Technical Rationale for Selection of Known Outages

TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4

08/02/2021

Compliance and Advanced Studies

SPP Southwest Power Pool

Revision History

Date	Author	Change Description
08/01/2019	SPP staff/TPLTF	Initial Draft
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Executive Summary

The SPP Planning Coordinator is obligated by TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4 to assess the impact of known outages planned in the Near-Term Planning Horizon upon System performance. To meet these requirements, this technical rationale document intends to guide the SPP Planning Coordinator's approach towards selecting known outages that will be assessed. The technical basis annotated in this document facilitates a comprehensive selection process that culminates in the assessment of known outages that are significant and prevents the unnecessary assessment of known outages which are unlikely to be problematic.

Table of Contents

Table of Figures

Background

The purpose of this document is to annotate the Southwest Power Pool (SPP) Planning Coordinator (PC) technical rationale that guides its approach to selecting those known outages to be assessed for impacts upon System performance "when known outage(s) of generation or Transmission Facility(ies) are planned in the Near-Term Planning Horizon"[1], in accordance with TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4.

The development of this technical rationale for selecting known outages is informed by FERC Order No. 786, paragraph 41 that asserted the principal that:

> *A properly planned transmission system should ensure the known, planned removal of facilities (i.e., generation, transmission or protection system facilities) for maintenance purposes without the loss of non-consequential load or detrimental impacts to system reliability such as cascading, voltage instability or uncontrolled islanding.*

Further, FERC expressed concern that maintenance outages of less than six months in duration within the Near-Term Transmission Planning Horizon may be excluded from annual Planning Assessments, despite their potential to cause unacceptable post-Contingency System performance, when assessed. This highlights an important consideration that known outage should not be excluded from selection and subsequent assessment simply based upon their duration.

An important affirmation made in FERC Order No. 786, paragraph 42 is that planned outages are not "hypothetical planned outages", implying that the concept of a known outage is one that has actual plans for execution. Additionally, known outages should not be simply treated equivalent to "multiple contingency conditions", such as those considered as TPL-001-4[2] Table 1 P6 Planning Events. This principal further highlights the importance of a technical rationale to select known outages for assessment.

It is, therefore, imperative that known outages, regardless of duration, be considered as candidates for selection as part of the analytical effort supporting the annual Planning Assessment of the Near-Term Transmission Planning Horizon. The process of selecting known outages for assessment, from the set of candidate known outages and consistent with a technical rationale, is summarized in Figure 1-1 and specified below.

[1] TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4, first sentence.

[2] As referenced in FERC Order No. 786, paragraph 42.

