
**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

North American Electric Reliability)
Corporation)

Docket No. RD14-___-000

**PETITION OF THE NORTH AMERICAN ELECTRIC RELIABILITY
CORPORATION FOR APPROVAL OF PROPOSED RELIABILITY STANDARDS
VAR-001-4 AND VAR-002-3 AND THE RETIREMENT OF RELIABILITY
STANDARDS VAR-001-3 AND VAR-002-2b**

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Pursuant to Section 215(d)(1) of the Federal Power Act (“FPA”)¹ and Section 39.5 of the Commission’s Regulations,² the North American Electric Reliability Corporation (“NERC”)³ hereby submits proposed Reliability Standards VAR-001-4 (Voltage and Reactive Control) and VAR-002-3 (Generator Operation for Maintaining Network Voltage Schedules) for Commission approval.⁴ NERC requests that the Commission approve proposed Reliability Standards VAR-001-4 and VAR-002-3 as just, reasonable, not unduly discriminatory or preferential, and in the public interest.⁵ NERC also requests approval of (i) the associated Implementation Plan, (ii) the associated Violation Risk Factors (“VRFs”) and Violation Severity Levels (“VSLs”), and (iii) the retirement of currently effective Reliability Standards VAR-001-3 and VAR-002-2b, as detailed in this Petition.

¹ 16 U.S.C. § 824o(d)(1) (2012).

² 18 C.F.R. § 39.5 (2013).

³ The Commission certified NERC as the electric reliability organization (“ERO”) in accordance with Section 215 of the FPA on July 20, 2006. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062, *order on reh’g and compliance*, 117 FERC ¶ 61,126 (2006), *aff’d sub nom. Alcoa Inc. v. FERC*, 564 F.3d 1342 (D.C. Cir. 2009) (“ERO Certification Order”).

⁴ The NERC Board of Trustees approved proposed Reliability Standards VAR-001-4 on February 6, 2014 and VAR-002-3 on May 7, 2014.

⁵ Unless otherwise designated, all capitalized terms shall have the meaning set forth in the *Glossary of Terms Used in NERC Reliability Standards* (“NERC Glossary”), available at http://www.nerc.com/files/Glossary_of_Terms.pdf.

As required by Section 39.5(a)⁶ of the Commission's Regulations, this Petition presents the technical basis and purpose of proposed Reliability Standards VAR-001-4 and VAR-002-3, a summary of the development history, and a demonstration that the proposed Reliability Standards meet the criteria identified by the Commission in Order No. 672.⁷ This Petition is organized as follows: First, the Petition presents an executive summary of the proposed Reliability Standards. Next, the Petition provides background on the regulatory structure governing the Reliability Standards approval process, as well as information on the existing Reliability Standards that proposed VAR-001-4 and VAR-002-3 Reliability Standards will replace. The Petition then discusses the proposed Reliability Standards in detail, including how they satisfy the governing statutory criteria and the Commission's directives associated with these Reliability Standards. Finally, we provide the requested effective date for the proposed Reliability Standards.

The following documents are attached as exhibits to this Petition: (a) the proposed Reliability Standards (Exhibit A, with VAR-001-4 as Exhibit A-1 and VAR-002-3 as Exhibit A-2), (b) the proposed Implementation Plan for the proposed Reliability Standards (Exhibit B), (c) a discussion of how the proposed Reliability Standards satisfy the Order No. 672 criteria (Exhibit C), (d) mapping documents showing how the proposed Reliability Standards compare to the corresponding existing Reliability Standards (Exhibit D, with VAR-001-4 compared against VAR-001-3 as Exhibit D-1 and VAR-002-3 compared against VAR-002-2b as Exhibit D-2), (e) an analysis of the VRFs and VSLs for the proposed Reliability Standards (Exhibit E), (f) a

⁶ 18 C.F.R. § 39.5(a) (2013).

⁷ *Rules Concerning Certification of the Electric Reliability Organization; and Procedures for the Establishment, Approval, and Enforcement of Electric Reliability Standards*, Order No. 672, FERC Stats. & Regs. ¶ 31,204, at PP 262, 321–37, *order on reh'g*, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006).

summary of the development history and record of development for the proposed Reliability Standards (Exhibit F), and (g) the standard drafting team roster (Exhibit G).

I. EXECUTIVE SUMMARY

The Voltage and Reactive (“VAR”) group of Reliability Standards, which consists of two continent-wide Reliability Standards, VAR-001-3 and VAR-002-2b,⁸ is designed to maintain voltage stability on the Bulk-Power System, protect transmission, generation, distribution, and customer equipment, and support the reliable operation of the Bulk-Power System. Voltage stability is the ability of a power system to maintain acceptable voltage levels throughout the system under normal operating conditions and following a disturbance. Failure to maintain acceptable voltage levels (*i.e.*, voltage levels become too high or too low) may cause violations of System Operating Limits (“SOLs”) and Interconnection Reliability Operating Limits (“IROLs”), result in damage to Bulk-Power System equipment, and thereby threaten the reliable operation of the Bulk-Power System. The primary factor in maintaining voltage stability is having the appropriate amount of Reactive Power on the system.⁹ Proposed Reliability Standards VAR-001-4 and VAR-002-3 are intended to replace and improve upon Reliability Standards VAR-001-3 and VAR-002-2b, respectively, to ensure that the Bulk-Power System operates at acceptable voltage levels and that sufficient Reactive Power is available to maintain voltage stability.

⁸ The VAR group of Reliability Standards also includes two regional Reliability Standards, VAR-002-WECC-1 and VAR-501-WECC-1. NERC is not proposing any modifications to these regional Reliability Standards. Additionally, VAR-001-3 includes a regional variance developed by the Western Electricity Coordinating Council (“WECC”) applicable to Generator Operators located in the WECC region. NERC has not substantively modified the WECC regional variance and it will be carried forward as part of VAR-001-4. Accordingly, this Petition does not discuss the two regional Reliability Standards or the regional variance.

⁹ Reactive Power is the portion of electricity that establishes and sustains the electric and magnetic fields of Bulk-Power System equipment and supports voltage stability.

In general, proposed Reliability Standard VAR-001-4 sets forth the requirements applicable to Transmission Operators for scheduling, monitoring, and controlling Reactive Power resources in the Real-time Operations, Same-day Operations, and Operational Planning time horizons to regulate voltage and Reactive Power flows for the reliable operation of the Bulk-Power System. Proposed Reliability Standard VAR-002-3 sets forth the requirements applicable to Generator Operators and Generator Owners for providing the necessary reactive support and voltage control necessary to maintain reliable operations. Generators are the largest and most reliable Reactive Power resource and play an integral role in maintaining voltage stability on the Bulk-Power System. Collectively, the proposed Reliability Standards are designed to prevent voltage instability and voltage collapse on the Bulk-Power System.

As described further below, proposed Reliability Standard VAR-001-4 requires each Transmission Operator to:

- Specify a system-wide voltage schedule (which is either a range or a target value with an associated tolerance band) as part of its plan to operate within SOLs and IROLs, and to provide the voltage schedule to its Reliability Coordinator and adjacent Transmission Operators upon request (Requirement R1);
- Schedule sufficient reactive resources to regulate voltage levels (Requirement R2);
- Operate or direct the operation of devices to regulate transmission voltage and reactive flows (Requirement R3);
- Develop a set of criteria to exempt generators from certain requirements under Reliability Standard VAR-002-3 related to voltage or Reactive Power schedules, automatic voltage regulations, and notification (Requirement R4);
- Specify a voltage or Reactive Power schedule (which is either a range or a target value with an associated tolerance band) for generators at either the high or low voltage side of the generator step-up transformer, provide the schedule to the associated Generator Operator, direct the Generator Operator to comply with that schedule in automatic voltage control mode, provide the Generator Operator the notification requirements for deviating from the schedule, and, if requested, provide the Generator Operator the criteria used to develop the schedule (Requirement R5); and

- Communicate step-up transformer tap changes, the time frame for completion, and the justification for these changes to Generator Owners (Requirement R6).

Proposed Reliability Standard VAR-002-3 requires each Generator Operator to:

- Operate each of its generators connected to the interconnected transmission system in automatic voltage control mode or in a different control mode as instructed by the Transmission Operator, unless the Generator Operator (1) is exempted pursuant to the criteria developed under VAR-001-4, Requirement R4, or (2) makes certain notifications to the Transmission Operator specifying the reasons it cannot so operate (Requirement R1);
- Maintain the Transmission Operator's generator voltage or Reactive Power schedule, unless the Generator Operator (1) is exempted pursuant to the criteria developed under VAR-001-4, Requirement R4, or (2) complies with the notification requirements for deviations as established by the Transmission Owner pursuant to VAR-001-4, Requirement R5 (Requirement R2);¹⁰
- Notify the Transmission Operator of a change in status of its voltage controlling device within 30 minutes, unless the status is restored within that time period (Requirement R3); and
- Notify the Transmission Operator of a change in reactive capability due to factors other than those described in VAR-002-3, Requirement R3 within 30 minutes unless the capability has been restored during that time period (Requirement R4).

