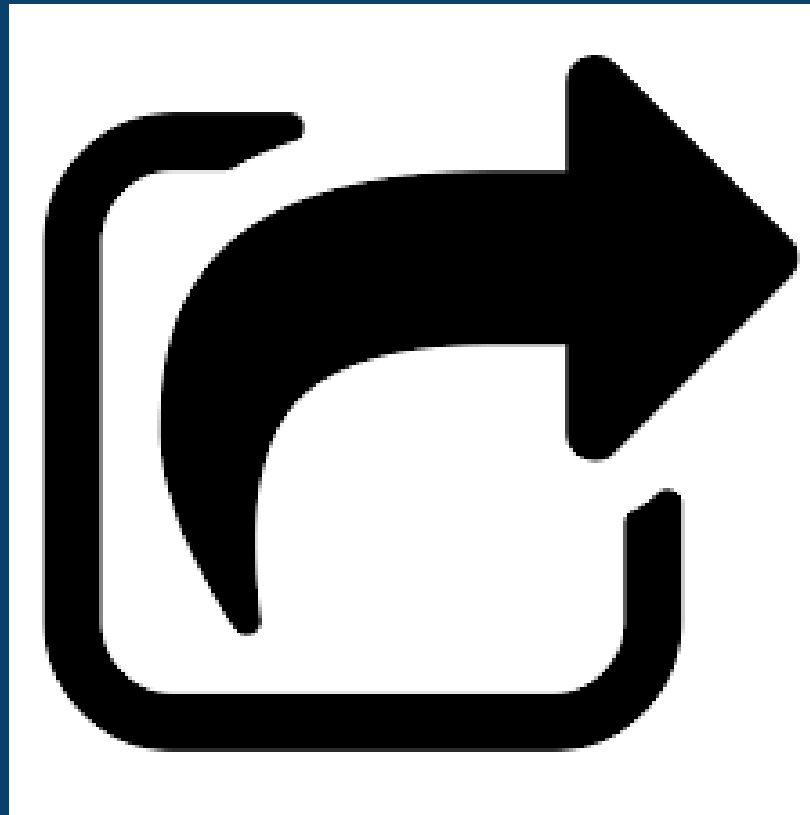
Breakers operated for line fault. Bkr Fail 86BF lockout relay operated clearing bus.

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Why?



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Example 3

Description of Misoperation/Failure

An incoming fault from a substation relayed out 2 breakers in switchyard. One breaker was slow to open, allowing the generator protection system to relay open all three generator breakers.

Misoperations Definition can be found on page 18 of the PRC-004-4 Standard.



Example 3

Investigation Results

OCB slow to operate (open) allowing Generator CBs to open.



Example 3

Corrective Action

Replace OCB with a new gas CB.



Example 3

Is this an example of a misoperation? Please use Google to submit your response.

Yes

No



Example 3

Was MIDAS reporting necessary? Please use Google to submit your response.

Yes

No



Example 3

Description of Misoperation/Failure

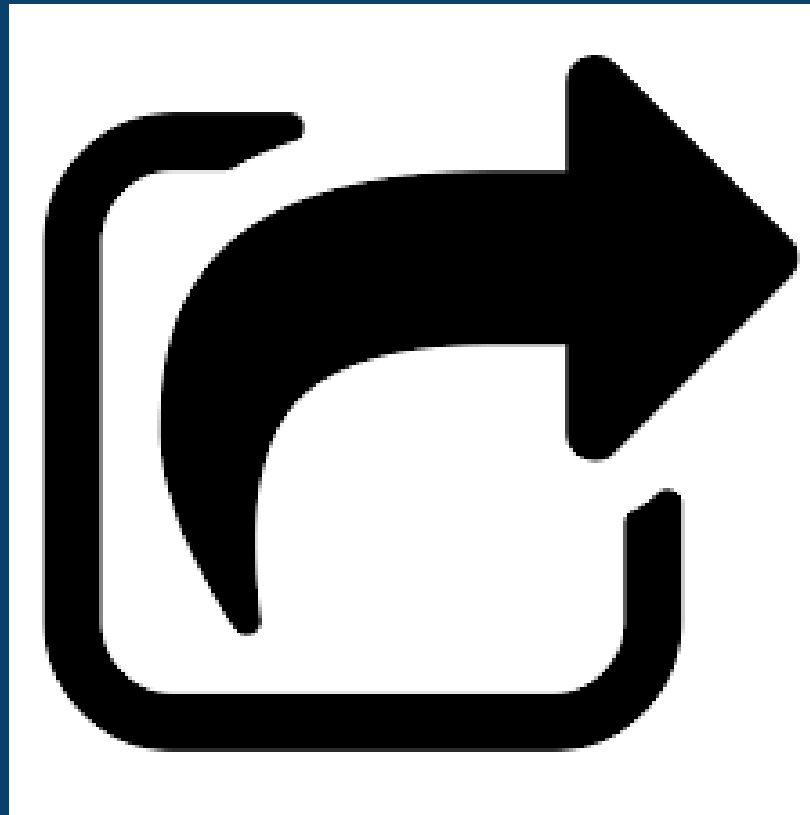
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Why?



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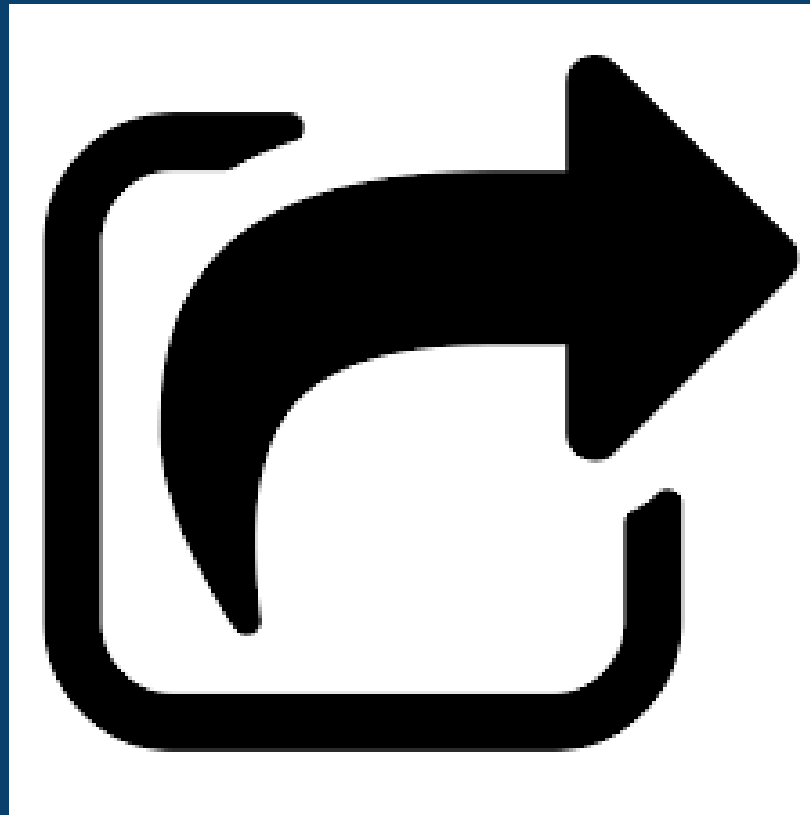
Current State



