NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Meeting Notes

Project 2010-05.3 Remedial Action Schemes Standard Drafting Team

February 25, 2015 | 2:00 p.m. – 5:00 p.m. ET

Conference Call with ReadyTalk Web Access

Administrative

- **Introductions and chair remarks**

  Al McMeekin brought the meeting to order at 2:06 p.m. ET on Wednesday, February 25, 2015 and welcomed everyone. Those in attendance were:

Name	Company	Member or Observer
Gene Henneberg	NV Energy / Mid-American	Member
Bobby Jones	Southern Company	Member
Amos Ang	Southern California Edison	Member
Alan Engelmann	ComEd / Exelon	Member
Davis Erwin	Pacific Gas and Electric	Member
Charles-Eric Langlois	Hydro-Quebec TransEnergie	Member
Robert J. O'Keefe	American Electric Power	Member
Hari Singh	Xcel Energy	Member
Sharma Kolluri	Entergy	Member
Al McMeekin	NERC	Member
Lacey Ourso	NERC	Member
Jonathan Meyer	Idaho Power	Observer
Milena Yordanova	NERC	Observer
Syed Ahmad	FERC	Observer
Tom Bradish	FERC	Observer

- **Determination of quorum**

  The rule for NERC standard drafting team (SDT or team) states that a quorum requires two-thirds of the voting members of the SDT. Quorum was achieved as 9 of the 10 voting members were present.

- **NERC Antitrust Compliance Guidelines and Public Announcement**

  Mr. McMeekin reviewed the NERC Antitrust Compliance Guidelines and public announcement disclaimer.

Agenda Items

1. **Review Modified Standard**

   The team reviewed each requirement in the current draft of the standard. In R1 the word "designated" in front of Reliability Coordinator was deleted. A brief discussion took place about how to handle one RAS in two different RC areas. It was decided to put in the rationale that both RC's would conduct the review.

   For R2, the team discussed whether we should require feedback from the RC to the RAS-owner. Some did not think it necessary - Mr. McMeekin will check with other standards developers. We decided not to put it in the requirement that the RC could get the Region to do the review. This will be mentioned in the FAQ.

   For R3, the team decided that permission was needed from the RC to retire a RAS. It was also decided to have separate data requirements in Attachment 1 for new RAS and for retiring RAS.

   For R4, the team discussed again whether the 5-year assessment should be done by the TP or the RAS-owner. It was decided to post with the TP as the responsible entity and see what feedback we get from the industry.

   For R5, the team decided to delete parts 5.1 and 5.2 and to put the CAP in the body of the requirement. Mr. Engelmann will revise words in the rationale.

   For R6, the team decided to delete the term "misoperation" and instead use the language "determine whether the RAS operated correctly". Mr. Henneberg will look at the white paper language and propose some words.

   For R7, the team discussed whether to require a faster creation of a CAP for an incorrect operation than for a deficiency found in a review. For now, both will be left as 6 months.

   For R8, no significant changes were made. Mr. Jones to provide more words for the rationale.

   For R9, R10, no significant changes were made.

2. **Next steps**

   Schedule an additional Ready Talk teleconference prior to the next face-to-face meeting

3. **Future meeting(s)**

   a. March 17-19, 2015 | New Orleans, LA

   b. April 14-16, 2015 | Atlanta, GA

4. **Adjourn**

   The meeting adjourned at approximately 5:00 p.m. ET.

From: Al McMeekin
To: spssdt_plus; spssdt@nerc.com
Subject: RAS Working documents
Date: Friday, February 27, 2015 11:53:00 AM
Attachments: PRC-012_Working_draft_02-27-15_team.docx
Attachment 1_02-26-15.docx
Attachment 2_02-26-15.docx
Attachment_3_02_26_15.docx
FAQ_start_02_26_2015.docx
Implementation Plan_2-14-2015_gh.docx
Technical Justification for Attachment 1_02_26_15.docx
Working Material_02-26-15.docx

Everyone,

I have attached all of the working draft documents we have created thus far. Please review them all and make sure I haven't missed anything. Although there were only a few actual assignments made, don't be shy about making any additions or edits you think are contributory. We have made good progress and need to continue the established pace to meet our May posting date.

Items to think about prior to our upcoming meetings:

1. PRC-012 – requirements, measures, rationales and technical basis write-ups
2. FAQ write-ups
3. Implementation Plan for PRC-012
4. How to handle "Misoperations"
5. Categorizations vs levels of review
6. Retirements
7. Additions to PRC-005 necessary for clarity regarding maintenance of RAS controllers and functional testing of the RAS operation
8. Mapping existing requirements in the six RAS-related PRC standards to our new requirements, etc.

Our next meeting will be a Ready Talk conference on March 12, 2015 |2 p.m. – 4 p.m. Eastern

Dial-in: 1-866-740-1260 | Access Code: 5301963 | Security Code: 676869

ReadyTalk Webinar | Enter Access Code: 5301963

My thanks to you all for you dedication and contributions to reliability every day.

Have a great weekend.

Al

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Working material

Remedial Action Scheme Classifications

Historical practice in North America led to several classification methods for RAS which were used primarily to determine the level of redundancy that a RAS must be designed to achieve and the intensity of the independent review process that a RAS was subjected to before being placed in service. Not all Regions used such a classification method, but a large majority of identified RAS are located in Regions that have used some such method.

This standard classifies RAS into four distinct types. Two words describe the severity of the contingency for which the RAS is designed to operate (Planning or Extreme) and two more words describe the scale of the System impact of the initiating (triggering) event if the RAS were not used or if the RAS operated inadvertently (Significant or Limited). Each classification uses the word or the first letter of that word from each category, e.g. Extreme Significant, ES or Planning Limited, PL. Even though a System impact may be evaluated as limited, that impact may still lie outside of acceptable performance on the BES.

For this RAS classification, the usage of Planning and Extreme contingencies are as described in NERC Reliability Standard TPL-001-4, or its successor.

A significant impact on the BES results from an event or sequence of events that are characterized by any of the following conditions:

a. Cascading
b. Loss of synchronism of generators that occurs at more than a single generating plant
c. Power oscillations that do not exhibit acceptable damping as established by the Planning Coordinator and Transmission Planner.

If a System impact is not "significant" from any of the above conditions, then the impact is "limited."

Table 1
RAS Classification Applications

Extreme Limited (EL)	**Extreme Significant (ES)**	**Planning Limited (PL)**	**Planning Significant (PS)**
An EL scheme is designed to limit the impact of two or more elements removed, an extreme event where failure or inadvertent operation of the scheme can have only a limited impact on the BES. Scheme failure to operate does not prevent meeting the TPL performance standards, so "no single point of	An ES scheme is designed to mitigate a significant impact following an extreme event. It will often perform load / generation shedding or reconfigure large parts of the System. Failure to operate does not prevent meeting the TPL performance standards, so "no single point of failure" is not required.	A PL scheme is often designed to avoid or delay a Facility installation in order to satisfy a reliability standard. Failure to operate has limited impact, but performance may still be outside acceptable levels. Thus "no single point of failure" is required. However, minimum redundancy requirements could apply to assure good	A PS scheme is often designed to avoid or delay a Facility installation in order to meet a TPL or other NERC reliability requirement. Failure to operate is unacceptable. This type of RAS must be extremely dependable. Conformance with "no single point of failure" philosophy for redundancy is required.

