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

**NORTH AMERICAN ELECTRIC) Docket No. RM12-4-000
RELIABILITY CORPORATION)**

**RESPONSE OF THE
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION
TO OFFICE OF ELECTRIC RELIABILITY'S
MAY 4, 2012 DATA REQUEST**

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On May 4, 2012, the Federal Energy Regulatory Commission's ("FERC" or the "Commission") Director of the Office of Electric Reliability issued a data request pursuant to 18 C.F.R. § 375.303 (2011) in response to the North American Electric Reliability Corporation's ("NERC") December 21, 2011, petition for approval of proposed reliability standard FAC-003-2—Transmission Vegetation Management ("Petition"). In compliance with the Commission's data request, NERC's responses are set forth below.

I. DATA REQUEST RESPONSES

QUESTION 1:

Provide the technical basis for the statement at page 6 of the petition that "The distances derived using the Gallet equation result in the probability of flashover in the range of 10⁻⁶."

NERC Response:

The probability of flashover, given a drop in voltage to 85% of the "Critical Flashover Voltage (CFO)," is roughly .135% (or approximately 10⁻³). This value represents the probability of a flashover, assuming the specified CFO is achieved or exceeded.

However, this is not the only event being considered when attempting to model the probability of a vegetation flashover. The probability of achieving a maximum switching overvoltage ("Peak Voltage") in excess of the CFO must also be considered. This is shown on page 40 in equation 6 of the Technical Reference Document, and is specified there as roughly 0.135% (also approximately 10⁻³).

In other words, the conditional probability of flashover given that the 85% CFO has been exceeded is approximately 10⁻³. However, the probability of the CFO being exceeded is *also* 10⁻³. As these can be treated as two independent events, the probability is statistically "joint"

(the probability of exceeding the CFO and the probability of a flashover given the exceeding of the CFO are independent events). Accordingly, the two probabilities are to be multiplied, yielding a probability on the order of magnitude of approximately 10^{-6} .

For a more specific accounting of the number, the probability of an event (as defined in a standard normal table) being in excess of the mean plus three standard deviations is approximately 0.13%. Multiplying this value by itself (once for each independent event) results in a value of 0.000169% (technically 1.69×10^{-6}), or approximately a 1 in 591,716 chance of occurrence.

QUESTION 2:

Please explain how implementation of the maintenance strategies, procedures processes, or specifications used to prevent encroachment under Requirement R3 of the proposed standard is mandatory and enforceable.

NERC Response:

The Transmission Owner will be obligated to show detailed documentation that clearly explains their system with regard to the geography and how the Transmission Owner will execute the plan to prevent encroachment into the MVCD.

As stated on pages 35-36 of the Petition:

Requirement R3 requires the Transmission Owner to have documentation describing its chosen approach(es) for managing vegetation. The approach must consider the movement of the conductor, as well as growth rate, control method, and inspection frequency. The measure for this requirement is as follows:

The maintenance strategies or procedures or processes or specifications provided demonstrate that the Transmission Owner can prevent encroachment into the MVCD considering the factors identified in the requirement.

In this case, the Transmission Owner is obligated to show documentation, and that documentation must be sufficient to satisfy the auditor that the information contained in that documentation is sufficient that the Transmission Owner can use it to prevent encroachment into the MVCD. The difference in sizes of applicable entities, the nature of vegetation, [consideration of climate,] and the number of techniques available to applicable entities to manage it require that the measure allow for sufficient flexibility in approach. For example, vegetation management in Arizona is likely to be much different from that in West Virginia. Similarly, the approach used to manage a small system may be described in a few short sentences, while the approach used on a much larger system might require several volumes to describe. Auditors will have to use judgment to evaluate the appropriateness of the documentation provided given the particular circumstances of the entity being audited. To guide them in this, the Violation Severity Levels provided for Requirement R3 gradate the severity of a violation based on the

completeness of the information provided. In this case, failures of the requirement would likely be identified during review of the document(s) as submitted in response to a data request to support an audit, spot-check, or a self-certification. The document(s) the requirement describes can generally be understood to encompass the broad strategy, direction and goals supported by analysis and information peculiar to the geographical area of the Transmission Owner and the characteristics of its system. This document generally should be the foundation for the detail and supporting evidence required in requirements 4 through 7. As a competency based requirement, this is the cornerstone of the Transmission Owner's program to ensure vegetation management is implemented to ensure no encroachment.

QUESTION 3:

Please explain whether or to what extent modifications to an “annual vegetation work plan” under proposed Requirement R7 allow Transmission Owners to delay completion of an annual vegetation workplan. If a delay is permitted, explain whether proposed FAC-003-2 requires an applicable entity to implement other corrective actions? Explain and provide examples with citations to specific Requirements.