Let's Discuss Assumptions about “Current State”

1. What do we assume about Misoperations identification?

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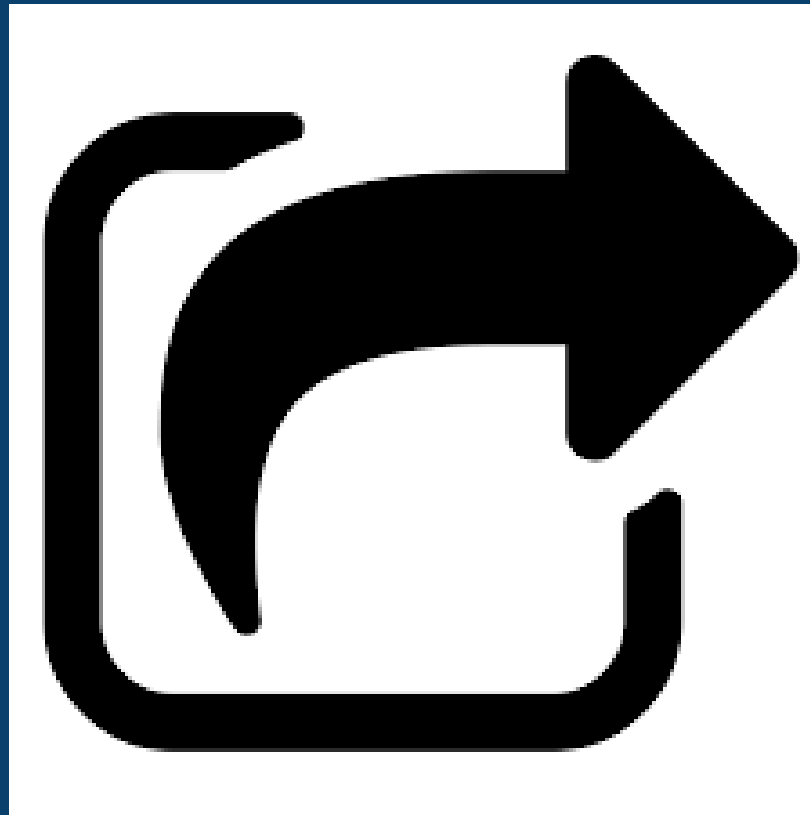
Let's Discuss Assumptions about "Current State"

2. What do we assume about the data collection process?

What do we assume about the data that is collected?

What do we assume about *how* the data is collected?

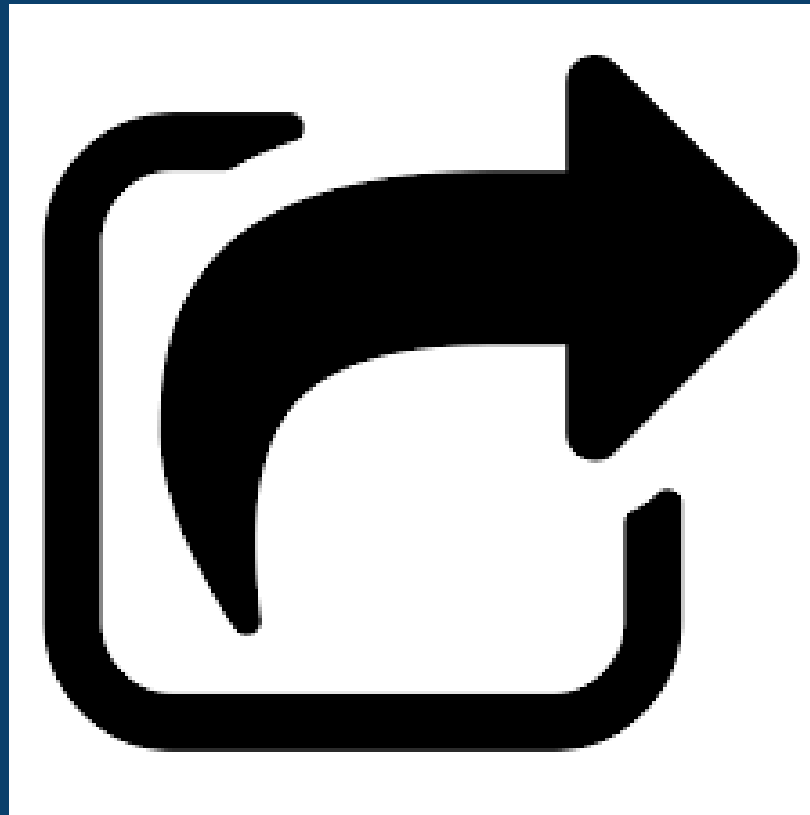
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Let's Discuss Assumptions about “Current State”

3. What do we assume about the data that is being reported?

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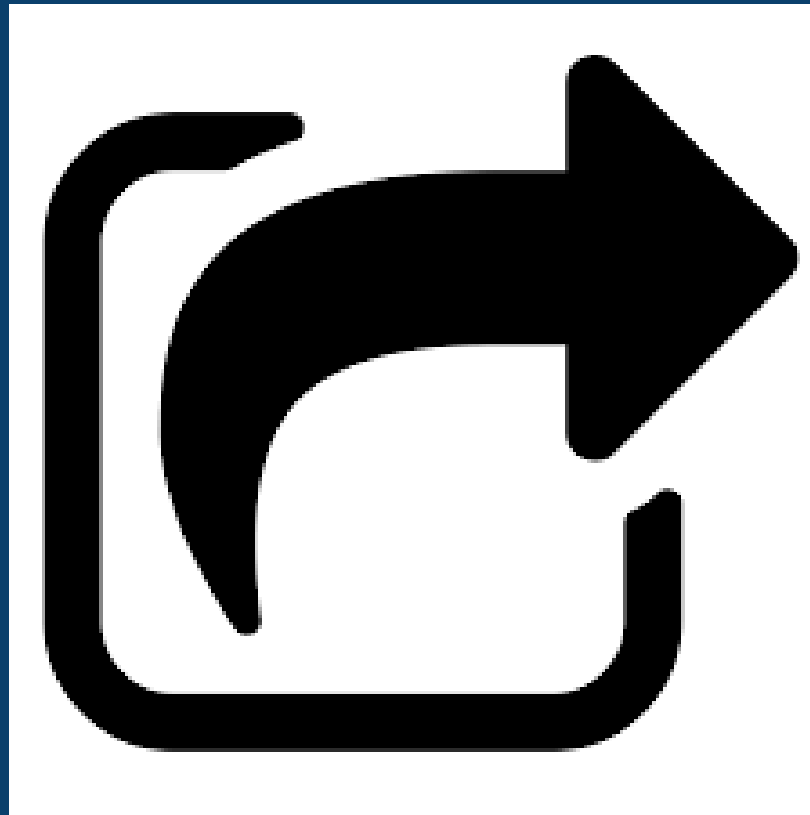


