

# Periodic Review Recommendations: VAR-001-4.1 – Voltage and Reactive Control

February 13, 2017

## Executive Summary

The periodic review team completed a comprehensive review of VAR-001-4.1 – Voltage and Reactive Control. The team found the standard is sufficient to protect reliability and meet the reliability objective of the standard; however, there may be future opportunity to improve a non-substantive or insignificant quality and content issue. The following are the observations and recommendations of the periodic review team.

## Introduction

The North American Electric Reliability Corporation (NERC) is required to conduct a periodic review of each NERC Reliability Standard at least once every ten (10) years, or once every five (5) years for Reliability Standards approved by the American National Standards Institute (ANSI) as an American National Standard.<sup>1</sup> The Reliability Standard identified above has been included in the current cycle of periodic reviews. The Review Team shall consist of two (2) subgroups; a Standing Review Team, which is appointed annually by the Standards Committee (SC) for periodic reviews, and a stakeholder Subject Matter Expert (SME) team. Consistent with Section 13 of the Standards Processes Manual (SPM)<sup>2</sup>, the SC may use a public nomination process to appoint the stakeholder Subject Matter Expert (SME) team, or may use another method to appoint that results in a team that collectively has the necessary technical expertise and work process skills to meet the objectives of the project. The technical experts provide the subject matter expertise and guide the development of the technical aspects of the periodic review, assisted by technical writers, legal and compliance experts. The technical experts maintain authority over the technical details of the periodic review.

Together, the Standing Review Team and SME stakeholder team are the Review Team for a particular periodic review project and complete their portion of the template below.

The purpose of the template is to collect background information, pose questions to guide a comprehensive review of the standard(s) by the Review Team, and document the Review Team's considerations and recommendations. The Review Team will post the completed template containing its recommendations for information and stakeholder input, as required by Section 13 of the NERC SPM.

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<sup>1</sup>American National Standards Institute website: [https://www.ansi.org/  
http://www.nerc.com/pa/Stand/Documents/Appendix\\_3A\\_StandardsProcessesManual.pdf](https://www.ansi.org/http://www.nerc.com/pa/Stand/Documents/Appendix_3A_StandardsProcessesManual.pdf).

<sup>2</sup> NERC Standard Processes Manual 45 (2013), posted at [http://www.nerc.com/pa/Stand/Documents/Appendix\\_3A\\_StandardsProcessesManual.pdf](http://www.nerc.com/pa/Stand/Documents/Appendix_3A_StandardsProcessesManual.pdf).

**Review Team Composition**

	<b>Standing Review Team</b>	<b>Plus Section 13 (SMEs):</b>
<b>Non-CIP Standards</b>	<p>Chairs of the following NERC Standing Committees<sup>3</sup>:</p> <ul style="list-style-type: none"> <li>• SC (Also the SC chair or his/her delegate from the SC will chair the Standing Review Team)<sup>4</sup></li> <li>• Planning Committee</li> <li>• Operating Committee (A regional representative will be included on the Standing Review Team.)</li> </ul> <p>The Standing Review Team will meet with SMEs and help to ensure a consistent strategy and approach across all of the reviews.</p>	<p>The SC will appoint stakeholder SMEs for the particular standard(s) being reviewed. The SMEs will work together with the Standing Review Team to conduct its review of the standard(s) and complete the template below.</p>
<b>CIP Standards</b>	<p>Chairs of the following NERC Standing Committees<sup>5</sup>:</p> <ul style="list-style-type: none"> <li>• SC (Also the SC chair or his/her delegate from the SC will chair the Standing Review Team)</li> <li>• CIPC</li> </ul>	<p>The SC will appoint stakeholder SMEs for the particular standard(s) being reviewed. The SMEs will work together with the Standing Review Team to conduct its review of the standard(s) and complete the template below.</p>

The Review Team will use the background information and the questions below, along with any associated worksheets or reference documents, to guide a comprehensive review that results in a recommendation from one of the following three (3) choices:

1. Recommend re-affirming the standard as steady-state (Green); or

<sup>3</sup>Each committee chair may, at his or her discretion, delegate participation on the Standing Review Team to another member of his or her committee.

<sup>4</sup> The Standards Committee chair may delegate one member of the SC to chair one Standing Review Team’s review of a standard s), and another SC member to chair a review of another standard(s).

<sup>5</sup> Each committee chair may, at his or her discretion, delegate participation on the Standing Review Team to another member of his or her committee.

2. Recommend that the standard is sufficient to protect reliability and meet the reliability objective of the standard; however there may be future opportunity to improve a non-substantive or insignificant quality and content issue – i.e., continue to monitor (Yellow); or
3. Recommend that the standard needs revision or retirement (Red).

If the team recommends a revision to, or a retirement of, the Reliability Standard, it must also submit a Standard Authorization Request (SAR) outlining the proposed scope and technical justification for the revision or retirement.

A completed Periodic Review Template and any associated documentation should be submitted by email to [Scott Barfield-McGinnis](mailto:Scott.Barfield-McGinnis@nerc.gov) via email or by telephone at 404-446-9689.

