PCS Misoperations Report

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Electric Reliability
& Security for the West

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PCS Misoperations Report

PCS performs this report annually

- Typically published October timeframe

Uses MIDAS submissions

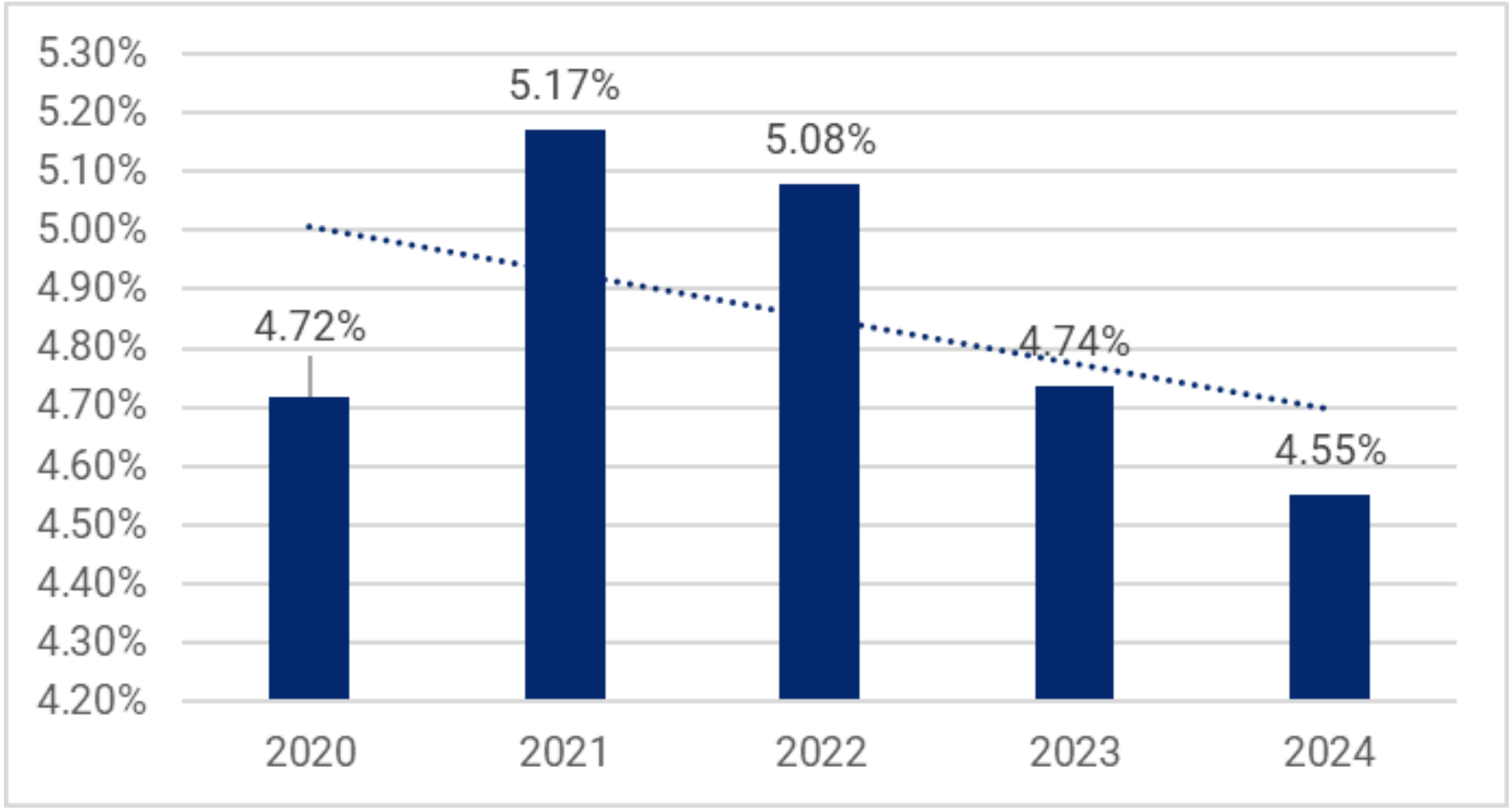
- NERC 1600 Request for reporting Protection System Misoperations on a quarterly basis