Let's Discuss Assumptions about “Current State”

5. What assumptions do we make regarding the relationship of the Misoperations data to reliability?



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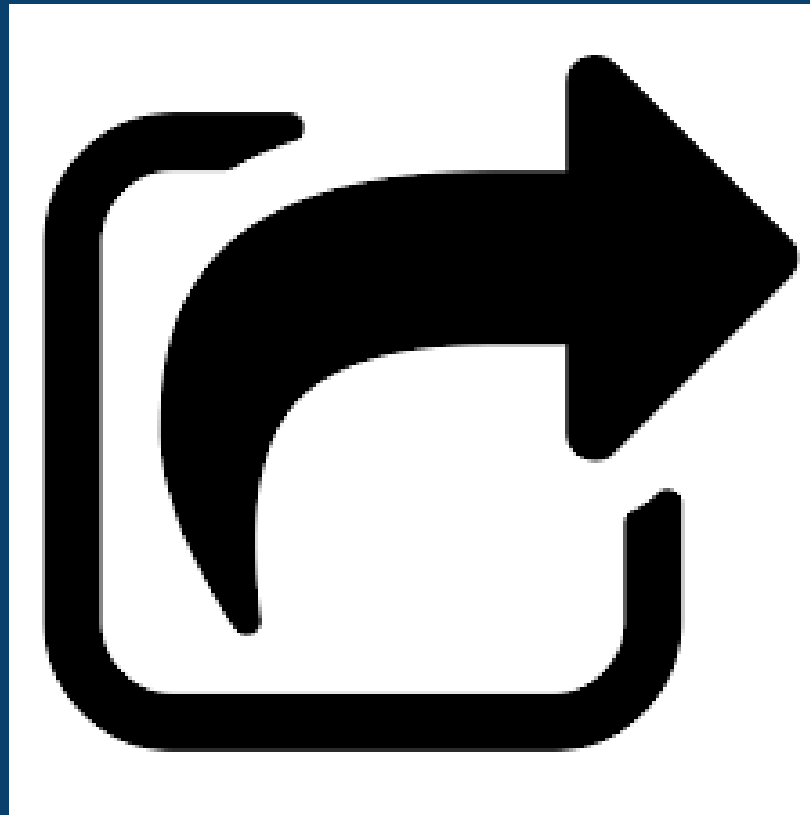


Let's Discuss Assumptions about "Current State"

On page 11 of the Draft ERO Strategic Plan, there is a proposed Misoperations goal of less than 8%.

6. What do you believe the outcomes of this requirement should be?
7. What do you assume the outcomes of this requirement will be?

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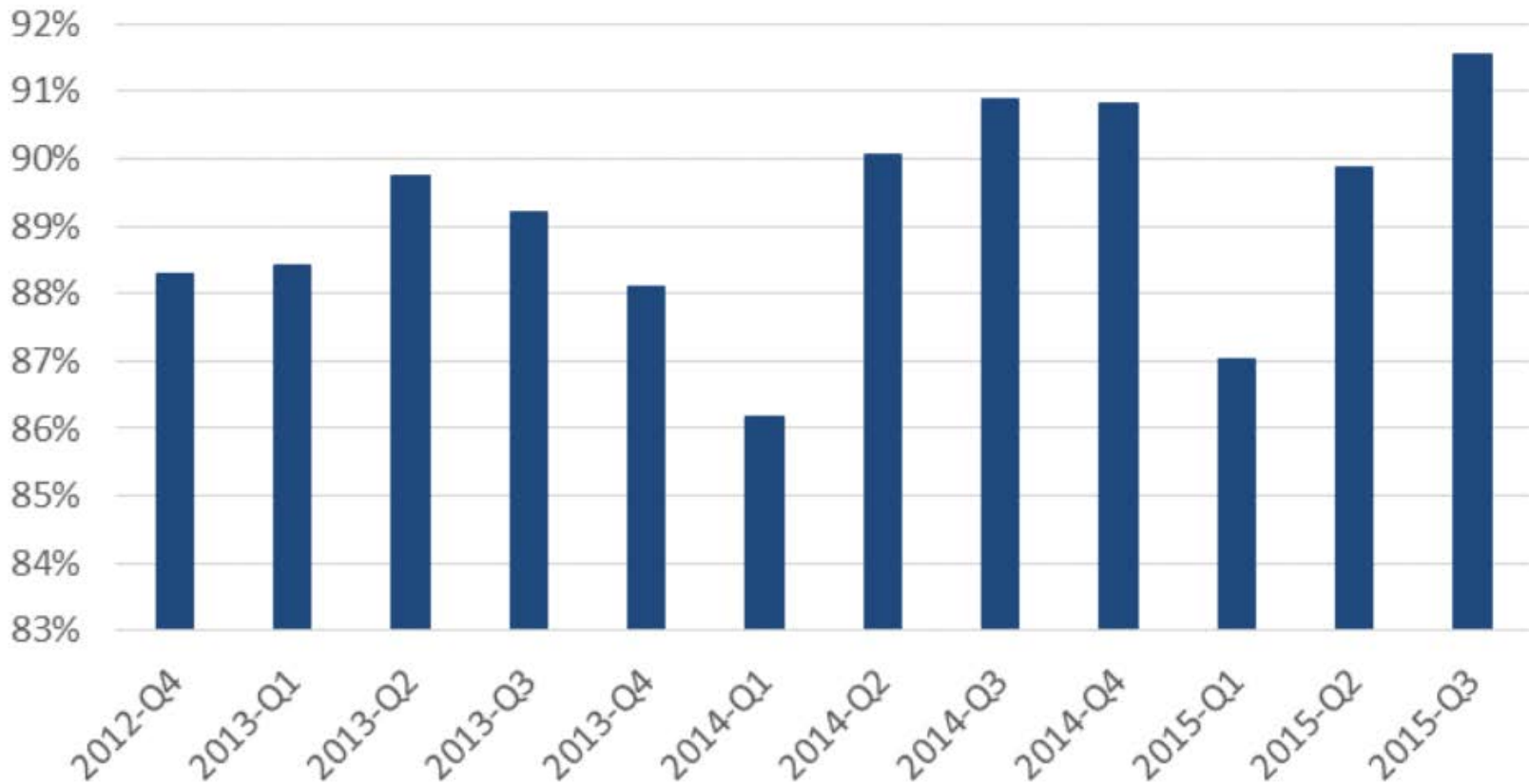