Proposed Reliability Standard VAR-002-3 also requires each Generator Owner to:

- Provide information on its step-up transformers and auxiliary transformers within 30 days of a request from the Transmission Operator or Transmission Planner (Requirement R5); and
- Comply with the Transmission Operator's step-up transformer tap change directives unless compliance would violate safety, an equipment rating, or applicable laws, rules or regulations (Requirement R6).

¹⁰ VAR-002-3, Requirement R2 also provides that: (1) when a generator's AVR is out of service or the generator does not have AVR, the Generator Operator shall use an alternative method to control the generator's Reactive Power output to meet the schedule; (2) when instructed to modify voltage, the Generator Operator shall comply or provide an explanation of why the schedule cannot be met; and (3) if the Generator Operator does not monitor voltage at the location specified in its voltage schedule, it shall have a methodology for converting the scheduled voltage specified by the Transmission Operator to the voltage point being monitored by the Generator Operator.

The proposed Reliability Standards were developed to address outstanding Commission directives from Order Nos. 693¹¹ and 724¹² and build upon the previous versions of the Reliability Standards to improve their quality and content.¹³ In addition to addressing certain Commission directives, the proposed Reliability Standards streamline language for increased clarity, omit requirements duplicative with or otherwise unnecessary when compared to existing Reliability Standards, and remove requirements that provide little to no reliability benefit. As discussed further below, Reliability Standard VAR-001-4 improves upon the prior version of the standard as follows:

- Requirements that are duplicative of other currently enforceable and pending Reliability Standards are removed.
- Requirement R1 improves reliability by requiring Transmission Operators to (1) define system voltage schedules, which may be a range or a target value with an associated tolerance band, to help ensure the Bulk-Power System operates within operating limits, and (2) coordinate with adjacent Transmission Operators and Reliability Coordinators regarding those system voltage schedules.
- Requirement R2 consolidates Requirements R2 and R9 of VAR-001-3 to clarify the Transmission Operator's responsibility to schedule sufficient reactive resources to regulate voltage levels under normal and Contingency conditions.¹⁴
- Requirement R3 consolidates Requirements R7 and R8 of VAR-001-3 to clarify the Transmission Operator's responsibility to provide the necessary voltage support (*i.e.*, "operate or direct the Real-time operation of devices"¹⁵) to help maintain voltage stability.
- Requirement R4 continues to provide Transmission Operators the flexibility to exempt generators from certain compliance obligations, but clarifies the obligations from which

¹¹ *Mandatory Reliability Standards for the Bulk Power System*, Order No. 693, FERC Stats. & Regs. ¶ 31,242 (2007), *order on reh'g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007).

¹² *Electric Reliability Organization Interpretations of Specific Requirements of Frequency Response and Bias and Voltage and Reactive Control Reliability Standards*, Order No. 724, 127 FERC ¶ 61,158 (2009).

¹³ Exhibits D-1 and D-2 to this Petition provide mapping documents comparing the existing VAR-001-3 and VAR-002-2b Reliability Standards to the proposed VAR-001-4 and VAR-002-3 Reliability Standards.

¹⁴ A Contingency is defined in the NERC Glossary as "the unexpected failure or outage of a system component, such as a generator, transmission line, circuit breaker, switch or other electrical element."

¹⁵ VAR-001-4, Requirement R3.

generators may be exempt. Requirement R4 also eliminates the need for Transmission Operators to maintain a list of all generators that have been granted an exemption as such a requirement provides little to no reliability benefit.

- Requirement R5 creates a more transparent information-sharing process between Transmission Operators and Generator Operators about voltage or Reactive Power schedules and notification requirements for deviating from such schedules.
- Requirement R5 also addresses the Commission's Order No. 693 directive to consider a time frame associated with an "incident" of non-compliance with VAR-002,¹⁶ as well as the Order No. 724 directive to develop and implement technically sound voltage schedules.

Further, in proposed Reliability Standard VAR-002-3:

- Requirements R1 and R2 carry forward the obligations that Generator Operators operate in automatic voltage control mode and follow the voltage or Reactive Power schedule provided by the Transmission Operator but provide Generator Operators increased flexibility to deviate from voltage or Reactive Power schedules and operational modes where system-specific circumstances or events may require these deviations to protect reliability and prevent equipment damage.
- Requirements R3 and R4 remove unnecessary and overly burdensome communication requirements that provide little to no reliability benefit. Eliminating these notification requirements will enable Transmission Operators to focus resources on improving system monitoring and responding to voltage issues as they may arise in Real-time.
- Requirements R5 and R6 improve clarity by removing extraneous language (Requirement R5) and adopting consistent language throughout the requirement (Requirement R6), which will help responsible entities understand and more effectively apply these requirements.

For the reasons discussed herein, NERC respectfully requests that the Commission approve proposed Reliability Standards VAR-001-4 and VAR-002-3 as just, reasonable, not unduly discriminatory or preferential, and in the public interest.

¹⁶ As further discussed in Section IV.C, this Commission directive was issued in reference to Reliability Standard VAR-002. However, the standard drafting team determined that this directive is more appropriately addressed in VAR-001-4, Requirement R5.

II. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing should be addressed to the following:¹⁷

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III. BACKGROUND

A. Regulatory Framework

In FPA section 215,¹⁸ Congress entrusted the Commission with the duties of approving and enforcing rules to ensure the reliability of the nation's Bulk-Power System, and certifying an ERO that would be charged with developing and enforcing mandatory Reliability Standards, subject to Commission approval.¹⁹ All users, owners, and operators of the Bulk-Power System in the United States are subject to Commission-approved Reliability Standards.²⁰ The ERO must obtain Commission approval of each Reliability Standard that the ERO proposes should become mandatory and enforceable in the United States, as well as modifications to the Reliability

¹⁷ Persons to be included on the Commission's service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission's Regulations, 18 C.F.R. § 385.203, to allow the inclusion of more than two persons on the service list in this proceeding.

¹⁸ 16 U.S.C. § 824o.

¹⁹ The Commission certified NERC as the ERO. *See* Order No. 672, *order on reh'g*, Order No. 672-A; ERO Certification Order, *supra* note 3.

²⁰ 16 U.S.C. § 824o(b)(1).

Standards,²¹ and the Commission may order the ERO to submit new or modified Reliability Standards.²²

The Commission has the regulatory responsibility to approve Reliability Standards that protect the reliability of the Bulk-Power System and to ensure that they are just, reasonable, not unduly discriminatory or preferential, and in the public interest. The Commission gives due weight to the technical expertise of the ERO with respect to the content of a Reliability Standard.²³

B. NERC Reliability Standards Development Procedure

NERC develops Reliability Standards in accordance with Section 300 of the NERC Rules of Procedure and the NERC Standard Processes Manual.²⁴ The Commission has found that the NERC Rules of Procedure provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards, and thus satisfy certain of the criteria for approving Reliability Standards.²⁵ The development process is open to any person or entity with a legitimate interest in the reliability of the Bulk-Power System. NERC considers all stakeholder comments and requires a vote by stakeholders as well as the NERC Board of Trustees to approve a Reliability Standard before NERC will submit the

²¹ 18 C.F.R. § 39.5(a).

²² 16 U.S.C. § 824o(d)(5).

²³ 16 U.S.C. § 824o(d)(2); 18 C.F.R. § 39.5(c)(1).

²⁴ Rules of Procedure of the North American Electric Reliability Corporation, § 300 (“NERC Rules of Procedure”), available at <http://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx>; Standard Processes Manual, v.3 (June 26, 2013), available at http://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf.

²⁵ ERO Certification Order at P 250.

Reliability Standard for Commission approval. NERC developed proposed Reliability Standards VAR-001-4 and VAR-002-3 in an open and fair manner and in accordance with this process.²⁶

C. The Existing VAR Reliability Standards

1. Reliability Standard VAR-001-3

Currently enforceable Reliability Standard VAR-001-3 requires Transmission Operators to monitor, control and maintain voltage levels, reactive flows and reactive resources within certain limits in Real-time to protect equipment and the reliable operation of the Interconnection.²⁷ Under the existing requirements,²⁸ each Transmission Operator is required to:

- Individually and jointly with other Transmission Operators ensure that formal policies and procedures are developed, maintained and implemented for monitoring and controlling voltage levels and MVar flows within their individual areas and the areas of neighboring Transmission Operators (Requirement R1);
- Acquire sufficient reactive resources within its areas to protect voltage levels under normal and Contingency conditions (Requirement R2);
- Specify criteria to exempt generators from compliance with the voltage or Reactive Power schedule developed by the Transmission Operator in accordance with VAR-001-3, maintain a list of exempted generators, and notify Generator Owners of any exempted generators (Requirement R3);
- Specify a voltage or Reactive Power schedule at the interconnection between the generator facilities and Transmission Owner's facilities, provide the schedule to the associated Generator Operator, and direct it to comply with the schedule in automatic voltage control mode (Requirement R4);

²⁶ Order No. 672 at P 334.

²⁷ As noted above, VAR-001-3 also includes a regional variance applicable to Generator Operators in the Western Interconnection. Because NERC is not proposing any substantive changes to that regional variance, it is not discussed herein.