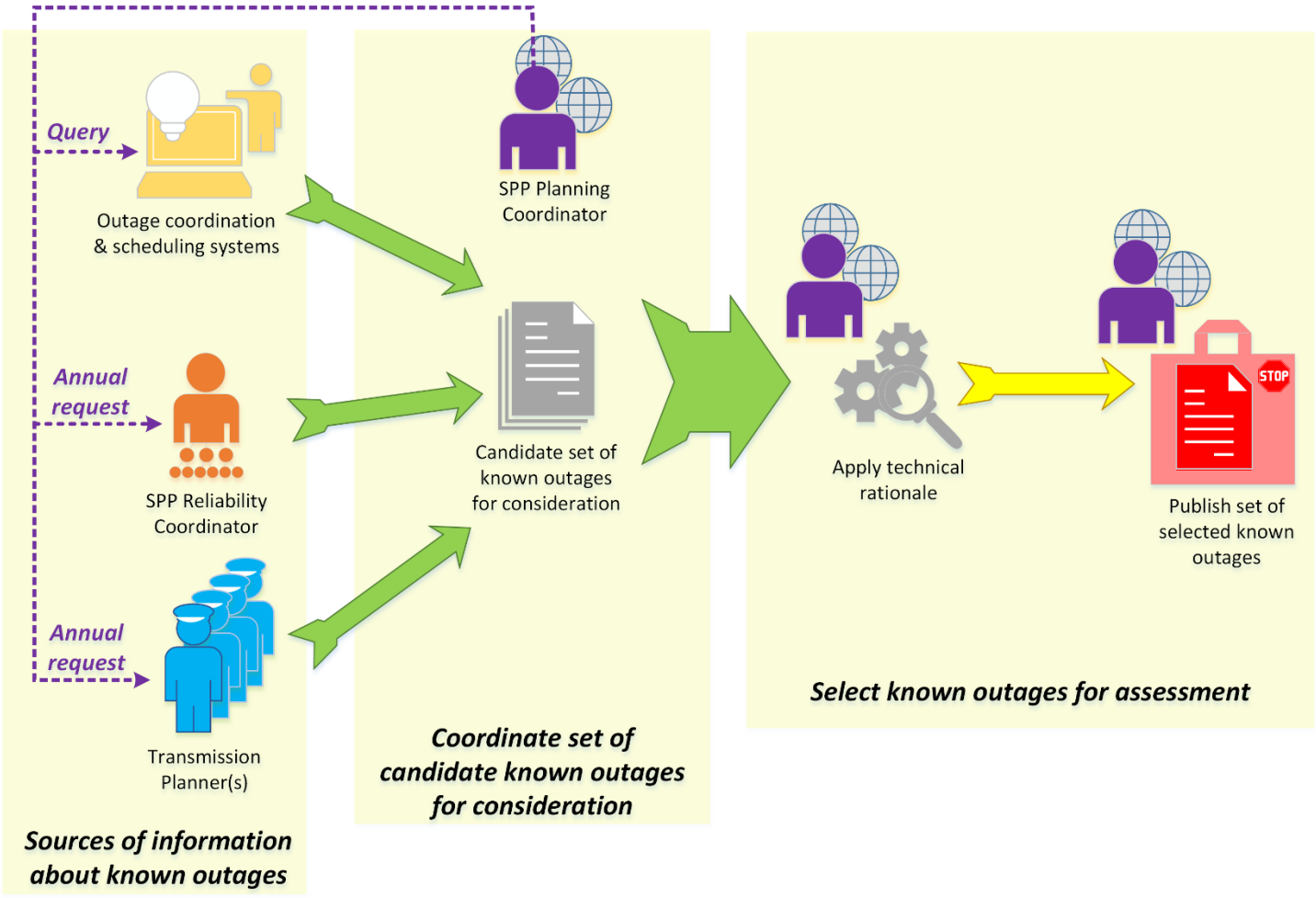

Figure 1-1. Overview of process to select known outages for assessment.

Known Outage Selection Process and Technical Rationale

The following annotates the Southwest Power Pool (SPP) Planning Coordinator process and technical rationale that selects known outages in the Near-Term Planning Horizon, to be assessed for impacts upon System performance, in accordance with TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4.

1.1 Determining the set of candidate known outages.

The initial step in selecting known outages of generation or Transmission Facilities in the Near-Term Planning Horizon to be assessed for impacts upon System performance, starts with identifying the System models that will be used in the assessment. It is fundamentally prerequisite that selection of known outages requires that the System models, maintained in accordance with TPL-001-5 Requirement R1 to be studied for the steady state and Stability analysis portions of the Planning Assessment of the Near-Term Transmission Horizon, exhibit those conditions defined by TPL-001-5 Requirement R2, Parts 2.1.1, 2.1.2, 2.4.1, and 2.4.2. The conditions and time periods represented by the System models establish which known outages shall comprise the set of candidate known outages from which known outages are selected for assessment. It is emphasized that the set of candidate known outages cannot be established before the Planning Coordination and Transmission Planner(s) specify which System models will be used for assessment. To reiterate: the Planning Coordinator and Transmission Planner(s) must specify the System models maintained consistent with TPL-001-5 Requirement R1 and representing conditions defined by TPL-001-5 Requirement R2, Parts 2.1.1 and, 2.1.2, 2.4.1, and 2.4.2 first, then only the known outages that are expected to occur during the time periods represented by the selected System models are included in the set of candidate known outages and may be selected for assessment according to this technical rationale. Known outages not coincident with the conditions and time periods of the TPL-001-5 Requirement R1 System models are not included in the set of candidate known outages. Once the System models have been identified, the query of authoritative sources of known outage scheduling shall be conducted. Outage duration shall not be the sole reason that an outage will be excluded from the candidate set of known outages.