Data Examination





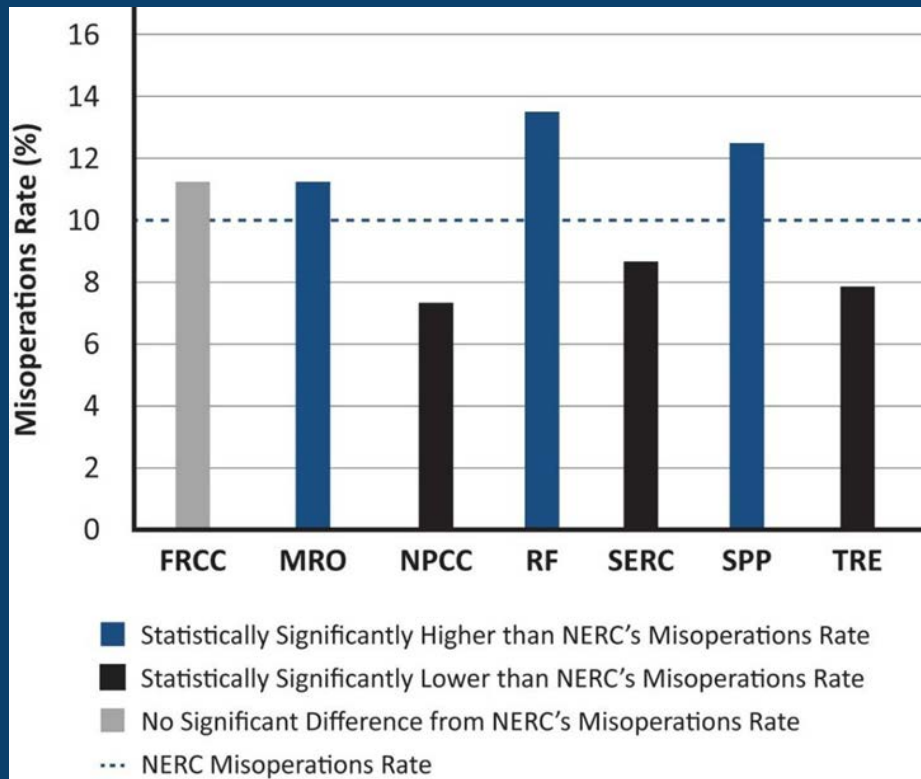
Correct Operation Rate



What meaningful conclusions can be gleaned from these data?

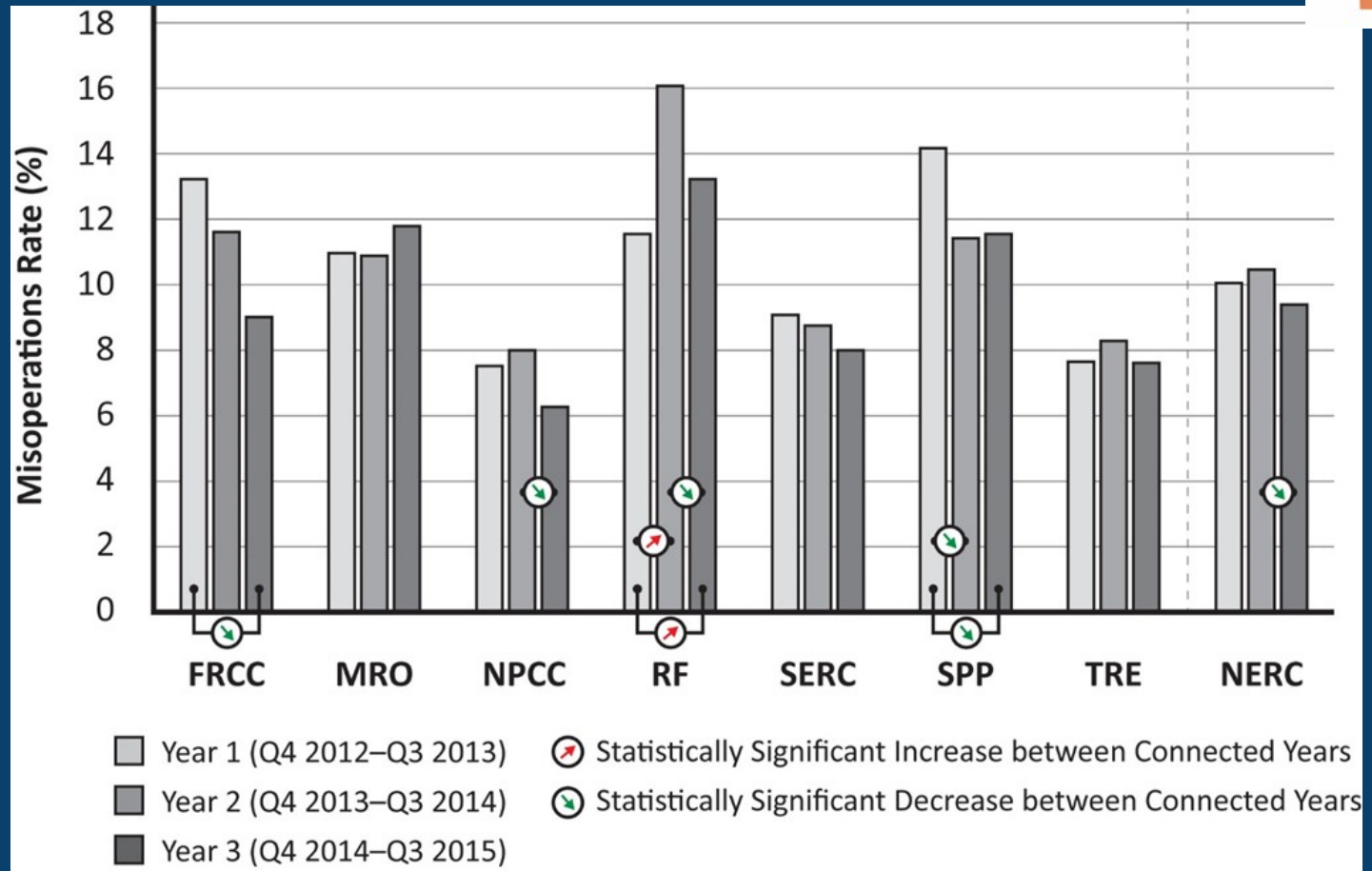


3-Year Misoperation Rate by Region (Q4 2012-Q3 2015)



What meaningful conclusions can be gleaned from these data?