²⁸ The Commission approved retirement of Requirement R5 effective January 21, 2014. *See Electric Reliability Organization Proposal to Retire Requirements in Reliability Standards*, Order No. 788, 145 FERC ¶ 61,147, at P 17 (2013).

- Know the status of all transmission Reactive Power resources and, when notified of the loss of an automatic voltage regulator (“AVR”) control, direct the Generator Operator to maintain or change its voltage or Reactive Power schedule (Requirement R6);
- Operate or direct operations of devices to regulate transmission voltage and reactive flow (Requirement R7);
- Operate or direct operations of capacitive and inductive reactive resources within its area to maintain system and Interconnection voltages within established limits (Requirement R8);
- Maintain reactive resources to support its voltage under first Contingency conditions and disperse and locate these resources to allow for effective and quick application when Contingencies occur (Requirement R9);
- Correct and report SOL and IROL violations resulting from reactive resource deficiencies (Requirement R10);
- Consult with and provide documentation to Generator Owners about required tap changes, timeframes for completion, and technical justification for these changes (Requirement R11); and
- Direct corrective action necessary to prevent voltage collapse when reactive resources are insufficient.

Currently enforceable Reliability Standard VAR-001-3, however, does not address the following outstanding Commission directives from Order Nos. 693 and 724:

- Include Reliability Coordinators as responsible entities;²⁹
- Address the power factor range at the interface between Load Serving Entities (“LSEs”) and the Bulk-Power System;³⁰
- Consider acceptable ranges of net power factors where LSEs receive service from the Bulk-Power System;³¹
- Specify and define requirements on “established limits” and “sufficient reactive resources” and identify voltage and Reactive Power margins to prevent voltage instability;³²

²⁹ Order No. 693 at P 1855.

³⁰ *Id.* at P 1861.

³¹ *Id.* at PP 1860, 1862.

³² *Id.* at P 1868.

- Require the performance of periodic voltage stability analysis using online and offline techniques to assist Real-time operations;³³ and
- Ensure voltage schedules reflect sound engineering and operating judgment and experience.³⁴

As discussed below, proposed Reliability Standard VAR-001-4 or other existing or pending Reliability Standards address these outstanding Commission directives.

2. Reliability Standard VAR-002-2b

Currently enforceable Reliability Standard VAR-002-2b requires that generators provide reactive and voltage control necessary to maintain voltage levels, reactive flows and reactive resources within applicable facility ratings to protect equipment and the reliable operation of the Interconnection. Under the existing requirements, each Generator Operator is required to:

- Operate in automatic voltage control mode unless it is exempted or the Generator Operator notifies its Transmission Operator that it is (1) operating the generator in start-up or shutdown mode pursuant to a Real-time communication or a procedure previously provided to the Transmission Operator, or (2) not operating the generator in automatic voltage control mode for a reason other than start-up or shutdown (Requirement R1);
- Maintain the voltage or Reactive Power schedule, unless otherwise exempted by the Transmission Operator, use an alternative method for controlling the generator voltage and Reactive Power output when a generator's AVR is out of service, and, when directed to modify voltage, provide an explanation to the Transmission Operator if it cannot meet the schedule (Requirement R2); and
- Notify its Transmission Operator as soon as practical, but within 30 minutes, of a status or capability change on any Reactive Power resource (generator or other), including the status of each AVR and power system stabilizer, and the expected duration of the identified change (Requirement R3).

Reliability Standard VAR-002-2b also requires each Generator Owner to:

- Provide tap-related information on step-up transformers and auxiliary transformers with primary voltages equal to or greater than the generator terminal voltage within 30

³³ *Id.* at P 1875.

³⁴ Order No. 724 at P 49.

calendar days of a request from the Transmission Operator and Transmission Planner (Requirement R4); and

- Ensure that transformer tap positions are changed according to the Transmission Operator's specifications, unless this action would violate safety, an equipment rating, or a regulatory or statutory requirement, in which case the Generator Owner must notify the Transmission Operator and justify why the Generator Owner is unable to comply (Requirement R5).

Currently enforceable Reliability Standard VAR-002-2b does not address the Commission's directive to consider an additional time frame associated with an "incident" of non-compliance with VAR-002.³⁵ As discussed below, this directive is addressed in proposed Reliability Standard VAR-001-4.

D. Procedural History of Project 2013-04 – Voltage and Reactive Control (VAR)

In February 2013, NERC initiated an informal development process to revive efforts to modify the existing VAR Reliability Standards to address the outstanding Commission directives from Order Nos. 693 and 724 related to those standards.³⁶ Participants in this informal process were industry subject matter experts, NERC staff, and FERC staff from the Office of Electric Reliability. The informal development group met numerous times between February 2013 and July 2013 to discuss the outstanding Commission directives and ways to improve the existing VAR Reliability Standards. The informal group also conducted industry outreach to obtain feedback on the existing standards.

After evaluating the VAR Reliability Standards and the Commission's directives, the informal group concluded that certain of the existing requirements and outstanding directives overlapped with or were duplicative of requirements in other Reliability Standards to maintain and operate within SOLs and IROLs or were otherwise unnecessary from a reliability

³⁵ Order No. 693 at PP 1883, 1885.

³⁶ In 2008, NERC initiated Project 2008-01 to address the directives from Order No. 693 related to the VAR Reliability Standards. That project was not completed due to project reprioritization.

perspective. To that end, the informal participants developed revised drafts of the VAR Reliability Standards to address Commission directives, eliminate duplicative or unnecessary requirements, and improve the quality and content of those existing requirements that are necessary to help maintain voltage stability on the Bulk-Power System.

As discussed further in Exhibit F, Project 2013-04 formally commenced on July 19, 2013 with the posting of a Standard Authorization Request (“SAR”) along with the initial drafts of the proposed Reliability Standards developed by the informal participants for a 45-day comment period and ballot. A formal standard drafting team was formed following the posting of the SAR and the initial drafts of the proposed Reliability Standards.³⁷

Following the close of the initial ballot, the standard drafting team addressed industry comments and posted second drafts of the proposed Reliability Standards on October 11, 2013 for an additional 45-day comment period and ballot. Proposed Reliability Standard VAR-001-4 received the requisite approval during the second ballot and was subsequently posted for a final ballot. The final ballot concluded on December 23, 2013 and received an approval rating of 75.35%. The NERC Board of Trustees approved proposed Reliability Standard VAR-001-4 on February 6, 2014.

The standard drafting team addressed additional industry comments on the second draft of proposed Reliability Standard VAR-002-3 and, on February 27, 2014, posted a third draft of the standard for a 45-day comment period and ballot. Proposed Reliability Standard VAR-002-3 received the requisite approval in the third ballot and was subsequently posted for a final ballot. The final ballot concluded on May 5, 2014 and received an approval rating of 88.26%. The NERC Board of Trustees approved proposed Reliability Standard VAR-002-3 on May 7, 2014.

³⁷ Exhibit G provides the standard drafting team roster.

IV. JUSTIFICATION FOR APPROVAL

As discussed below and in Exhibit C, proposed Reliability Standards VAR-001-4 and VAR-002-3 satisfy the Commission's criteria in Order No. 672 and are just, reasonable, not unduly discriminatory or preferential, and in the public interest. The following sections provide: (1) the basis and purpose of the proposed Reliability Standards; (2) a discussion of the requirements in the proposed Reliability Standards; (3) an explanation of how the proposed Reliability Standards satisfy outstanding Commission directives from Order Nos. 693 and 724; and (4) a discussion of the enforceability of the proposed Reliability Standards.

A. Basis and Purpose of the Proposed Reliability Standards

Proposed Reliability Standards VAR-001-4 and VAR-002-3 replace and improve upon the prior versions of the standards (VAR-001-3 and VAR-002-2b) by addressing outstanding Commission directives from Order Nos. 693 and 724, improving reliability, clarifying language in certain requirements, and eliminating redundant or unnecessary requirements. As is further discussed in Section IV.C below, the outstanding Commission directives are addressed by proposed Reliability Standards VAR-001-4 and VAR-002-3, or already have been addressed in other currently enforceable or pending Reliability Standards. So as to avoid unnecessary redundancies or duplicative requirements, NERC does not propose to address in VAR-001-4 and VAR-002-3 those directives already addressed by other existing or pending Reliability Standards.

The standard drafting team sought to modify the currently enforceable Reliability Standards VAR-001-3 and VAR-002-2b to improve the clarity, quality, and content of the standards. These efforts include, but are not limited to, the following:

- VAR-001-4, Requirement R1 removes voltage level controls and monitoring obligations duplicative with other currently enforceable Reliability Standards and improves reliability by requiring Transmission Operators to (1) specify system voltage schedules,

which may be either a range or a target value with associated tolerance bands, and (2) coordinate with adjacent Transmission Operators and Reliability Coordinators regarding those system voltage schedules.