NERC Response:

As stated on pages 39-40 of the Petition:

Because of the dynamic nature of vegetation, the plan must also be dynamic. While in theory this might allow an entity to modify its plan to avoid compliance risk, such modification would not eliminate the obligation that the modified plan be executed to avoid encroachment of vegetation into the MVCD. [Stated another way, the ability to make any modification to an annual work plan is expressly conditioned such that the modification cannot result in encroachment of vegetation into the MVCD.] Any such encroachment would be a violation of R1 or R2, and any changes to the plan that resulted in such encroachment would be a violation of R7. The VSLs recommended for Requirement R7 are gradated based on the percentage of the final plan not completed. Such failures would be identified using NERC's normal Compliance Monitoring and Enforcement processes – primarily through self-certification and self-reporting, but also through audits, spot checking, compliance violation investigations, and complaints as appropriate. In order for auditors to make appropriate judgments as to the completed plan and any modifications, the initial work plan may be requested via a self certification or data submittal prior to its initiation and then compared to the completed plan at the end of the time period.

QUESTION 4:

Explain whether and to what extent “documented maintenance strategies” under Requirement R3 may be generalized and require no specific actions to prevent encroachments.

NERC Response:

The Transmission Owners will in fact be expected to show documentation of their strategy with sufficient detail to include specific actions to accomplish the maintenance strategies.

As stated in Exhibit A to the Petition at 19-20:

R3 is a competency based requirement concerned with the maintenance strategies, procedures, processes, or specifications, a Transmission Owner uses for vegetation management.

An adequate transmission vegetation management program formally establishes the approach the Transmission Owner uses to plan and perform vegetation work to prevent transmission Sustained Outages and minimize risk to the transmission system. The approach provides the basis for evaluating the intent, allocation of appropriate resources, and the competency of the Transmission Owner in managing vegetation. There are many acceptable approaches to manage vegetation and avoid Sustained Outages. However, the Transmission Owner must be able to show the documentation of its approach and how it conducts work to maintain clearances.

An example of one approach commonly used by industry is ANSI Standard A300, part 7. However, regardless of the approach a utility uses to manage vegetation, any approach a Transmission Owner chooses to use will generally contain the following elements:

- 1. the maintenance strategy used (such as minimum vegetation-to-conductor distance or maximum vegetation height) to ensure that MVCD clearances are never violated.*
- 2. the work methods that the Transmission Owner uses to control vegetation*
- 3. a stated Vegetation Inspection frequency*
- 4. an annual work plan*

The conductor's position in space at any point in time is continuously changing in reaction to a number of different loading variables. Changes in vertical and horizontal conductor positioning are the result of thermal and physical loads applied to the line. Thermal loading is a function of line current and the combination of numerous variables influencing ambient heat dissipation including wind velocity/direction, ambient air temperature and precipitation. Physical loading applied to the conductor affects sag and sway by combining physical factors such as ice and wind loading. The movement of the transmission line conductor and the MVCD is illustrated in Figure 1 below. In the Technical Reference document more figures and explanations of conductor dynamics are provided.

QUESTION 5

With respect to proposed Requirement R6, how will NERC and Regional Entity auditors determine whether a Transmission Owner performed a vegetation inspection "at least once per

calendar year and with no more than 18 calendar months between inspections” at a particular location on the Transmission Owner’s Right of Way?

NERC Response:

As specified in Measure M6, the Transmission Owner will be expected to provide evidence that it conducted Vegetation Inspections of the transmission line ROW for all applicable lines at least once per calendar year but with no more than 18 calendar months between inspections on the same ROW. Examples of acceptable forms of evidence may include completed and dated work orders, dated invoices, or dated inspection records.

This measure is consistent with the approaches used to verify compliance with the current FAC-003-1 (M1.1, which accepts as evidence “documentation that the Transmission Owner performed the vegetation inspections as identified in Requirement 1.1”). Additionally, this is consistent with the manner in which other standards are enforced as well. For example, PRC-005-1b (Transmission and Generation Protection System Maintenance and Testing) measures compliance with R2 based on the provision of documentation demonstrating implementation.

QUESTION 6

Explain whether and to what extent proposed FAC-003-2 requires qualification or training of personnel directly involved in implementation of vegetation management, and provide citations to any relevant Requirements or sub-Requirements of any current Reliability Standard.

NERC Response:

As discussed in the Petition (including at 23-24), the proposed FAC-003-2 Reliability Standard does not require qualifications or training of personnel directly involved in implementation of vegetation management.

QUESTION 7

Does the proposed standard allow for any exceptions to the requirements of Requirement R6 other than a failure to timely perform a Vegetation Inspection as a direct result of a “natural disaster” as stated in footnote 5 of the proposed standard? Explain.

NERC Response:

No. A Transmission Owner could seek an “Entity Variance,” which would have to be vetted through the Standards Development Process and approved by the Commission, in order to have any sort of exception to this requirement.

QUESTION 8

The proposed standard provides an effective date “on the first calendar day of the first calendar quarter one year after” the date of Commission approval. Explain why a 12-month transition

period is necessary and appropriate for implementing this proposed vegetation management standard.