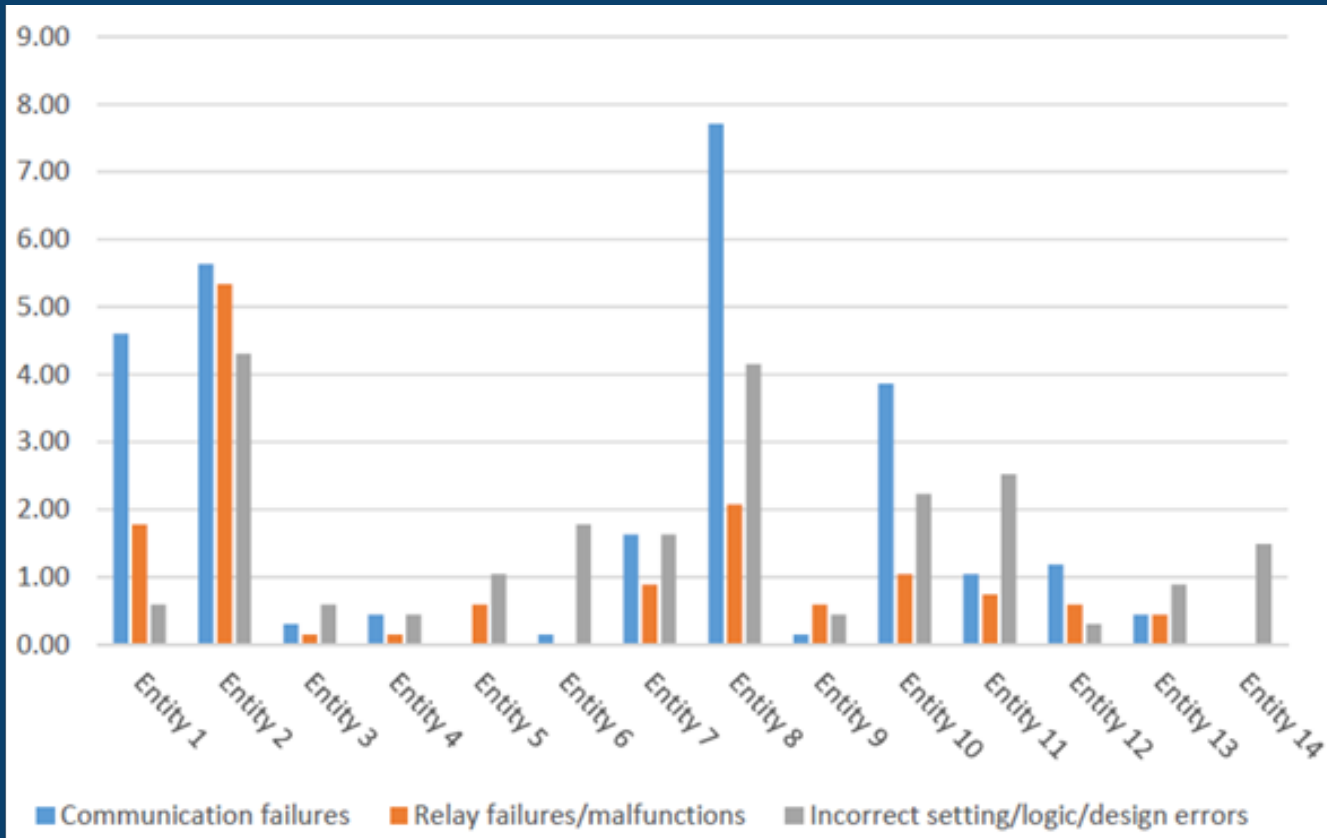
Year-Over-Year Changes in Misoperation Rate by Region and NERC



What meaningful conclusions can be gleaned from these data?



Misoperations (% of RTO Total)



What meaningful conclusions can be gleaned from these data?



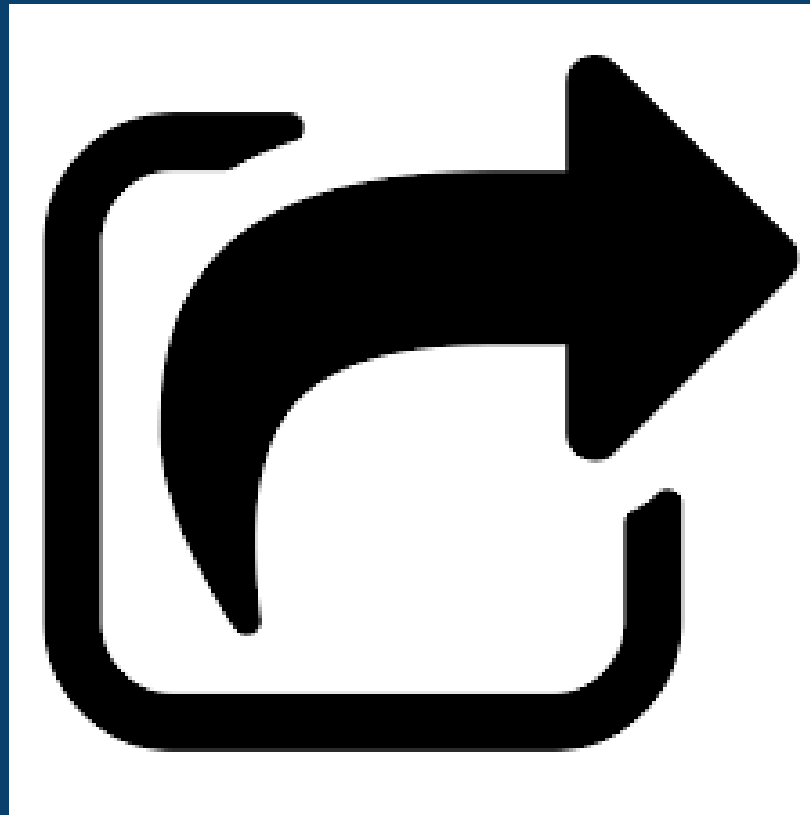


What assumptions do we make regarding the relationship of the Misoperations data to risk?

Do all Misoperations create equal risks to the BES? Why? Why not?

Does the available data accurately reflect the current state? In other words, do you see the data as valid and reliable? Why? Why not?

Share



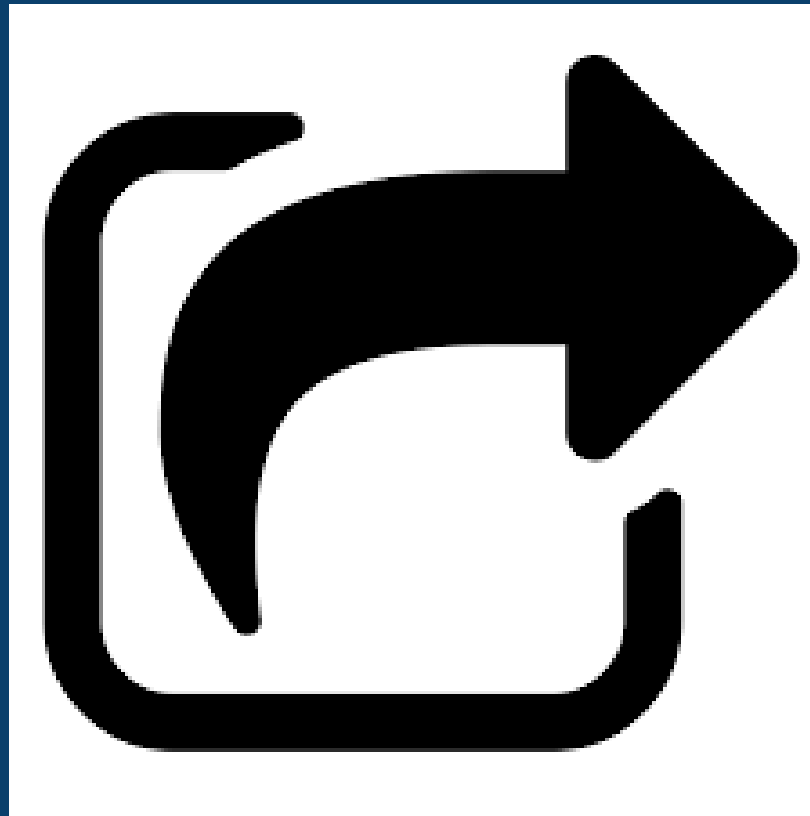
NERC has identified Communication Failures, Relay Failures and Malfunctions, and Incorrect settings/logic/design as the top three Misoperations, comprising 65% of Misoperations.