<b>Applicable Reliability Standard: VAR-001-4.1 &amp; VAR-002-4</b>
<b>Team Members (include name and organization):</b>
<ol style="list-style-type: none"> <li>1. Stephen Solis (Chair), Electric Reliability Council of Texas, Inc.</li> <li>2. Dennis Sauriol (Vice Chair), American Electric Power</li> <li>3. Alex Chua, Pacific Gas and Electric</li> <li>4. Kevin Harrison, ITC Holdings</li> <li>5. Bill Harm, PJM Interconnection, LLC</li> <li>6. Tim Kucey, PSEG Fossil, LLC</li> <li>7. Michael Scott, NextEra Energy, Inc.</li> </ol>
<b>Date Review Completed:</b>

**Background Information (to be completed initially by NERC staff)**

1. Are there any outstanding Federal Energy Regulatory Commission (FERC) directives associated with the Reliability Standard? *(If so, NERC staff will attach a list of the directives with citations to associated FERC orders for inclusion in a SAR.)*
  - Yes
  - No
  
2. Have stakeholders requested clarity on the Reliability Standard in the form of an (outstanding, in progress, or approved) Interpretation or Compliance Application Notice (CAN)? *(If there are, NERC staff will include a list of the Interpretation(s), CAN(s), or other stakeholder-identified issue(s) that apply to the Reliability Standard.)*
  - Yes
  - No

**Please explain:**

3. Is the Reliability Standard one of the most violated Reliability Standards?

Yes

No

**Please explain:**

If so, does the cause of the frequent violation appear to be a lack of clarity in the language?

Yes

No

**Please explain:**

### Questions for the Review Team

If NERC staff answered “Yes” to any of the questions above, the Reliability Standard probably requires revision. The questions below are intended to further guide your review. Some of the questions reference documents provided by NERC staff, as indicated in the Background questions above. Either as a guide to help answer the ensuing questions or as a final check, the Review Team is to use Attachment 3: Independent Expert Evaluation Process.

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#### I. Quality

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1. **Reliability Need, Paragraph 81:** Do any of the requirements in the Reliability Standard meet criteria for retirement or modification based on Paragraph 81 concepts? *Use Attachment 2: Paragraph 81 Criteria to make this determination.*

Yes

No

**Please summarize your application of Paragraph 81 Criteria, if any:**

2. **Clarity:** From the Background Information section of this template, has the Reliability Standard been the subject of an Interpretation, CAN or issue associated with it, or is frequently violated because of ambiguity?

a. Does the Reliability Standard have obvious ambiguous language?

b. Does the Reliability Standard have language that requires performance that is not measurable?

- c. Are the requirements consistent with the purpose of the Reliability Standard?
- d. Should the requirements stand alone as is, or should they be consolidated with other standards?
- e. Is the Reliability Standard complete and self-contained?
- f. Does the Reliability Standard use consistent terminology?

Yes

No

**Please summarize your assessment:**

3. **Definitions:** Do any of the defined terms used within the Reliability Standard need to be refined?

Yes

No

**Please explain:**

4. **Compliance Elements:** Are the compliance elements associated with the requirements (Measures, Data Retention, Violation Risk Factors (VRF), Violation Severity Levels (VSL) and Time Horizons) consistent with the direction of the Reliability Assurance Initiative (RAI) and FERC and NERC guidelines?

Yes

No

**If you answered "No," please identify which elements require revision, and why:**

5. **Consistency with Other Reliability Standards:** Does the Reliability Standard need to be revised for formatting and language consistency among requirements within the Reliability Standard, or for coordination with other Reliability Standards?

Yes

No

**If you answered "Yes," please describe the changes needed to achieve formatting and language consistency:**

6. **Changes in Technology, System Conditions, or other Factors:** Does the Reliability Standard need to be revised to account for changes in technology, system conditions or other factors?

Yes

No

**If you answered “Yes,” please describe the changes and specifically what the potential impact is to reliability if the Reliability Standard is not revised:**

Requirement R4 does not require periodic review of the exemption or review triggered by other changes such as changes in technology, system conditions or other factors, this may require a periodic review of the exemption criteria; and the generators that may have been exempted by the Transmission Operator.

For Requirement R5, the Generator Operator may need to raise concerns to the Transmission Operator over the inability to meet the voltage schedule. This concern may result in an exemption, voltage schedule revision, or possibly some other action. This concern could be addressed with a revision to the Standard or some equivalent technical guidance (e.g., guideline). The requirement does not have a feedback loop to raise such concerns.

Requirement R2 requires the Transmission Operator to maintain sufficient reactive resources to regulate voltage levels under normal and Contingency conditions. The standard’s purpose statement notes that reactive resources among other things are monitored. There does not appear to be a requirement to monitor reactive resources (i.e., reserves) to ensure sufficiency.

7. **Practicable:**

- a. Can the Reliability Standard be practically implemented?

Yes

No

- b. Is there a concern that it is not cost effective as drafted?

Yes

No

**Please summarize your assessment of the practicability of the standard:**

8. **Consideration of Generator and Transmission Interconnection Facilities:** Is responsibility for generator Interconnection Facilities and Transmission Interconnection Facilities appropriately accounted for in the Reliability Standard?

Yes

No

*Guiding Questions:*

- a. If the Reliability Standard is applicable to Generator Owners (GOs) and/or Generator Operators (GOPs), is there any ambiguity about the inclusion of generator Interconnection Facilities? (If generation Interconnection Facilities could be perceived to be excluded, specific language referencing the Facilities should be introduced in the Reliability Standard.)

*Response: The standard is not applicable to GOPs continent-wide and only GOPs according to the Western Interconnection variance in the standard. There is no ambiguity about the inclusion of generator Interconnection Facilities.*

- b. If the Reliability Standard is not applicable to GOs and/or GOPs, is there a reliability-related need for treating generator Interconnection Facilities as Transmission Lines for the purposes of this Reliability Standard? (If so, GOs that own and/or GOPs that operate relevant generator Interconnection Facilities should be explicit in the Applicability section of the Reliability Standard.)

