NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	TPL-001-5.1 Footnote 13.d		
Date Submitted:	12/08/2022		
SAR Requester			
Name:	Scott Hayes or Tyler Brun		
Organization:	Pacific Gas and Electric (PG&E)		
Telephone:	916-769-8363 or 530-591-3105	Email:	Scott.Hayes or Tyler.Brun@PGE.com
SAR Type (Check as many as apply)			
☐ New Standard ☒ Revision to Existing Standard ☐ Add, Modify or Retire a Glossary Term ☐ Withdraw/retire an Existing Standard		☐ Imminent Action/ Confidential Issue (SPM Section 10) ☐ Variance development or revision ☐ Other (Please specify)	
Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)			
☐ Regulatory Initiation ☐ Emerging Risk (Reliability Issues Steering Committee) Identified ☐ Reliability Standard Development Plan		☐ NERC Standing Committee Identified ☐ Enhanced Periodic Review Initiated ☒ Industry Stakeholder Identified	
Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):			
The NERC TPL-001-4 Reliability Standard was revised to TPL-001-5.1 (subject to Enforcement July 1, 2023), which expanded Footnote 13[1] from specific Protection System[2] relays to include communication systems,			

[1] TPL-001-5.1 Footnote 13: For purposes of this standard, non-redundant components of a Protection System to consider are as follows:

a. A single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times;
b. A single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (an exception is a single communications system that is both monitored and reported at a Control Center);
c. A single station dc supply associated with protective functions required for Normal Clearing (an exception is a single station dc supply that is both monitored and reported at a Control Center for both low voltage and open circuit);
d. A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center).

[2] Glossary of Terms Used in NERC Reliability Systems:

Requested information
station DC supply, and control circuitry. More specifically, Footnote 13.d now applies to control circuitry from the DC supply through and including the circuit breaker trip coil. However, the footnote only provides an exclusion for a single (non-redundant) monitored and reported trip coil, but not the control circuit itself. By only excluding the trip coil and not permitting the control circuitry to be excluded, it implies that the remainder of the Protection System control circuitry is not excluded, even if it is monitored and reported. For example, it is very common to install trip circuit monitoring which monitors the control circuitry and the trip coil, but the trip coil is the only component that qualifies for the TPL-001-5.1 exclusion. The current exclusion provides no practical mechanism to be used by the Distribution Provider (DP), Generator Owner (GO), and Transmission Owner (TO) other than installing redundant control circuitry when necessary to meet Bulk Electric System (BES) performance requirements under TPL-001-5.1. Modern Protection System design includes many additional components that typically are monitored (or could become monitored and reported). Including all of the components that are monitored and reported will result in a more practical, efficient, and effective Footnote 13.d exclusion rather than adding to Protection System complexity by installing completely redundant control circuits. By modifying the Footnote 13.d exception to apply to any monitored and reported components of the control circuitry to be consistent with Protection System design and operational functionality will allow the DP, GO, and TO to achieve the required transmission performance mandated by TPL-001-5.1 in a much more efficient manner.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
The goal is to enhance the language of the Footnote 13.d exclusion to include “any non-redundant components of the control circuitry that are both monitored and reported” in addition to the current exclusion of the single trip coil. The proposed modification will reduce the burden on the DP, GO, and TO that would be required to install redundant control circuitry to ensure the BES will operate reliably over a broad spectrum of system conditions and following a wide range of probable contingencies that are studied under the TPL-001-5.1 Reliability Standard. This goal can be accomplished by modifying the exclusion language to include monitored and reported components of the control circuitry while reducing risk to BES performance by avoiding additional Protection System complexity.

Continued from page 1.

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.