PCS Meets quarterly

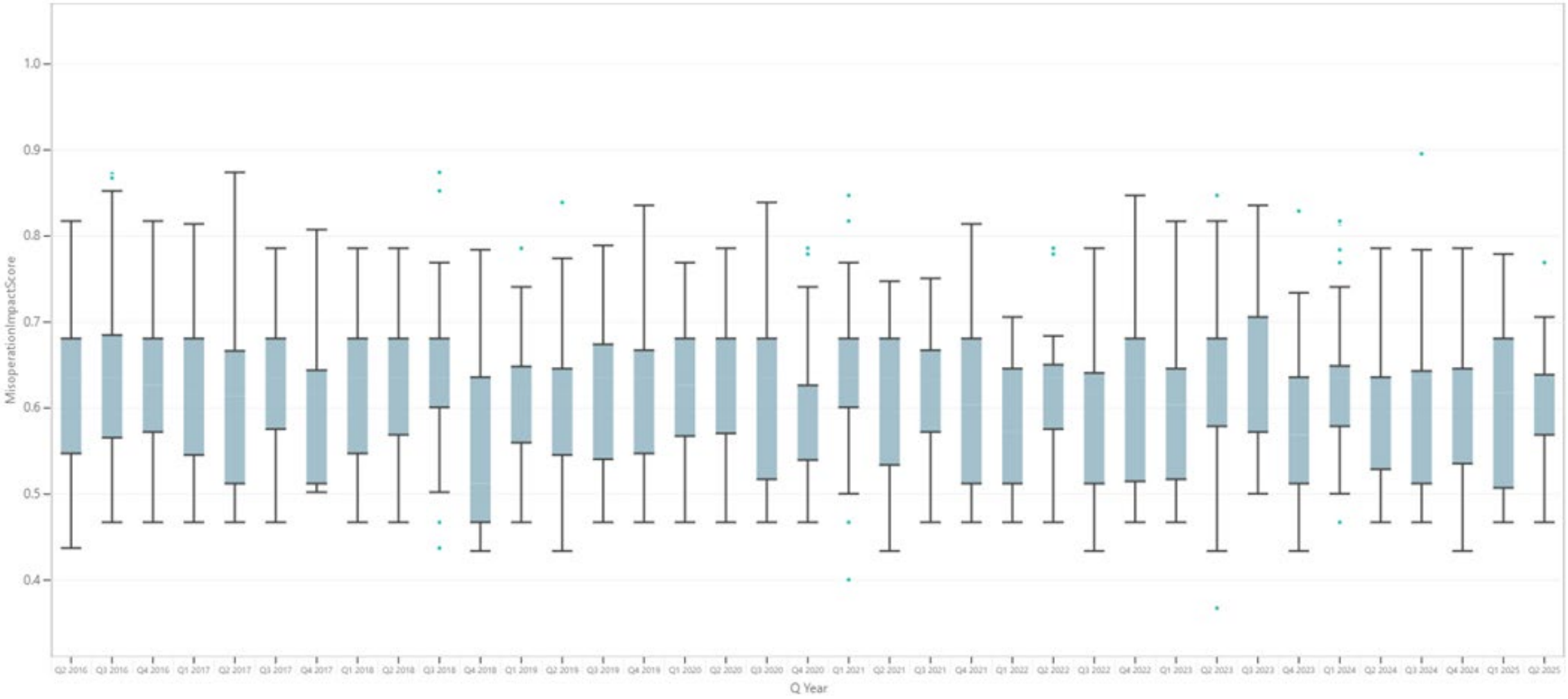
- Closed session to review that quarters MIDAS submissions
- Incorrect or unclear submissions are flagged for corrections/updates