failure" is not required. Inadvertent operation can have only a limited adverse impact, thus security, while important is less critical than for an ES scheme.	Inadvertent operation can have a very adverse impact, thus security is the prime concern.	reliability and address a potential reliability gap transitioning from PRC-012-0 R1.3.	
No redundancy required	No redundancy required	No redundancy required	Redundancy required
Review: confirm classification Emphasize security	Review: confirm classification, system performance (for failure to operate), design implementation, operator visibility Emphasize security	Review: confirm classification Emphasize dependability	Review: confirm classification, normal RAS performance, failure to operate and inadvertent operation performance, design implementation, operator visibility Emphasize dependability
Is CIP applicability really needed?	CIP required	Is CIP applicability really needed?	CIP required
If any Regional classifications were used for existing RAS. The following corresponding classifications will be transferred until such time as that RAS undergoes a review under the (new) R2 [grandfather class]	NPCC: Type II WECC: Safety Net (SN)	NPCC: Type III ERCOT: Type 2 WECC: Local Area Protection Scheme (LAPS)	NPCC: Type I ERCOT: Type 1 WECC: Wide Area Protection Scheme (WAPS)
		?? existing NPCC Type III's would not need redundancy upgrades to the NPCC standard (if in excess of new NERC) until such time as a new R2 review was performed for that RAS. [partially grandfather redundancy]	

Table 2
RAS Classification Characteristic Summary

Issue Priority	Review Rigor	No single Point of Failure, "Redundancy"
High / Full	PS	PS
Medium / Minimum	ES	PL
Low / Discretionary	PL, EL	EL, ES

Working definition of significant and limited impacts

A significant impact on the BES is characterized by any of the following conditions:

a. Cascading
b. Loss of synchronism of generators that occurs at more than a single generating plant
c. Power oscillations that do not exhibit acceptable damping as established by the Planning Coordinator and Transmission Planner.

If an impact is not "significant" from the above definition, then the impact is "limited."

Working Definition of Significant (2-12-2015)	White Paper Definition of Significant
BES: any instability that results in Cascading	These criteria identify system performance indicative of the potential for instability, uncontrolled separation, or cascading outages
BES: any loss of synchronism of generators that extends to more than a single generating plant	Loss of synchronism between two or more portions of the system each including more than one generating plant
Power oscillations that do not exhibit acceptable damping as established by the Planning Coordinator and Transmission Planner. [language from TPL-001-4] or unacceptable BES dynamic response: oscillations not acceptably(?) damped within 30 seconds of the initiating event.	Negatively damped oscillations
BES voltage levels in violation of applicable emergency limits;	No direct voltage measures

(power flows) loadings on BES facilities in violation of applicable emergency limits.	No direct loading measures
No references to “local” or “wide” areas.	Consider only the electrical scale of the event (no geographic or electrical difficulty with “wide” and “local” areas)
No direct load / generation loss measures	Non consequential 300 MW load loss / Largest resource in interconnection

Do the proposed voltage and loading measures perhaps substantially expand what would be considered to be a “significant” impact, compared to the load/generation options in the white paper?

Is the anti-Cascading proposal narrower than the white paper?

Working definition of "significant" or "functional" modifications

RAS Significant (Functional?) Modification: Any modification to RAS hardware beyond the substitution of components that merely preserve the original functionality, any change in RAS logic, RAS relay settings, RAS control settings, or any other modification that affects overall RAS functionality, timing, or redundancy level as documented in the original submission for review, or RAS modifications identified by a Corrective Action Plan developed pursuant to R4 or R6?.

(WECC) Possible added Requirement?: Owners will separately inform all their neighbors who may be affected by a scheme that the scheme is being significantly modified /removed. (probably already covered under PRC-001)

Functional modifications of RAS consist of any of the following:

- Changes to inputs, outputs, or internal scheme logic
- Major component changes
- Revision of the existing RAS architecture
- CAP modifications resulting from R3 evaluations or Rx misoperations

RAS removal is a form of RAS functional modification. Any RAS proposed for removal shall be evaluated under the "Transmission Planning Evaluation" section of the Attachment 1 checklist. Implementation Design and Operational Data sections are not required for RAS removals.

Working definition of "RAS Reporting Entity" (RAS-entity)

RAS Entity: Any NERC functional model entity responsible for the planning, ownership, installation, operation, or control of RAS equipment. Such entities may include one or more of the following:

Transmission Planners
Transmission Owners
Transmission Operators
Generator Owners
Generator Operators

The RAS Reporting Entity (RAS-entity) will be identified from among the following entities, where applicable for each specific RAS:

- Transmission Owner
- Generator Owner
- Distribution Provider

When all RAS Facilities and components have a single owner, the "RAS Reporting Entity" is that owner,

When the Facilities or components that make up a RAS have more than one owner, the multiple owners may designate a single entity as the "RAS Reporting Entity." If the multiple owners do not designate a single owner, the "RAS Reporting Entity" is the entity that (alt 1) is responsible to implement the functional specifications of the RAS or (alt 2) is the owner of the RAS controller. (alt 3) anything else?

[Historically, as this function is used within WECC, the RAS Reporting Entity (i.e. Reporting Party) when there are multiple owners has usually been the owner of the RAS controller.]

Generator Operators or Transmission Operators of Facilities or components of a RAS have the responsibility to keep all other Operators involved in a RAS informed of any functional modifications made to their individual Facilities or components. This is a form of coordination per PRC-001_R2. While Owners do not have direct responsibility under PRC-001, they will finance any RAS modifications that then need coordination.

Working definition of "RAS Review Entity"

RAS are individually designed, unique control schemes that require a higher level of experience and expertise to evaluate, design, implement, test, operate, and maintain that more routine Element protection systems or small scale control systems such as those described in the exclusions in the RAS defintion. Similarly, the skills required for review of RAS are multidisciplinary, virtually always including transmission planning, transmission operations, relaying systems, and often, depending on the specific RAS characteristics, also including generation operation, telecommunication, automation, control systems, information technology, and/or substation design. Specific RAS applications may also require additional skills. Equally important is the ability to integrate these skills into a comprehensive review process.

Because of their complexity and potentially large System impact, it does not promote reliability for the RAS Review Entity to have a close corporate relationship with the RAS Reporting Entity. For example, in certain areas of North America (e.g. WECC and probably FRCC), Planning Coordinators are often staffed by the same Transmission Planners and all are employed by the same Transmission Owner who is the RAS Reporting Entity. The PC/TP area of responsibility is substantially coincident with the Facilities owned by that Transmission Owner. This situation is a clear conflict of interest for the purpose of an independent review. This structure also results in a narrower view of the System than is appropriate for RAS reviews.

In order to avoid such conflicts of interest, the RAS Reporting Entity should be an independent, third party with the appropriate skills available to it. The existing NERC Functional Model does not appear to have any existing single or combination of entities that has the institutional structure to provide the necessary skill set for independent RAS reviews. The Reliability Assurer (RA) would seem to have possibilities, though no entities have registered as a RA (see below). The PC's structure and skill set focus on planning for System performance within its area of responsibility, but PCs don't have the appropriate physical design or transmission operations skills. The RC focuses on near-term transmission planning (startimg with day ahead) and transmission operation within its area of responsibility, but similar to the PC, does not have the appropriate physical design skills. Neither the PC nor RC has any particular skills in testing and maintenance issues. Transmission Owners usually have the skill sets available to them that RAS review requires, but have an inherent conflict of interest for review of their own RAS.

