

Technical, Policy and Regulatory Issues Addressed by FAC-003 SDT

Q1: FERC generally requires that revised standards provide an adequate level of reliability in a manner that is at least as effective and efficient as the previously balloted and approved version of the standard. How does draft Standard FAC-003-2 meet this objective? Please provide specific explanation of how the portfolio of proposed requirements provides a defense-in-depth strategy for ensuring bulk power system reliability that is equally efficient and effective to or superior to the current Standard, FAC-003-1 — Transmission Vegetation Management Program. A specific explanation of how each requirement, when combined with the other requirements of the draft standard, contributes to a defense-in-depth strategy will be helpful.

A1: This Standard is more effective and efficient in ensuring an adequate level of reliability than FAC-003-1 because it has the following attributes.

- It removes the “fill-in-the-blank” ambiguity previously contained in FAC-003-1.
- It separates performance requirements (R1, R2, R4, R5, R6, and part of R7) from documentation requirements (R3 and the remainder of R7), and minimizes the burden of those documentation requirements.
- It has explicit and therefore clearer expectations to manage vegetation to: 1) prevent observable vegetation encroachments inside the Minimum Vegetation Clearance Distance (MVCD) and 2) prevent a confirmed Fault even in the absence of a Sustained Outage (R1, R2).
- It places more emphasis on those lines that pose the greatest risk to the reliability of the interconnected transmission system. This is accomplished by converting the previous FAC-00301 R1 into the new R1 and R2 and assigning the high VRF to the more important lines in R1.
- It requires the management of vegetation to prevent encroachments by specific types, which are indicative of the quality of that management. Those quality-related encroachment types also allow more specificity for determining the severity level of a violation.
- It establishes a clear, industry proven method for flash-over distance (clearance) that is not subject to external standards established for other purposes (through use of the Gallet Equations to establish the MCVD).
- It has an unambiguous expectation for Vegetation Inspection intervals.

- It separates inspections and communications of imminent threats into individual and clearer requirements that can be appropriately weighted by VRFs and VSLs (both of these items were previously addressed in sub-requirements of FAC-003-1 R1).
- It correctly moves reporting obligations from the requirements section (FAC-003-1 R3) to the Additional Compliance Information Section.
- It has additional supporting text in the Background, Rationale, and Guidelines and Technical Basis sections to aid the industry in using the Standard and understanding conductor dynamics and the interrelationship of vegetation growth, inspection frequencies, and vegetation control methods.
- It requires vegetation be managed with equal rigor over all lands regardless of the ownership of those lands.

This standard utilizes three types of requirements to provide layers of protection to prevent vegetation related outages that could lead to Cascading:

- 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 bulk power system performance 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?*

The defense-in-depth strategy for reliability standards development recognizes that each requirement in a NERC reliability standard has a role in preventing system failures, and that these roles are complementary and reinforcing. Reliability standards should not be viewed as a body of unrelated requirements, but rather should be viewed as part of a portfolio of requirements designed to achieve an overall defense-in-depth strategy and comport with the quality objectives of a reliability standard.

This NERC Vegetation Management Standard (“standard”) uses a defense-in-depth approach to improve the reliability of the electric Transmission System by:

- Requiring that vegetation be managed to prevent vegetation encroachment inside the flash-over clearance (R1 and R2);

- Requiring documentation of the maintenance strategies, procedures, processes and specifications used to manage vegetation to prevent potential flash-over conditions including consideration of 1) conductor dynamics and 2) the interrelationships between vegetation growth rates, control methods and the inspection frequency (R3);
- Requiring timely notification to the appropriate control center of vegetation conditions that could cause a flash-over at any moment (R4);
- Requiring corrective actions to ensure that flash-over distances will not be violated due to work constraints such as legal injunctions (R5);
- Requiring inspections of vegetation conditions to be performed annually (R6); and
- Requiring that the annual work needed to prevent flash-over is completed (R7).

