

NERC is responsible for ensuring that the Reliability Standards, Violation Risk Factors (VRF), Violation Severity Levels (VSL), definitions, Variances, and Interpretations developed by drafting teams are developed in accordance with NERC processes. They must also meet NERC's benchmarks for Reliability Standards, as well as criteria for governmental approval.

In FERC Order No. 672,¹ the Federal Energy Regulatory Commission (FERC) identified a number of criteria that it will use to analyze Reliability Standards proposed for approval to ensure they are just, reasonable, not unduly discriminatory or preferential, and in the public interest. The discussion below identifies these factors, and explains how the proposed Regional Reliability Standard has met or exceeded the criteria:

1. Proposed reliability standards must be designed to achieve a specified reliability goal.

The proposed Reliability Standard must address a reliability concern that falls within the requirements of section 215 of the Federal Power Act. That is, it must provide for the reliable operation of Bulk-Power System facilities. It may not extend beyond reliable operation of such facilities or apply to other facilities. Such facilities include all those necessary for operating an interconnected electric energy transmission network, or any portion of that network, including control systems. The proposed Reliability Standard may apply to any design of planned additions or modifications of such facilities that is necessary to provide for reliable operation. It may also apply to Cybersecurity protection. Order No. 672 at P 321.

NERC Reliability Principles - "NERC Reliability Standards are based on certain reliability principles that define the foundation of reliability for North American bulk power systems. Each reliability standard shall enable or support one or more of the reliability principles, thereby ensuring that each standard serves a purpose in support of reliability of the North American bulk power systems."

NERC Reliability Principle 1 states: "Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards."²

¹ http://www.nerc.com/files/final_rule_reliability_Order_672.pdf

² http://www.nerc.com/files/Reliability_Principles.pdf

The Purpose of VAR-501-WECC-3 is “to ensure the Western Interconnection is operated in a coordinated manner under normal and abnormal conditions by establishing the performance criteria for WECC power system stabilizers.”

2. Proposed reliability standards must contain a technically sound method to achieve the goal.

The proposed Reliability Standard must be designed to achieve a specified reliability goal and must contain a technically sound means to achieve this goal. Although any person may propose a topic for a Reliability Standard to the ERO, in the ERO’s process, the specific proposed Reliability Standard should be developed initially by persons within the electric power industry and community with a high level of technical expertise and be based on sound technical and engineering criteria. It should be based on actual data and lessons learned from past operating incidents, where appropriate. The process for ERO approval of a proposed Reliability Standard should be fair and open to all interested persons. Order No. 672 at P 324.

Standard Development

The proposed standard was developed using the NERC and WECC Standards development processes that were approved by FERC and in effect at each point in the process. Among other things, these processes include drafting of the standard by a drafting team composed of subject matter experts (SME). Biographies of those SMEs are provided with this filing.

These processes also include repeated public iterative comment/response cycles whereby comments are received from the industry and responses to those comments are provided by the drafting team.

Technically Sound

A technical review of the PSS tuning specifications is provided in Attachment F of this filing, *WECC-0107 VAR-501-WECC-3 Power System Stabilizers, Use of Minimum-Load for Tuning In Proposed Requirement R3, WECC-0107 Drafting Team (DT), Kestrel Consulting, Mr. Leo Lima, Kestrel Consulting, July 2, 2015.*

A technical review of the applicability threshold is addressed in Attachment F1 of this filing, *Power System Stabilizer Applicability in the WECC System, Study Progress Report to WECC-0107 Drafting Team, Shawn Patterson of the United States Bureau of Reclamation, April 2014.*

Lessons Learned

PSSs are part of the Automatic Voltage Regulation (AVR) system of a generator and are designed to add or subtract torque to a generator with the goal of damping oscillations on the WECC Interconnection's Bulk Electric System (BES) that otherwise would be amplified if the AVR is operated by itself.

PSSs within WECC (originally called Supplementary Control Systems) were developed in the 1960s in response to power system oscillations on the Pacific Intertie within the Western Interconnection. These oscillations occur at very low frequencies (<1 hertz), are very lightly dampened, and became known as "inter-area modes" (modes) of oscillation because they occurred when real power was transferred from one Western Interconnection geographic region to another (such as between the Pacific Northwest and the Southwest).

These modal oscillations are the result of a combination of many machines on one part of the Western Interconnection BES whose voltage support response to system fluctuations is not in phase with the response of machines on another part of the Interconnection's BES.