Reports are published on the PCS Document Library site

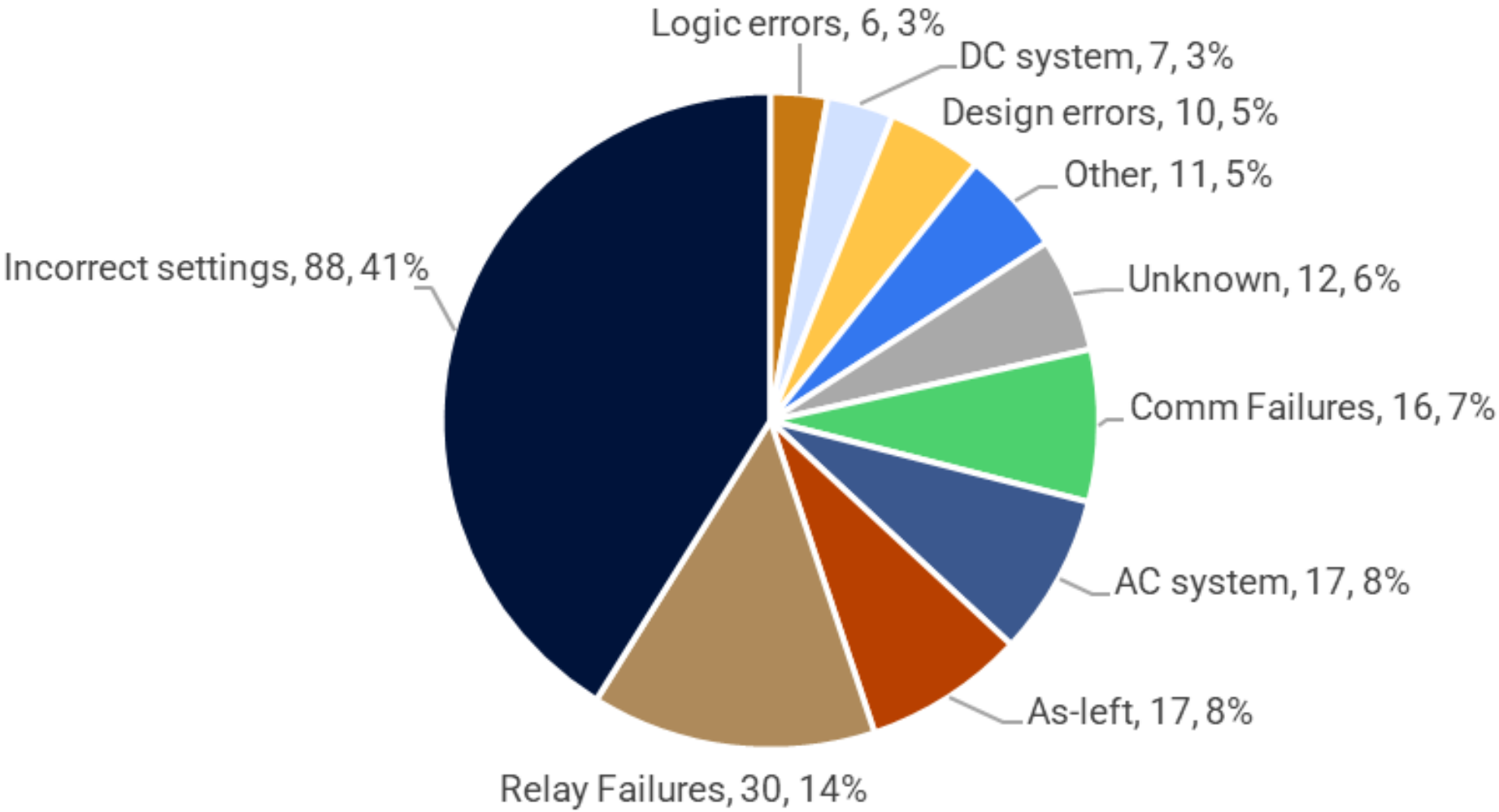
Misoperations Rate



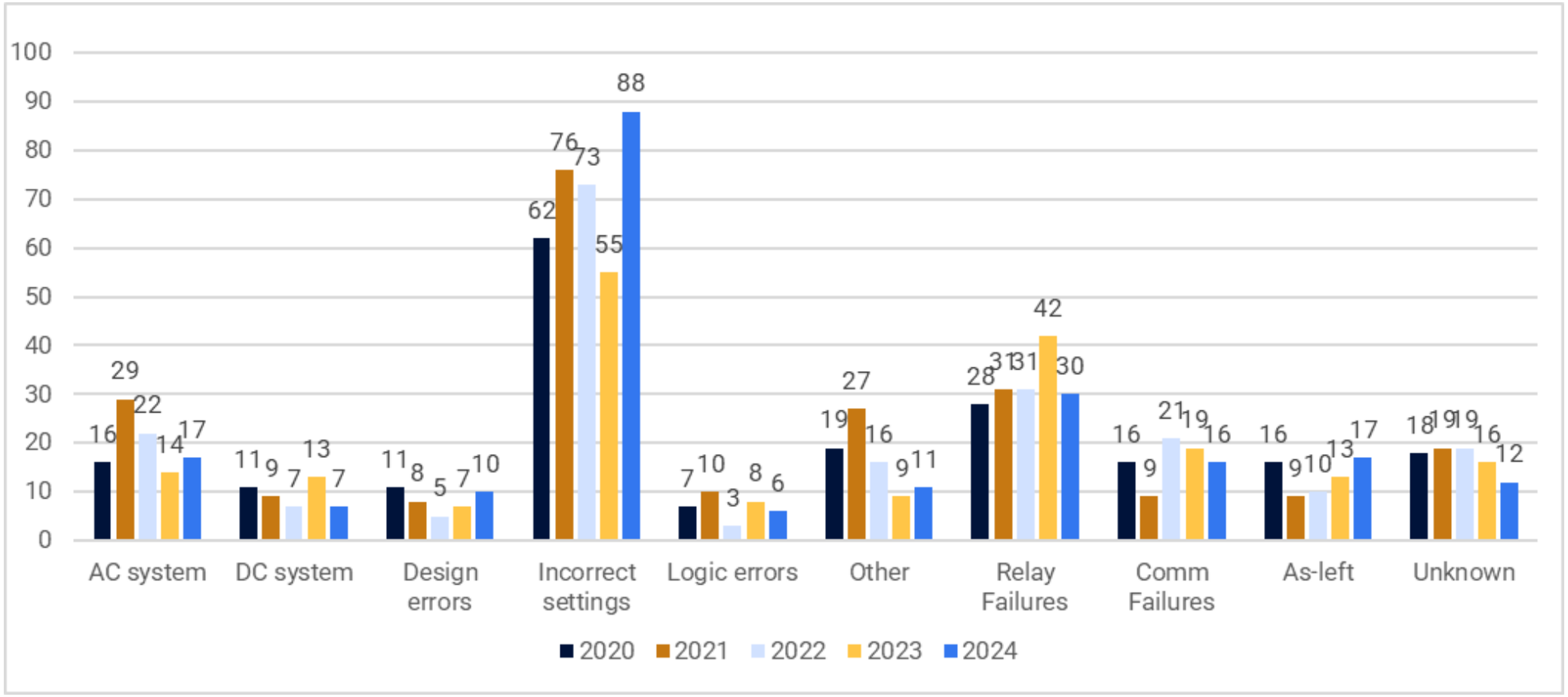
Misoperations Impact Score