For this standard, the requirements have been developed as follows:

- Performance-based: Requirements 1 and 2
- Competency-based: Requirement 3
- Risk-based: Requirements 4, 5, 6 and 7

R3 serves as the first line of defense by ensuring that entities understand the problem they are trying to manage and have fully developed strategies and plans to manage the problem. R1, R2, and R7 serve as the second line of defense by requiring that entities carry out their plans and manage vegetation. R6, which requires inspections, may be either a part of the first line of defense (as input into the strategies and plans) or as a third line of defense (as a check of the first and second lines of defense). R4 serves as the final line of defense, as it addresses cases in which all the other lines of defense have failed.

Q2: The primary FERC directive in Order 693 is that the standard should specify minimum clearances to avoid Sustained Outages under all applicable conditions. Where in the Revised FAC-003-2 are references made to the ‘all applicable conditions’ issues? Is it understood that the revised standard is intended to protect facilities during emergency conditions?

A2: There are numerous references in the Standard to ensure that facilities are protected for all applicable conditions, including emergency conditions and conditions that would prevent the entity from carrying out its annual work plan. Those references are provided below along with a conclusion answer.

- See R1 and R2 which include the phrase “...operating within its **Rating and all Rated Electrical Operating Conditions.**”(Emphasis added)
- Also see R3 which states:

“Each Transmission Owner shall have documented maintenance strategies or procedures or processes or specifications it uses to prevent the encroachment of vegetation into the MVCD of its applicable lines that include(s) the following:

- 3.1 Accounts for the movement of applicable line conductors under their **Rating and all Rated Electrical Operating Conditions;** ”
- Also see R5 which states “When a Transmission Owner is **constrained** from performing vegetation work on applicable lines operating within its **Rating and all Rated Electrical Operating Conditions**, and the constraint may lead to a vegetation encroachment into the MVCD prior to the implementation of the next annual work plan, then the Transmission Owner **shall take corrective action** to ensure continued vegetation management to prevent encroachments.”
- Also see **Periodic Data Submittal**: The Transmission Owner will submit a quarterly report to its Regional Entity, or the Regional Entity’s designee, identifying all Sustained Outages of applicable lines operated within their **Rating and all Rated Electrical Operating Conditions**
- Also see **Guideline and Technical Basis** discussion for Requirements R1, R2 and R3, which reinforces the concept that applicable line clearances are to be observed throughout a line’s **Rating and under all Rated electrical Operating Conditions**.

The MVCD is the minimum clearance needed under all **Rating and Rated Electrical Operating Conditions**. The **Rated Electrical Operating Condition** is defined in the glossary as “the specified or reasonably anticipated conditions under which the electrical system or an individual electrical circuit is intend/ designed to operate.’ As such if there is an emergency rating for a line, it would be covered by this standard.

Q3: Cost and cost effectiveness management have been raised as issues by stakeholders, state regulators and some FERC commissioners. How will the Revised FAC-003-2 affect companies’ abilities to perform ROW maintenance in the most cost effective manner that does not compromise reliability? Will the Revised FAC-003-2 facilitate or restrict companies from ensuring cost effective ROW maintenance compared to FAC-003-1?

A3: This is a Results Based Standard. It addresses core rules to ensure an adequate level of reliability and removes fill-in-the-blank requirements, as well as requirements for excessive documentation. It allows efficiency in Vegetation Inspections by allowing them to be combined with other line inspections, and it focuses more on “what” to do than “how” to do it. Altogether, this allows the applicable entity the latitude to choose the most cost effective methods to achieve compliance.

Q4: FAC-003-1 identifies two clearances in R1.2.1 and R1.2.2: a clearance to be achieved when performing vegetation management work (Clearance 1), and a minimum clearance to prevent flashover (Clearance 2). Revised FAC-003-2 only identifies the minimum clearance to prevent flashover (based on the Gallet equations), and does not identify a clearance to be achieved when performing vegetation management work. How does the new standard ensure that vegetation management work is performed that would provide a similar level of performance as is currently required? Does the removal of Clearance 1 provide public interest benefits or cost savings that should be considered by regulatory authorities and other stakeholders? i.e., there is a trade off from C1 & C2 to MVCD so how do we find comfort with this?