*Response: The standard is applicable to Transmission Operators. There is no reliability-related need for treating generator Interconnection Facilities as Transmission Lines for the purposes of this Reliability Standard.*

- c. If the Reliability Standard is applicable to Transmission Operators (TOPs) and/or Distribution Providers (DPs), is there any ambiguity about the inclusion of Transmission Interconnection Facilities? (If Transmission Interconnection Facilities could be perceived to be excluded, specific language referencing the Facilities should be introduced in the Reliability Standard.)

*Response: The standard is applicable to Transmission Operators. There is no ambiguity about the inclusion of Transmission Interconnection Facilities.*

9. **Results-Based Standard (RBS):** Is the Reliability Standard drafted as a RBS?

Yes

No

**If not, please summarize your assessment:**

*Guiding Questions:*

- a. Does the Reliability Standard address performance, risk (prevention) and capability?

Yes

No

- b. Does the Reliability Standard follow the RBS format (for example, requirement and part structure) in Attachment 1?
- Yes
- No
- c. Does the Reliability Standard follow the Ten Benchmarks of an Excellent Reliability Standard<sup>6</sup>?
- Yes
- No

## II. Content

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10. **Technical accuracy:** Is the content of the requirements technically correct, including identifying who does what and when?
- Yes
- No

**If not, please summarize your assessment:**

As VAR-001-4.1 Requirement R5 is written, the Transmission Operator (TOP) has flexibility to determine the duration that a generator can be outside the voltage bandwidth. A TOP may have varying criteria depending on the specific unit size, location, amount that the unit is outside of the target or bandwidth. If the TOP does not specify a timing portion (i.e., duration when notification required) to its notification requirements in Part 5.2 (e.g., outside range for 5 minutes), there can be a lack of clarity of the notification requirements for the Generator Operator. Specifying the timing portion within the notification requirements while maintaining the necessary flexibility is recommended.

VAR-001-4.1, Requirement R5 does not include the Reliability Coordinator (RC) as a recipient of voltage or Reactive Power schedules. In Requirement R1, Part 1.1, the TOP must provide the system voltage schedule to the RC within 30 days of a request. If there is a reliability need for the TOP to provide the RC with the voltage and Reactive Power Schedule when notifying the Generator Operator, Requirement R5 should include how the RC obtains the voltage and Reactive Power schedule.

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<sup>6</sup> Ten Benchmarks of an Excellent Reliability Standard, posted at Page 626 of:  
[http://www.nerc.com/pa/Stand/Resources/Documents/DT\\_Reference\\_Manual\\_Resource\\_Package\\_080114.pdf](http://www.nerc.com/pa/Stand/Resources/Documents/DT_Reference_Manual_Resource_Package_080114.pdf)

11. **Functional Model:** Are the correct functional entities assigned to perform the requirements consistent with the Functional Model?

Yes

No

**If not, please summarize your assessment:**

12. **Applicability:** Is there a technical justification for revising the Applicability of the Reliability Standard, or specific requirements within the standard, to account for differences in reliability risk?

Yes

No

**If so, please summarize your assessment:**

13. **Reliability Gaps:** Are the appropriate actions for which there should be accountability included, or is there a gap?

Yes

No

**If a gap is identified, please explain:**

14. **Technical Quality:** Does the Reliability Standard have a technical basis in engineering and operations?

Yes

No

**If not, please summarize your assessment:**

15. **Does the Reliability Standard reflect a higher solution than the lowest common denominator?**

Yes

No

**If not, please summarize your assessment:**

**16. Related Regional Reliability Standards:** Is there a related regional Reliability Standard, and is it appropriate to recommend the regional Reliability Standard be retired, appended into the continent-wide standard, or revised in favor of a continent-wide standard?

Yes

No

**If yes, please identify the regional standard(s) and summarize your assessment:**

- 1.) The Western Electricity Coordinating Council (WECC) region should consider whether VAR-002-WECC-2 (*Automatic Voltage Regulators (AVR)*) should be retired in light of the most recent versions of VAR-001-4.1 and VAR-002-4 which require all AVRs to be in service and in voltage control mode unless exempted by the TOP based on identified criteria.
- 2.) In VAR-001-4.1, Requirement R5 has no requirement to identify the “initial” status of the PSS. However, VAR-002-4 Requirement R3 requires the Generator Operator to notify the Transmission Operator of a power system stabilizer (PSS) status change. The initial status of the PSS should be clarified within the notification required by Requirement R5. The status of the PSS raises the question whether any of the VAR-501-WECC-2 (*Power System Stabilizer*), or any subsequent new version, PSS requirements should be established similar to AVR requirements for inclusion of the continent-wide standards.
- 3.) The WECC variance E.A.18 is specific to external control loops to the manufacturer’s AVR control loop. Due to the system configuration of the WECC, it was one of the earlier adopters of AVR and PSS controls. Due to the age of the controls or difficulty with setting reactive droop compensation on some older style controls, external loop controls were implemented from the plant control system. This can be done via DCS or SCADA. Variance E.A.18 requires that if external controls are used, that they do not affect the AVR’s transient response during fault conditions.

There is a need to determine if this type of control is used outside of the WECC. Adding this variance to the continent wide NERC standard might be justified if other utilities practice this method of voltage control and there have been documented cases that the external control hindered the AVR from responding properly during a fault event.<sup>7</sup>

## RED, YELLOW, GREEN GRADING

Using the questions above, the Review Team shall come to a consensus on whether the Reliability Standard is Green – i.e., affirm as steady-state; Yellow – is sufficient to protect reliability and meet the

<sup>7</sup> See also ([http://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20150602\\_Generator\\_Distributed\\_Control\\_System\\_Impact\\_on\\_Automatic\\_Voltage\\_Regulators.pdf](http://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20150602_Generator_Distributed_Control_System_Impact_on_Automatic_Voltage_Regulators.pdf))

reliability objective of the standard, however, there may be future opportunity to improve a non-substantive or insignificant quality and content issue – i.e., continue to monitor; or Red - either retire or needs revision, and, thus, a SAR should be developed to process the standard through the standards development process for retirement or revision. The reasons for the Review Team’s conclusions of Green, Yellow, or Red shall be documented. If a consensus is not reached within the Review Team, minority reviews shall be posted for stakeholder comment, along with the majority opinion on whether the Reliability Standard is Green, Yellow, or Red.