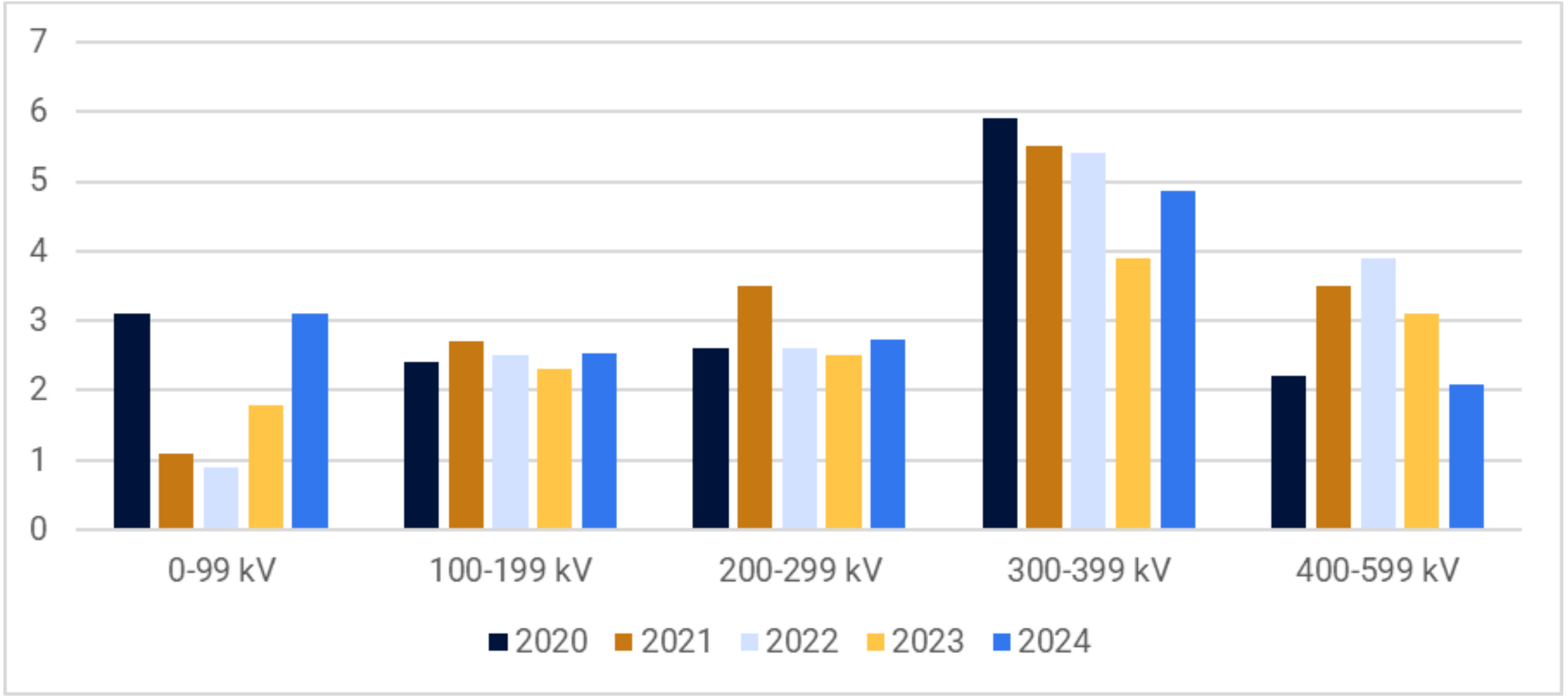
Breakdown of Misoperations by Cause



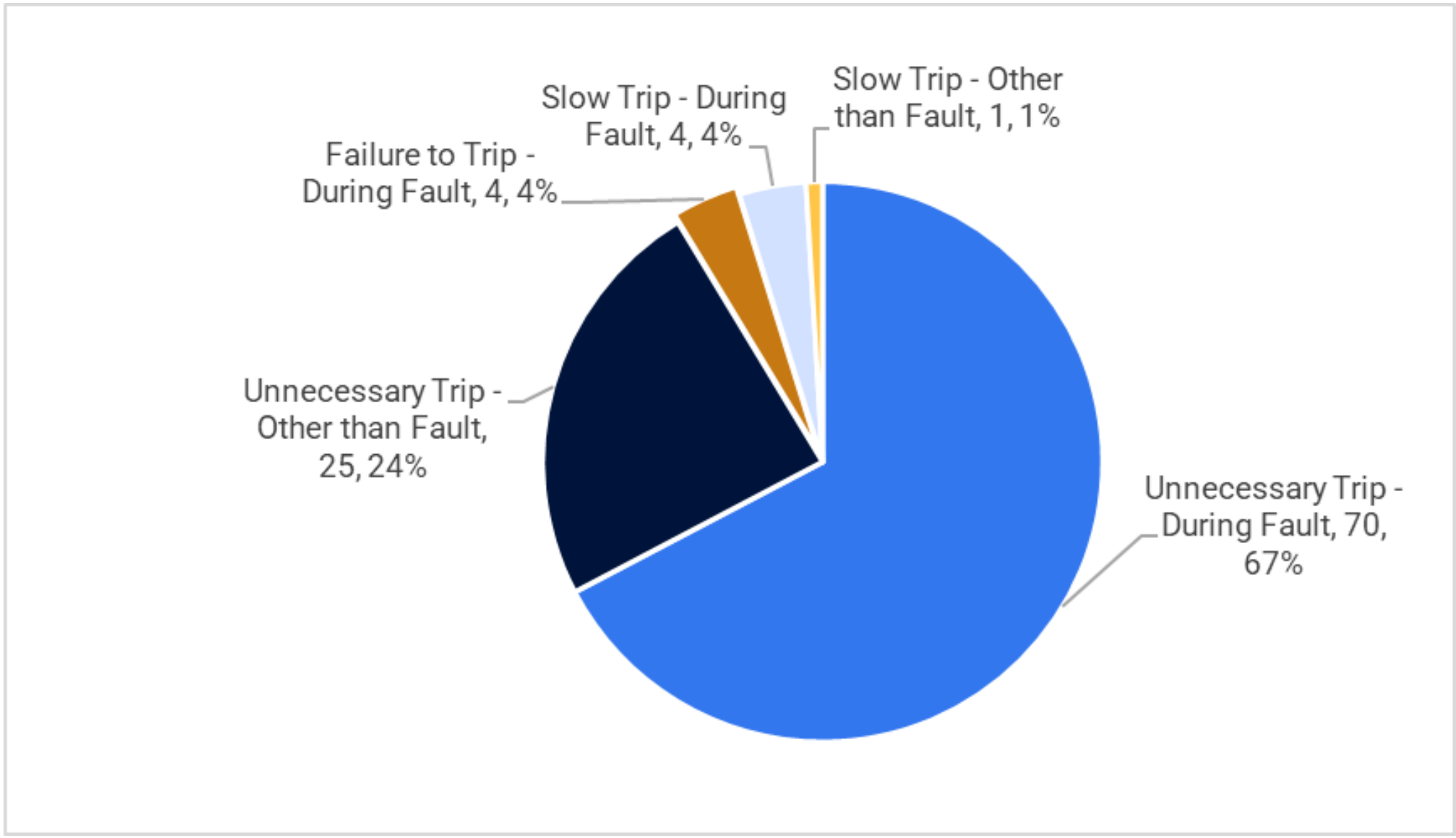
5 Year Cause Trending Chart



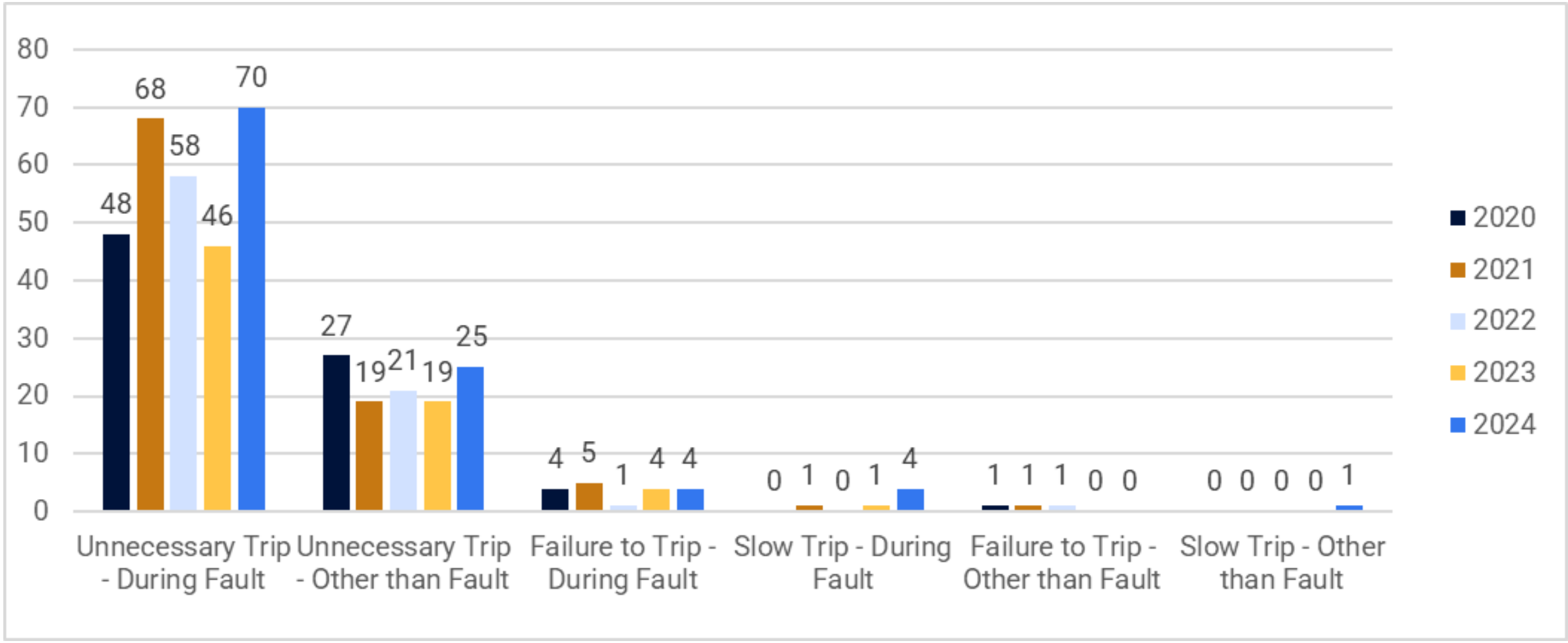