- What kind of intelligence can be gained by calculating and comparing the Misoperations rate by region?

NERC has identified Communication Failures, Relay Failures and Malfunctions, and Incorrect settings/logic/design as the top three Misoperations, comprising 65% of Misoperations.

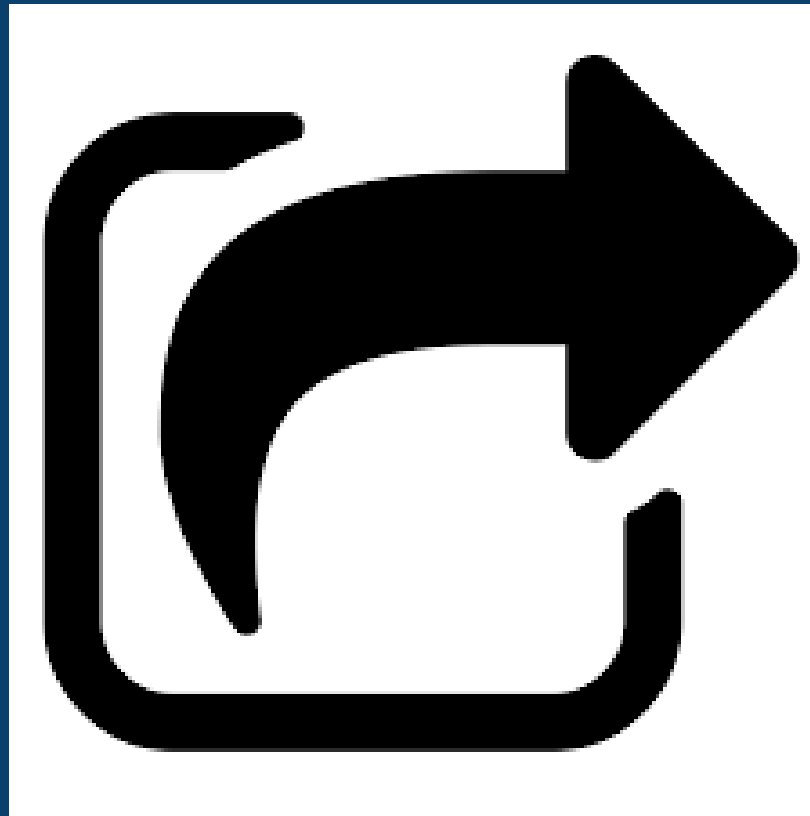
- How much of a reduction in these Misoperations numbers is required to significantly lower the risk to the BES?

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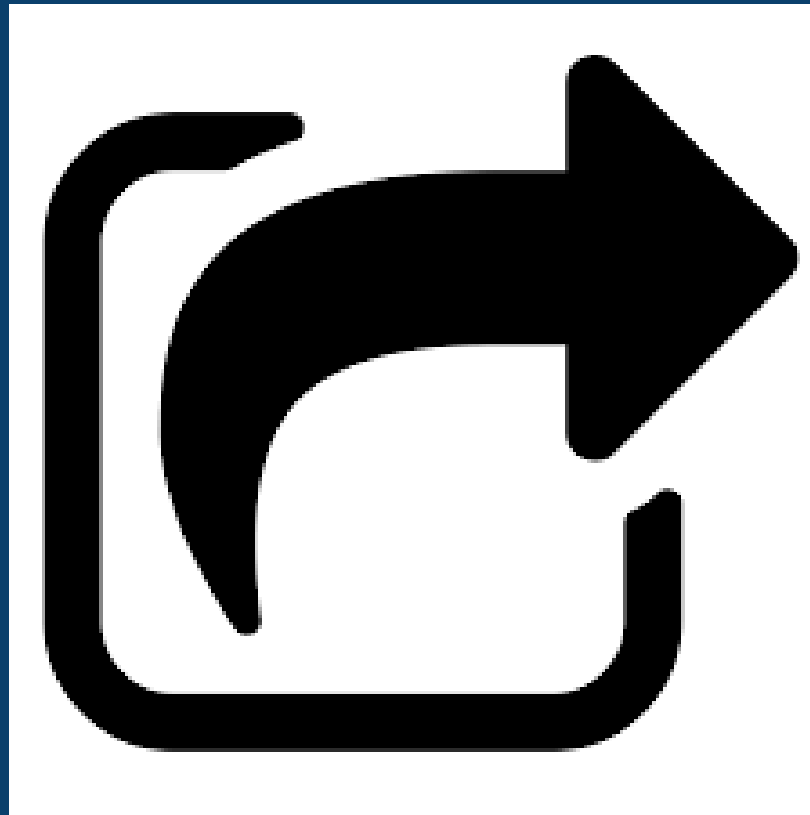


As we approach the goal to reduce Misoperations' rates below 8%, should our efforts be directed equally across all Misoperations' causes and all voltages? Why? Why not?

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Hypotheses and Risk





Example 4

Description of Misoperation/Failure

A single-end trip occurred on a 161 kV line during a thunderstorm. There was no loss of load, since the line remained energized from the opposite end. The cause of the trip was determined to be a false instantaneous input to the relay due to a voltage spike caused by lightning. The line is in close proximity to sensitive transmission and distribution equipment and the settings in the relay were valid according to documented calculations developed with the information available prior to the event. However, upon further investigation of the circumstances of this event, engineering personnel recommended a 1/4 cycle delay setting be added to possibly prevent this from happening in the future.



Example 4 – Please use Google to submit your response.

1. Do you consider this event a Misoperation?

Yes No

2. Do you believe this event could have been prevented? Yes No

3. How would you assess the risk of this event to the BES?

High Moderate Minimal



Example 4– Please use Google to submit your response.

Do you believe this event should be included in the NERC Misoperation Information Data Analysis System (MIDAS) reporting?