### Recommendation

The answers to the questions above, along with its Red, Yellow, or Green grading and the recommendation of the Review Team, will be posted for a 45-day comment period, and the comments publicly posted. The Review Team will review the comments to evaluate whether to modify its initial recommendation, and will document the final recommendation which, will be presented to the SC.

### Preliminary Recommendation (to be completed by the Review Team after its review and prior to posting the results of the review for industry comment):

- RE-AFFIRM (*This should be checked only if there are no outstanding directives, Interpretations or issues identified by stakeholders.*) GREEN
- REVISE (*The standard is sufficient to protect reliability and meet the reliability objective of the standard; however, there may be future opportunity to improve a non-substantive or insignificant quality and content issue.*) (Would include revision of associated RSAW.) YELLOW
- REVISE (*The recommended revisions are required to support reliability.*) (Would include revision of associated RSAW.) RED
- RETIRE (Would include retirement of associated RSAW.) RED

Technical Justification (*If the Review Team recommends that the Reliability Standard be revised, a draft SAR may be included and the technical justification included in the SAR*):

### Preliminary Recommendation posted for industry comment (date):

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### Final Recommendation (to be completed by the Review Team after it has reviewed industry comments on the preliminary recommendation):

- RE-AFFIRM (*This should be checked only if there are no outstanding directives, Interpretations or issues identified by stakeholders.*) GREEN
- REVISE (*The standard is sufficient to protect reliability and meet the reliability objective of the standard; however, there may be future opportunity to improve a non-substantive or insignificant quality and content issue.*) (Would include revision of associated RSAW.) YELLOW
- REVISE (*The recommended revisions are required to support reliability.*) (Would include revision of associated RSAW.) RED
- RETIRE (Would include retirement of associated RSAW.) RED

Technical Justification (*If the Review Team recommends that the Reliability Standard be revised, a draft SAR must be included and the technical justification included in the SAR*):

### Date submitted to Standards Committee:

## Attachment 1: Results-Based Standards

Question 9 for the Review Team asks if the Reliability Standard is results-based. The information below will be used by the Review Team in making this determination.

Transitioning the current body of standards into a clear, concise, and effective body will require a comprehensive application of the RBS concept. RBS concepts employ a defense-in-depth strategy for Reliability Standards development where each requirement has a role in preventing system failures, and the roles are complementary and reinforcing. Reliability Standards should be viewed as a portfolio of requirements designed to achieve an overall defense-in-depth strategy and comply with the quality objectives identified in the resource document titled, "[Acceptance Criteria of a Reliability Standard](#)."

Accordingly, the Review Team shall consider whether the Reliability Standard contains results-based requirements with sufficient clarity to hold entities accountable without being overly prescriptive as to how a specific reliability outcome is to be achieved. The RBS concept, properly applied, addresses the clarity and effectiveness aspects of a standard.

A Reliability Standard that adheres to the RBS format should strive to achieve a portfolio of performance-, risk-, and competency-based mandatory reliability requirements that support an effective defense-in-depth strategy. Each requirement should identify a clear and measurable expected outcome, such as: a) a stated level of reliability performance, b) a reduction in a specified reliability risk, or c) a necessary competency.

- a. **Performance-Based**—defines a particular reliability objective or outcome to be achieved. In its simplest form, a results-based requirement has four components: who, under what conditions (if any), shall perform what action, to achieve what particular result or outcome?
- b. **Risk-Based**—preventive requirements to reduce the risks of failure to acceptable tolerance levels. A risk-based reliability requirement should be framed as: who, under what conditions (if any), shall perform what action, to achieve what particular result or outcome that reduces a stated risk to the reliability of the bulk power system?
- c. **Competency-Based**—defines a minimum set of capabilities an entity needs to have to demonstrate it is able to perform its designated reliability functions. A competency-based reliability requirement should be framed as: who, under what conditions (if any), shall have what capability, to achieve what particular result or outcome to perform an action to achieve a result or outcome or to reduce a risk to the reliability of the bulk power system?

Additionally, each RBS-adherent Reliability Standard should enable or support one or more of the eight reliability principles listed below. Each Reliability Standard should also be consistent with all of the reliability principles.

1. 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. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained, and implemented.
5. Facilities for communication, monitoring, and control shall be provided, used, and maintained for the reliability of interconnected bulk power systems.
6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
7. The reliability of the interconnected bulk power systems shall be assessed, monitored, and maintained on a wide-area basis.
8. Bulk power systems shall be protected from malicious physical or cyber attacks.

If the Reliability Standard does not provide for a portfolio of performance-, risk-, and competency-based requirements or consistency with NERC's reliability principles, NERC staff and the Review Team should recommend that the Reliability Standard be revised or reformatted in accordance with the RBS format.

## Attachment 2: Paragraph 81 Criteria

The first question for the Review Team asks if one or more of the requirements in the Reliability Standard meet(s) criteria for retirement or modification based on Paragraph 81 concepts.<sup>8</sup> Use the Paragraph 81 criteria explained below to make this determination. Document the justification for the decisions throughout and provide them in the final assessment in the Periodic Review Template.