- VAR-001-4, Requirements R2 and R3 simplify and consolidate several existing requirements while ensuring sufficient reactive resources are scheduled (Requirement R2) and voltage support is provided (Requirement R3).
- VAR-001-4, Requirement R4 removes unnecessary compliance complexities and offers Transmission Operators the flexibility to tailor exemption criteria to area-specific needs.
- VAR-001-4, Requirement R5 improves transparency of Transmission Operator voltage or Reactive Power schedules for generators and provides the Transmission Operator the flexibility to develop notification requirements for deviations from those schedules based on the unique characteristics and needs of its system.
- VAR-001-4, Requirement R6 maintains and improves upon the existing tap setting requirements to avoid an adverse reliability impact caused by an improper tap setting that in turn may affect the Reactive Power output of a generator.
- VAR-002-3, Requirement R1 improves upon the prior version of the Reliability Standard by providing an option for certain Generator Operators to operate in modes other than automatic voltage control mode, as may be instructed by the Transmission Operator. Further, in addition to start-up or shutdown, Requirement R1 adds testing as a time when a generator need not operate in automatic voltage control mode or a different mode instructed by the Transmission Operator.
- VAR-002-3, Requirement R2 carries forward the requirement that Generator Operators maintain the generator voltage or Reactive Power schedule provided by the Transmission Operator pursuant to VAR-001-4, Requirement R5 but allows the Generator Operator to deviate from that schedule if it is exempted or satisfies the notification requirements established by the Transmission Operator under VAR-001-4, Requirement R5, Part 5.2. VAR-002-3, Requirement R2 also clarifies that Generator Operators that do not monitor voltage at the location specified in their voltage schedule provided by the Transmission Operator may convert the schedule to the voltage point monitored by the Generator Operator using a documented conversion methodology.
- VAR-002-3, Requirements R3 and R4 limit status change notification requirements to those changes lasting longer than 30 minutes because notification of changes resolved within a 30-minute window provides minimal, if any, reliability benefit.
- VAR-002-3, Requirements R5 and R6 include clarifying edits to remove an unnecessary sub-part (Requirement R5) and uniformly reference the applicable entity (Requirement R6).

B. Requirements in the Proposed Reliability Standards

1. Reliability Standard VAR-001-4

Proposed Reliability Standard VAR-001-4 consists of six requirements and is applicable to Transmission Operators and, for the WECC regional variance maintained and carried forward from Reliability Standard VAR-001-3, Generator Operators within the Western Interconnection. An explanation of the six requirements and the omission of certain VAR-001-3 requirements are provided below.³⁸

VAR-001-4, Requirement R1

R1. Each Transmission Operator shall specify a system voltage schedule (which is either a range or a target value with an associated tolerance band) as part of its plan to operate within System Operating Limits and Interconnection Reliability Operating Limits.

1.1. Each Transmission Operator shall provide a copy of the voltage schedules (which is either a range or a target value with an associated tolerance band) to its Reliability Coordinator and adjacent Transmission Operators within 30 calendar days of a request.

Requirement R1 is intended to replace and simplify the currently-effective VAR-001-3, Requirement R1, which requires Transmission Operators, individually and jointly, to develop formal policies and procedures for controlling and monitoring voltage levels and MVar flows. In evaluating VAR-001-3, Requirement R1, the standard drafting team concluded that because controlling and monitoring voltage levels and MVar flows is already required by the Transmission Operations (“TOP”) group of Reliability Standards, it should not be duplicated in proposed Reliability Standard VAR-001-4. Specifically, currently effective Reliability Standard TOP-004-2, Requirement R6 also requires “Transmission Operators, individually and jointly

³⁸ The WECC regional variance is not reproduced herein as it has not been substantively modified from the currently enforceable VAR-001-3 regional variance. Only non-material changes have been made to reference the replacement of VAR-001-4, Requirements R4 and R5, rather than VAR-001-3, Requirements R3 and R5.

with other Transmission Operators, [to] develop, maintain, and implement formal policies and procedures to provide for transmission reliability.” That requirement specifies that the “policies and procedures shall address the execution and coordination of activities that impact inter- and intra-Regional reliability, including,” among other things, “monitoring and controlling voltage levels and real and reactive power flows.”

Additionally, currently effective TOP Reliability Standards require that Transmission Operators plan to meet SOLs and IROLs (TOP-002-2.1b, Requirement R10) and operate within SOLs and IROLs (TOP-004-2, Requirement R1).³⁹ As stated in the NERC Glossary, a SOL is defined as:

the value (such as MW, MVar, Amperes, Frequency or Volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. [SOLs] are based upon certain operating criteria. These include, but are not limited to: [1] Facility Ratings (Applicable pre- and post-Contingency equipment or facility ratings); [2] Transient Stability Ratings (Applicable pre- and post-Contingency Stability Limits); [3] Voltage Stability Ratings (Applicable pre- and post-Contingency Voltage Stability); and [4] System Voltage Limits (Applicable pre- and post-Contingency Voltage Limits).⁴⁰

Accordingly, to meet the obligations under Reliability Standards TOP-002-2.1b, Requirement R10 and TOP-004-2, Requirement R1 to plan to meet and operate within SOLs and IROLs, a Transmission Operator is required to monitor and control voltage levels and MVar flows. Failure to do so could lead to a violation of these requirements.

Similarly, monitoring and controlling voltage and MVar flows is fundamental to complying with TOP-004-2, Requirements R2 and R3, which require a Transmission Operator to

³⁹ Reliability Standard FAC-014-2, Requirement R2 requires a Transmission Operator to establish SOLs (as directed by its Reliability Coordinator) for its portion of the Reliability Coordinator Area that are consistent with its Reliability Coordinator’s SOL Methodology.

⁴⁰ An IROL is defined in the NERC Glossary as “[a] SOL that, if violated, could lead to instability, uncontrolled separation, or Cascading outages that adversely impact the reliability of the Bulk Electric System” (footnote omitted).

operate to protect against instability, uncontrolled separation, or cascading outages from (1) the most severe single contingency (Requirement R2), and (2) multiple outages, as specified by its Reliability Coordinator (Requirement R3). Failure to monitor and control voltage and MVar flows could result in a violation of these requirements.

Certain of the TOP Reliability Standards are currently being modified as part of a standards development project at NERC. While certain language and obligations from the existing TOP Reliability Standards may change, the obligation to monitor and control voltage levels and reactive flows will remain. Specifically, as proposed, draft Reliability Standards TOP-001-3 and TOP-002-4 would collectively require Transmission Operators to plan to meet and operate within SOLs and IROLs.⁴¹ In addition, those draft Reliability Standards would require each Transmission Operator to (1) monitor facilities within its area and neighboring areas to maintain reliability in its area, and (2) perform a Real-time Assessment at least once every 30 minutes. To comply with these obligations, Transmission Operators must monitor and control voltage, as discussed above.

Because controlling and monitoring voltage and MVar flows is covered elsewhere, the standard drafting team modified VAR-001-4, Requirement R1 to only require that Transmission Operators (1) specify a system voltage schedule as part of its plan to operate with SOLs and IROLs, and (2) provide such schedules to adjacent Transmission Operators and applicable Reliability Coordinators, upon request. The requirement to specify a system voltage schedule as a range or a target value with an associated tolerance band will help ensure that the system maintains an appropriate voltage level in Real-time. The reactive behavior of any particular system depends on a myriad of local conditions which change over time. The intent of

⁴¹ As of the date of this Petition, proposed Reliability Standards TOP-001-3 and TOP-002-4 have been posted for an initial comment period and ballot, which is scheduled to close on July 2, 2014.

Requirement R1 is not to mandate that Transmission Operators set and maintain a static voltage level; rather it is to require Transmission Operators to identify the acceptable voltage limits (either by identifying a range or a target value with an associated tolerance band) that supports reliable operations in Real-time.

The requirement to share the voltage schedule with neighboring Transmission Operators and Reliability Coordinators will allow for increased and improved coordination between neighboring areas. Given the interconnected nature of the Bulk-Electric System, voltage coordination is necessary to help ensure that sufficient Reactive Power is available to support both Real-time and day-ahead operations.

VAR-001-4, Requirement R2

R2. Each Transmission Operator shall schedule sufficient reactive resources to regulate voltage levels under normal and Contingency conditions. Transmission Operators can provide sufficient reactive resources through various means including, but not limited to, reactive generation scheduling, transmission line and reactive resource switching, and using controllable load.

Requirement R2 modifies and consolidates the obligations in currently-effective VAR-001-3, Requirements R2 and R9 to require the scheduling of sufficient reactive resources. As noted above, the primary factor in maintaining voltage stability is having the appropriate amount of Reactive Power on the system. Proposed Requirement R2 helps ensure that sufficient reactive resources are online and scheduled in Real-time.

VAR-001-3, Requirements R2 and R9 require each Transmission Operator to (1) “acquire sufficient reactive resources . . . within its area to protect the voltage levels under normal and Contingency conditions” and (2) “maintain reactive resources . . . to support its voltage under first Contingency conditions,” respectively. The standard drafting team concluded that these requirements should be combined into a single requirement that more directly states

the desired performance for ensuring that sufficient Reactive Power is on the system in Real-time to maintain voltage stability (*i.e.*, to “schedule sufficient reactive resources to regulate voltage levels under normal and Contingency conditions”).⁴²

Requirement R2 also clarifies the language with respect to the manner in which Transmission Operators may schedule sufficient reactive resources (*e.g.*, through reactive generation scheduling, transmission line and reactive resource switching, and using controllable load). Consistent with the Commission’s directive in Order No. 693,⁴³ Requirement R2 includes the use of controllable load in the non-exhaustive list of ways to provide sufficient reactive resources. As the Commission stated, “in many cases, load response and demand-side investment can reduce the need for reactive power capability in the system.”⁴⁴

VAR-001-4, Requirement R3

R3. Each Transmission Operator shall operate or direct the Real-time operation of devices to regulate transmission voltage and reactive flow as necessary.