How about using some combination of neighboring PCs, Owners, and RCs as the RAS Review Entity when the specific PC would have a conflict of interest? Such an approach could provide the individual skills from other PCs, Owners, and RCs which are appropriate for RAS review, but not available from PCs and RCs alone. The disadvantages include that each RAS review would need to be separately organized, perhaps with different membership, imposing a potentially significant administrative burden on the RAS

Reporting Entity. There would also be minimum opportunity for continuity and consistency as a RAS Reporting Entity by the reviewers to develop the integrated system-wide view that is important to a RAS review.

Could an engineering contractor provide the necessary RAS reviews? Many Engineering firms have wide ranging skills available to them, perhaps including the listed skills. But they do expect and deserve to be paid for their services. The entity that has the money available to finance contractor services is the Owner. A contractor paid by the RAS Reporting Entity (owner) for review would be expected to keep the owner's interest clearly in mind, raising the same conflict of interest issue inherent to PC/TP/Owner review discussed above. In addition, contractors are not any kind of Entities in the NERC Functional Model, so cannot have responsibilities assigned to them through the standards.

Since the proposed PRC-012-1 standard does not require "approval" by the Reviewing Entity, but rather review and feedback between the RAS Reporting Entity and the RAS Review Entity, the existing Regions may be in a good position to provide the RAS Review service. All the Regions have access to the necessary skills through their organizations and/or their individual members and already have a Regional RAS or SPS review process in place. It is not possible to assign such responsibilities to the Regions directly through the Standards process for the similar reasons as a contractor cannot be assigned such responsibilities. If the Regions were to perform a review service it could not be directly as a result of assignment in a standard. Such an arrangement, if possible, may require implementation through contractual or other appropriate means.

The RAS SDT considers that, at present, the Regions are best positioned historically, with appropriate skill sets, wide-area oversight, continuity (including minimal disruption to existing RRO review processes), and without conflicts of interest to perform RAS reviews. The SDT recognizes that continuing to use the Regions similar to historical practice, but outside direct assignment of responsibilities through the standards, will have potentially difficult business and perhaps regulatory issues associated.

If the Regions cannot perform RAS reviews, the Reliability Assurer definition and tasks seem an almost equally appropriate entity,

> The functional entity that monitors and evaluates the activities related to planning and operations, and coordinates activities of functional entities to secure the reliability of the Bulk Electric System within a Reliability Assurer area and adjacent areas.

Relationships with Other Functional Entities

1. Coordinates reliability assurance activities of the functional entities within the Reliability Assurer area.
2. Coordinates reliability assurance activities with adjacent Reliability Assurers.
3. Coordinates critical infrastructure protection programs with functional entities.
4. Collects information from functional entities related to Reliability Assurance processes.

Reliability Assurance Tasks

1. Coordinate reliability assurance among adjacent Reliability Assurers through the development of necessary protocols and processes.

2. Coordinate the activities related to maintaining critical infrastructure protection.
3. Establish reliability assurance processes and documentation related to planning and operations within the Reliability Assurer's area including such things as a regional reliability plan or a Reliability Coordinator plan.
4. Identify and address gaps in reliability processes and responsibilities.

The NERC white paper also suggests the RA as a reasonable entity to provide RAS reviews. However, since no entity appears to have ever filed to become a Reliability Assurer, it raises questions about the necessity of the function and its place in the Function Model. If it hasn't been needed so far to assure reliability of the BES, is it actually needed? Is anyone else doing these functions now? If not, why not? Does that leave serious holes in System reliability? Is it needed?

Description of the meaning of redundancy of RAS

The fundamental concept of RAS Redundancy: No single component failure shall prevent the RAS from operating as intended or designed to achieve the system performance the RAS was intended to accomplish.

(WECC) Redundancy should extend to the following RAS components:
a) Detection
b) Power supplies, batteries and chargers
c) Telecommunications (not including M/W towers)
d) Logic controllers (if applicable)
e) RAS trip circuits

(NPCC) Areas of common exposure should be kept to a minimum to reduce the possibility of all groups being disabled by a single event such as fire, evacuation, water leakage, and other such incidents. There shall be two sources of station service ac supply, each capable of carrying at least all the battery chargers associated with the **RAS**. The equipment for each group shall be separated physically on non-adjacent panels and designed to minimize the risk of more than one **protection group** being disabled simultaneously by a single event or condition. Where **RAS** redundancy is achieved by the use of independent **protection groups** tripping the same circuit breakers without overarming, which is defined as providing for more corrective action than would be necessary if no failures are considered, each circuit breaker shall be equipped with two independent trip coils. (This dual trip coil criterion does not apply to Type II **RAS**.) Where the design of an **RAS** is composed of multiple **protection groups** for redundancy and each group requires a communication channel: The communication medium outside the substation/plant physical perimeter for each **protection group** shall be designed to minimize the risk of both **protection groups** being disabled simultaneously by a single event or condition. In addition, physical separation of the communication media outside the substation fence shall be a minimum of three feet. In cases where constraints do not allow three feet separation, this distance may be reduced if a proposed alternative design can achieve comparable physical protection of the communication medium. If an alternative design cannot be met, then an alternative communication path or protection scheme should be proposed. Except as identified

otherwise in these criteria, the two **teleprotection** groups shall not share the same component. The use of a single communication tower for radio communication systems used by the two protection **groups** of an **RAS** is permitted as long as diversity of the communication signals is achieved. Where telecommunication route diversity cannot be achieved, overarming of the appropriate **RAS** trip outputs is an acceptable mitigation. If an **RAS** is designed to have multiple **protection groups** at a single location for redundancy, each individual **protection group** and **teleprotection** of the **RAS** shall be on non-adjacent vertical mounting assemblies or enclosures. If an **RAS** is designed to have multiple **protection groups** at a single location for redundancy, wiring for each individual **protection group** and **teleprotection** of the **RAS** shall not be in the same cable.

(White Paper) Redundancy should extend to the following RAS components:

• Any single ac current source and/or related input to the RAS. Separate secondary windings of a free-standing current transformer (CT) or multiple CTs on a common bushing should be considered an acceptable level of redundancy.

• Any single ac voltage source and/or related input to the RAS. Separate secondary windings of a common capacitance coupled voltage transformer (CCVT), voltage transformer (VT), or similar device should be considered an acceptable level of redundancy.

• Any single device used to measure electrical quantities used by the RAS. [other than CTs and PTs?]

• Any single communication channel and/or any single piece of related communication equipment used by the RAS.

• Any single computer or programmable logic device used to analyze information and provide RAS operational output.

• Any single element of the dc control circuitry that is used for the RAS, including breaker closing circuits.

• Any single auxiliary relay or auxiliary device used by the RAS.

• Any single breaker trip coil for any breaker operated by the RAS.

• Any single station battery or single charger, or other single dc source, where central monitoring is not provided for both low voltage and battery open conditions.

Some RAS utilize an Energy Management System (EMS) for transmitting signals or calculating information necessary for RAS operation such as the amount of load or generation to trip. Loss of the EMS system must be considered when assessing the impact of a single component failure. For example, when the EMS is used to transmit a signal, a separate communication path must be available. When a non-redundant EMS provides a calculated value to two otherwise independent systems, a backup calculation or default value must be provided to the RAS in the event of an EMS failure.