For a Reliability Standard requirement to be proposed for retirement or modification based on Paragraph 81 concepts, it must satisfy **both**: (i) Criterion A (the overarching criterion); and (ii) at least one of the Criteria B listed below (identifying criteria). In addition, for each Reliability Standard requirement proposed for retirement or modification, the data and reference points set forth below in Criteria C should be considered for making a more informed decision.

### *Criterion A (Overarching Criterion)*

The Reliability Standard requirement requires responsible entities (“entities”) to conduct an activity or task that does little, if anything, to benefit or protect the reliable operation of the BES.

Section 215(a) (4) of the United States Federal Power Act defines “reliable operation” as: “... operating the elements of the bulk power system within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements.”

### *Criteria B (Identifying Criteria)*

#### **B1. Administrative**

The Reliability Standard requirement requires responsible entities to perform a function that is administrative in nature, does not support reliability and is needlessly burdensome.

This criterion is designed to identify requirements that can be retired or modified with little effect on reliability and whose retirement or modification will result in an increase in the efficiency of the ERO compliance program. Administrative functions may include a task that is related to developing procedures or plans, such as establishing communication contacts. Thus, for certain requirements, Criterion B1 is closely related to Criteria B2, B3 and B4. Strictly administrative functions do not inherently negatively impact reliability directly and, where possible, should be eliminated or modified for purposes of efficiency and to allow the ERO and entities to appropriately allocate resources.

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<sup>8</sup> In most cases, satisfaction of the Paragraph 81 criteria will result in the retirement of a requirement. In some cases, however, there may be a way to modify a requirement so that it no longer satisfies Paragraph 81 criteria. Recognizing that, this document refers to both options.

**B2. Data Collection/Data Retention**

These are requirements that obligate responsible entities to produce and retain data which document prior events or activities, and should be collected via some other method under NERC's rules and processes.

This criterion is designed to identify requirements that can be retired or modified with little effect on reliability. The collection and/or retention of data do not necessarily have a reliability benefit and yet are often required to demonstrate compliance. Where data collection and/or data retention is unnecessary for reliability purposes, such requirements should be retired or modified in order to increase the efficiency of the ERO compliance program.

**B3. Documentation**

The Reliability Standard requirement requires responsible entities to develop a document (*e.g.*, plan, policy or procedure) which is not necessary to protect reliability of the bulk power system.

This criterion is designed to identify requirements that require the development of a document that is unrelated to reliability or has no performance or results-based function. In other words, the document is required, but no execution of a reliability activity or task is associated with or required by the document.

**B4. Reporting**

The Reliability Standard requirement obligates responsible entities to report to a Regional Entity, NERC or another party or entity. These are requirements that obligate responsible entities to report to a Regional Entity on activities which have no discernible impact on promoting the reliable operation of the BES and if the entity failed to meet this requirement there would be little reliability impact.

**B5. Periodic Updates**

The Reliability Standard requirement requires responsible entities to periodically update (*e.g.*, annually) documentation, such as a plan, procedure or policy without an operational benefit to reliability.

This criterion is designed to identify requirements that impose an updating requirement that is out of sync with the actual operations of the BES, unnecessary, or duplicative.

**B6. Commercial or Business Practice**

The Reliability Standard requirement is a commercial or business practice, or implicates commercial rather than reliability issues.

This criterion is designed to identify those requirements that require: (i) implementing a best or outdated business practice or (ii) implicating the exchange of or debate on commercially sensitive information while doing little, if anything, to promote the reliable operation of the BES.

### **B7. Redundant**

The Reliability Standard requirement is redundant with: (i) another FERC-approved Reliability Standard requirement(s); (ii) the ERO compliance and monitoring program; or (iii) a governmental regulation (e.g., Open Access Transmission Tariff, North American Energy Standards Board (“NAESB”), etc.).

This criterion is designed to identify requirements that are redundant with other requirements and are, therefore, unnecessary. Unlike the other criteria listed in Criterion B, in the case of redundancy, the task or activity itself may contribute to a reliable BES, but it is not necessary to have two duplicative requirements on the same or similar task or activity. Such requirements can be retired or modified with little or no effect on reliability and removal will result in an increase in efficiency of the ERO compliance program.

### *Criteria C (Additional data and reference points)*

Use the following data and reference points to assist in the determination of (and justification for) whether to proceed with retirement or modification of a Reliability Standard requirement that satisfies both Criteria A and B:

#### **C1. Was the Reliability Standard requirement part of a FFT filing?**

The application of this criterion involves determining whether the requirement was included in a FFT filing.

#### **C2. Is the Reliability Standard requirement being reviewed in an ongoing Standards Development Project?**

The application of this criterion involves determining whether the requirement proposed for retirement or modification is part of an active Standards Development Project, with consideration for the status of the project. If the requirement has been approved by Registered Ballot Body and is scheduled to be presented to the NERC Board of Trustees, in most cases it will not need to be addressed in the periodic review. The exception would be a requirement, such as the Critical Information Protection (CIP) requirements for Version 3 and 4, that is not due to be retired for an extended period of time. Also, for informational purposes, whether the requirement is included in a future or pending Standards Development Project should be identified and discussed.

#### **C3. What is the VRF of the Reliability Standard requirement?**

The application of this criterion involves identifying the VRF of the requirement proposed for retirement or modification, with particular consideration of any requirement that has been assigned as having a Medium or High VRF. Also, the fact that a requirement has a Lower VRF is not dispositive that

it qualifies for retirement or modification. In this regard, Criterion C3 is considered in light of Criterion C5 (Reliability Principles) and C6 (Defense in Depth) to ensure that no reliability gap would be created by the retirement or modification of the Lower VRF requirement. For example, no requirement, including a Lower VRF requirement, should be retired or modified if doing so would harm the effectiveness of a larger scheme of requirements that are purposely designed to protect the reliable operation of the BES.