A4: The MVCD was chosen to replace Clearance 2 because it defines the distance that will prevent a flash-over based on tested and proven principles. The FAC-003-1 Clearance 2 was inappropriately based on worker safety considerations; FAC-003 is not a worker safety standard. The Revised FAC-003-2 is now based on science, and not on another ANSI safety standard which may change for reasons beyond the scope of this Standard.

Clearance 1 is an entity-specific fill-in-the blank requirement; as such, it was removed.

R3 requires that the entity's documented maintenance strategies must account for the movement of the conductors under their Rating(s) and all Rated Electrical Operating Conditions. This is superior to the previous Clearance 1, as it leaves the necessary latitude for the applicable entity to exercise its full easement rights to manage vegetation at the time the work is performed (through methods such as use of herbicides or mechanical means, which may result in the complete elimination of the vegetation). Such exercise of full easements rights is often more efficient than pruning to a Clearance 1. In some cases property owners have incorrectly interpreted Clearance 1 as a limitation on the applicable entities' vegetation management rights. Such incorrect interpretations can exacerbate the execution of best work practices. If an applicable entity was not exercising its full rights due to external pressures or due to the assumption that Clearance 1 was fully sufficient at the time of maintenance, that entity is now (under FAC-003-2) relieved of that assumption, which will lead more directly to the consideration of the most cost effective vegetation management method(s).

FAC-003-2 Requirement R5 states that when the applicable entity is constrained from performing vegetation work that may lead to an encroachment into the MVCD prior to the implementation of the next annual work plan that the entity shall take corrective *action to ensure continued vegetation management to prevent encroachments*. This ensures that the clearance obtained at the time work is performed will be fully adequate.

R6 requires an Annual Inspection which by its definition is "The systematic examination of vegetation conditions on a Right-of-Way and those vegetation conditions under the Transmission Owner's control that are likely to pose a hazard to the line(s) prior to the next planned maintenance or inspection". Therefore this inspection will identify annually those vegetation conditions that require attention regardless of how, when or to what clearance distance the work was last performed. As such the required inspection provides the

mechanism to allow the applicable entity to address any work that must be performed even in advance of the next planned maintenance. Requirement R7 requires that the work plan be executed to ensure that no vegetation encroachments occur within the MVCD.

Therefore, separately and collectively R3, R5, R6 and R7 are superior to the previous requirement to establish a Clearance 1.

Q5: FAC-003-1 R1.3 required a transmission vegetation management program that mandated personnel involved in the establishment of the TVMP hold appropriate qualifications and training. How is this requirement addressed in the Revised FAC-003-2 or otherwise addressed in other NERC reliability standards?

A5: The FAC-003-1 requirement for “appropriate” qualifications and training was ambiguous and therefore removed. Applicable entities (as well as contractors that are retained by applicable entities to perform vegetation management) are subject to numerous state and federal environmental and worker safety regulations related to right of way work. Imposing additional NERC requirements for “appropriate” qualifications and training on personnel and contractors that may perform right of way maintenance is not helpful to reliability, and overly burdensome. To the extent such personnel qualifications are needed, they would be better addressed in the PER standards.

Q6: In one respect, revised FAC-003-2 appears to reduce applicability of the Standard. Section 4.2.4 indicates the Standard only applies to those transmission lines “outside the fenced area of the switchyard, station or substation or any portion of the span the transmission line that is crossing the substation fence.” These areas are currently within the scope of FAC-003-1, and removing them from the Standard would appear to create a reliability gap. Is this correct? How is this reliability gap addressed?