Requested information
Project Scope (Define the parameters of the proposed project):
Modify Footnote 13.d exclusion language on single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (any non-redundant components of the control circuitry may be excluded if they are both monitored and reported at a Control Center).
Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification[3] which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (*e.g.,* research paper) to guide development of the Standard or definition):
The scope of Footnote 13 d is the entire control circuitry, however the current wording of Footnote 13 d only excludes a single trip coil if it is both monitored and reported. This SAR requests that any non-redundant components of the control circuitry may be excluded if they are both monitored and reported. Adding unnecessary complexity to Protection System control circuitry, through redundancy when monitoring and reporting is an efficient and effective way to ensure Protection Systems are reliable, could increase misoperations related to Human Error[4] in the DC system and design. The 2022 State of Reliability[5] (SOR) report specifically documented an area of "Increasing Complexity of Protection and Control Systems Protection and Control Systems." As the system of interconnected power generation, transmission, and distribution assets has evolved, so too has the numbers and types of automated tools and systems. This technologically diverse environment allows an operator to manage specified controls from virtually anywhere and at a cost far lower than what would have been possible otherwise. When designed and implemented properly, automated tools can enhance the reliable and secure use of new technologies and concepts that become available. On the other hand, maintaining, prudently replacing, and upgrading Bulk Power System[6] (BPS) control system assets can lead to protection and control system misoperations. Misoperations can initiate more frequent and/or more widespread outages. Figure 4.23 from the 2022 SOR shows that DC system and design error make up 8-9% of the Misoperation causes for years 2017-2021.

[3] The NERC Rules of Procedure require a technical justification for new or substantially revised Reliability Standards. Please attach pertinent information to this form before submittal to NERC.
[4] Human Error: relative human factor performance that include any incorrect action traceable to employees and/or contractors to companies operating, maintaining, and/or assisting the Transmission Owner.
[5] See, NERC State of Reliability 2022 report, pp. 50-58, https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2022.pdf
[6] Bulk-Power System: (A) facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and (B) electric energy from generation facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy. (Note that the terms "Bulk-Power System" or "Bulk Power System" shall have the same meaning.)

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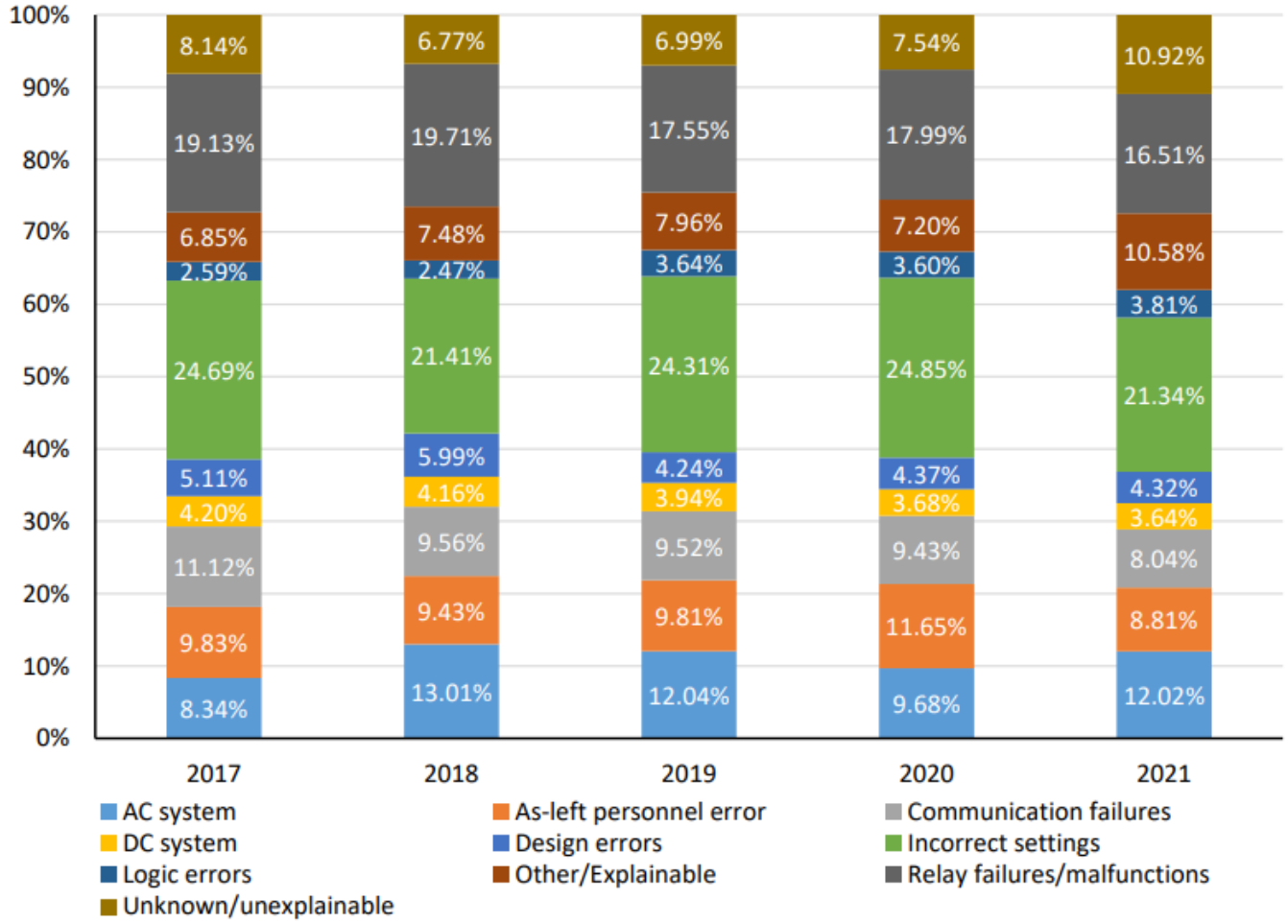