Fraction of Misoperations per TADS Element by Voltage Class, 2020–2024



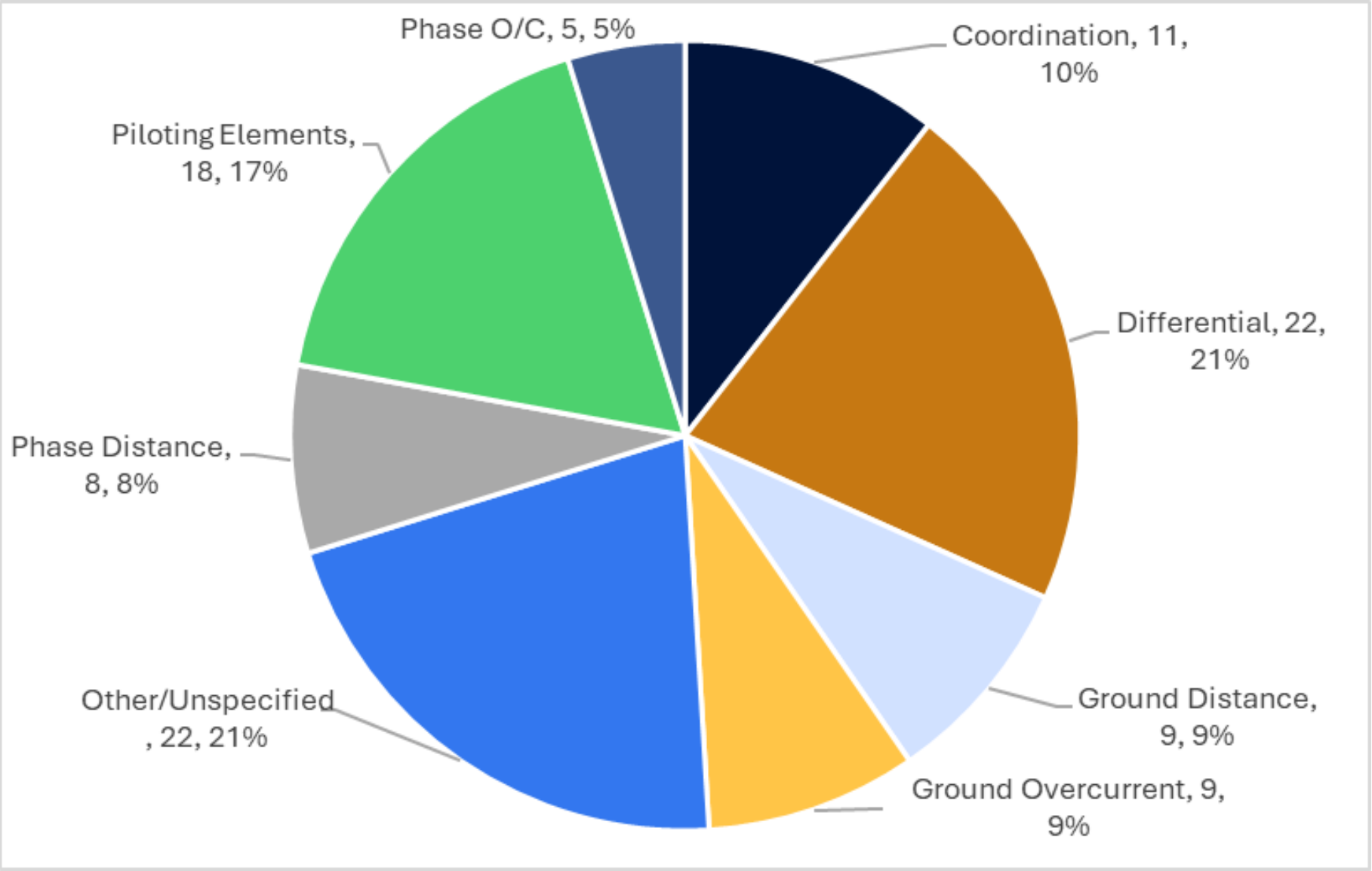
2024 Incorrect Settings, Logic Errors, and Design Errors by Misoperation Category



