

ERO Enterprise CMEP Practice Guide

Considerations for TPL-001-4 and TPL-001-5.1 Table 1 Contingencies¹

November 18, 2021

Background

In support of successful implementation and compliance with the North American Electric Reliability Corporation (NERC) Reliability Standards, the Electric Reliability Organization (ERO) Enterprise² adopted the Compliance Guidance Policy.³ The Compliance Guidance Policy outlines the purpose, development, use, and maintenance of guidance for implementing Reliability Standards. According to the Compliance Guidance Policy, Compliance Guidance includes two types of guidance – Implementation Guidance and Compliance Monitoring and Enforcement Program (CMEP) Practice Guides.⁴

Purpose

CMEP Practice Guides are developed solely by the ERO Enterprise to reflect the independent, objective professional judgment of ERO Enterprise CMEP staff (CMEP staff), and, at times, may be initiated following policy discussions with industry stakeholders. Following development, they are posted for transparency on the NERC website. It is to be noted, especially to registered entities using this guide as a reference, that while some aspects of this guide may assist CMEP staff directly in determining compliance, some parts of the guide are to assist CMEP staff in understanding how an entity mitigates risk in order to inform risk-based compliance monitoring. This understanding of the controls to mitigate risk can affect monitoring activities, including requests for information and adjustments to an entity's compliance oversight plan.

The purpose of this CMEP Practice Guide is to provide guidance to CMEP staff during the evaluation of the processes and controls pertaining to the identification of Contingencies performed by Transmission Planners for use in TPL-001-4 and TPL-001-5.1 studies.⁵ Based on audit observations from FERC and NERC staff, the ERO Enterprise has identified a need to provide additional guidance regarding the evaluation of the supporting rationale for Contingency identification, as well as guidance pertaining to the maintenance and coordination of Contingency lists. An inconsistent understanding of the TPL-001-4 Table 1 Contingency categories or inconsistent approaches to the development of identifying Contingencies can introduce risk to transmission planning for the BPS. Entity-specific facts and circumstances should always

¹ This document will consistently be applicable for both TPL-001-4 and TPL-001-5.1. TPL-001-5.1 has been approved to replace TPL-001-4 and will become effective on 7/1/2023; <https://www.nerc.com/files/TPL-001-5.1.pdf>

² The ERO Enterprise consists of NERC and the six Regional Entities.

³ The ERO Enterprise Compliance Guidance Policy is located on the NERC website at:

<https://www.nerc.com/pa/comp/guidance/Documents/Compliance%20Guidance%20Policy.pdf>

⁴ **Implementation Guidance** provides a means for registered entities to develop examples or approaches to illustrate how registered entities could comply with a standard that are vetted by industry and endorsed by the ERO Enterprise. **CMEP Practice Guides** differ from Implementation Guidance in that they address how ERO Enterprise CMEP staff executes compliance monitoring and enforcement activities, rather than examples of how to implement the standard.

⁵ NERC Reliability Standard TPL-001-4; <https://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-4.pdf>

be considered by CMEP staff when assessing risks and determining compliance. Risk information can be used to inform CMEP staff's understanding of a registered entity (i.e., compliance oversight plan, audit approach, etc.). Compliance determinations are to be made in light of specific facts and circumstances of the individual registered entities and the language of the requirements.

This document will also provide CMEP staff a common list of failure points and potential questions to pursue when auditing TPL-001-4 and TPL-001-5.1. This document contains initial guidance for TPL-001-4 and TPL-001-5.1, as it is limited to the development of Contingency lists and some related issues. NERC may continue to expand this document or develop additional Practice Guides to ensure a common approach when reviewing transmission planning Reliability Standard requirements.

P5 Contingencies

CMEP staff shall seek to understand how entities are considering Category P5 Contingencies for transmission circuits for all Contingency scenarios. For Category P5 events, the Standard includes a single-line to ground fault plus the failure of a relay to operate, whereby the operation of a backup Protection System introduces additional time delay before fault clearing. It is important to note that in TPL-001-4, specific relay numbers are provided in footnote 13 of Table 1 to include pilot (#85), distance, (#21), differential (#87), current (#50, 51, and 67), voltage (#27 and 59), directional (#32 and 67), and tripping (#86 and 94) for the P5 Contingencies. This footnote and respective definition of a P5 Contingency is materially changed between version 4 and 5.1 to read as "non-redundant components of a Protection System" failure to operate. This helps define the type of protection schemes to study when building a P5 Contingency list.