1.1.1 What is a known outage?

"Known outage" is not a NERC-defined term, nor is it explained in the TPL-001-5 Reliability Standard and its accompanying Technical Rationale for TPL-001-5[3]. While this vagueness allows some flexibility in interpreting the term, generally "outage" is well-understood to refer to a period of equipment unavailability due to being deenergized for maintenance and/or construction. In FERC Order No. 867 approving TPL-001-5, the Commission noted the challenge defining a "known outage." In Paragraph 27, it is clear that FERC intended known outages to include future planned outages and reinforced the FERC Order No. 786, Paragraph 44 concept that planned outages should be addressed in annual Planning Assessments. Specifically, excluding hypothetical outages, the following categorically defines known outages in the Near-Term Planning Horizon:

1.1.1.1 An outage that is planned and scheduled in the Near-Term Planning Horizon.

[3] NERC Project 2015-10 "Technical Rationale for TPL-001-5", October 2018, available at: https://www.nerc.com/pa/Stand/Project_201510%20Single%20Points%20of%20Failure_TPL001_DL/2015-10_Technical%20Rationale_10112018.pdf

1.1.1.2 An outage that is planned and scheduled in the Near-Term Planning Horizon, but its schedule has uncertainty (e.g., due to the nature of the outage, being that it could be implemented earlier or later than scheduled).

1.1.1.3 An outage that is planned in the Near-Term Planning Horizon, but not yet scheduled.

This technical rationale has been developed to ensure that known outages in the Near-Term Planning Horizon are properly and comprehensively considered. Section 1.1.3 ensures outages that are scheduled in the Near-Term Planning Horizon are included in the set of candidate outages for selection. Further, scheduled outages in the Near-Term Planning Horizon with scheduling uncertainty are not excluded from the set of candidate outages for selection and, further, are addressed in the screening process shown in Section 1.2.1. By including outages from sources other than the outage scheduling systems (Section 1.1.3), this technical rational directly addresses the concern expressed by FERC Order No. 867, Paragraph 27, that "known" will be interpreted as simply meaning scheduled.

1.1.2 Scope of equipment.

It is generally understood that the known outages that must be assessed consistent with TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4 are known outages of BES generation and Transmission equipment. Facilities[4], such as transmission circuits, transformers, bus sections, generating resources, and reactive compensation devices, that are the subject of transmission known outages should be considered when selecting known outages. While Protection System maintenance outages are often concurrently scheduled with outages of generation and Transmission Facilities, experience has shown that it is rare for Protection System maintenance periods alone to be scheduled in the Near-Term Transmission Planning Horizon. Likewise, outages of Protection System equipment typically affect Contingency event development, not the actual BES generation and Transmission equipment simulated to be out-of-service during the known outage. The extent to which known outages of Facilities in neighboring transmission Systems are considered should be addressed in a similar manner to how Contingencies on adjacent Systems are coordinated consistent with TPL-001-5 Requirement R3, Part 3.4.1 and Requirement R4, Part 4.4.1. Authoritative sources of known outage information shall be used when developing candidate set of BES generation and Transmission Facility known outages.

[4] NERC-defined term; intrinsically BES.

1.1.3 Query the outage coordination and scheduling systems.

At a minimum, the authoritative sources shown below shall be consulted for the purpose of assembling the set of known Bulk Electric System (BES) outages that may be candidates for assessment of their impacts upon System performance. Not all the sources shown below may be applicable to all Transmission Planners in the SPP Planning Coordinator Planning area:

1.1.3.1 NERC System Data Exchange (SDX)

1.1.3.2 SPP-Reliability Coordinator Control Room Operations Window (CROW) Outage Scheduler

The known outages of BES Facilities[5] within the SPP Reliability Coordinator footprint and for SPP Reliability Coordinator Tier 1 neighboring companies obtained from outage coordination and scheduling systems shall be added to the set of candidate outages for selection.

1.1.4 Candidate known outage coordination.

SPP, as the Planning Coordinator, will coordinate with its Transmission Planners within its Planning area and the SPP Reliability Coordinator[6] to identify those known outages in the Near-Term Planning Horizon that shall be added to the set of candidate outages from which the known outages to be assessed for impacts upon System performance shall be selected, in accordance with TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4. SPP, as the Planning Coordinator, shall submit a documented request sent via electronic mail:

1.1.4.1 To the Reliability Coordinator requesting known outages of BES Facilities, within the SPP Reliability Coordinator footprint and for SPP Reliability Coordinator Tier 1 neighboring companies, in the Near-term Transmission Planning Horizon.

1.1.4.2 To the Reliability Coordinator requesting outages that are known to the Reliability Coordinator to have been rescheduled or denied twice or more within the prior two calendar years, expressly due to System conditions exhibiting the inability to support removal of Facilities for maintenance purposes[7]. The Planning Coordinator will request the dates and reasoning the outage(s) were denied

[5] The usage of "BES" and "Facility" in this document refers to the NERC-defined terms. While somewhat redundant, the term "BES Facility" is used to emphasize focus on BES equipment such as transmission circuits, transformers, generating resources, and reactive compensation devices that are the subject of transmission known outages.