Also see “Redundancy Considerations for Protective Relaying Systems,” IEEE PSRC I-19, 2009
“Redundancy of Protection System Elements”, NERC SPCS, Jan 2009

Attachment 1
Supporting Documentation for RAS Review

The following checklist identifies important RAS information for each new or functionally modified[i] RAS that the RAS-owner shall document and provide to the Reliability Coordinator for review pursuant to Requirement R1.

I. General

- ❑ Locational Data – Maps, one-lines, substation drawings, etc. as necessary to ensure that the RAS review team is able to understand the physical and electrical location of the RAS and related facilities.

- ❑ For proposed functional modifications to existing RAS – Summary documentation of the pre- and post-modified functionality of the RAS.

- ❑ When a RAS has been previously reviewed under either this standard or an earlier Regional review process, modifications subsequently proposed to that RAS require review only of the modifications. However, it will be helpful to the reviewers if the RAS Owner provides a summary of the unmodified functionality, when appropriate.

II. Transmission Planning Evaluation (Assessment)

- ❑ Design Objectives – Contingencies and system conditions that the RAS is intended to remedy. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.1]

- ❑ Operational Data – The actions to be taken by the RAS in response to disturbance conditions. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.2]

- ❑ Functional Data – Information on detection logic, equipment or hardware, and settings/parameters that control the operation of the RAS. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.3]

- ❑ Identification of the RAS-Owner's classification of the RAS.

- ❑ Documentation of technical studies including study year(s), system conditions, and contingencies analyzed (N-1, N-1-1, N-2, and Extreme) on which the RAS design is based, when those technical studies were performed, and information regarding any future system plans that will impact the RAS. [Reference NERC Reliability Standard PRC-014, R3.2]

- ❑ Documentation that the proposed RAS actions satisfy System performance objectives for the scope of System events and conditions that the RAS is intended to remedy.

- ❑ If RAS modifications are proposed pursuant to a Corrective Action Plan (CAP), provide a copy of the CAP.

- ❑ Documentation that inadvertent operation of the RAS satisfies the same System performance requirements as those required of the contingency for which it was designed. For RAS that are installed for conditions or contingencies for which System performance requirements are not specified, demonstrate that the inadvertent operation satisfies the System performance

requirements of Table 1, Category P7 of NERC Reliability Standard TPL-001-4 or its successor. [Reference NERC Reliability Standard PRC-012, R1.4]

- ❑ Documentation that the RAS coordinates with other RAS, and protection and control systems. [Reference NERC Reliability Standards PRC-012, R1.5 and PRC-014, R3.4]

- ❑ Documentation indicating whether or not the RAS could impact Bulk Electric System facilities located in another Reliability Coordinator area. [Reference NERC Reliability Standard PRC-014, R2]

III. Implementation Design

- ❑ Documentation describing the use of equipment for detection, telecommunications, transfer trip, logic processing, and monitoring, whichever are applicable.

- ❑ Documentation that any multifunction device used to perform RAS function(s), in addition to other functions such as protective relaying or SCADA, does not compromise the reliability of the RAS when the device is not in service or is being maintained.

- ❑ Documentation that a single component failure, when the [Planning Significant (PS) or Planning Limited (PL)] RAS was intended to operate, does not prevent the Bulk Electric System from meeting the performance requirements defined in NERC Reliability Standard TPL-001-4, or its successor. The documentation should describe or illustrate how the implementation design achieves this objective. [Reference NERC Reliability Standard PRC-012, R1.3]

IV. Operational Data

- ❑ Documentation of all misoperations since the last review if applicable. The documentation shall include implementation status of any corrective actions and/or CAPs associated with misoperations. [Reference NERC Reliability Standard PRC-012, R1.7]

[i] Functionally Modified: Scheme modifications including changes to the hardware, transfer levels, or any change with possible impact to the overall functionality, timing, or redundancy level documented at the time of the original submission for review.

Attachment 2
Database Information

1. RAS name
2. RAS-owner and contact information
3. Name and contact information for the individual with sufficient detail necessary to model the RAS
4. Expected in-service date; most recent review date; 5-year comprehensive evaluation date; and, to the extent applicable, date of retirement
5. RAS classification (as identified in Attachment 1)
6. Description of the contingencies or System conditions for which the RAS was designed
7. Information on parameters that control operation of the RAS
8. System performance issue necessitating the RAS (*e.g.*, thermal overload, angular instability, poor oscillation damping, voltage instability, under-/over-voltage, slow voltage recovery)
9. Corrective action taken by the RAS

Attachment 3
Reliability Coordinator RAS Review Checklist

Introduction

The following checklist identifies important design and implementation information that the Reliability Coordinator shall review for each new or functionally modified[i] RAS.

DESIGN

- ❑ RAS actions satisfy System performance objectives for the scope of System events and conditions that the RAS is intended to remedy.
- ❑ Identify the classification of the RAS (PS, PL, ES, EL); for a scheme modification, does this classification change?
- ❑ RAS actions are permissible in accordance with NERC TPL standards, specifically limits on non-consequential load loss where applicable.
- ❑ RAS actions satisfy NERC TPL standard performance requirements associated with the contingency type the RAS is intended to remedy.
- ❑ The appropriateness of RAS arming conditions to the System performance objectives, if applicable.
- ❑ The possibility of miscoordination or adverse interaction with other RAS, protection systems, control schemes, and operating procedures.
- ❑ System configuration changes due to RAS operation to not adversely affect protection relay function, e.g. distance relays OC supervision, potential source switching, bF relay pickup.
- ❑ The effect of RAS misoperation, including inadvertent operation and failure to operate.
- ❑ Identify effect of future system plans on the design and operation of the RAS, when possible.

If the RC's RAS review concludes that the RAS is properly classified as either PL or EL (Planning or Extreme Limited), the RC may elect review of the Implementation Design is not required.

IMPLEMENTATION

- ❑ Implementation of RAS logic correlates desired actions (outputs) with system events and conditions (inputs); the timing of RAS actions is appropriate to achieve system performance objectives.
- ❑ The redundancy of RAS components is required if the RAS must to satisfy NERC TPL or other System performance standards. – also see classifications
- ❑ The implementation of redundancy, if required.

- ❑ Scheme testing procedure considerations

OPERATIONS

- ❑ RAS operating procedure documentation, if applicable.
- ❑ Whether the RAS is armed automatically or manually, if applicable.
- ❑ RAS arming procedures implemented in consideration of reducing the risk of unintended operation
- ❑ Monitor operational status and arming status of the RAS as required by PRC-001, R6 and TOP-003-2, R5. And suggested in the white paper – (at least what the TOP and RC requires)
- ❑ RAS component maintenance procedure considerations

[i] Functionally Modified: Scheme modifications including changes to the hardware, transfer levels, or any change with possible impact to the overall functionality, timing, or redundancy level documented at the time of the original submission for review.

When this standard receives Board adoption, the rationale boxes will be moved to the Supplemental Material Section of the standard.

A. Introduction

1. **Title:** **Remedial Action Schemes**

2. **Number:** **PRC-012-2**

3. **Purpose:** To ensure that all Remedial Action Schemes (RAS) are properly designed, meet performance requirements, and are coordinated with other protection systems.