TPL-001-4 uses the terminology "non-redundant relay," and this language is used throughout this document. TPL-001-5.1 replaces the term "non-redundant relay" with "non-redundant component of a Protection System." This document will use the term "relay" throughout as it pertains to the version that is enforceable at the time of this document's release. Following the effective date of TPL-001-5.1, the term "non-redundant component of a Protection System" should be considered in place of the term "non-redundant relay." Additionally, footnote 13 of Table 1 includes replacement language for what should be considered in place of specific relay numbers. Those considerations are:

- 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).

Table 1 Contingency List Development

Entities are currently required to apply identified Contingencies through several analyses per the language of the requirements of TPL-001-4 and TPL-001-5.1. This document will primarily focus on Contingency list development for the analyses rather than the analyses themselves.

While the language of the subparts of TPL-001-4/TPL-001-5.1 R3 and R4 does afford entities flexibility in identifying the most appropriate Contingencies, CMEP staff shall seek to understand how the entity implements a method that adequately identifies Contingencies that are expected to produce more severe System impacts on its portion of the Bulk Electric System (BES).⁶ Transmission Planners could include Contingencies associated with the loss of radial lines or other devices, as long as the loss of that element severely impacts the BES. The Transmission Planner (TP) and Planning Coordinator (PC) are required to identify and evaluate the planning events in Table 1 that are expected to produce more severe system impacts on their portion(s) of the BES and develop a rationale to support the development of the selected Contingencies. CMEP staff shall look for robust processes and controls to establish sufficient supporting rationale to ensure that Transmission Planners are identifying these more severe System impacts for both “extreme events” and “planning events.”

Common Failure Points

CMEP staff shall consider the following three common failure points when reviewing a TP’s or PC’s processes and procedures. These should each be considered as potential areas for focus to ensure that entities are incorporating a thorough approach to Contingency list development.

1. Failure of sufficiently documented or implemented study and Contingency selection method

- a. Per Requirement 3, “[t]he rationale for those Contingencies selected for evaluation shall be available as supporting information.” CMEP staff will review the sufficiency of the technical rationale for how the identified Contingencies were selected for the entity’s most current steady-state and Stability analyses.
 - i. Specifically, for Table 1 category P5, CMEP staff shall evaluate how the entity identifies non-redundant relays for its development of P5 Contingencies. This evaluation shall include coordination and collaboration efforts with the entity’s relaying department or relaying departments within their footprint. There are places in the BES where zone 3 distance relaying or ground overcurrent relaying is not (or is not able to be) perfectly coordinated. At such locations, a protection system failure could result in breakers being opened in more substations than just those in stations immediately adjacent.

⁶ See Appendix A for relevant requirements and language.

- ii. Furthermore, review of documentation is expected to justify the clearing times studied under a P5 Contingency. If ground time overcurrent elements at multiple remote breakers are used for SLG fault remote backup, determination of the expected clearing time or worst case clearing time may be non-trivial.
- b. CMEP staff are expected to measure the adequacy and sufficiency of the entity's rationales against the entity's own criteria as well as the audit team's transmission planning experience, Regional/entity-specific information, and the entity's risk profile.
 - i. For example, an entity's system may experience more severe impacts during single-line-to-ground or 3-phase faults. While this is uncommon, as generally 3-phase faults are attributed to larger events, some entities have identified instances where the single-line-to-ground fault creates a more extreme fault current condition.⁷ CMEP staff should pursue additional questions about the entity's applied rationale based on professional judgment.
 - ii. CMEP staff shall consider sampling the entity's protection systems to test the effectiveness of the entity's identification method for non-redundant relays.

Potential Questions for CMEP Staff to Consider:

- How does the entity identify what relays are non-redundant?
 - Which breakers will be tripped during the P5 Contingencies?
 - Having determined which breakers will be tripped, what is the clearing time that should be used for each breaker in the Contingency?
- What criteria does the entity use to categorize severe System impacts?
- Does the entity include neighboring/adjacent protection system owners when identifying non-redundancy?
- How does the entity ensure that each applicable category in Table 1 of TPL-001-4 and TPL-001-5.1 is effectively studied and that appropriate and complete studies are performed?
 - Can the entity walk through the process of planning projects that include new relays or modifying existing relay settings? Verify that this walkthrough is consistent with documented processes for coordination and list maintenance.
 - Is there a difference between the number of Contingencies studied under TPL-001-4 and the number of required Contingencies based on Table 1? If so, what technical rationale supports an expansion or reduction?