Year	2017	2018	2019	2020	2021
Misoperation Count	1,550	1,539	1,345	1,167	1,180

Figure 4.23: Misoperations by Cause Code (2017–2021)

Human Error and Protection System Misoperations

Protection System misoperations remain an important indicator of the reliability of the BPS; Human Error is one of the potential causes for misoperations to occur. Figure 4.29 from the 2022 SOR shows the number of misoperations due to Human Error by Regional Entity. There are two different causes of Human Error misoperations reported to NERC through the Misoperation Information Data Analysis System (MIDAS): As-left Personnel Errors and Incorrect Settings/Logic/Design Errors. Together, these account for roughly 40% of misoperations over years 2017-2021. As-left Personnel Errors can be the as-left condition of the composite protection system following maintenance or construction procedures. These include test switches left open, wiring errors not associated with incorrect drawings, carrier grounds left in place, settings placed in the wrong relay, or settings left in the relay that do not match engineering intended and approved settings.

Requested information
Unnecessarily requiring redundant control circuitry increases the opportunity for increase "as-left" condition errors, which can lead to misoperation. Design errors involve incorrect physical design. Examples include incorrect configuration on AC or DC schematics on wiring drawings or incorrectly applied protective equipment.

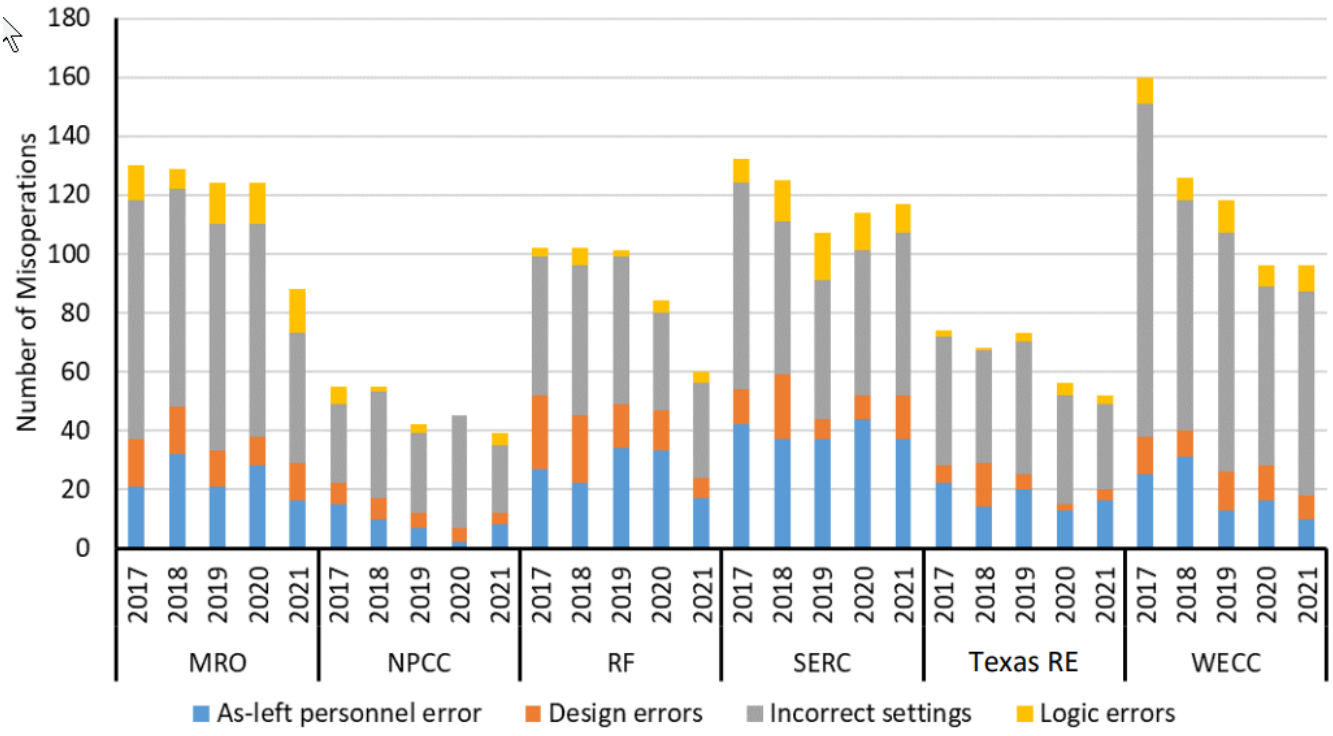

Figure 4.29: Protection System Misoperations Due to Human Error by Regional Entity[58]

*Figure 4.29 Footnote #58: Protection System Operation data collection for WECC began in Q2 2016.

Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
Adopting the proposed change would have no known increased cost impact.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):
None known.
To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (*e.g.*, Transmission Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):
Based on the scope of this SAR there would not be any changes to the applicability of TPL-001-5.1, which is applicable to the Planning Coordinator and Transmission Planner. However, it should be noted that Footnote 13 directly affects Protection System equipment that is the responsibility of the DP, GO, and TO.

Requested information
Do you know of any consensus building activities[7] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
PG&E has made presentations to the Centre for Energy Advancement through Technological Innovation, North American Transmission Forum, Edison Electric Institute, Western Electricity Coordinating Council Relay Working Group, and NERC System Protection and Control Working Group. While formal endorsement of the SAR was not made by these organizations, feedback for the need to revise TPL-001-5.1 was favorable.
Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)?
None known.
Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives.
None known. A modification to the TPL-001-5.1 Reliability Standard is recommended because the current Footnote 13.d language is limited to only an exclusion for the trip coil within the Protection System control circuitry. To address this concern, revision to the language is required to allow the full exclusion of a single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the DC supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (any non-redundant components of the control circuitry may be excluded if they are both monitored and reported at a Control Center) so that the performance requirements of TPL-001-5.1 may be achieved efficiently and effectively.

Reliability Principles	
Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply.	
☒	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☐	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☐	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.

[7] Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

Reliability Principles	
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

Market Interface Principles	
Does the proposed standard development project comply with all of the following Market Interface Principles?	Enter (yes/no)
1. A reliability standard shall not give any market participant an unfair competitive advantage.	Yes
2. A reliability standard shall neither mandate nor prohibit any specific market structure.	Yes
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard.	Yes
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.	Yes

Identified Existing or Potential Regional or Interconnection Variances	
Region(s)/ Interconnection	Explanation
e.g., NPCC	N/A

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SAR Status Tracking (Check off as appropriate).	
☐ Draft SAR reviewed by NERC Staff ☐ Draft SAR presented to SC for acceptance ☐ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ SAR denied or proposed as Guidance document

Version History

Version	Date	Owner	Change Tracking
1	June 3, 2013		Revised
1	August 29, 2014	Standards Information Staff	Updated template
2	January 18, 2017	Standards Information Staff	Revised
2	June 28, 2017	Standards Information Staff	Updated template

3	February 22, 2019	Standards Information Staff	Added instructions to submit via Help Desk
4	February 25, 2020	Standards Information Staff	Updated template footer