Whereas Requirement R2 obligates the Transmission Operator to ensure that there are sufficient reactive resources online and scheduled, Requirement R3 requires that a Transmission Operator actually provide sufficient voltage support in Real-time by operating its own devices or directing others to do so.

Requirement R3 carries forward the obligation from VAR-001-3, Requirement R7. However, by deleting the phrase “be able to” Requirement R3 creates an affirmative obligation to operate or direct the operation of devices to regulate transmission voltage and reactive flow

⁴² VAR-001-4, Requirement R2.

⁴³ Order No. 693 at P 1879.

⁴⁴ *Id.*

when necessary.⁴⁵ Additionally, the standard drafting team concluded that there was no need to separately carry forward VAR-001-3, Requirement R8 because it was subsumed in proposed VAR-001-4, Requirement R3.

VAR-001-4, Requirement R4

R4. The Transmission Operator shall specify the criteria that will exempt generators from: 1) following a voltage or Reactive Power schedule, 2) from having its automatic voltage regulator (AVR) in service or from being in voltage control mode, or 3) from having to make any associated notifications.

4.1 If a Transmission Operator determines that a generator has satisfied the exemption criteria, it shall notify the associated Generator Operator.

As discussed below, proposed Reliability Standard VAR-002-3 imposes requirements on the Generator Operator for providing reactive support, including: (1) following the voltage or Reactive Power schedule provided by the Transmission Operator; (2) operating its generator(s) in automatic voltage control mode; and (3) notifying the Transmission Operator of any deviations from the schedule or changes to the status of its voltage control mode. In certain circumstances, however, it may not be necessary or desired for a Generator Operator to comply with such requirements. For instance, a Generator Operator may need to be exempt from performance for the following system events, among others: (1) maintenance during shoulder months; (2) scenarios where two generators are located within close proximity and cannot both operate in voltage control mode; and (3) system voltage swings where it would harm reliability if all Generator Operators provided deviation notifications to their respective Transmission Operators at one time.

⁴⁵ VAR-001-3, Requirement R7 states as follows: “The Transmission Operator shall *be able to* operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow” (emphasis added).

Requirement R4 carries forward the authority in currently enforceable Reliability Standard VAR-001-3, Requirement R3 for a Transmission Operator to exempt a Generator Operator from having to comply with all or some of its Reactive Power obligations. Proposed Requirement R4 clarifies that a Transmission Operator may exempt a Generator Operator from the following requirements: (1) complying with a voltage or Reactive Power schedule; (2) operating in automatic voltage control mode; and (3) certain notification requirements. Requirement R4 also allows each Transmission Operator to tailor its criteria for exemptions to its area's specific needs.

Further, Requirement R4 simplifies Reliability Standard VAR-001-3, Requirement R3 by removing the need for Transmission Operators to maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule. Removal of this list requirement alleviates unnecessary compliance burdens and complexities related to how often to update and maintain these lists. Instead, proposed Requirement R4 focuses on whether the exemption criteria are transparent and whether the Transmission Owner notified the Generator Operator that it is exempt.

VAR-001-4, Requirement R5

R5. Each Transmission Operator shall specify a voltage or Reactive Power schedule (which is either a range or a target value with an associated tolerance band) at either the high voltage side or low voltage side of the generator step-up transformer at the Transmission Operator's discretion.

5.1. The Transmission Operator shall provide the voltage or Reactive Power schedule (which is either a range or a target value with an associated tolerance band) to the associated Generator Operator and direct the Generator Operator to comply with the schedule in automatic voltage control mode (the AVR is in service and controlling voltage).

5.2. The Transmission Operator shall provide the Generator Operator with the notification requirements for deviations from the voltage

or Reactive Power schedule (which is either a range or a target value with an associated tolerance band).

- 5.3.** The Transmission Operator shall provide the criteria used to develop voltage schedules [or] Reactive Power schedule (which is either a range or a target value with an associated tolerance band) to the Generator Operator within 30 days of receiving a request.

Requirement R5 carries forward the obligation from currently-effective Reliability Standard VAR-001-3, Requirement R4 that Transmission Operators must provide a voltage or Reactive Power schedule for each generator and direct the associated Generator Operator to comply with that schedule in automatic voltage control mode unless otherwise instructed or exempted. Proposed Requirement R5 modifies that requirement to clarify that a Transmission Operator may provide the voltage or Reactive Power schedule at either the high or low voltage side of the generator step-up transformer.⁴⁶ Specifying the location of the voltage or Reactive Power schedule provides a mechanism for the Generator Operator to convert the scheduled voltage to the voltage point it monitors. As discussed below, VAR-002-3, Requirement R2, Part 2.2 clarifies that if the Generator Operator does not monitor voltage at the location specified in the schedule provided by the Transmission Operator, the Generator Operator may use a conversion methodology for converting the scheduled voltage to the voltage point monitored by the Generator Operator.

As with the system level voltage schedule, the voltage or Reactive Power schedule provided to Generator Operators must be a range or a target value with an associated tolerance band. Specifying the voltage schedule as a range or as a target value with an associated tolerance

⁴⁶ VAR-003-1, Requirement R4 simply states that the Transmission Operator must “specify a voltage or Reactive Power schedule at the interconnection between the generator facility and the Transmission Operator’s facilities” (footnote omitted).

band provides information that Generator Operators can use to set their control devices to appropriate settings to maintain operation within the specified tolerances.

Further, Part 5.2 requires Transmission Operators to provide Generator Operators the notification requirements for deviations from the voltage or Reactive Power schedule. Part 5.2 ensures that Generator Operators are aware of the notification requirements for deviating from the required schedule while also providing Transmission Operators the flexibility to develop notification requirements that best suit their needs.

Lastly, Requirement R5 provides for increased transparency of the Transmission Operator's development of voltage and Reactive Power schedules. Part 5.3 requires Transmission Operators to provide Generator Operators the criteria for developing the voltage or Reactive Power schedule, if requested. Part 5.3 will help ensure that the Transmission Operator has a technical basis for setting the required voltage and Reactive Power schedule that takes into account system needs and any limitations of the specific generator. Providing such criteria may alleviate some operational disputes between Transmission Operators and Generator Operators regarding the technical justifications for the voltage and Reactive Power schedules.

VAR-001-4, Requirement R6

R6. After consultation with the Generator Owner regarding necessary step-up transformer tap changes and the implementation schedule, the Transmission Operator shall provide documentation to the Generator Owner specifying the required tap changes, a timeframe for making the changes, and technical justification for these changes.

Requirement R6 updates currently-effective VAR-001-3, Requirement R11 to allow for scheduling consultation. Because an improper tap setting may affect the amount of VARs produced by a generator, the standard drafting team concluded that this requirement needed to be included in proposed Reliability Standard VAR-001-4.

Omitted VAR-001-3 Requirements

Several currently enforceable requirements from Reliability Standard VAR-001-3 have been omitted from proposed Reliability Standard VAR-001-4 because they have been retired (Requirement R5)⁴⁷ or are duplicative with other currently enforceable and pending Reliability Standards (existing Requirements R6, R10 and R12). On this last category of omitted requirements:

- VAR-001-3, Requirement R6 is duplicative of currently enforceable TOP-006-2, Requirement R1, which requires that Transmission Operators know the status of all generating and transmission resources, including Reactive Power resources, available for use. In addition, TOP-006-2, Requirement R2 requires, among other things, each Reliability Coordinator, Transmission Operator, and Balancing Authority to monitor applicable real and reactive power flows, voltage, and the status of rotating and static reactive resources, which requires monitoring of power system stabilizers (“PSS”) in areas that rely on PSS equipment. The TOP Reliability Standards currently in development would require each Transmission Owner to monitor Facilities, sub-100 kV facilities, and the status of Special Protection Systems within its area and neighboring areas, as needed to maintain reliability within its Transmission Operator Area.⁴⁸ This monitoring activity requires Transmission Operators to know the status of Reactive Power resources.
- VAR-001-3, Requirement R10 is duplicative of currently enforceable TOP-004-2, Requirement R1, which provides that Transmission Operators shall operate within SOLs and IROLs. This would include taking action to correct SOL and IROL violations resulting from reactive resource deficiencies. Additionally, TOP-004-2, Requirement R4 requires Transmission Operators that enter an unknown operating state (*i.e.*, any state for which valid operating limits have not been determined) to restore operations to respect proven reliable power system limits within 30 minutes. The TOP Reliability Standard currently in development will continue to require Transmission Operators to operate within SOLs and IROLs and take action to correct and report such violations.⁴⁹

⁴⁷ The Commission approved the retirement of Requirement R5 of VAR-001-2. *See* Order No. 788 at P 17 (accepting retirement of VAR-001-2, Requirement R5, effective January 21, 2014, because it is redundant with the *pro forma* Open Access Transmission Tariff and any resulting reliability gap is addressed by currently enforceable VAR-001-3, Requirement R2). (Currently effective VAR-001-3, Requirement R5 also notes that Requirement R5 will be retired effective January 21, 2014.) Proposed VAR-001-4, Requirement R2 will also achieve the reliability objective envisioned by retired Requirement R5.