4. **Applicability:**

   4.1. Functional Entities:

   4.1.1. Reliability Coordinator with designated responsibility for RAS-review

   4.1.2. Planning Coordinator

   4.1.3. Transmission Planner

   4.1.4. RAS-owner - Transmission Owner, Generator Owner, or Distribution Provider that owns RAS components

   4.2. Facilities:

   4.2.1. Remedial Action Schemes (RAS)

   4.2.2. (Subset of Facilities)

   4.3. Exemptions:

   4.3.1. (Subset of Facilities) **(DELETE GREEN TEXT PRIOR TO PUBLISHING) Include this section only if there are certain facilities exempt from the standard.**

5. **Effective Date:** See Implementation Plan for PRC-012-2

6. **Standard-Only Definition:** **(DELETE GREEN TEXT PRIOR TO PUBLISHING) This section is to be used only for standards that currently have standard only definitions. Going forward a standard must provide a justification as to why the standard needs a standard-only definition and cannot be moved to the NERC Glossary of Terms.**

B. Requirements and Measures

Rationale for Requirement R1: Because each Remedial Action Scheme (RAS) is unique and its action(s) can have a significant impact on the reliability and integrity of the Bulk Electric System (BES), the SDT contends that a thorough review of proposed new RAS or existing RAS proposed for functional modifications or retirement (removal from service), must be completed prior to implementation. To facilitate a comprehensive review that ensures reliability, the RAS-owner must provide the reviewer with sufficient details of the RAS design, function, and operation. This data and supporting documentation are identified in Attachment 1 of this standard, and Requirement R1 mandates the RAS-owner provide them. The SDT assigned this task to the designated Reliability Coordinator. The RC designated for the review will be the RC that coordinates the area where the RAS is located. In cases where a RAS crosses RC Area boundaries, both RCs would conduct reviews.

R1. Prior to placing a new or functionally modified RAS in-service or retiring an existing RAS, each RAS-owner shall submit the information identified in Attachment 1 to the Reliability Coordinator(s), for review. *[Violation Risk Factor:] [Time Horizon:]*

M1. Acceptable evidence is a copy of the Attachment 1 documentation and the dated communications with the Reliability Coordinator in accordance with Requirement R1.

Rationale for Requirement R2: Requirement R2 mandates the Reliability Coordinator provide a review of each new or functionally modified RAS proposed for installation in its Reliability Coordinator Area. The SDT selected the Reliability Coordinator (RC) because of its wide area perspective that provides continuity to the review process and facilitates the coordination aspects of RAS with other RAS. The RC selection minimizes the possibility of conflict of interest due to association with the RAS-owner or Transmission Planner (TP), thus providing a more independent review.

The RC is required to perform the review in accordance with Attachment 3, which identifies important design and implementation aspects of the RAS. Attachment 3 includes a checklist that when followed will assure consistent reviews for each RAS submitted. The RC must review the proposed RAS and provide written feedback to the RAS-owner within 4 full calendar months of receipt of Attachment 1. The timeframe of 4 full calendar months is consistent with current utility practice; however, flexibility is provided by allowing the parties to negotiate a different schedule for the review. (do we need to modify IRO-001-1.1- RC responsibilities)

R2. For each RAS submitted pursuant to Requirement R1, the Reliability Coordinator shall, within 4 full calendar months of receipt or on a mutually agreed upon schedule, perform a review of the RAS and provide feedback to the RAS-owner in accordance with Attachment 3: *[Violation Risk Factor:] [Time Horizon:]*

M2. Acceptable evidence may include, but is not limited to, date-stamped reports, or other documentation detailing the RAS review, and the dated communications with the RAS-owner in accordance with Requirement R2.

Rationale for Requirement R3: Requirement R3 mandates the RAS-owner address all reliability-related issues identified by the Reliability Coordinator during the RAS review, and reach agreement with the Reliability Coordinator that the RAS implementation can proceed. This interaction promotes reliability and security of the BES by minimizing the introduction of inadvertent actions (risks). A specific time period for the RAS-owner to respond is not necessary because an expeditious response is in the self-interest of the RAS-owner to effect a timely implementation. (Rob to add retirement section to Attachment 1)

R3. Following the review performed pursuant to Requirement R2, each RAS-owner shall address each identified reliability-related issue and obtain agreement from the reviewing RC, prior to placing a new or functionally modified RAS in-service or retiring a RAS. *[Violation Risk Factor:] [Time Horizon:]*

M3. Acceptable evidence may include, but is not limited to, date-stamped documentation and date-stamped communications with the Reliability Coordinator in accordance with Requirement R3.

Rationale for Requirement R4: The purpose of periodic RAS evaluation is to verify the continual effectiveness and coordination of the RAS, as well as its inadvertent operation performance. This periodic evaluation is needed due to possible changes in system topology and operating conditions that may have occurred since the previous RAS evaluation (or initial review) was completed. Based on the periodicity time frames for similar requirements in Reliability Standards PRC-006-1 and PRC-010-1, and in current RAS evaluation practices, it was determined that 60 calendar months between the RAS evaluations is both reasonable and adequate. The RAS evaluation can be performed sooner if it is determined that material changes to system topology or system operating conditions that could potentially impact the effectiveness or coordination of the RAS, have occurred since the previous RAS evaluation. The periodic RAS evaluation will typically lead to one of the following outcomes – affirmation that the existing RAS implementation is adequate; or, identification of changes needed to the existing RAS implementation; or, justification for RAS retirement. Because the items addressed in the evaluations (Parts 4.1, 4.2, 4.3) are planning analyses, the SDT asserts that the functional entity best qualified to perform them is the Transmission Planner (TP). To promote reliability, the TP is required to provide the RAS-owner and the Reliability Coordinator with the results of each evaluation.

R4. Each Transmission Planner shall perform an evaluation of each RAS in its planning area at least once every 60 calendar months and provide the RAS-owner(s) and the Reliability Coordinator(s) the results including any identified deficiencies. Each evaluation shall include, but is not limited to, analyses that evaluate whether: *[Violation Risk Factor:] [Time Horizon:]*

- **4.1** The RAS addresses the System condition(s) for which it was designed.
- **4.2** The RAS is coordinated with other RAS, protection and control systems.
- **4.3** The inadvertent operation of the RAS satisfies the same performance requirements as those for which it was designed.

M4. Acceptable evidence may include, but is not limited to, date-stamped reports or other documentation of the analyses comprising the evaluation of each RAS and date-stamped communications with the RAS-owner(s) and Reliability Coordinator(S) in accordance with Requirement R3.

Rationale for Requirement R5: Deficiencies identified by the periodic RAS evaluation conducted by the Transmission Planner in Requirement R4 are likely to pose a reliably risk to the BES due to the impact of either a RAS operation or incorrect operation. To avoid this reliability risk, Requirement R5 mandates the RAS-owner develop a Corrective Action Plan that establishes the mitigation methods and timetable to address the deficiency. Submitting the Corrective Action Plan to the Reliability Coordinator provides a second check of the mitigating actions, ensuring any deficiencies are adequately addressed in a timely manner. (Al to provide more explanation)

R5. Each RAS-owner notified of a deficiency in its RAS, based on the evaluation performed pursuant to Requirement R4, shall submit a Corrective Action Plan to the Reliability Coordinator within 6 full calendar months of receipt. *[Violation Risk Factor:] [Time Horizon:]*

M5. Acceptable evidence is a date-stamped Corrective Action Plan and date-stamped communications with the Reliability Coordinator in accordance with Requirement R5.