WECC Physical Characteristics

The Federal Energy Regulatory Commission (FERC) Order 740, Docket No. RM09-15-000, P23, noted that "in the Western Interconnection a significant number of transmission paths are voltage or frequency stability-limited, in contrast to other regions of the [BES] where transmission paths more often are thermally-limited. Disturbances resulting in a stability-limited transmission path overload, generally, must be responded to in a shorter time frame than a disturbance that results in a thermally-limited transmission path overload. [FERC has also noted] its understanding that this physical difference is one of the reasons for the need for certain provisions of regional Reliability Standards in the Western Interconnection."

When coupled with generator operations within WECC, these physical characteristics create modal oscillations, that when not corrected by the

installation and accurate operation of PSS, could contribute to instability within the WECC Interconnection.

3. Proposed reliability standards must be applicable to users, owners, and operators of the bulk power system, and not others.

The proposed Reliability Standard may impose a requirement on any user, owner, or operator of such facilities, but not on others. Order No. 672 at P 322.

VAR-501-WECC-3 complies with Order 672 in that it applies to the Generator Operator and the Generator Owner.

4. Proposed reliability standards must be clear and unambiguous as to what is required and who is required to comply.

The proposed Reliability Standard should be clear and unambiguous regarding what is required and who is required to comply. Users, owners, and operators of the Bulk-Power System must know what they are required to do to maintain reliability. Order No. 672 at P 325.

VAR-501-WECC-3 complies with Order 672 in that it applies to the Generator Operator and the Generator Owner and specifically states the task(s) each of those entities is required to perform.

The proposed standard requires the Generator Owner to: 1) inform the applicable entities as to the known circumstances when a power system stabilizer (PSS) will be out-of-service (R1), 2) tune the PSS to stated specifications (R3), and 3) establish installation (R4) and servicing criteria (R5) for the PSS.

The proposed standard requires the Generator Operator to have the PSS in-service unless otherwise specified (R2).

5. Proposed reliability standards must include clear and understandable consequences and a range of penalties (monetary and/or non-monetary) for a violation.

The possible consequences, including range of possible penalties, for violating a proposed Reliability Standard should be clear and understandable by those who must comply. Order No. 672 at P 326.

Violation Risk Factors

The WECC-0107 VAR-501-WECC-3 - Power System Stabilizer Drafting Team (DT) used the NERC-provided guidance document for Violation Risk Factors (VRF) to determine the VRF for each requirement. Based on the guidance document, the DT assigned a low VRF to Requirement R1 because the requirement is administrative in nature addressing the planning horizon. A violation of the requirement would not—under the emergency, abnormal, or restorative conditions anticipated by the preparations—be expected to adversely affect the electrical state or capability of the Bulk Electric System (BES), or the ability to effectively monitor, control, or restore the BES.

All other requirements were assigned a medium VRF.

The remaining requirements address the operational horizon. If violated, they could directly affect the electrical state or the capability of the BES, or the ability to effectively monitor and control the BES. However, violation of these medium-risk requirements is unlikely to lead to BES instability, separation, or cascading failures.

Violation Severity Level (VSL)

The DT used the NERC-provided guidance document for VSLs to determine the VSL for each requirement. Based on the guidance document, the DT assigned a severe VSL to Requirements R1, R4 and R5, because the requirements are binary in nature, that is a “pass or fail” type requirement where any degree of noncompliant performance would result in totally or mostly missing the reliability intent of the Requirements.

For each of the remaining Requirements, the DT assigned a graduated performance schedule with each requirement being assigned four increasing tiers for non-compliance. In each case the DT concluded that partial performance would have some reliability-related value.

The VSL for Requirement R2 is based on the passage of time. The longer a Generator Operator leaves its power system stabilizer out of service, the greater the VSL becomes.

The VSL for Requirement R3 is based on the cumulative number of times the Generator Owner failed to meet the prescribed performance. Each piece of the prescribed performance contributes equally to the reliability-related objective; therefore, the VSL was uniformly applied for each piece.

6. Proposed reliability standards must identify clear and objective criterion or measure for compliance, so that it can be enforced in a consistent and non-preferential manner.

There should be a clear criterion or measure of whether an entity is in compliance with a proposed Reliability Standard. It should contain or be accompanied by an objective measure of compliance so that it can be enforced and so that enforcement can be applied in a consistent and non-preferential manner. Order No. 672 at P 327.