⁴⁸ *See* draft Reliability Standard TOP-001-3, Requirement R10, *available at* <http://www.nerc.com/pa/Stand/Pages/Project-2014-03-Revisions-to-TOP-and-IRO-Standards.aspx>.

⁴⁹ *See* draft Reliability Standard TOP-001-3, Requirements R12–R15.

- VAR-001-3, Requirement R12 is also duplicative with requirements in TOP-004-2 to take corrective action, including load-shedding, to operate within SOLs and IROLs and prevent voltage collapse. The TOP Reliability Standard currently in development will continue to require Transmission Operators to take action to prevent voltage collapse.⁵⁰ Additionally, Reliability Standard EOP-003-2 covers plans for load shedding to prevent voltage collapse.

2. Reliability Standard VAR-002-3

Proposed Reliability Standard VAR-002-3 consists of six requirements and is applicable to Generator Operators and Generator Owners. An explanation of each of the six requirements is provided below.

VAR-002-3, Requirement R1

R1. The Generator Operator shall operate each generator connected to the interconnected transmission system in the automatic voltage control mode (with its automatic voltage regulator (AVR) in service and controlling voltage) or in a different control mode as instructed by the Transmission Operator unless: 1) the generator is exempted by the Transmission Operator, or 2) the Generator Operator has notified the Transmission Operator of one of the following:

- That the generator is being operated in start-up,^[FN1] shutdown,^[FN2] or testing mode pursuant to a Real-time communication or a procedure that was previously provided to the Transmission Operator; or
- That the generator is not being operated in automatic voltage control mode or in the control mode that was instructed by the Transmission Operator for a reason other than start-up, shutdown, or testing.

[FN1: Start-up is deemed to have ended when the generator is ramped up to its minimum continuously sustainable load and the generator is prepared for continuous operation.]

[FN2: Shutdown is deemed to begin when the generator is ramped down to its minimum continuously sustainable load and the generator is prepared to go offline.]

Requirement R1 carries forward the obligation in currently effective VAR-002-2b, Requirement R1 for Generator Operators to operate generators in automatic voltage control

⁵⁰ See *id.*

mode, but modifies the requirement to allow a Generator Operator to operate in a different control mode if instructed by the Transmission Operator. From a reliability perspective, it is beneficial for generators to operate in automatic voltage control mode. Once set in “voltage controlling” mode, the AVR should automatically adjust to voltage swings within its pre-defined voltage band. A different control mode, however, may be appropriate in certain circumstance. For instance, where two large generators are located within close proximity, if both generators operate in voltage control mode it may result in undesirable effects, such as voltage swings due to the units competing to control voltage. In such instances, to improve voltage regulation and stability, it may be beneficial to allow one of the units to be in automatic voltage control mode while directing the other unit to operate in an alternative mode. Proposed Reliability Standard VAR-002-3 therefore provides for a default mode of operation (*i.e.*, automatic voltage control mode) while also providing flexibility for Transmission Operators and Generator Operators to coordinate if a different control mode would be more effective.

Additionally, Requirement R1 modifies currently effective VAR-002-2b, Requirement R1 to add testing as a time when a generator need not operate in automatic voltage control mode or a different mode instructed by the Transmission Operator.

VAR-002-3, Requirement R2

R2. Unless exempted by the Transmission Operator, each Generator Operator shall maintain the generator voltage or Reactive Power schedule^[FN3] (within each generating Facility’s capabilities^[FN4]) provided by the Transmission Operator, or otherwise shall meet the conditions of notification for deviations from the voltage or Reactive Power schedule provided by the Transmission Operator.

2.1. When a generator’s AVR is out of service or the generator does not have an AVR, the Generator Operator shall use an alternative method to control the generator reactive output to meet the voltage or Reactive Power schedule provided by the Transmission Operator.

- 2.2. When instructed to modify voltage, the Generator Operator shall comply or provide an explanation of why the schedule cannot be met.
- 2.3. Generator Operators that do not monitor the voltage at the location specified in their voltage schedule shall have a methodology for converting the scheduled voltage specified by the Transmission Operator to the voltage point being monitored by the Generator Operator.

[FN3: The voltage or Reactive Power schedule is a target value with a tolerance band or a voltage or Reactive Power range communicated by the Transmission Operator to the Generator Operator.]

[FN4: Generating Facility capability may be established by test or other means, and may not be sufficient at times to pull the system voltage within the schedule tolerance band. Also, when a generator is operating in manual control, reactive power capability may change based on stability considerations.]

Requirement R2 carries forward the affirmative obligation from VAR-003-1, Requirement R2 that the Generator Operator maintain the voltage or Reactive Power schedule provided by the Transmission Operator, unless the Transmission Operator exempts the Generator Operator from doing so. Proposed Requirement R2 adds that the Generator Operator need not comply with the schedule if it satisfies the notification requirements for deviations established by the Transmission Operator under Reliability Standard VAR-001-4, Requirement R5, Part 5.2. By removing prescriptive notification requirements for the entire continent and providing additional flexibility, proposed Requirement R2, together with VAR-001-4, Requirement R5, Part 5.2, allows each Transmission Operator to determine the notification requirements for each of its respective Generator Operators based on system requirements and generator needs.

Additionally, proposed Requirement R2 includes a new Part 2.3 to allow Generator Operators that do not monitor voltage at the location specified in their voltage schedule provided by the Transmission Operator to convert the schedule to the voltage point monitored by the Generator Operator. As noted above, proposed Reliability Standard VAR-001-4, Requirement

R5 clarifies that the Transmission Operator may specify the schedule at either the high or low voltage side of the generator step-up transformer. Part 2.3 of proposed VAR-002-3 was included to allow a generator to continue monitoring voltage based on existing equipment, provided it has a methodology for conversion. There are many ways to convert the voltage schedule, including the development of voltage regulation curves for the transformers or the use of straight ratio conversion. This standard provides Generator Operators with the ability to meet a voltage schedule based on metering equipment while providing the necessary voltage support.

VAR-002-3, Requirements R3 and R4

- R3.** Each Generator Operator shall notify its associated Transmission Operator of a status change on the AVR, power system stabilizer, or alternative voltage controlling device within 30 minutes of the change. If the status has been restored within 30 minutes of such change, then the Generator Operator is not required to notify the Transmission Operator of the status change.

- R4.** Each Generator Operator shall notify its associated Transmission Operator within 30 minutes of becoming aware of a change in reactive capability due to factors other than a status change described in Requirement R3. If the capability has been restored within 30 minutes of the Generator Operator becoming aware of such change, then the Generator Operator is not required to notify the Transmission Operator of the change in reactive capability.

Proposed Requirements R3 and R4 separate the notification requirements in currently-effective VAR-002-2b, Requirement R3 into two requirements: (1) for AVR/PSS status changes (proposed Requirement R3), and (2) for reactive capability changes (proposed Requirement R4). Each of the proposed requirements provides for a 30-minute window to allow a Generator Operator time to resolve an issue before having to notify the Transmission Operator of a change. For example, proposed Requirement R3 limits the notifications required when an AVR goes out of service and quickly comes back in service (*i.e.*, within 30 minutes) because notification of this type of status change provides little to no benefit to reliability. For the same reason, proposed

Requirement R3 also removes existing Part 3.1, which requires that the Generator Operator provide an estimate for the expected duration of the status change.

Proposed Requirement R4 also limits the notifications required when a reactive capability change occurs and is quickly restored (*i.e.*, within 30 minutes) because notification of this type of status change provides little to no benefit to reliability. Proposed Requirement R4 improves VAR-002-2b, Requirement R3, which requires notification as soon as the reactive capability change occurs, to allow Generator Operators to report reactive capability changes after they become aware of the change. Proposed Requirement R4 also removes existing Part 3.2, which requires that the Generator Operator provide an estimate for the expected duration of the status change.

VAR-002-3, Requirement R5

R5. The Generator Owner shall provide the following to its associated Transmission Operator and Transmission Planner within 30 calendar days of a request.

5.1. For generator step-up transformers and auxiliary transformers with primary voltages equal to or greater than the generator terminal voltage:

5.1.1. Tap settings.

5.1.2. Available fixed tap ranges.

5.1.3. Impedance data.

Requirement R5 maintains most of currently-effective VAR-002-2b, Requirement R4 because of the importance of accurate tap settings. That is, if the tap setting is not properly set, then the VARs available from a particular generator may be affected. Proposed Requirement R5 removes existing Sub-part 4.1.4, which requires that a Generator Owner provide “[t]he +/- voltage range with step-change in % for load-tap changing transformers.” This percentage

information is extraneous because tap settings, available fixed tap ranges and impedance data already are required⁵¹ and can be used to calculate the step-change percentage, if needed.