Incorrect Settings, Logic Errors, and Design Errors by Misoperation Category, 2020–2024



2024 Incorrect Settings, Logic Errors, and Design Errors by Protection Elements



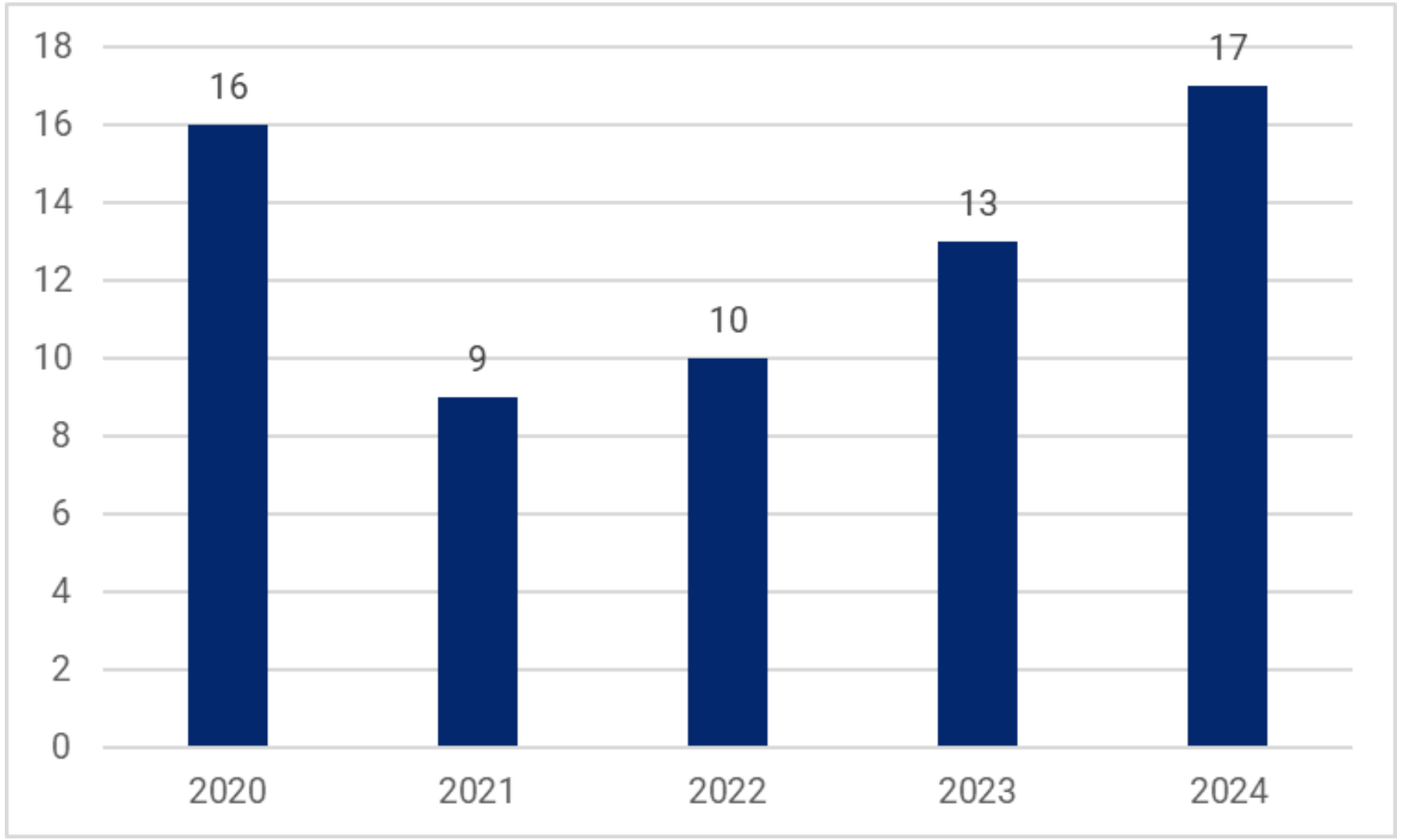
Recommendations for Incorrect Settings Section