Rationale for Requirement R6: Because the correct operation of a Remedial Action Scheme (RAS) is important to maintaining the reliability and integrity of the Bulk Electric System (BES), the SDT contends that all operations of a RAS should be analyzed. Any incorrect operation of a RAS indicates the RAS effectiveness and/or coordination has been compromised. (Check white paper for definition of misoperation) (Gene will add proposed language)

R6. Following the operation of a RAS, the RAS-owner shall analyze the operation to determine whether the RAS operated correctly. *[Violation Risk Factor:] [Time Horizon:]*

M6. Acceptable evidence may include, but is not limited to, date-stamped documentation detailing the analysis of the RAS operation in accordance with Requirement R6.

Rationale for Requirement R7: Requirement R7 mandates the RAS-owner develop a Corrective Action Plan to address any identified incorrect operation. Any incorrect operation of a RAS indicates its effectiveness and/or coordination is compromised, which poses a reliability risk to the BES. Since incorrect operation of a RAS indicates potential deficiency(ies) in the RAS implementation and/or coordination, the RAS-owner must identify these deficiency(ies) and develop a Corrective Action Plan to address them. Submitting the Corrective Action Plan (CAP) to the Reliability Coordinator ensures that any deficiencies are adequately addressed in a timely manner. (insert Al's new language here too)

R7. For any identified incorrect operation that requires a functional modification to the RAS, the RAS-owner shall submit a Corrective Action Plan to the Reliability Coordinator within 6 full calendar months of identifying the incorrect operation. *[Violation Risk Factor:] [Time Horizon:]*

M7. Acceptable evidence is a date-stamped Corrective Action Plan and date-stamped communications with the Reliability Coordinator in accordance with Requirement R7.

Rationale for Requirement R8: Requirement R8 mandates the RAS-owner implement a Corrective Action Plan developed to address any identified deficiency found in conjunction with the periodic evaluation pursuant to Requirement R4, and any identified incorrect operation found by the analysis of an actual RAS operation pursuant to Requirement R6. Implementing the Corrective Action Plan (CAP) developed pursuant to either Requirement R5 or R7 ensures that any identified deficiency (ies) or incorrect operations are addressed in a timely manner. The CAP identifies the work (corrective actions) as well as the work schedule (the time frame within which the corrective actions are to be taken).

R8. For each CAP developed pursuant to Requirements R5 or R7, each RAS-owner shall implement the CAP. *[Violation Risk Factor:] [Time Horizon:]*

M8. Acceptable evidence may include, but is not limited to, dated documentation (electronic or hardcopy format) such as work management program records, work orders, and maintenance records that document the implementation of a CAP in accordance with Requirement R8.

Rationale for Requirement R9: The purpose of the RAS database is to comprise a comprehensive record of all RAS existing in a Reliability Coordinator's area, along with basic descriptive information about each RAS including its purpose, operating actions, and "who to" contact information if detailed information is needed. Other functional entities may have a reliability-based need to be aware of existing RAS, for example, to ensure coordination with other schemes; therefore, an accurate source of such information must be maintained. At a minimum, the information described in Attachment 2 facilitates this purpose. Continued maintenance of the RAS database is required to ensure accuracy. The RC will be receiving the information required for the database as each new or modified RAS is submitted for review, so it is logical that the RC be assigned this responsibility.

R9. Each Reliability Coordinator shall maintain a RAS database containing the information in Attachment 2. *[Violation Risk Factor:] [Time Horizon:]*

M9. Acceptable evidence may include, but is not limited to, date-stamped spreadsheets, database reports, or other documentation demonstrating a RAS database was maintained in accordance with Requirement R9.

Rationale for Requirement R10: The STD contends that other registered entities may have a reliability need for modeling RAS operations and will require additional information then what is listed in Attachment 2 in order to model RAS accurately. Requirement R10 mandates that the RAS-owner provide detailed information to the relevant functional entity to model RAS operation. Such information may be needed to address one or more of the following reliability needs:

- Perform periodic RAS evaluation
- Planning assessment studies
- Operations planning and/or real-time analyses
- BES event analyses
- Coordinating RAS actions between entities

R10. Each RAS-owner shall provide other registered entities with a reliability need, information to model RAS operation, within 30 calendar days of a written request. *[Violation Risk Factor:] [Time Horizon:]*

M10. Acceptable evidence may include, but is not limited to, date-stamped communications e.g. emails, letters, or other documentation demonstrating information to model RAS operation was provided in accordance with Requirement R10.

FAQ (a start)

Why was the Reliability Coordinator chosen to perform RAS reviews?

The FERC directive (753? Re: PRC-012, PRC-013, PRC-014) that rejected the Regions as an acceptable entity for responsibility under NERC Functional Model and standards identified that the proper entity(ies) must have Planning or Operating responsibilities within the NERC Functional Model. The NERC white paper suggested either the PC or RC for the review responsibility. The Regions have as many as 30 PCs for one RC, though other Regions have a single PC and RC for the Region. Overall, there are 15 RCs and about 80 PCs. Since this standard needs to apply across North America, the Reliability Coordinators clearly have the consistently widest possible view of the System of any Operating or Planning entity.

The RCs have corporate independence from RAS owners, while PCs in some Regions often are effectively subsidiaries of a RAS owner. Such PCs could not effectively perform an independent review of any RAS proposed by their owner.

The RCs have a much better opportunity than any other entity acceptable to FERC to organize the appropriate individual skill sets in a multi-disciplinary review team that can provide consistent and experienced RAS reviews.

The SDT considers the RC as the FM entity most likely to represent the reliability interests of independence, wide geographic oversight, and continuity characteristic of the present RRO administered reviews. The SDT considers the RC as unlikely to be a stakeholder in any given RAS and thus a sufficiently independent FM entity to conduct the reviews. In many instances the RC geographic oversight exceeds that of the respective PCs. The larger RC geographic oversight will minimize fragmentation of the present RRO administered reviews. With regard to the need for multi-disciplinary expertise, the RC may designate another entity to conduct the review per the checklist in Attachment 3 if the RC does not believe it has the necessary qualifications itself. The present assignment to the RROs may continue under this standard should the RRO agree to continue the review function at the request of the RC(s). Continuity may be assured by institutionalization of the review panel within a RC or RRO area.

1. FAQ document [Consider timing of when to release this; after 1st posting/comment]
    a. Address and explain areas where differ from recommendations of white paper
        i. Scheme classifications changes (significant)
        ii. Redundancy for PL classification
        iii. Who is the RAS Review Entity
        iv. Annual and “comprehensive” assessments (evaluations) and who does them
        v. More??

Why are PCs not required to perform annual evaluations of RAS performance? (white paper)

TOP-005-1_R3 requires BAs and TOs to perform operational reliability assessments (e.g. RTCA, day ahead, and seasonal), which may include data describing new or degraded special protection

systems [RAS]. In addition, IRO-005-1_R12 requires that RCs must share any pertinent data, such as SPS [RAS] with potentially affected BAs and TOs. Short- to medium-term operating assessments which may include RAS are already required, so an additional requirement duplicating that effort is not necessary.

TPL-001-4_R2 already requires the TP and PC to perform annual Planning Assessments of the Near-Term Transmission Planning Horizon. R2.7.1 acknowledges that new, modified, or removed SPS [RAS] may be part of a CAP used to fulfill Table 1 performance requirements. Planning horizon annual assessments are already required, including RAS, so an additional requirement duplicating that effort is not necessary.