VAR-002-3, Requirement R6

R6. After consultation with the Transmission Operator regarding necessary step-up transformer tap changes, the Generator Owner shall ensure that transformer tap positions are changed according to the specifications provided by the Transmission Operator, unless such action would violate safety, an equipment rating, a regulatory requirement, or a statutory requirement.

6.1. If the Generator Owner cannot comply with the Transmission Operator's specifications, the Generator Owner shall notify the Transmission Operator and shall provide the technical justification.

Requirement R6 maintains most of currently-effective VAR-002-2b, Requirement R5 due to the importance of accurate tap settings, as explained above. However, Requirement R6 updates VAR-002-2b, Requirement R5 to clarify that the requirement and corresponding part apply to the same functional entity (Generator Owners).⁵²

C. Proposed VAR-001-4 and VAR-002-3 Satisfy Outstanding Commission Directives

Project 2013-04 was initiated to address outstanding Commission directives from Order Nos. 693 and 724. The following is a discussion of each outstanding directive and the manner in which proposed Reliability Standards VAR-001-4 and VAR-002-3 address them.⁵³

Applicability to Reliability Coordinators: In Order No. 693, the Commission directed NERC to modify Reliability Standard VAR-001 to “include reliability coordinators as applicable

⁵¹ VAR-002-2b, Requirement R4, Sub-parts 4.1.1–4.1.3; VAR-002-3, Requirement R5, Sub-parts 5.1.1–5.1.3.

⁵² Existing Requirement R5 references “Generator Owner” in Requirement R5 and “Generator Operator” in Part 5.1. Proposed Requirement R6 modifies the reference to “Generator Operator” in Part 5.1 to reference “Generator Owner” in what is now Part 6.1.

⁵³ Since the issuance of Order No. 693, the Commission withdrew its directives from paragraphs 1863 and 1869 of Order No. 693 related to the VAR Reliability Standards. *Electric Reliability Organization Proposal to Retire Requirements in Reliability Standards*, 145 FERC ¶ 61,147 at PP 25–26, Att. A (2013).

entities and include a new requirement(s) that identifies the reliability coordinator’s monitoring responsibilities.”⁵⁴ The Commission reasoned that because “a reliability coordinator is the highest level of authority overseeing the reliability of the Bulk-Power System it is important to include the reliability coordinator as an applicable entity to assure that adequate voltage and reactive resources are being maintained.”⁵⁵ Because the Interconnection Reliability Operations and Coordination (“IRO”) group of Reliability Standards address Reliability Coordinator monitoring functions, the standard drafting team concluded that any additional requirements on the Reliability Coordinator monitoring function regarding voltage should be addressed in the IRO Reliability Standards. There is currently a NERC standards development project, Project 2014-03 – Revisions to TOP and IRO Standards, which is modifying the IRO Reliability Standards. The standard drafting team for that project is considering whether any revisions are necessary to address this directive.⁵⁶ Therefore, NERC does not propose to apply VAR-001-4 to Reliability Coordinators or develop any additional VAR-001-4 requirements applicable to Reliability Coordinators at this time.

Reactive Power requirements for LSEs: As directed by the Commission,⁵⁷ NERC addressed Reactive Power requirements for LSEs on a comparable basis with purchasing-selling

⁵⁴ Order No. 693 at P 1855.

⁵⁵ *Id.*

⁵⁶ Specifically, the drafting team for Project 2014-03 has proposed a new IRO-002-4, Requirement R4, which provides:

Each Reliability Coordinator shall monitor Facilities within its Reliability Coordinator Area and neighboring Reliability Coordinator Areas to determine any potential [SOL and IROL] exceedances within its Reliability Coordinator Area, including sub-100 kV facilities needed to make this determination and the status of Special Protection Systems in its Reliability Coordinator Area.

⁵⁷ Order No. 692 at P 1858.

entities in Reliability Standard VAR-001-2, Requirement R5.⁵⁸ Subsequently, the Commission approved retirement of the requirement addressing this directive because the directive is effectively addressed in Schedule 2 (Reactive Supply and Voltage Control from Generation or Other Sources Service) of the Commission's *pro forma* Open Access Transmission Tariff.⁵⁹ As such, NERC does not propose to address this directive in the proposed Reliability Standards.

Power factor range at the interface between LSEs and the Bulk-Power System: The Commission directed NERC to develop a modification to the VAR Reliability Standards "to address the power factor range at the interface between LSEs and the Bulk-Power System."⁶⁰ The Commission was concerned that during high loads, if the power factor at the interface between many LSEs and the Bulk-Power System is so low as to result in low voltages at key busses on the Bulk-Power System, then there is risk for voltage collapse. Since the issuance of this directive, however, other Reliability Standards approved by the Commission address this issue. Specifically, Reliability Standard TPL-001-4, which has been approved by the Commission and subject to future enforcement, requires that system models include Real and reactive Load forecasts.⁶¹ These system model inputs provide the appropriate power factors to be maintained. Additionally, Reliability Standard FAC-001-1 requires that each Transmission Owner and applicable Generator Owner provide a written summary of its plan to achieve the required system performance for "Voltage, Reactive Power, and *power factor control*."⁶² Because currently enforceable Reliability Standards TPL-001-4 and FAC-001-1 address the

⁵⁸ NERC Petition for Approval of Proposed Modifications to Reliability Standards BAL-002-1; EOP-002-3; FAC-002-1; MOD-021-2; PRC-004-2; and VAR-001-2, 134 FERC ¶ 61,015 (2011).

⁵⁹ Order No. 788 at P 17.

⁶⁰ Order No. 693 at P 1861.

⁶¹ TPL-001-4, Requirement R1, Part 1.1.4, available at <http://www.nerc.com/files/TPL-001-4.pdf>.

⁶² See FAC-001-1, Requirement R3, Part 3.1.9, available at <http://www.nerc.com/files/FAC-001-1.pdf> (emphasis added).

appropriate power factors to be maintained, the VAR standard drafting team determined it would be duplicative and unnecessary for reliability purposes to add the same or similar requirements to proposed Reliability Standards VAR-001-4 and VAR-002-3.

Consideration of acceptable ranges of net power factor range: The Commission directed NERC to consider the difficulty of reaching “an agreement on acceptable ranges of net power factors at the interfaces where LSEs receive service from the Bulk-Power System because the acceptable range of power factors at any particular point on the electrical system varies based on many location-specific factors.”⁶³ The standard drafting team considered this directive carefully and determined that it has been addressed by the interconnection process and related agreements, as well as by currently enforceable Reliability Standards TPL-001-4 and FAC-001-1, as discussed above. Therefore, the standard drafting team did not include any additional language to proposed Reliability Standards VAR-001-4 and VAR-002-3 to address this directive.

Detailed and definitive requirement on established limits and sufficient reactive resources: The Commission directed NERC to “include more detailed and definitive requirements on ‘established limits’ and ‘sufficient reactive resources’ and identify acceptable margins (*i.e.*, voltage and/or reactive power margins) above voltage instability points to prevent voltage instability and to ensure reliable operation.”⁶⁴ The Commission, in part, was addressing concerns that the Transmission Operator should be required to have a technical basis for setting the required voltage schedule that takes into account system needs and any limitations of the specific generator.⁶⁵ Proposed Reliability Standard VAR-001-4 addresses this concern by requiring Transmission Operators to (1) share their system voltage schedules with their

⁶³ Order No. 693 at PP 1860, 1862.

⁶⁴ *Id.* at P 1868.

⁶⁵ *See id.* at P 1864.

Reliability Coordinators and adjacent Transmission Operators (Requirement R1, Part 1.1), and (2) provide Generator Operators the criteria used to develop generator-specific voltage and Reactive Power schedules (Requirement R5, Part 5.3). This increased transparency will help ensure that Transmission Operators have a technical basis for setting system-wide and generator specific voltage and Reactive Power schedules that takes into account system needs and any limitations of the specific generator.

Additionally, the Commission stated that “the Reliability Standard would benefit from having more defined requirements that clearly define what voltage limits are used and how much reactive resources are needed to ensure voltage instability will not occur under normal and emergency conditions.”⁶⁶ Currently enforceable FAC and TOP Reliability Standards approved by the Commission following the issuance of Order No. 693, however, address this directive by requiring entities to develop methodologies for establishing SOLs and IROLs that include detailed and definitive requirements for voltage limits and margins. Specifically, Reliability Standard FAC-011-2, Requirement R1 requires the Reliability Coordinator to have a documented methodology for use in developing SOLs (the “SOL Methodology”) within its Reliability Coordinator Area for use in the operations horizon.⁶⁷ Among other things, the SOL Methodology must include a requirement that SOLs provide BES performance consistent with maintaining voltage stability.⁶⁸

⁶⁶ *Id.* at P 1870.

⁶⁷ Reliability Standard FAC-010-2.1 requires the Reliability Coordinator to have a documented SOL Methodology for use in the planning horizon.

⁶⁸ Specifically, FAC-011-2, Requirement R2 provides that:

[t]he Reliability Coordinator’s SOL Methodology shall include a requirement that SOLs provide BES performance consistent with the following:

continued . . .