Yes

No



Example 4

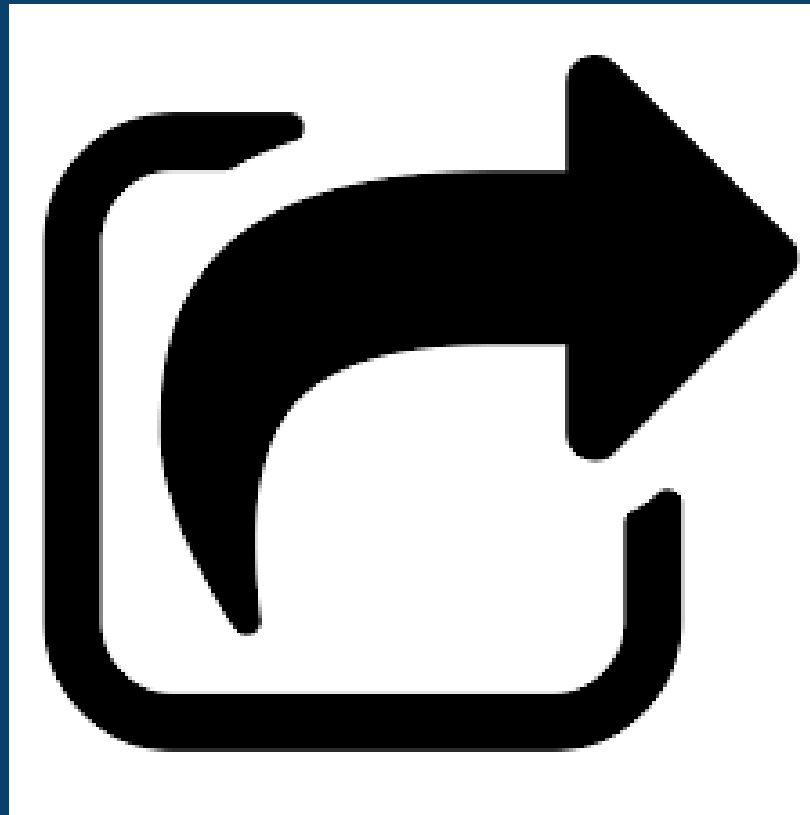
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Why?



Share





Example 5

Description of Misoperation/Failure

A single-end trip occurred on a 345 kV line during a thunderstorm. There was no loss of load, since the line remained energized from the opposite end. The cause of the trip was determined to be a false instantaneous input to the relay due to a voltage spike caused by lightning. The line is not in close proximity to sensitive transmission and distribution equipment and the settings in the relay were found to be invalid according to documented calculations. The 1/2 cycle delay setting deployed to possibly prevent this from happening was mistakenly not programmed into the relay by the technician during commissioning.



Example 5 – Please use Google to submit your response.

1. Do you consider this event a Misoperation?

Yes

No

2. Do you believe this event could have been prevented? Yes No

3. What is your assessment of risk to the Bulk Electric System posed by this event?

High

Moderate

Minimal



Example 5 – Please use Google to submit your response.

Do you believe this event should be included in the NERC Misoperation Information Data Analysis System (MIDAS) reporting?

Yes

No



Example 5

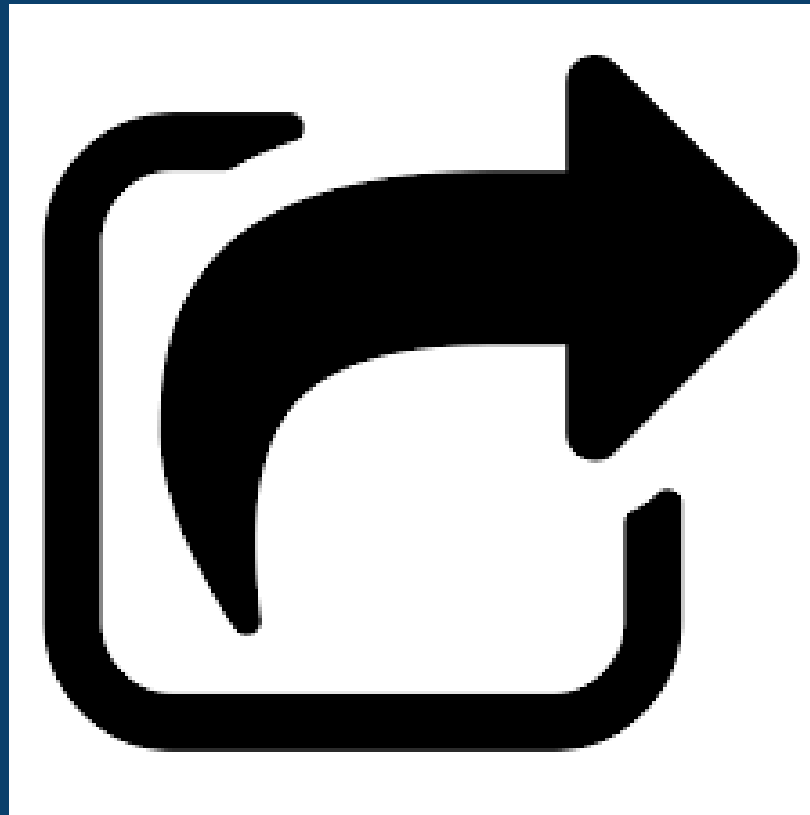
Description of Misoperation/Failure

A single-end trip occurred on a 345 kV line during a thunderstorm. There was no loss of load, since the line remained energized from the opposite end. The cause of the trip was determined to be a false instantaneous input to the relay due to a voltage spike caused by lightning. The line is not in close proximity to sensitive transmission and distribution equipment and the settings in the relay were found to be invalid according to documented calculations. The 1/2 cycle delay setting deployed to possibly prevent this from happening was mistakenly not programmed into the relay by the technician during commissioning.

Why?



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Example 6

Description of Misoperation/Failure

There was a fault between Sub A and Sub B, Sub B is a Sectionalizer substation. Breakers at Sub A and Sub C cleared the fault as expected. The sectionalizing breaker R1-4 at Sub B failed to open and sectionalize the line as it should have causing the line from Sub A to Sub C to lockout.



Example 6 – Please use Google to submit your response.

1. Do you consider this event a Misoperation?

Yes

No

2. Do you believe this event could have been prevented? Yes No

3. What is your assessment of risk to the Bulk Electric System posed by this event?

High

Moderate

Minimal



Example 6 – Please use Google to submit your response.

Do you believe this event should be included in the NERC Misoperation Information Data Analysis System (MIDAS) reporting?

Yes

No



Example 6

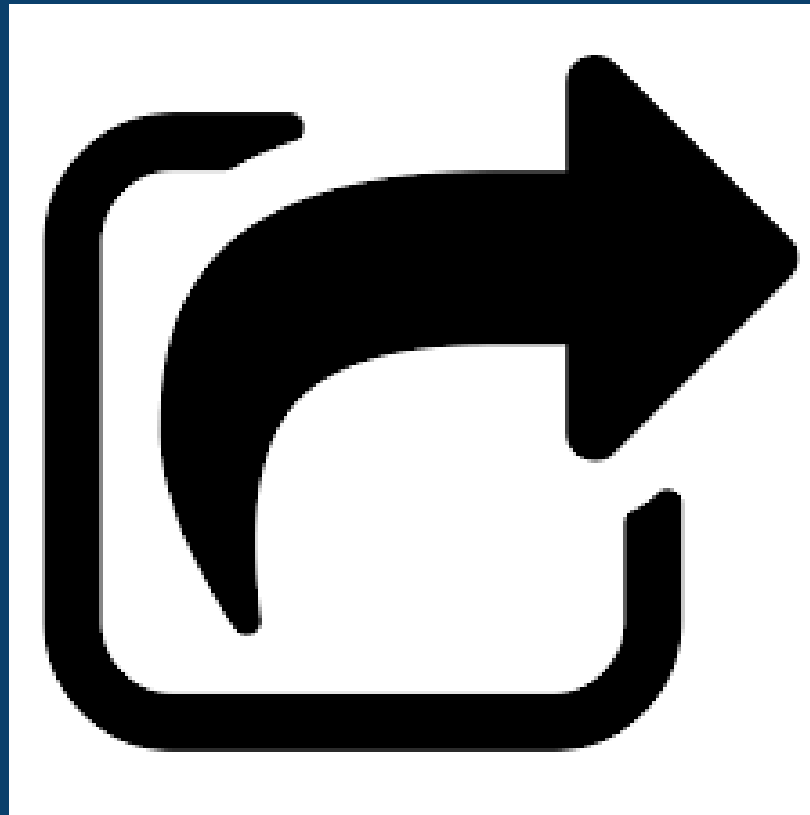
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Why?