Why is the 5-year evaluation (assessment) assigned to the TP, rather than the RC? (white paper)

Why were the Regions not included as part of the review process?

Regions are not Planning, Operating or Owning Entities in the NERC Functional Model, so cannot have responsibilities assigned to them by the standards.

Why do RAS need to be reviewed by a group outside of the owner?

RAS are unique and customized conglomerations of various protection and control components that do not follow any standardized or otherwise typical or customary utility practices. As such, they have a potential to introduce serious reliability risks if not carefully planned, designed, and installed. While a RAS may be installed to address a reliability issue, or achieve an economic or operational advantage, it might also introduce other reliability risks that may not be apparent to a RAS entity focused on the issue or advantage at hand. Any such unforeseen risks need to be identified, and a review by a multi-disciplinary panel of SMEs is the best means to identify such RAS introduced risks and recommend RAS modifications where necessary.

Why is RAS approval required as part of the outside review?

Focus

Why was a continent-wide review body not prescribed?

Reviews limited specific areas are difficult enough to identify an appropriate reviewing body. No appropriately skilled continent-wide body presently exists. Some familiarity by the reviewers with the area electric system pertinent to each RAS is very useful to promote an efficient RAS review process, which would be much more difficult for a single continent-wide reviewing body.

b. Description of redundancy (minimum requirement for redundancy; see NPCC document)
c. Why is redundancy required for PS classified schemes?

If a RAS is deemed necessary to satisfy the performance requirements of a NERC reliability standard such as, and in particular, TPL-001, it is necessary that its operation under the conditions and events for which it is designed to operate be assured in the operational realm as well as in the planning realm. Full redundancy of the RAS components achieves

this goal. Full redundancy is also consistent with the performance requirements of TPL-001, Table 1, Category P5 where a component (relay) failure of a protection system is combined with a normal planning contingency. The companion consideration associated with the PS redundancy requirement is the assurance of avoiding significant adverse system impacts.

Implementation Plan (considerations, a start)

Transitioning to the new RAS classification system

When a Regional classification is used for an existing RAS, the following corresponding classifications will be transferred until such time as that RAS undergoes an evaluation under the (new) R4. Review by the RC is not required until a functional modification is proposed (R1).

Default "grandfather" classifications pending first "evaluation" under new R4

Extreme Significant, ES	**Planning Limited, PL**	**Planning Significant, PS**
NPCC: Type II WECC: Safety Net (SN)	NPCC: Type III ERCOT: Type 2 WECC: Local Area Protection Scheme (LAPS)	NPCC: Type I ERCOT: Type 1 WECC: Wide Area Protection Scheme (WAPS)

Periodic RAS Evaluations

For existing RAS, if a dated RAS evaluation (assessment) is available from prior to the applicability date of this standard, use that (earlier) evaluation (assessment) date to schedule the next 5-year evaluation (R4). If no dated evaluation (assessment) is available from prior to the applicability date of this standard, complete an evaluation (R4) within 24 months of the standard applicability date.

Review by the RC is not required until a functional modification is proposed pursuant to R1 and R2. In either case, the TP will provide (or confirm) the RAS classification as part of this first (R4) evaluation following the standard applicability date. The RC will not need to review such classification until RAS modifications are proposed pursuant to R1 and R2.

Transition of RAS reviews from the Regions to the RCs

The SDT recognizes that its authority is absent in the execution of this new standard. However, the SDT is convinced that continuity of the RAS review process should not be compromised in the transition of RAS reviews from the Regions to the RCs. Continuity is important to the quality of the results of those reviews.

The SDT strongly suggests that the most effective way to maintain such continuity and assure quality reviews following the standard applicability date would be for the RCs to contract(?) with their Region to continue to use the existing Regional RAS (or SPS) review organizations (e.g. in WECC this would be the Remedial Action Scheme Reliability Subcommittee) for some mutually agreed period. Such an arrangement would still leave the review responsibility, pursuant to Requirement R2, with the RC.

Technical Justification for Attachment 1
Supporting Documentation for RAS Review

RAS OWNER'S Review Checklist

- ❑ Locational Data – Maps, one-lines, substation drawings, etc. as necessary to ensure that the RAS review team is able to understand the physical and electrical location of the RAS and related facilities.

  The drawing(s) should provide sufficient information to allow the review committee members to assess design reliability, and should include information such as the bus arrangement, circuit breakers, the associated switches, etc. For each site, indicate whether detection, logic, action, or a combination of these is present.

- ❑ Design Objectives – Contingencies and system conditions that the RAS is intended to remedy. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.1]

  This item should include basic RAS design information such as purpose of the scheme. e.g. SOL level, arming conditions, and the contingencies for which the scheme is designed to operate.

- ❑ Operational Data – The actions to be taken by the RAS in response to disturbance conditions. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.2]

  This item should identify the action taken by the RAS when it operates.

- ❑ Functional Data – Information on detection logic, equipment or hardware, and settings/parameters that control the operation of the RAS. [Reference NERC Reliability Standards PRC-012, R1.2 and PRC-013, R1.3]

  This column should identify how the events that trigger the RAS action are detected, e.g. line loss detection for critical contingency lines.

- ❑ Identification of the RAS-Owner's classification of the RAS.

  The owner should identify the classification of the RAS; the reviewers will make the final determination of the scheme classification. The RAS owner must provide adequate information for the reviewing committee members to judge the proposed scheme classification.

- ❑ Documentation of technical studies including study year(s), system conditions, and contingencies analyzed (N-1, N-1-1, N-2, and Extreme) on which the RAS design is based, when those technical studies were performed, and information regarding any future system plans that will impact the RAS. [Reference NERC Reliability Standard PRC-014, R3.2]

  Any RAS, to be effective, must satisfy the objectives for which it was designed, both when initially placed in service and over its lifetime. The listed items summarize those conditions and

the actual studies document the modeled system performance when the RAS operates as designed.

- ❑ Documentation that the proposed RAS actions satisfy System performance objectives for the scope of System events and conditions that the RAS is intended to remedy.

  This item allows a more detailed examination of RAS performance, especially compared to any pertinent standards.

- ❑ If RAS modifications are proposed pursuant to a Corrective Action Plan (CAP), provide a copy of the CAP.

  When a periodic evaluation (R4) or RAS misoperation analysis (R6) identifies that functional changes are needed to a RAS, those planned modifications are documented, including a schedule, with a Corrective Action Plan. If a CAP is pertinent to this review requeswt, it needs to be provided to the reviewers.

- ❑ Documentation that inadvertent operation of the RAS satisfies the same System performance requirements as those required of the contingency for which it was designed. For RAS that are installed for conditions or contingencies for which System performance requirements are not specified, demonstrate that the inadvertent operation satisfies the System performance requirements of Table 1, Category P7 of NERC Reliability Standard TPL-001-4 or its successor. [Reference NERC Reliability Standard PRC-012, R1.4]

  Inadvertent RAS operation will also have some impact on system performance. That potential impact needs to be identified and evaluated. Such impact must not be worse than the impact of the original system event(s) that the RAS was designed to mitigate when a performance requirement is specified. Extreme events do not specify a required performance level, but inadvertent operation of such schemes must not result in worse System performance that would be allowed for the worst performance that is specified in TPL-001-4.