**C4. In which tier of the most recent Actively Monitored List (AML) does the Reliability Standard requirement fall?**

The application of this criterion involves identifying whether the requirement proposed for retirement or modification is on the most recent AML, with particular consideration for any requirement in the first tier of the AML.

**C5. Is there a possible negative impact on NERC's published and posted reliability principles?**

The application of this criterion involves consideration of the eight following reliability principles published on the NERC webpage.

**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. Each reliability standard shall also be consistent with all of the reliability principles, thereby ensuring that no standard undermines reliability through an unintended consequence.

Principle 1. 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.

Principle 2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.

Principle 3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.

Principle 4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained, and implemented.

Principle 5. Facilities for communication, monitoring, and control shall be provided, used, and maintained for the reliability of interconnected bulk power systems.

Principle 6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.

Principle 7. The reliability of the interconnected bulk power systems shall be assessed, monitored, and maintained on a wide-area basis.

Principle 8. Bulk power systems shall be protected from malicious physical or cyber attacks.  
*(footnote omitted)*

**C6. Is there any negative impact on the defense in depth protection of the BES?**

The application of this criterion considers whether the requirement proposed for retirement or modification is part of a defense in depth protection strategy. In other words, the assessment is to verify whether other requirements rely on the requirement proposed for retirement or modification to protect the BES.

**C7. Does the retirement or modification promote results or performance based Reliability Standards?**

The application of this criterion considers whether the requirement, if retired or modified, will promote the initiative to implement results- and/or performance-based Reliability Standards.

# Attachment 3: Independent Expert Evaluation Process

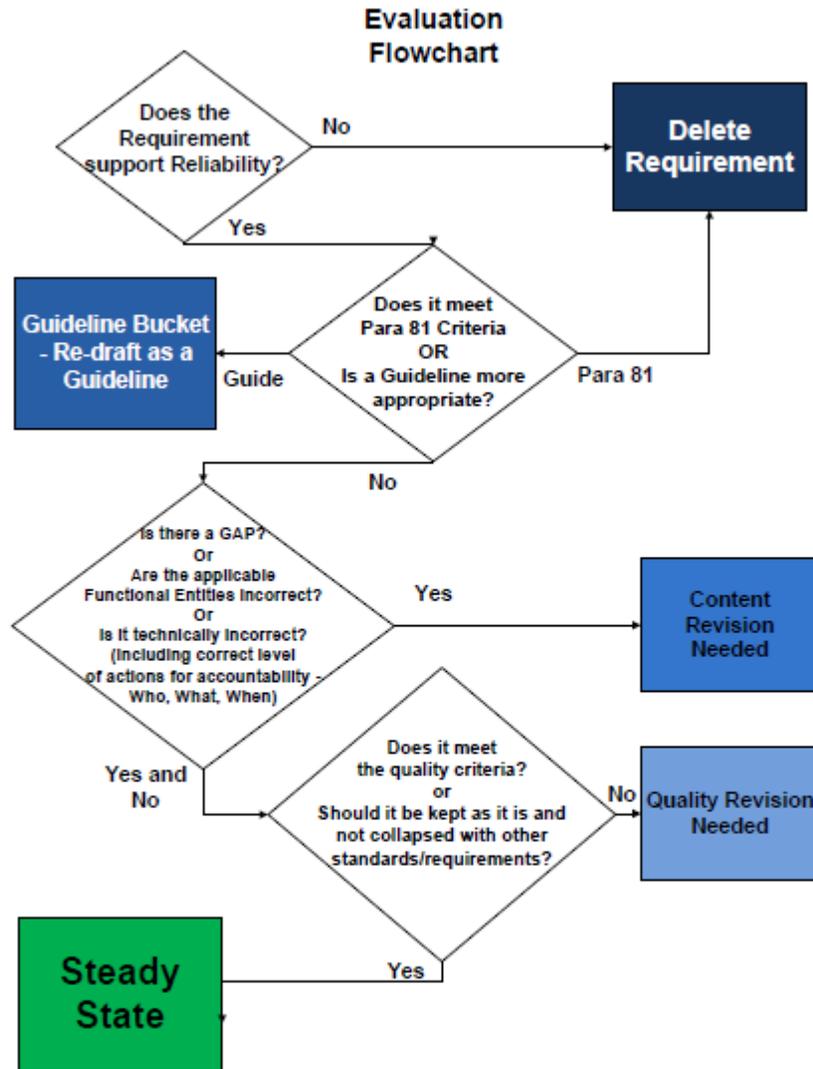


Figure 1: Evaluation Flow Chart

## Attachment 4: Potential Errata Revisions/Corrections

The periodic review team has consolidated a number of errata and minor errors that could be cleaned up by a drafting team should the standard be opened for revision. If providing comment during the posting period, please reference comments with the observation number.