[6] Consistent with IRO-017-1, the Reliability Coordinator is required to develop, implement, and maintain an outage coordination process for generation and Transmission outages within its Reliability Coordinator Area. As such, Transmission Operators are obligated to perform the outage coordination functions specified by the Reliability Coordinator's outage coordination process. Thus, the documented request for candidate known outage information is addressed to the Reliability Coordinator as the coordinating authority, not to individual Transmission Operators. However, section 1.1.4 does not prevent Transmission Planners from seeking or considering candidate known outage information from Transmission Operators.

[7] This consideration recognizes that outages may be denied in the Operations Horizon because of Non-Firm Transmission Service commitments or Market Flow conditions that are not reflected in System models maintained by the Planning Coordinator and Transmission Planner that represent forecasted Load, known commitments for Firm Transmission Service and Interchange, as well as Resource dispatched as required for Load. Nonetheless, seeking information from the Reliability Coordinator about recently rescheduled or denied outages can assist in assuring that problematic outages are considered for

by the Reliability Coordinator, and confirm with the Transmission Owner or Generator Owner who submitted the rescheduled or denied outage, as well as the applicable Transmission Planner, that it remains valid to be considered for assessment in the Near-term Transmission Planning Horizon

1.1.4.3 To the Transmission Planners within the SPP Planning Coordinator Planning area requesting any known outages of BES Facilities within its Transmission Planning footprint in the Near-term Transmission Planning Horizon, including reasoning for including the known outage(s) as part of the candidate set.

The known outages of BES Facilities received from the Reliability Coordinator and Transmission Planner(s) in response to the request shall be added to the set of candidate outages for selection.

1.2 Screening candidate known outages.

The purpose of screening the set of candidate known outages according to these technical attributes is to select those known outages expected to cause more severe System impacts. This process of screening allows the Planning Coordinator, Transmission Planner, and Reliability Coordinator to assess which known outages are significant and prevents conducting unnecessary assessment of known outages[8].

1.2.1 Scheduling and simultaneity of known outages.

It is well-understood that system maintenance may be adjusted for several reasons, impacting the actual implementation of known outages. This is especially true in the Near-term Transmission Planning Horizon when outage scheduling may be less certain at the time of planning the known outage and dates reserved during outage coordination outside the operations horizon (less than one year from present) may not be exact. Despite scheduling uncertainty, it remains important to screen for known outages that, when scheduled simultaneously, may be expected to produce more severe System impacts on the Planning Coordinator or Transmission Planner's portion of the BES. To reasonably account for scheduling ambiguity outside the operations horizon and the concurrence of known outages, all known outages shall be screened for simultaneity according to the following approach:

1.2.1.1 Establish an expanded outage timeframe for each candidate known outage. This expanded outage timeframe shall be used for screening and selecting known outages only, indicating a range of time that is likely to accommodate the actual scheduled outage, according to its outage duration:

- For a known outage 5 days or less in duration: the expanded outage timeframe that shall be considered is equal to the outage duration, both earlier and later than the known outage scheduled dates.
- For a known outage > 5 days in duration: the expanded outage timeframe that shall be considered is seven days both earlier and later than the known outage scheduled dates.

1.2.1.2 The expanded outage timeframe shall only extend within the Peak or Off-Peak period that the

assessment in the Near-Term Transmission Planning Horizon.

[8] Which is consistent with the "NERC Project 2015-10 Technical Rationale for TPL-001-5", October 2018, page 13.

candidate known outage is scheduled for. If an expanded outage timeframe extends outside its scheduled Peak or Off-Peak period, the expanded outage timeframe will be truncated to terminate within the Peak or Off-Peak period for which it is scheduled.

1.2.1.3 Using the expanded outage timeframe, determine all known outage(s) of BES Facilities that may have overlapping out-of-service dates, indicating the possibility that they may occur simultaneously with another known outage from the candidate set.

1.2.1.4 Simultaneous known outages, based upon their expanded outage timeframe, shall be screened together for selection according to Section 1.2.2, except when known outages are scheduled to occur successively[9]. This approach ensures simultaneous known outages are screened according to identical technical attributes to those of single, non-simultaneous known outages.