- ❑ Documentation that the RAS coordinates with other RAS, and protection and control systems. [Reference NERC Reliability Standards PRC-012, R1.5 and PRC-014, R3.4]

  Coordination of RAS with other RAS and other protection and control systems prevents both inadvertent operations and failure to operate when needed. Such coordination is required for the RAS to accomplish its intended purpose.

  For example, if a RAS detects a line outage as a trigger to action, but can delay executing that action until automatic reclosing is attempted and fails, then the delay time for the action must be longer than the reclosing open interval on the line.

  Generator and Transmission Operators are already required to coordinate protective systems with their neighbors, including their BAs (PRC-001).

- ❑ Documentation indicating whether or not the RAS could impact Bulk Electric System facilities located in another Reliability Coordinator area. [Reference NERC Reliability Standard PRC-014, R2]

  All entities that may be impacted by RAS operation (or its failure to operate) need to be aware of the scheme's existence and its basic operation.

Implementation Design

- Documentation describing the use of equipment for detection, telecommunications, transfer trip, logic processing, and monitoring, whichever are applicable.

1) Describe the design philosophy (e.g. failure is to be a non-credible event).
2) Describe the design criteria (e.g. failure of a single component, element or system will not jeopardize the successful operation of the RAS).
3) RAS Logic - Provide a description of the RAS Logic in the form of written text, flow charts, matrix logic tables, timing tables, etc. as appropriate and identify the inputs and outputs. Provide appropriate diagrams and schematics.
4) RAS Logic Hardware - Provide a description of the logic hardware (relay, digital computer, etc.) and describe how the RAS logic function is achieved.
5) Redundancy - Provide a discussion of the redundancy configuration and if appropriate, why redundancy is not provided. Include discussion of redundant:
    a) Detection.
    b) Power supplies, batteries and chargers.
    c) Telecommunications (also mentioned in item 10d).
    d) Logic controllers (if applicable).
    e) RAS trip circuits.
6) Arming - Describe how the RAS is armed (i.e. remotely via SCADA, locally, automatic, etc.).
7) Detection - Define all inputs to the RAS for the scheme to perform its required purpose. Examples:
    a) Devices needed to determine line-end-status such as circuit breaker (52 a/b contacts) and disconnect status.
    b) Protective relay inputs.
    c) Transducer and IED (intelligent electronic device) inputs (watts, vars, voltage, current).
    d) Rate-of-change detectors (angle, power, current, voltage)
    e) All other inputs (e.g. set points, time from a GPS clock and wide area measurements such as voltage angle between two stations).
    f) Provide details of other remote data gathering or control equipment.
    g) Coordination with Protection and Control Systems

8) Describe all protection and control systems interactions with the RAS, in addition to the RAS inputs described in (7) above.
    a) System configuration changes due to RAS operation do not adversely affect protective relay functions such as distance relay overcurrent supervision, breaker failure pickup, switching of potential sources, overexcitation protection activation, or other functions pertinent to the specific relays or protection scheme.
    b) If studies indicate that transient or sustained low voltages are expected in conjunction with elevated line flows during or after RAS operation, confirm that any protection settings on affected lines will not cause cascading outages related to the low system voltages.

9) Potential adverse interactions with any other protection or control systems.

10) Telecommunications.

a) Provide a graphical display or diagram for each telecom path used in the proposed RAS scheme, including extent of redundancy employed. See references. Indicate ownership of the circuits, paths, and segments. Indicate responsibility for maintenance. If a telecom circuit utilizes a public network, describe monitoring and maintenance agreements including repair response, details of availability, and how possible change of ownership is addressed. Describe maintenance agreements and response commitments when the RAS communication utilizes multiple private systems.

b) Describe and list the telecommunications media and electronic equipment (e.g. microwave radio, optical fiber cable, multiplex node, power line carrier, wire pair, etc.) including redundancy employed in each telecom path. For each of the paths and segments of the RAS, identify the type of telecom equipment employed. For example, whether analog or digital licensed microwave radio, unlicensed spread spectrum radio, fiber optic SONET node, etc are applied.

c) Provide a description of common facilities used for each RAS telecom path and segment that are not specifically excluded from redundancy by the WECC critical communication circuit design guideline (e.g. towers, generators, batteries). Identify paths or segments routed through common equipment chassis such as Digital Cross-connect System, SONET node, or router. Identify physical media carried or supported by the same structure, such as a transmission line tower, pole structure, or duct bank. Discuss outside plant and inside plant routing diversity. See references.

d) Provide a discussion of communications system performance including, circuit or path quality in terms of availability. Provide details of reliability (e.g., availability of 99.95%), and other supporting reliability information such as equipment age, history, maintenance, etc. Telecommunication reliability information is the average overall percentage, and not point-to-point information. See references.

e) Provide a discussion about performance of any non-deterministic communication systems used (such as Ethernet). If RAS performance is dependent upon successful operation through a non-deterministic communications system or path, then describe how timing and latency issues will be addressed and verified. Include timing and latency planning or management and verification for initial commissioning and in the event of network modifications or additions. Identify which industry standard is applied.

f) Acknowledge provision of appropriate high voltage entrance protection if wire pairs are used.

11) Remedial Actions Initiated - Provide a functional description of the action(s) produced by the scheme and include a simplified

- ❑ Documentation that any multifunction device used to perform RAS function(s), in addition to other functions such as protective relaying or SCADA, does not compromise the reliability of the RAS when the device is not in service or is being maintained.

A multifunction device is a single device that is used to perform the function of a RAS in addition to protective relaying and/or SCADA simultaneously. It is important that other applications in the multifunction device do not compromise the functionality of the RAS when the device is in service or when is being maintained.

a) Describe how the multifunction device is applied in the RAS.
b) Show the general arrangement and describe how the multi-function device is labeled in the design and application, so as to identify the RAS and other device functions.
c) Describe the procedures used to isolate the RAS function from other functions in the device.
d) Describe the procedures used when each multifunction device is removed from service and whether any other coordination with other protection is required.
e) Describe how each multifunction device is tested, both for commissioning and during periodic maintenance testing, with regard to each function of the device.
f) Describe how overall periodic RAS functional and throughput tests are performed if multifunction devices are used for both local protection and RAS.
g) Describe how upgrades to the multifunction device, such as firmware upgrades, are accomplished. How is the RAS function taken into consideration?

- ❑ Documentation that a single component failure, when the [Planning Significant (PS) or Planning Limited (PL)] RAS was intended to operate, does not prevent the Bulk Electric System from meeting the performance requirements defined in NERC Reliability Standard TPL-001-4, or its successor. The documentation should describe or illustrate how the implementation design achieves this objective. [Reference NERC Reliability Standard PRC-012, R1.3]

Operational Data

- ❑ Documentation of all misoperations since the last review if applicable. The documentation shall include implementation status of any corrective actions and/or CAPs associated with misoperations. [Reference NERC Reliability Standard PRC-012, R1.7]

1) Provide assurances that the overall performance and operating time of the RAS will meet the requirements identified in system studies.
2) When using the existing equipment and components, such as the EMS, RAS controllers, and arming devices, address the following items as they pertain to the operational history of such equipment and procedures.
   a) How long has the RAS been in operation and how many times has it operated?
   b) How many times has the RAS failed to operate when it should have? Provide details of causes and impacts.
   c) How many times has it operated unnecessarily? Provide details of causes and impacts.
   d) What modifications, if any, are planned as a result of b and c above?