Each proposed requirement has a corresponding measure stating the objective evidence required to illustrate compliance.

7. Proposed reliability standards should achieve a reliability goal effectively and efficiently - but does not necessarily have to reflect “best practices” without regard to implementation cost.

The proposed Reliability Standard does not necessarily have to reflect the optimal method, or “best practice,” for achieving its reliability goal without regard to implementation cost or historical regional infrastructure design. It should however achieve its reliability goal effectively and efficiently. Order No. 672 at P 328.

The proposed standard was posted eight times for comment. Each time, the industry was invited to provide comments on all aspects of the document. Cost concerns were raised by PPL Montana in Posting 1. In response, the DT reassured PPL that the standard would not apply to all units; it would only apply to those impacting the BES. In the following seven postings the DT received no comments regarding costs.

8. Proposed reliability standards cannot be “lowest common denominator,” i.e., cannot reflect a compromise that does not adequately protect bulk power system reliability.

The proposed Reliability Standard must not simply reflect a compromise in the ERO's Reliability Standard development process based on the least effective North American practice — the so-called “lowest common denominator” — if such practice does not adequately protect Bulk-Power System reliability. Although the Commission will give due weight to the technical expertise of the ERO, we will not hesitate to remand a proposed Reliability Standard if we are convinced it is not adequate to protect reliability. Order No. 672 at P 329.

The proposed standard takes the existing standard and builds on its strengths. The existing standard has but one requirement calling for a PSS to be in-service for 98% of the time. The spirit of the requirement is retained but redrafted so the applicable entities no longer have to count each hour but are still required to keep the PSS in-service.

In addition to retention of the in-service requirement, the proposed standard adds requirements to install, tune, repair and document the operations of its PSS.

9. Proposed reliability standards may consider costs to implement for smaller entities but not at consequence of less than excellence in operating system reliability.

A proposed Reliability Standard may take into account the size of the entity that must comply with the Reliability Standard and the cost to those entities of implementing the proposed Reliability Standard. However, the ERO should not propose a “lowest common denominator” Reliability Standard that would achieve less than excellence in operating system reliability solely to protect against reasonable expenses for supporting this vital national infrastructure. For example, a small owner or operator of the Bulk-Power System must bear the cost of complying with each Reliability Standard that applies to it. Order No. 672 at P 330.

See response to Question 7.

10. Proposed reliability standards must be designed to apply throughout North America to the maximum extent achievable with a single reliability standard while not favoring one area or approach.

A proposed Reliability Standard should be designed to apply throughout the interconnected North American Bulk-Power System, to the maximum extent this is achievable with a single Reliability Standard. The proposed Reliability

Standard should not be based on a single geographic or regional model but should take into account geographic variations in grid characteristics, terrain, weather, and other such factors; it should also take into account regional variations in the organizational and corporate structures of transmission owners and operators, variations in generation fuel type and ownership patterns, and regional variations in market design if these affect the proposed Reliability Standard. Order No. 672 at P 331.

Matters not Covered Elsewhere

The Federal Energy Regulatory Commission (FERC) has stated that, Regional Entity Standards or Regional Variances to a NERC Reliability Standard (Standard) are permissible if:

- they set more stringent reliability requirements than the NERC Reliability Standard;
- cover matters not covered by an existing NERC Reliability Standard; or
- are necessitated by a physical difference in the Bulk-Power System (BES).³

As mentioned in Question 8, the proposed standard adds requirements not otherwise addressed in existing NERC Standards.

WECC Physical Characteristics

The Federal Energy Regulatory Commission (FERC) Order 740, Docket No. RM09-15-000, P23, noted that “in the Western Interconnection a significant number of transmission paths are voltage or frequency stability-limited, in contrast to other regions of the [BES] where transmission paths more often are thermally-limited. Disturbances resulting in a stability-limited transmission path overload, generally, must be responded to in a shorter time frame than a disturbance that results in a thermally-limited transmission path overload. [FERC has also noted] its understanding that this physical difference is one of the reasons for the need for certain provisions of regional Reliability Standards in the Western Interconnection.”

³ Order No. 672 at P 291. See also NERC Functional Model, Version 5, “2. Reliability Standards,” page 36.

When coupled with generator operations within WECC, these physical characteristics create modal oscillations, that when not corrected by the installation and accurate operation of PSS, could contribute to instability within the Western Interconnection.