Application note: Across the wide area of the Planning Coordinator or Transmission Planner's portion of the BES, there may be multiple known outages that are scheduled to occur simultaneously, but are electrically disassociated because of topological distance. Despite electrical disassociation, it is expected that screening simultaneous known outages will indicate and assist in differentiating single or multiple simultaneous known outages expected to produce more severe System impacts on the Planning Coordinator or Transmission Planner's portion of the BES[10].

1.2.2 Known outage attributes for selection.

Using the set of candidate known outages, known outages of BES Facilities with any duration that have an expanded outage timeframe that coincides with the time period represented by the System model(s) maintained in accordance with TPL-001-5 Requirement R1 will be selected for assessment if they have one or more of the following attributes:

Attribute 1. Known outage may cause Non-Consequential Load Loss when combined with a TPL-001-5 Table 1 P1 Planning Event given System peak or Off-Peak conditions that the System is expected to experience during the known outage without System pre-positioning, System adjustments, or other operational mitigations employed (e.g., market redispatch, congestion management measures).

Inclusion example: Generator known outage that, given previous study or knowledge of the System for the P1.2[11] Event (Loss of a Transmission Circuit), causes a feeder transmission circuit to load in excess of its Facility Rating which is mitigated by non-consequentially shedding load on the feeder. This generator known outage shall be selected for assessment in the Near-Term Planning Horizon.

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[9] For the purpose of this document, successive outages are those which do not occur simultaneously because of interdependency or mutual exclusivity. For example, a one-week maintenance outage that must be completed prior to commencing a subsequent one-week maintenance outage must be screened separately (non-simultaneously), despite the outages scheduled for the same time period represented by a System model.

[10] Information derived from screening and potential study of simultaneous known outages in an annual Planning Assessment can be valuable information communicated to the Reliability Coordinator, consistent with IRO-017-1 Requirements R3 and R4, including recommendations that known outages not be scheduled concurrently.

[11] TPL-001-5 Table 1 Events are referred to various ways including P12, P1.2, or P1-2.

Exclusion example: Generator known outage that, given previous study or knowledge of the System for the P1.2 Event (Loss of a Transmission Circuit), has no effect on the ability of the System to meet load obligations consistent with System performance requirements of TPL-001-5 Table 1. This generator known outage does not require selection for assessment in the Near-Term Planning Horizon based upon Attribute 1.

Application note: Many known outages and a subsequent Table 1 P1 event may already be assessed as a similar Table P3 event and, if exhibiting unsatisfactory Non-Consequential Load Loss, may be identified in an annual Planning Assessment with a Corrective Action Plan. In general, however, there may be a time period between identification of a Corrective Action Plan in an annual Planning Assessment and its implementation. This period may imply that a known outage meeting this screening attribute should be included for assessment, despite whether related or unrelated Corrective Action Plans have been previously identified, simply for the purpose of completeness. Furthermore, the Table 1 P6 event allows non-Consequential Load Loss for which a Corrective Action Plan may not have been previously identified. This reinforces the concept that candidate known outages coupled with Table 1 P1 events that cause significant Non-Consequential Load Loss may be important to identify and select for assessment.

Attribute 2. Known outage may cause instability, Cascading, or uncontrolled islanding when combined with a TPL-001-5 Table 1 P1 Planning Event given System peak or Off-Peak conditions that the System is expected to experience during the known outage.

Inclusion example: Transmission circuit known outage that, given previous study or knowledge of the System for the P1.2 Event (Loss of a Transmission Circuit), causes the remaining transmission circuits serving a load pocket to be vulnerable to voltage collapse. This transmission circuit known outage shall be selected for assessment in the Near-Term Planning Horizon.

Exclusion example: Transmission circuit known outage that includes a transmission reconfiguration to serve load during the known outage, and given previous study or knowledge of the System for the P1.2 Event (Loss of a Transmission Circuit), has no effect on the ability of the System to meet load obligations consistent with System performance requirements of TPL-001-5 Table 1. This transmission circuit known outage does not require selection for assessment in the Near-Term Planning Horizon based upon Attribute 2.

Attribute 3. The System model represents loading on the transmission circuit or transformer of the known outage in excess of 15%[12] of its continuous (normal) Facility Rating given System peak or Off-Peak conditions that the System is expected to experience during the known outage.

Inclusion example: A transmission circuit has a continuous (normal) Facility Rating of 50 MVA. During Off-peak conditions, this transmission circuit is expected to be loaded at 20 MVA (40% of its continuous Facility Rating). This transmission circuit has a planned outage during System Off-peak conditions. This transmission circuit is loaded in excess of 15% of its continuous Facility Rating given System Off-Peak conditions expected when the known outage is planned. This transmission circuit known outage shall be selected for assessment in the Near-Term Planning Horizon.