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Example 7

Description of Misoperation/Failure

There is a failure of a protection system on a distribution transformer that is configured in a manner which the clearing of the high side of the transformer affects a BES line.



Example 7 – Please use Google to submit your response.

1. Do you consider this event a Misoperation?

Yes No

2. Do you believe this event could have been prevented? Yes No

3. What is your assessment of risk to the Bulk Electric System posed by this event?

High Moderate Minimal



Example 7 – Please use Google to submit your response.

Do you believe this event should be included in the NERC Misoperation Information Data Analysis System (MIDAS) reporting?

Yes

No



Example 7

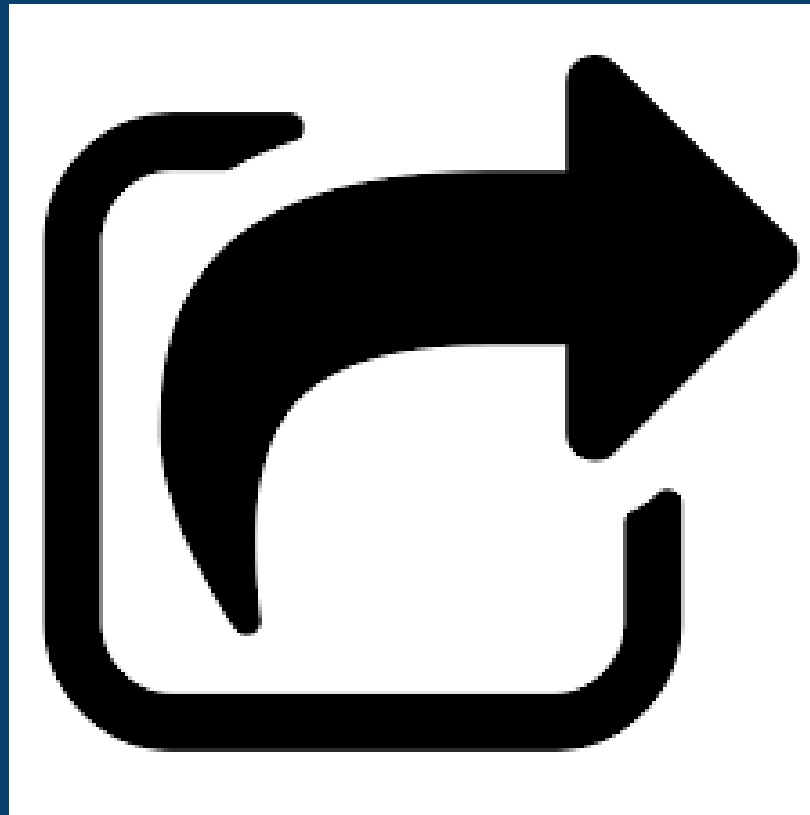
Description of Misoperation/Failure

There is a failure of a protection system on a distribution transformer that is configured in a manner which the clearing of the high side of the transformer affects a BES line.

Why?



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Hypothesis

- This is a proposed explanation of why the Misoperations' rates are above 8% and a prediction about countermeasures that could lower the Misoperations' rates.

Hypothesis

- Example: Misoperations related to Communication Failures are due to abc.
- If countermeasure xyz is implemented, then there will be a significant reduction in Misoperations related to Communication Failures.



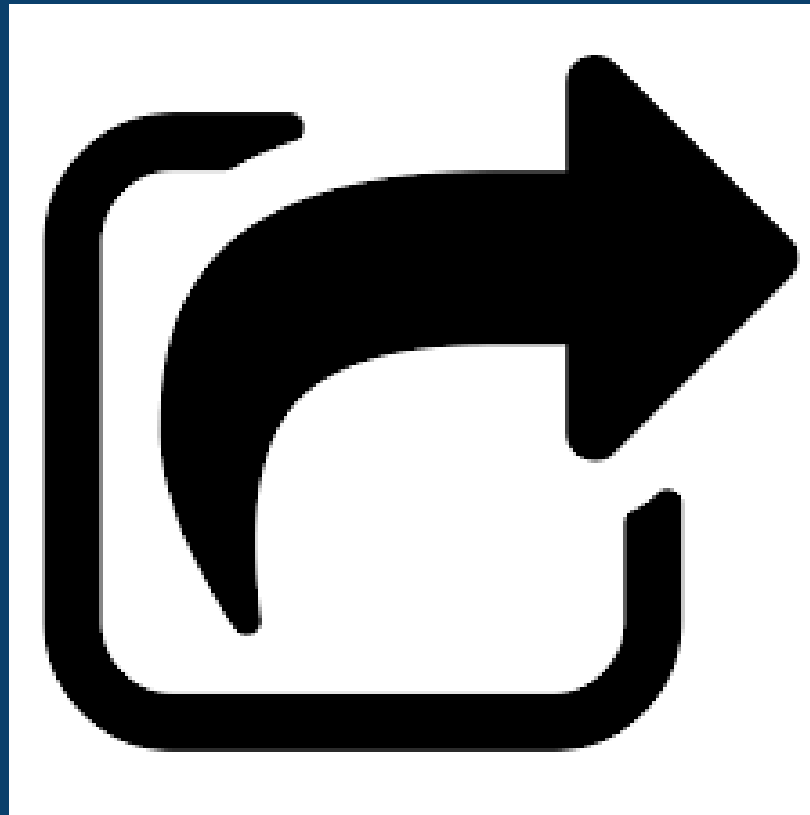
Hypothesis

Misoperations related to _____ are due to _____.

If countermeasure _____ is implemented, then there will be a significant reduction in Misoperations related to _____.

Refer to Cause Code handout on your table.

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Testing Your Hypotheses



Small Group Discussion

- Choose a countermeasure that could be implemented to reduce Misoperations while concurrently reducing the risk to the BES? And describe how it would be implemented (e.g., tools, processes/procedures).
- What is the relationship between your countermeasure and increased reliability?
- What data would you collect to document this relationship?



Let's Brainstorm!

1. What data should be collected analyzed?
2. What trends in the data might you expect and how can you detect those trends?
3. How can the data you're proposing to collect illustrate the impact of countermeasures?
4. What conclusions and recommendations would you like to be able to draw from the data?

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