A6: Transmission line right of way maintenance programs do not normally extend inside those fenced areas, and some of those areas require special access permissions for entry. There are no reported or known vegetation related outages that have occurred in those areas. The fenced areas under lines are typically either paved or maintained as grassy areas. The lines within fenced areas are usually very short in length as compared to the miles of line outside the fenced areas. The lands within the fenced area are typically held fee-simple, precluding the need for special easements to maintain vegetation. That land is typically maintained such that buses, switchgear, ground-mat grids, touch and step potentials mitigation, and switchyard maintenance are of highest priority and therefore tree growth is not allowed. The maintenance of those fenced areas is often performed by other specialized contractors that do not maintain transmission line Right-of-Way. The ownership of the line often changes at the switchyard fence. For all those reasons it is neither necessary nor practical to have this Standard apply

inside those areas based on the premise that such a limitation would lower the bar or create a reliability gap.

Q7: Revised FAC-003-2 has a minimum inspection cycle requirement. Order 693 did not ask for a minimum inspection cycle. What is the technical need for this requirement? Does the addition of this requirement provide reliability benefits that offset changes to other requirements?

A7: In 693 the Commission noted its concern about minimizing outages and expressed support for a realistic inspection cycle. The Commission further directed the ERO to develop compliance audit procedures, using relevant industry experts, which would identify appropriate inspection cycles based on local factors. However, the Commission also expressed its support for a realistic inspection cycle and expressed concern when entities performed inspections on cycles of less than every 3 years or even “as needed”. The Commission expressed concern with leaving complete discretion to the transmission owners in determining inspection cycles which could limit the effectiveness of the Reliability Standard.

The Team received industry feedback regarding their desire to perform vegetation surveys in conjunction with other line inspections, which are typically annual surveys. The Team then chose to request industry to comment on the adequacy of annual Vegetation Inspections with the condition that the Vegetation Inspection could be performed in conjunction with other inspections. Industry comments were highly supportive of this approach.

The annual inspection cycle requirement is viewed by the Team as realistic, clear, unambiguous, easily performed, and not overly burdensome, since inspections can be performed aerially, on the ground, and in conjunction with other inspections. Regional Entities can develop Regional Standards or supplements to require increased frequencies in their regions if they determine that their regional vegetation growth rates justify such an increase.

Development of compliance audit procedures that account for local factors was considered and vetted by the Team. The Team concluded that the substantial variability in local factors would place undue burden on the ERO to develop continent-wide compliance audit procedures that would be clear and unambiguous. Furthermore the Team felt that waiting on the development of audit procedures and the implementation of those audit procedures could place Applicable Transmission Lines at greater risk than the proposed annual inspection cycle in FAC-003-2 which will provide a timelier “find-and-fix” solution to emerging problems with existing corrective and preventative maintenance processes. The Team suggests that the Annual Inspection requirement will ensure that applicable entities “find those conditions...likely to pose a hazard to the line prior to the next planned maintenance or inspection.” This alternative approach accomplishes the reliability objective targeted by the Commission of identifying appropriate inspection cycles based on local factors.

Q8: Revised FAC-003-2 requires in R7 that the Transmission Owner “complete 100% of its annual vegetation work plan of applicable lines.” What is required to be included in the plan? How does this differ from what is required under FAC-003-1 R1 and R2?

A8: The annual work plan will need to include the planned vegetation maintenance work necessary to ensure no vegetation encroachments occur within the MVCD. Regarding how this approach differs from FAC-003-1 Requirement 1 (which is about the documentation of practices and is silent on annual work planning), FAC-003-2 addresses similar documentation in Requirement R3. As far as how this approach differs from R2 in FAC-003-1, this FAC-003-2 Requirement 7 is not about details of creation of a plan with prescriptive descriptions of “how to” contents; it focuses instead on the necessary end results: specifically, work execution necessary to ensure no vegetation encroachments occur within the MVCD.

R7 continues to allow adjustments or modifications to the work plan and gives various examples to aid users of the Standard.

Q9: It appears that the SDT based the VSLs for R1 and R2 on the reliability consequences of an encroachment, rather than whether or not an encroachment occurred. NERC standards address consequences as an aspect of risk through the Violation Risk Factor, rather than the VSL. Why is the team choosing to attempt to address reliability consequences in both the VRF and the VSL?