NERC Response:

As stated in Exhibit B to the Petition:

The effective date is the date entities are expected to meet the performance identified in this standard. The effective date allows entities time to make revisions to their existing transmission vegetation management programs to comply with the new requirements. This standard becomes effective on the first calendar day of the first calendar quarter one year after the date of the order approving the standard from applicable regulatory authorities where such explicit approval is required. Where no regulatory approval is required, the standard becomes effective on the first calendar day of the first calendar quarter one year after Board of Trustees adoption.

To provide further explanation, the obligation to perform an *annual* inspection of 100% of its applicable lines is a new threshold of performance being established by this standard, as the previous version only required entities “define a schedule for... ROW inspections.” Establishing this new threshold will require additional financial planning and budgeting for some entities, as it goes beyond their current plans. For example, Alberta Electric System Operator provided the following comment during the development of the standard: “In many of the areas in Alberta, due to cold climate and arid conditions, we have slow vegetation growth rates. The requirement for minimum annual inspection is not necessary.” Hydro One Networks, Inc., Orange and Rockland Utilities, Inc., and National Grid commented “Once per calendar year is not sensitive to local and environmental factors... Other TOs may be located in parts of the continent with little or no vegetation and not need a once per calendar year inspection.” As such, although some entities may already perform some sort of inspection on an annual basis, providing a one year period for entities to plan and budget for the manner in which they will meet the requirements of the standard is reasonable.

QUESTION 9

The proposed standard revises NERC’s definition of “Right-Of-Way” (ROW). What obligations govern a Transmission Owner who identifies a vegetation condition that might encroach into the MVCD, if the vegetation is located outside of the ROW as defined by the TO under the proposed standard, but inside of the legal ROW?

NERC Response:

The use of the term “legal ROW” in Question 9 is unclear. We assume that this term is intended to mean any other legal land rights of the Transmission Owner that are not considered part of the “Right-of-Way,” based on the NERC definition of “Right-of-Way” shown below:

Right-of-Way (ROW)

The corridor of land under a transmission line(s) needed to operate the line(s). The width of the corridor is established by engineering or construction standards as documented in either construction documents, pre-2007 vegetation maintenance records, or by the blowout standard in effect when the line was built. The ROW width in no case exceeds the Transmission Owner's legal rights but may be less based on the aforementioned criteria.

NERC's response below is based on this interpretation of the Commission's use of the phrase "legal ROW."

The following scenarios explain the obligations that govern a Transmission Owner (TO) who identifies a vegetation condition that might encroach into the Minimum Vegetation Clearance Distance (MVCD), if the vegetation is located outside of the ROW as defined by the TO under the proposed standard, but inside of the legal ROW.

1. A grow-in from a tree or the tree wall into the ROW. The definition of ROW provides for "The corridor of land under a transmission line(s) needed to operate the line(s)." Therefore, in order to operate the line consistent with its rating, the ROW includes space for "blowout" of the lines within the context of the MVCD. With respect to the grow in of a tree from outside the ROW as defined but within the legal ROW, the TO will use vegetations inspections to identify "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." In the event, an inspection shows that a tree has already grown inside the MVCD, the TO would be in violation of R1 item 1 or R2 item 1. Another way to consider this issue is that tree growing into the MVCD from the side is no different from a tree growing into the MVCD from below the line.

2. A fall-in of danger timber (dead, diseased or dying) from outside of the ROW but within the TO's control. The definition of inspection covers vegetation "...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." Under this requirement, if the TO is regularly identifying its danger trees and has a program for managing the risk of fall-in there would be no violation. Conversely, if an outage occurs and it is confirmed that the TO was not attempting to identify its danger timber risk, the TO would be in violation of R6:

R6. Each Transmission Owner shall perform a Vegetation Inspection of 100% of its applicable transmission lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW

Also, if the TO identifies the danger tree but puts no plan into effect to manage the risk of fall-in, the TO would be in violation of R7:

R7. Each Transmission Owner shall complete 100% of its annual vegetation work plan of applicable lines to ensure no vegetation encroachments occur within the MVCD. Modifications to the work plan in response to changing conditions or to findings from

vegetation inspections may be made (provided they do not allow encroachment of vegetation into the MVCD) and must be documented.

The same is the case if the TO had knowledge of a probable encroachment into the MVCD and did nothing to eliminate the encroachment.

3. A fall-in of a green tree from outside of the ROW but within the TO's control. No practical inspection program or technology is capable of identifying which green or "healthy" trees may fall into the MVCD. Further, the fact that the TO owns additional ROW over and above than that needed by the MVCD is insufficient reason to cut healthy green trees. To require the cutting of green, healthy trees that pose no known threat would likely not be environmentally, socially or politically acceptable.

4. Acts of God. There will always be the possibility that Acts of God, such as tornadoes, strong thunderstorms and hurricanes will propel trees into lines from beyond the ROW and MVCD. Since Acts of God are beyond the control of the TO, there would be no violation if a tree from outside the ROW is propelled by an Act of God into the MVCD or line.