Exclusion example: A transmission circuit has a continuous (normal) Facility Rating of 35 MVA. During peak conditions, this transmission circuit is expected to be loaded at 3 MVA (8.6% of its continuous Facility Rating). This transmission circuit has a planned outage during System peak conditions. This Transmission Facility is not loaded in excess of 15% of its continuous Facility Rating given System peak conditions expected when the known outage is planned. This transmission circuit known outage does not require selection for assessment in the Near-Term Planning Horizon based upon Attribute 3.

Application note: To determine the loading applicable to this technical screening attribute for the transmission circuit or transformer of the known outage, refer to the load flow solution of the System model representing TPL-001-5 Table 1 P0 Event conditions. No pre-study, pre-assessment, or Contingency analysis is required to perform screening for this technical attribute.

1.3 Final selection of known outages for assessment.

Based upon the candidate known outages determined in section 1.1 and screened according to the technical rationale of section 1.2, a list of known outages of BES Facilities selected for assessment in the Near-Term Transmission Planning Horizon shall be established.

1.3.1 Deselection.

Under one or both of the following special circumstances, certain selected known outages may be deselected and not assessed in the Near-Term Transmission Planning Horizon:

1.3.1.1 In the first circumstance, if a selected known outage is redundant to or expected to produce less severe System impacts on the Planning Coordinator's portion of the BES than another known outage,

[12] Contingency analysis results supporting the 2019 and 2020 SPP annual TPL Planning Assessments showed that no BES branch or transformer loaded less than 15.98% of its continuous (normal) Facility Rating (System intact) yielded any failure to meet System performance requirements when removed from service as part of a single Contingency (TPL-001-4 Table 1, P1 Event). In other words, using the single Contingency (P1) results (all System peak and Off-Peak conditions, including sensitivity cases) as a proxy for single outage impacts to the System, this illustrates that lightly-loaded transmission branches and transformers may be satisfactorily omitted from known outage consideration. This finding is made additionally conservative by recognizing than the single Contingency without System adjustments (P1) is likely a more severe scenario than the planned removal of a transmission branch or transformer where the System may be adjusted to accommodate the known outage.

the selected outage may be unselected in favor of the known outage that is expected to produce more severe System impacts on the Planning Coordinator's portion of the BES.

1.3.1.2 In the second circumstance, the selected outage may be unselected if past or current studies illustrate comparable post-Contingency System conditions and configuration such as those following P3 or P6 category events in TPL-001-5 Table 1.

In both circumstances, all known outages that are unselected from the list of known outages to be assessed in the Near-Term Transmission Planning Horizon shall be documented in the annual Planning Assessment.

The list of known outages of BES Facilities selected for assessment in the Near-Term Transmission Planning Horizon shall be made available to the Planning Coordinator, or any other registered entity that demonstrates a reliability related need for it.

1.4 Application note.

The TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4 are identical, except for a solitary dissimilarity that recognizes an inherent difference between how steady state analyses and Stability analyses are initialized for simulation:

- Part 2.1.4 requires that the assessment shall be performed on the P0 and P1 categories identified in Table 1.
- Part 2.4.4 requires that the assessment shall be performed on the P1 category identified in Table 1.

Conclusion

The purpose of this document is to annotate the SPP Planning Coordinator process and technical rationale that guides its approach to selecting known outages that are planned in the Near-Term Planning Horizon to be assessed for impacts upon System performance, in accordance with TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4. This document is consistent with the Project 2015-10 Standard Drafting Team (SDT) intent expressed in the TPL-001-5 Technical Rational that: "The proposed modifications [to TPL-001-5 Requirement R2, Parts 2.1.4 and 2.4.4] place limitations on the known outages that need to be considered."[13] This SPP Planning Coordinator technical rationale document delineates the technical support for appropriately selecting known outages for assessment. Likewise, consistent with the Project 2015-10 SDT TPL-001-5 Technical Rational, this document has accounted for other factors that may form a reasonable basis supporting that a known outage need not be assessed. Ultimately, this SPP Planning Coordinator technical rationale document facilitates a process that seeks to assess which known outages are significant and prevent unnecessary assessment of known outages which are unlikely to be problematic[14].

[13] NERC Project 2015-10 "Technical Rationale for TPL-001-5", October 2018, page 13.

[14] Ibid.