2. Failure of sufficiently implemented practices and controls for data change management

CMEP staff will consider whether:

⁷ This particular condition typically occurs near the wye side of a solidly grounded delta-wye transformer.

- a. The entity explained and provided sufficient documentation for how the entity ensures that its PO base case is maintained and accurate to include all: new projects, duration of known outages, potential projects, up-rates, reconductors, generation retirements, generation acquisitions, etc.
- b. The entity explained and provided sufficient documentation for how the entity ensures that the full list of Contingencies is studied for its most current steady-state and Stability analyses.
 - i. Specifically, for Table 1 category P5, CMEP staff should understand how the list of non-redundant relays for development of P5 Contingencies is maintained.
 - ii. CMEP staff should primarily seek to understand and test the entity's internal controls.
 - iii. A secondary test would include performing a data quality inspection through sampling if the entity's controls appear to be adequate or appropriately implemented.

CMEP staff should also consider changes in the PO base case when using previous Planning Assessments as technical rationale for exclusion in current Planning Assessments--in particular, changes that would alter the Contingency list.

Potential Questions for CMEP Staff to Consider:

- How does the entity maintain the lists of all relays, including those that are identified as non-redundant?
 - How is this list archived or maintained if used for other or prior year Planning Assessments?
- How are those lists coordinated between departments, including protection, planning, operations, and engineering?
- Can the entity walk through the process for transmission planning studies to incorporate changes to this list of relays and relay settings? Verify that this walkthrough is consistent with documented processes for coordination and list maintenance.
- How do you ensure that all pertinent staff (including new hires) are sufficiently trained and are implementing all change management practices effectively?

3. Failure of sufficiently implemented practices and controls for coordination

CMEP staff will consider whether:

- a. The entity explained and provided sufficient documentation for how it ensures all departments and associated entities effectively coordinate changes to: 1) base case modeling elements, 2) protection equipment settings, 3) Steady-state and Stability analysis criteria, and 4) Contingency lists to satisfy all relevant Table 1 categories are studied.

- i. Specifically, for Table 1 category P5, CMEP staff should understand how the identified non-redundant relays for the entity's development of P5 Contingencies are coordinated (including verification of primary and backup relaying).
- ii. CMEP staff should be familiar with the differences in protection system software and how entities with different tools ensure completeness and accuracy.
- b. The entity provided sufficient detail on how these items are effectively coordinated with neighboring entities as well as with entities with shared equipment or shared Facilities.
 - i. This could include entities that coordinate as part of larger transmission working groups. If so, CMEP staff should seek to ensure a Regional understanding of working group's member's roles, timelines, and work products.
 - ii. CMEP staff should achieve assurance on how the entity meets any such working group's expectations for coordination and is not simply accepting data from other members.

Potential Questions for CMEP Staff to Consider:

- Explain how Contingency list development and maintenance is coordinated between internal departments (e.g., protection, planning, operations, and engineering groups).
- How are Contingency lists developed, maintained, and coordinated between different companies? CMEP staff shall verify the entity's processes and roles if coordinating with other registered entities in an established working group.

Appendix A

Relevant Standard requirement language from TPL-001-4 and TPL-001-5.1 pertaining to Contingency list development:

TPL-001-4

“R3.4: Those planning events in Table 1, that are expected to produce more severe System impacts on its portion of the BES, shall be identified and a list of those Contingencies to be evaluated for System performance in Requirement R3, Part 3.1 created. The rationale for those Contingencies selected for evaluation shall be available as supporting information.

3.4.1: The Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are included in the Contingency list.”

“R3.5: Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R3, Part 3.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted.”

“R4.4: Those planning events in Table 1 that are expected to produce more severe System impacts on its portion of the BES, shall be identified, and a list created of those Contingencies to be evaluated in Requirement R4, Part 4.1. The rationale for those Contingencies selected for evaluation shall be available as supporting information.

4.4.1: Each Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are included in the Contingency list.”

“R4.5: Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R4, Part 4.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted.”

TPL-001-5.1

“R3.4: Those planning events in Table 1, that are expected to produce more severe System impacts on its portion of the BES, shall be identified and a list of those Contingencies to be evaluated for System performance in Requirement R3, Part 3.1 created. The rationale for those Contingencies selected for evaluation shall be available as supporting information.

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“R4.5: Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R4, Part 4.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information.

Revision History

Revision #	Revision Date	Revision Details
V1.0	11/18/2021	Initial Draft