Incorrect Setting, Logic Errors, and Design Errors Misoperation Recommendations:

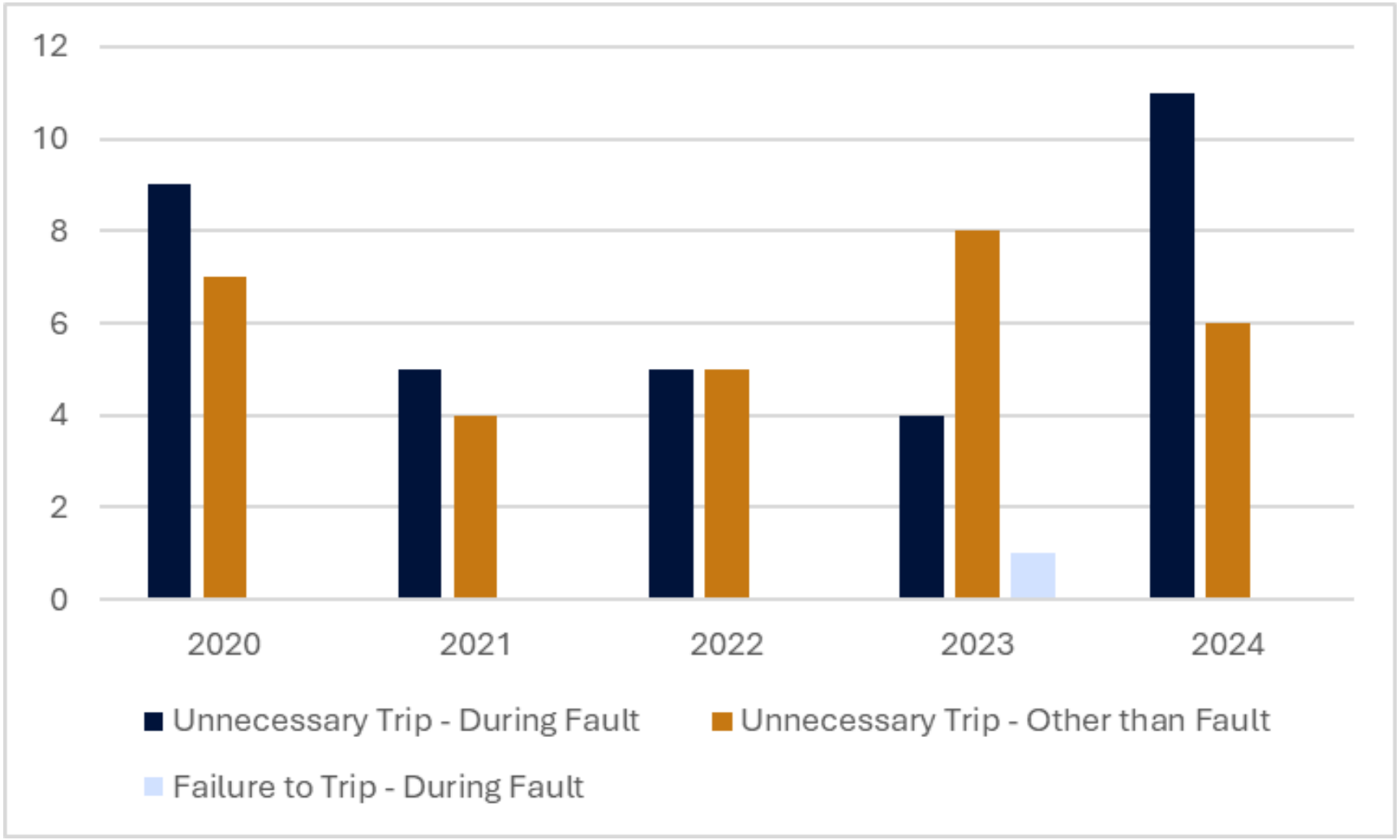
Entities should consider the following recommended practices:

- Develop written standards and guides explaining the expectations for their protection engineers about verifying that the fault system model is correct including mutual coupling, the settings have been properly coordinated, the contingencies considered for coordination are consistently addressed, proper setting values of the elements are applied, and the elements for the application are enabled to ensure consistent performance.
- Develop a process for reviewing new and existing settings to ensure changes to the system do not result in misoperations. Have a formal training process for employees who are new to the Protection Department.
    - Use experienced personnel as mentors.
    - Establish a strategy on what and when skills should be introduced as experience is developed; for instance, non-directional overcurrent followed by transformer, differential followed by step distance, etc. during the first year to guide the mentor in developing the new engineer.
    - Establish familiarity with company standards and practices for protection systems.
    - Involve new employees in the setting testing process.
    - Review the process for developing and updating short-circuit models and testing programs.
    - Consider impedance testing of transmission lines to verify parameters used in models
- Use satellite-synchronized testing technologies when commissioning communications-assisted schemes to ensure all components of the protection system work as designed.
- Use standardized settings templates to reduce the opportunity for human errors when developing settings.
- Develop a process to regularly review existing ground overcurrent settings to ensure changing system conditions do not result in a misoperation.