1. Paragraph 81 (None)
2. Clarity
  - 2.1. There is a grammatical error in the first sentence of VAR-001, Requirement R4 in which the word "from:" should be moved after the "1) following..." to read "1) from following..." as shown below:

***R4. The Transmission Operator shall specify the criteria that will exempt generators ~~from:~~ 1) from 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.***
  - 2.2. Insert the word "calendar" between "30 days" for VAR-001-4.1, Requirement R5, Part 5.3 to be consistent with other uses within the standard and the Measure.
  - 2.3. Measure M1 should use the term "calendar" like the requirement.
  - 2.4. Measure M5 uses the capitalized term "Reactive Power Schedule" that is not a glossary term. "Reactive Power" is a defined term. Lowercase the word "schedule."
  - 2.5. Requirement E.A.18 (i.e., WECC Variance) uses the capitalized term "Automatic Voltage Regulators" that is not a glossary term. Lowercase the capitalized term "Automatic Voltage Regulators."
  - 2.6. The Guidelines and Technical Basis, Rationale for R1, section should lowercase the capitalized term "Voltage Stability Ratings," a carryover from the old System Operating Limit (SOL) defined glossary term. If still in progress, coordinate with Project 2015-09 (Establish and Communicate System Operating Limits) SDT concerning the use of this term in the defined SOL term which may be changing.
  - 2.7. The Guidelines and Technical Basis, Rationale for R1 section should lowercase the capitalized term "post-Contingency Voltage Limits" a carryover from the old System Operating Limit (SOL) definition, the "Voltage Limits" portion should be lowercase. "Contingency" is a defined glossary term. If still in progress, coordinate with Project 2015-09 (*Establish and Communicate System Operating Limits*) SDT concerning the use of this term in the defined SOL term, which may be changing.

- 2.8. The Guidelines and Technical Basis, Rationale for R5 section, if retained, use lowercase "Voltage Schedule" because it is not a defined glossary term. If defined in the future, ensure consistency within the standard.
- 2.9. Use the format of "Mvar" rather than "MVAR" for Mega-voltampere reactive to be consistent with the IEEE designation throughout VAR-001. Spell out the first occurrence.
- 2.10. VAR-001-4.1, Requirement R6 should have the term "necessary" removed as it is superfluous.
3. Definitions (None)
4. Compliance Elements
  - 4.1. Requirement R1 incorrectly states the Time Horizon of "Operational Planning" and it should be "Operations Planning." Correct this inconsistency in the Requirement and Table of Compliance Elements (i.e., VSL).
  - 4.2. Requirement R2 incorrectly states the Time Horizon of "Operational Planning" and it should be "Operations Planning." Correct this inconsistency in the Requirement and Table of Compliance Elements (i.e., VSL).
  - 4.3. Requirement R3 incorrectly states the Time Horizon of "Operational Planning" and it should be "Operations Planning." Correct this inconsistency in the Requirement and Table of Compliance Elements (i.e., VSL).
  - 4.4. Requirement R3 Time Horizons<sup>9</sup> of Same-day Operations and Operational Planning are inappropriate. The requirement states "shall operate or direct the Real-time operation of devices", which would imply a Time Horizon of "Real-time Operations." Therefore, replace the time horizons of Same-day Operations and Operational Planning with "Real-time Operations."
  - 4.5. Measure M2 incorrectly states the Time Horizon of "Operational Planning" and it should be "Operations Planning." Correct this inconsistency.
  - 4.6. Measure M3 has "may include," but not the full phrase "may include, but is not limited to..." Add the additional verbiage for completeness.
  - 4.7. The sentence construction of VAR-001-4.1 Measure M4 is incorrect and should be updated for correctness. The word "from:" should be moved to "1) from following..."
5. Consistency with other Reliability Standards (None)
6. Changes Technology, System Conditions, or other Factors (None)

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<sup>9</sup> Time Horizons are used as a factor in determining the size of a sanction. If an entity violates a requirement and there is no time to mitigate the violation because the requirement takes place in real-time, then the sanction associated with the violation is higher than it would be for violation of a requirement that could be mitigated over a longer period of time. [http://www.nerc.com/files/Time\\_Horizons.pdf](http://www.nerc.com/files/Time_Horizons.pdf)

7. Practicable (None)
8. Consideration of Generator and Transmission Interconnection Facilities (None)
9. Results-Based Standard (RBS) (None)
10. Technical accuracy (None)
11. Functional Model (None)
12. Applicability (None)
13. Reliability Gaps (None)
14. Technical Quality (None)
15. Does the Reliability Standard reflect a higher solution than the lowest common denominator?  
(None)
16. Related Regional Reliability Standards (None)

## Attachment 5: Other Miscellaneous Corrections/Revisions

The periodic review team has consolidated a number of observations here that could be considered by a drafting team should the standard be opened for revision. If providing comment during the posting period, please reference comments with the observation number.

### 1. Paragraph 81

- 1.1. The second part of VAR-001-4.1, Requirement R5, Part 5.1 (i.e., "*and direct the Generator Operator to comply with the schedule in automatic voltage control mode (the AVR is in service and controlling voltage).*") appears redundant with VAR-002-4, Requirement R1 and could be retired.

Background: The periodic review team recognizes that an automatic voltage regulator or "AVR" has several different operating modes, one being constant voltage, and another being constant reactive output. The requirement to operate with the AVR in the automatic mode is the driver of the requirement. The Transmission Operator should have flexibility to direct either voltage or reactive control at a specified voltage point (i.e., AVR in automatic). This issue would go away if the second part of VAR-001-4.1, Requirement R5.1 (i.e., "*and direct the Generator Operator to comply with the schedule in automatic voltage control mode (the AVR is in service and controlling voltage).*") is removed from VAR-001-4.1, Requirement R5.1.

### 2. Clarity

- 2.1. VAR-001-4.1, Requirement R6 implies the consultation is a performance of the requirement (see Measure M6) due to the construction of the Requirement leading off with "After consultation with the Generator Owner...". Re-structure the Requirement to show the consultation a part of the performance to align with the Measures "...and that it consulted with the Generator Owner" or another equally effective option to eliminate the ambiguity.
- 2.2. VAR-001-4.1, Requirement R4 does not provide clarity on how the exemption criteria developed (e.g., blanket or specific). This applies to the voltage schedule and/or Reactive Power schedule in VAR-001, Requirement R5. Additional clarity on how the exemption criteria is developed in Requirement R4 could be helpful. For example, whether it is a blanket exemption or specific to certain generating units. Additionally, if a Generator Operator is unable to meet its voltage schedule, how would an exemption be applied where a small generator is trying to control voltage when another large generator is driving Mvar flow? How would this work in the case where the Transmission Operator has determined that there will be no criteria for exemption under Requirement R4?