A9: The action verb in R1 and R2 is to “manage.” The Subject Matter Experts on the team, with industry feedback, recognized that the types of encroachments provide a valuable method to determine the effectiveness of a vegetation program’s ability to manage vegetation effectively.

The most egregious vegetation management failure, and the most predictable, is to allow vegetation that is directly under the line to continue growing until it contacts the conductor. An entity that is unable to meet this obligation either does not have a vegetation program of significant value or does but is not implementing it faithfully.

The next most obvious vegetation management failure mode would be vegetation that has grown adjacent to the line sufficiently close such that the line and vegetation could be blown together. In this case, the entity is likely implementing a relatively effective program, but was unable to identify this particular risk.

Less obvious and less predictable vegetation management failures are caused by falling trees that are tall enough to lodge into the line and cause a Sustained Outage. This is due to the challenges in predicting the various causes for and the numerous ways that trees fail (decay, erosion, defects, excavation, wind forces) and fall and the likely direction (up to 360 degrees

available) that the tree will fall. An entity can have a very effective program, but fail to mitigate a risk of such occurrence.

Along with the difficulties just stated, it is deemed an even lesser vegetation maintenance failure to not find and remove every single tree before it has grown just enough to fall near the line and cause a brief Fault when it falls; or growth that reaches within the MVCD, but has not caused a fault. Again, an entity can have a very effective program, but fail to mitigate a risk of such occurrence.

Accordingly, the Team believes that the type and result of encroachment is indicative of an entity's overall performance and ability to "manage" vegetation.

Q10: Revised FAC-003-2 under R1 assigns a high VRF to those lines that are part of an IROL and/or are a WECC transfer path. Encroachment violations for all other lines are assigned a Medium VRF under R2. In the previous version of the standard, all lines were subject to the same requirements (i.e., the clearances were specified for all lines in R1.2, and clearances for all lines were expected to be maintained under R2). Splitting these elements into two different requirements, with two different VRFs, may create the perception that FAC-003-2 is "lowering the bar" by either reducing performance requirements or reducing potential penalties. How does the standard ensure that this "lowering" of the bar will not occur? Alternately, if this "lowering" is intentional, why is this reduction in expected performance or penalties reasonable and in the public interest?

A10: The reliability risk incurred by the outage of a transmission line within the interconnected transmission network is higher for some lines than for others. NERC's VRF definitions indicate that a High Violation Risk Factor is only appropriate for:

A requirement that, if violated, could directly cause or contribute to bulk electric system instability, separation, or a cascading sequence of failures, or could place the bulk electric system at an unacceptable risk of instability, separation, or cascading failures; or, a requirement in a planning time frame that, if violated, could, under emergency, abnormal, or restorative conditions anticipated by the preparations, directly cause or contribute to bulk electric system instability, separation, or a cascading sequence of failures, or could place the bulk electric system at an unacceptable risk of instability, separation, or cascading failures, or could hinder restoration to a normal condition.

In FERC's May 18, 2007 Order on Violation Risk Factors, FERC identified Guideline 5, which states that where a single requirement co-mingles a higher risk reliability objective and a lesser risk reliability objective, the VRF assignment must not be "watered down" to reflect the lower risk level associated with the less important objective. By not drawing a distinction between those lines with the ability to cause instability, separation, and cascading and those that do not, the previous standard co-mingled these objectives, and appropriately had a VRF of High

assigned. However, the Team has chosen to eliminate that co-mingling, has split the requirement, and has accordingly assigned the appropriate VRFs to the separate requirements.

From a practical perspective, FAC-003-2 continues to find applicable entities in violation for all the types of encroachments that they were subject to in FAC-003-1. FAC-003-2 requires all of the sub-200 kV IROL and WECC Major Transfer Path lines be included in the applicability, which provide more specificity than what was required in the previous version of the standard. There is now a clear inclusion of violations for those Faults confirmed-after-the-fact, as well as for confirmed MVCD encroachments that are found and removed prior to a Fault. Given the VRF definitions, FERC's guidance, and the above additional considerations, the Team believes FAC-003-2 continues to require an appropriate level of performance.