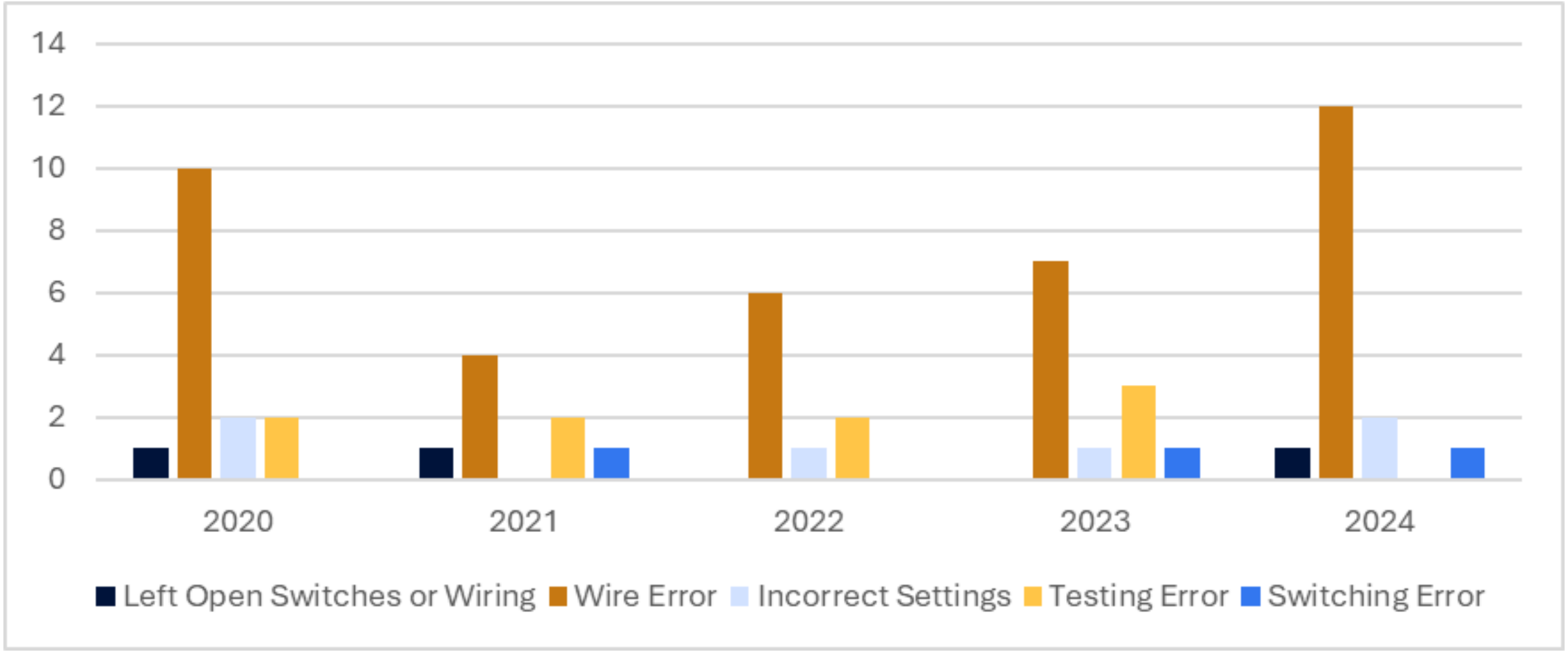
Western Interconnection As-Left Personnel Error Misoperations, 2020–2024



As-Left Personnel Error Misoperations by Tripping Category, 2020–2024



As-Left Personnel Error Misoperations by Cause, 2020–2024



Recommendations for As-Left Personnel Error

As-Left Personnel Error Recommendations

Entities should consider the following recommended practices:

- Perform peer reviews of the CT connections. Two common errors are: wrong CT ratios, and shorting screws improperly left in place. These should be easy to identify because the proper configuration can be confirmed visually even before in-service (load) checks are performed.
    - One form of peer review will use a different person to perform wiring checks than the person who did the original wiring.
- Perform in-service checks to confirm correct CT and PT phasing and polarity. If system conditions make in-service (load) checks difficult or inconclusive, primary injection tests can be helpful. Using the differential command to verify no operating current can be helpful as well.
- Use commissioning checklists. Most of these issues can be successfully addressed using appropriate commissioning checklists, including in-service and primary injection checks, checking for tight connections, tugging on connections, and leaving quality assurance marking at the terminal block.
- Relay technicians should compare as-found and as-left settings after relay maintenance testing to reduce the chances of leaving wrong settings on a relay.
- Settings engineers should review as-left settings from the field and verify that any changes from the issued settings are acceptable.
- Perform test procedures designed to use engineer-issued settings (not requiring temporary “test” settings) to reduce testing and Incorrect Settings errors. When this is not practical or possible, to minimize the chance that “test” settings could be left in place when “issued” settings should be restored, system design could include SCADA, annunciator, or HMI alarms when a “test” setting group is active or a selector switch is in the “test” position. Use design or operations practices that result in all test switches being closed during normal operation, making it easy to identify improperly open test switches.
- Point-to-point continuity checks can be documented to be completed with acknowledgement on the wiring diagram using a known marking color that represents completion of the task.

NERC SPCWG MAT Efforts

SPCWG MAT

- NERC SPCWG would like to start producing an annual report

- Team's efforts this year
  - Identifying which changes to the MIDAS 1600 Request would assist in this effort and submitting change request
  - Identify responsibilities for regional protection groups and Regional Entities
  - Determining focus of report (example: all cause categories vs focus on a few categories)

2025 Focus

- These efforts are broken out into three main sections
  1. Ensuring completeness of Data
  2. Misoperation metrics for 2020-2024
     a) Provide the regional Misoperation rate by year
     b) Provide the counts and percentages for your top three causes of misoperations by year. Include Incorrect Settings and Relay Failure if not one of your top three causes
     c) Provide the 5-year counts and percentages for your top three causes by:
        a) Equipment Type
        b) Misoperation Category
  3. Regional Feedback

WECC

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