Reliability Standard FAC-014-2 then requires (1) each Reliability Coordinator to ensure that SOLs, including IROLs, for its Reliability Coordinator Area are established and consistent with its SOL Methodology, and (2) each Transmission Operator to establish SOLs (as directed by its Reliability Coordinator) for its portion of the Reliability Coordinator Area that are consistent with its Reliability Coordinator’s SOL Methodology.

These FAC Reliability Standards operate in tandem with the TOP Reliability Standards, which, as discussed above, require that each Transmission Operator plan to meet and operate within SOLs and IROLs. The standard drafting team determined that these currently enforceable FAC and TOP Reliability Standards collectively provide sufficient detail on “established limits” and margins, and it was unnecessary to include any additional definitive and detailed requirements in VAR-001-4 or VAR-002-3 to address voltage instability and ensure reliable operations. The standard drafting team determined, however, that because acceptable voltage limits and the level of sufficient Reactive Power necessary to maintain voltage depends on the unique characteristics of each system, the proposed Reliability Standards cannot dictate a specific, “one-size-fits-all” approach to determining what constitutes a sufficient level of Reactive Power. Rather, the SOL Methodologies developed by Reliability Coordinators under FAC-011-2 will provide the necessary detail tailored to the needs of the system in question.

Periodic voltage stability analysis: The Commission directed NERC to include a requirement to “perform voltage stability analysis periodically, using online techniques where

R2.1. In the pre-contingency state, the BES shall demonstrate transient, dynamic and ***voltage stability***; all Facilities shall be within their Facility Ratings and within their thermal, voltage and ***stability limits***. . . .

R2.2. [T]he system shall demonstrate transient, dynamic and ***voltage stability***; all Facilities shall be operating within their Facility Ratings and within their thermal, ***voltage and stability limits***; and Cascading or uncontrolled separation shall not occur.

(Emphasis added.)

commercially-available, and offline simulation tools where online tools are not available, to assist real-time operations.”⁶⁹ The Commission stated that “[t]he ERO should consider the available technologies and software as it develops this modification to VAR-001-1 and identify a process to assure that the Reliability Standard is not limiting the application of validated software or other tools.”⁷⁰ The standard drafting team concluded that requiring periodic voltage stability analysis in proposed VAR-001-4 was duplicative of requirements in the TOP group of Reliability Standards. Specifically, period voltage stability analysis is already required to comply with Reliability Standards TOP-002-2.1b, Requirements R10⁷¹ and R11,⁷² TOP-004-2, Requirement R6,⁷³ and TOP-006-2, Requirement R2.⁷⁴ Each of these existing Reliability Standards requires active planning and monitoring to operate within SOLs. Because periodic voltage stability analysis is an inherent component of these monitoring requirements, particularly TOP-002-2.1b, Requirement R11, the standard drafting team did not propose to duplicate these requirements in proposed Reliability Standards VAR-001-4 and VAR-002-3. As noted above, the TOP Reliability Standards currently in development propose to carry forward the obligation

⁶⁹ Order No. 693 at P 1875.

⁷⁰ *Id.*

⁷¹ Reliability Standard TOP-002-2.1b, Requirement R10 provides that “[e]ach Balancing Authority and Transmission Operator shall plan to meet all [SOLs] and [IROLs].”

⁷² Reliability Standard TOP-002-2.1b, Requirement R11 provides that the “Transmission Operator shall perform seasonal, next-day, and current-day Bulk Electric System studies to determine SOLs.” The requirement also specifies that the “Transmission Operator shall update these Bulk Electric System studies as necessary to reflect current system conditions; and shall make the results of Bulk Electric System studies available to the Transmission Operators, Balancing Authorities (subject to confidentiality requirements), and to its Reliability Coordinator.”

⁷³ TOP-004-2, Requirement R6 provides that “Transmission Operators, individually and jointly with other Transmission Operators, shall develop, maintain, and implement formal policies and procedures to provide for transmission reliability. These policies and procedures shall address the execution and coordination of activities that impact inter- and intra-Regional reliability, including . . . [m]onitoring and controlling voltage levels and real and reactive power flows.

⁷⁴ TOP-006-2, Requirement R2 requires that “[e]ach Reliability Coordinator, Transmission Operator, and Balancing Authority shall monitor applicable transmission line status, real and reactive power flows, voltage, load-tap-changer settings, and status of rotating and static reactive resources.”

to plan to meet and operate within SOLs and IROLs. Further, draft Reliability Standard TOP-002-4, Requirement R1 would require Transmission Operators to perform an Operational Planning Analysis that will allow it to assess whether its planned operations for the next day within its Transmission Operator Area will exceed any of its SOLs.⁷⁵ An Operational Planning Analyses would include a voltage stability analysis to assist Real-time operations.

NERC is not proposing to modify its Reliability Standards to require that entities perform periodic voltage stability analyses using online techniques where commercially-available or offline simulation tools where online tools are not available. From a Reliability Standards perspective, the goal is to ensure that relevant entities perform periodic voltage stability analyses in a manner that helps maintain reliable operation in Real-time, not to limit or dictate the techniques or tools used to perform the analysis. An entity may perform the analysis using online techniques or offline simulation tools based on their availability and effectiveness. To comply with the TOP Reliability Standards, however, the entity must show that it performed a voltage stability analysis using techniques and/or tools designed to assess voltage stability effectively.

Controllable load: The Commission directed NERC to include controllable load as a reactive resource.⁷⁶ As noted above, proposed Reliability Standard VAR-001-4, Requirement R2 addresses this directive as controllable load is included as a “sufficient reactive resource.”

⁷⁵ The term “Operational Planning Analysis” is proposed to be modified as follows:

An evaluation of projected system conditions to assess anticipated (pre-Contingency) and potential (post-Contingency) conditions for next-day operations. The evaluation shall reflect inputs including, but not limited to, load forecasts; generation output levels; Interchange; known Protection System and Special Protection System status or degradation; Transmission outages; generator outages; Facility Ratings; and identified phase angle and equipment limitations.

⁷⁶ Order No. 693 at P 1879.

VAR-002 non-compliance window: The Commission directed NERC to consider modifying VAR-002 to add a time frame associated with an “incident” of non-compliance with VAR-002.⁷⁷ The standard drafting team considered modifications to VAR-002, but could not reach consensus on establishing, or developing guidelines for defining, a continent-wide time frame that would apply to all generators under VAR-002. Rather, the directive was addressed in an equally effective and efficient manner in proposed Reliability Standard VAR-001-4, Requirement R5, which requires that each Transmission Operator provide its Generator Operators with applicable voltage or Reactive Power schedules and notification requirements for deviations from those schedules. This approach provides the necessary flexibility to each Transmission Operator to define time frames based on its unique system assessments and tailor deviation notifications to the voltage constraints experienced in a particular area.

Technically sound voltage schedules: In Order No. 724, the Commission remanded to NERC an interpretation of VAR-001-1, Requirement R4 to ensure voltage schedules “reflect sound engineering, as well as operating judgment and experience.”⁷⁸ To address this directive, Requirement R5, Part 5.3 requires a Transmission Operator, upon request, to provide the Generator Operator the technical support for how a voltage schedule and an associated tolerance band was established. This increased transparency will help ensure that the schedules reflect sound engineering and operating judgment.

D. Enforceability of the Proposed Reliability Standards

Proposed Reliability Standards VAR-001-4 and VAR-002-3 include VRFs and VSLs. The VRFs and VSLs guide how NERC will enforce the requirements of the proposed Reliability

⁷⁷ *Id.* at PP 1883, 1885.

⁷⁸ Order No. 724 at P 49.

Standards and comport with NERC and Commission guidelines related to their assignment. Exhibit E provides a detailed review of the VRFs and VSLs, as well as analysis on how the VRFs and VSLs were determined using the NERC and Commission guidelines.

The proposed Reliability Standards also include measures that support each requirement promulgated thereunder by clearly identifying what is required for compliance and how the requirement will be enforced. These measures help ensure that the requirements will be enforced in a clear, consistent and non-preferential manner and without prejudice to any party.⁷⁹

V. EFFECTIVE DATE

As described in the Implementation Plan attached hereto as Exhibit B, NERC respectfully requests that the Commission approve proposed Reliability Standards VAR-001-4 and VAR-002-3 and the retirement of VAR-001-3 and VAR-002-2b, effective on the first day of the first calendar quarter after Commission approval. The proposed implementation period will provide sufficient time for responsible entities to develop or modify their processes to transition from compliance with existing Reliability Standards VAR-001-3 and VAR-002-2b to proposed Reliability Standards VAR-001-4 and VAR-002-3.

⁷⁹ Order No. 672 at P 327 (“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.”).

VI. CONCLUSION

For the reasons set forth above, NERC respectfully requests that the Commission approve:

- Proposed Reliability Standards VAR-001-4 and VAR-002-3 and the associated elements included in Exhibit A, effective as proposed herein;
- The proposed Implementation Plan included in Exhibit B; and
- The retirement of the currently effective Reliability Standards VAR-001-3 and VAR-002-2b, effective as proposed herein.

Respectfully submitted,

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