- 2.3. Some entities are evaluating dynamic voltage schedules developed in the next-day or Real-time environment. As written the standard provides a Transmission Operator the flexibility to develop a voltage schedule that encompasses whatever time period and operating parameters that are appropriate. If VAR-001-4.1, Requirement R5 is revised in the future, edits should preserve the flexibility to allow for specifying the schedule in both Real-time and day-ahead.
  - 2.4. When implementing a voltage schedule, the Transmission Operator needs to coordinate and be cognizant of the system response due to a change of any generator's voltage schedule. VAR-001-4.1, Requirement R5 should consider additional clarity (could be addressed in the Guidelines and Technical Basis section) around coordination of implementing the voltage schedules so that they are not all implemented at the same point in time (e.g., seasonal, time of day based, Voltage schedules for multiple generators).
  - 2.5. There is inconsistency between VAR-001-4.1, Requirement R1 and Requirement R5 to clarify that the system voltage schedule in Requirement R1 may be the same schedule or at the same points in the system as that of Requirement R5, where one "schedule" may be derived and used for both requirements (e.g., The "system" schedule may be identified to be at the high-side of the generator step-up unit transformers only). Requirement R5 uses "voltage schedule" and "Reactive Power schedule," but only [system] voltage schedule is used in Requirement R1. Consider the need to include "Reactive Power schedule" in Requirement R1. The language should also retain flexibility so that Requirement R1 can be the same or different points in the system as Requirement R5.
3. Definitions
    - 3.1. Defining the following terms "generator voltage schedule" and "generator Reactive Power schedule," "system voltage schedule," and "automatic voltage regulator (AVR)" (could be technology specific) may improve clarity. If so, review the Reliability Guideline: "Reactive Power Planning" section to determine if the Application Guideline in the standard provides clarity or at a minimum is consistent with the Reliability Guideline.
4. Compliance Elements
    - 4.1. Measure M2 uses "resources based on their assessments of the system" as a measure for performance not required by the requirement. The clause "based on their assessments of the system" should be removed from the measure or added to the requirement to be consistent.
    - 4.2. Measure M2: "For the operational planning time horizon, Transmission Operators shall have evidence of assessments used as the basis for how resources were scheduled" is all inclusive. Reword the measure to conform to the requirement. For example, evidence may include..."
    - 4.3. Measure M3 does not include "or direct" in the language. Revise the Measure to be consistent (i.e., direct or instruct, if changed according to other recommendations herein).

- 4.4. Section C1.2, Evidence Retention is silent on the Generator Operator (within the WECC Region), which is an applicable functional entity in the standard. The evidence retention section should provide minimum periods for all applicable entities listed in the standard.
- 4.5. The VSL in Requirement R5 does not make the distinction (e.g., High uses "all" and Severe use "any") as to the number of missed notifications, but the Measure M5 uses "applicable" which gives guidance that the requirement is implicitly not including exempt Generator Operators.
- 4.6. The second portion of the Severe VSL for Requirement R5 VSL language may need a High VSL component to address the notification component of the requirement for deviations.
- 4.7. The VSL for Requirement R5 needs to replace "does" (present tense) with "did" (past tense). VSLs are based on what happened in the past.
- 4.8. Requirement R4 may need to include Real-time Operations Time Horizon. It is practical that this exemption could be issued in Real-time.
- 4.9. Some entities are evaluating dynamic voltage schedules developed in the next-day or Real-time environment. If implementing Real-time or close to Real-time voltage scheduling a Transmission Operator would need to provide the required clarity. VAR-001-4.1 Requirement R5 may need to include the Real-time Operation Time Horizon.
5. Consistency with other Reliability Standards
  - 5.1. VAR-001-4.1, Requirement R1 should include an additional clarifier to "adjacent" such as "within an Interconnection" or similar which could add clarity that voltage schedules for asynchronously adjacent Transmission Operators across a DC tie do not need to provide voltage schedules to one another. Voltage output on each side of the DC tie is controlled by the DC tie operator (e.g., language in COM-001-2).
  - 5.2. Requirements R3 and R5.1 use the term "instruct" in lieu of "direct" to align more closely with more recent changes in IRO/TOP/COM standards which replaced the term "directive" with "Operating Instruction."
  - 5.3. There are cases, primarily for non-U.S. entities, for which the Transmission Owner (TO) owns the generator step-up (GSU) transformer. Requirement R6 properly identifies the Generator Owner functional entity, but does not include the TO that owns the GSU transformer. The requirement should include the TO in order to address those cases where the TO owns GSUs transformer.
6. Changes Technology, System Conditions, or other Factors (None)
7. Practicable (None)
8. Consideration of Generator and Transmission Interconnection Facilities (None)
9. Results-Based Standard (RBS)

9.1. Requirement R6 is not results-based and should be evaluated whether it can be restructured. For example, the requirement lists “how” to accomplish the goal of providing tap changes to the Generator Owner rather than specifically identifying “what” is required by the Transmission Operator (See also Attachment 6, Item 2.1).

10. Technical accuracy (None)

11. Functional Model (None)

12. Applicability (None)

13. Reliability Gaps (None)

14. Technical Quality (None)

15. Does the Reliability Standard reflect a higher solution than the lowest common denominator?  
(None)

16. Related Regional Reliability Standards (None)