11. Proposed reliability standards should cause no undue negative effect on competition or restriction of the grid.

As directed by section 215 of the FPA, the Commission itself will give special attention to the effect of a proposed Reliability Standard on competition. The ERO should attempt to develop a proposed Reliability Standard that has no undue negative effect on competition. Among other possible considerations, a proposed Reliability Standard should not unreasonably restrict available transmission capability on the Bulk-Power System beyond any restriction necessary for reliability and should not limit use of the Bulk-Power System in an unduly preferential manner. It should not create an undue advantage for one competitor over another. Order No. 672 at P 332

The proposed standard is not anticipated to have any negative impact on competition.

12. The implementation time for the proposed reliability standards must be reasonable.

In considering whether a proposed Reliability Standard is just and reasonable, the Commission will consider also the timetable for implementation of the new requirements, including how the proposal balances any urgency in the need to implement it against the reasonableness of the time allowed for those who must comply to develop the necessary procedures, software, facilities, staffing or other relevant capability. Order No. 672 at P 333

Implementation

For more detail please refer to Attachment E of this filing.

With the exception of Requirement R3, VAR-501-WECC-3 has a standardized Effective Date.

Use of this separate Effective Date for Requirement R3 highlights the fact that the reliability-related tasks included in Requirement R3 are a change from existing tuning parameters and could impose an entity-specific

burden that is moderate to severe, depending on the existing practices of each entity. The tiered implementation of Requirement R3 reduces the burden by allowing entities to address the Requirement over a longer period of time.

Units placed into first-time service after regulatory approval will require initial testing, tuning, and set-up. As such, immediate compliance with Requirement R3 for new units should impose no undue burden. Many of the units already in service are currently and adequately tuned to pre-Requirement R3 parameters and need not be immediately revisited. The five-year applicability date for those units already in service lessens the burden while targeting a uniform tuning across the Western Interconnection.

Consideration of Early Compliance

Early compliance should impose no negative impacts. Because many of the Requirements are based on existing WECC guidelines, many Applicable Entities within WECC will already be in voluntary compliance.

13. The reliability standard development process must be open and fair.

Further, in considering whether a proposed Reliability Standard meets the legal standard of review, we will entertain comments about whether the ERO implemented its Commission-approved Reliability Standard development process for the development of the particular proposed Reliability Standard in a proper manner, especially whether the process was open and fair. However, we caution that we will not be sympathetic to arguments by interested parties that choose, for whatever reason, not to participate in the ERO's Reliability Standard development process if it is conducted in good faith in accordance with the procedures approved by the Commission. Order No. 672 at P 334.

WECC followed the standard development process that was approved by FERC and in effect at the time of each step in the process.

In accordance with the WECC Reliability Standards Development Procedures, all drafting team meetings are open to the public.

This drafting team met in excess of 35 times.

Notice of the meetings was provided to NERC, posted on the WECC website and embedded in the minutes of each meeting. Meeting minutes are posted on the WECC website and accessible by the public.

All meetings were supported by a telephone conference bridge associated with an online internet visual capability allowing all participants to see the document(s) as they were being developed. Further, this team held an open-mic standards briefing prior to balloting affording the industry an additional opportunity to have its questions addressed.

The project was posted for comment on eight occasions. On each occasion comments were received, considered, and addressed.

In addition, the project was posted at NERC for a 45-day comment period.

Comments and their responses are currently posted on the WECC website at the WECC-0107 Project Page on the Submit and Review Comments accordion and have been provided with this filing.

14. Proposed reliability standards must balance with other vital public interests.

Finally, we understand that at times development of a proposed Reliability Standard may require that a particular reliability goal must be balanced against other vital public interests, such as environmental, social and other goals. We expect the ERO to explain any such balancing in its application for approval of a proposed Reliability Standard. Order No. 672 at P 335

WECC is not aware of any other vital public interests. No such balancing concerns were raised or noted.

15. Proposed reliability standards must consider any other relevant factors.

In considering whether a proposed Reliability Standard is just and reasonable, we will consider the following general factors, as well as other factors that are appropriate for the particular Reliability Standard proposed. Order No. 672 at P 323

Inter alia, the DT considered and addressed the following issues:

- 1) cost allocation,
- 2) operational impact to smaller entities, and
- 3) inclusion / exclusion of units based on size.

Although not all suggested changes were adopted by the DT, the DT is confident that each voiced concern was heard, considered and addressed.