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NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Improved Violation Risk Factors Proposal

Executive Summary

The current Violation Risk Factor (VRF) definitions were never vetted through the NERC Standards Process, primarily due to time constraints during the Electric Reliability Organization (ERO) startup. While the current definitions were a useful start, the lack of examples and clear divisions between risk levels led to inconsistency in their application and potential misallocation of resources.

Another primary problem is that risk is confused with importance. There are many requirements in the standards that are important, but implementing them incorrectly or late does not necessarily lead to cascading failures. Risk, as it applies to the Bulk Electric System (BES), includes both the impact of an event and the probability of the event occurring.

There has been a ratcheting effect in the current standards development and approval process that tends to inflate assigned risk. While this may seem to enhance reliability, it actually draws attention and resources away from true priorities.

This document provides two things: 1) a plan to develop a clearer set of VRF definitions, and 2) a plan to develop a more consistent and objective approach of assigning VRFs to reliability standards.

Background

Violation Risk Factors (VRF) were initially developed by the NERC Compliance and Certification Committee (CCC) as a means to communicate the significance of violations to the NERC Board of Trustees. The VRF definitions were drafted within the CCC and were never publicly vetted with the industry. Since the VRFs were seen as vital to the compliance enforcement process of the ERO, the VRFs were developed through a series of expedited surveys and balloting periods for the approval of the Version 0 and 1 sets of standards in their entireties.

While the VRF definitions were a good start, there were several problems identified as they were assigned to the standards:

- The initial assessment of VRFs by the NERC CCC classified 2/3 of all requirements in the V0 standards as high risk, indicating a lack of consistency in their application.
- The subsequent Violation Risk Factor drafting team noted many cases where they were tasked to assign risk factors to administrative items or explanatory text.
- Eventually an average score of survey responses was used to assign risk. The first surveys had default answers to the questions. If an entity chose not to answer a section of the survey, the default answers skewed the results.
- Changes to NERC- assigned VRFs directed by the FERC once the standards were filed further implies a lack of common understanding of risk, and the need for a more objective and transparent process.

Risk Discussion

Merriam-Webster's Dictionary defines risk as *possibility of loss or injury* and also *the degree of probability of such loss.* Risk, as it applies to the Bulk Electric System (BES), includes both the impact of an event and the probability of it occurring[1]. Risk, as it applies to the NERC Reliability Standards, should include both the potential impact of not complying with an individual standard requirement along with the probability of the potential impact of occurrence.

Proper assignment of Violation Risk Factors (VRF) to requirements in the reliability standards will help to ensure that the industry's resources are properly prioritized and committed to those areas which present the highest risk and most direct impact on BES reliability.

The original NERC operating policies were based on an evolving defense-in-depth philosophy which inherently included the risk concept and survives today in its purest form as contingency analysis. Conventional operations rely on continuously positioning a system to be able to withstand the next credible contingency without adverse impacts on the interconnected BES. Risk is factored into the credibility of a contingency.

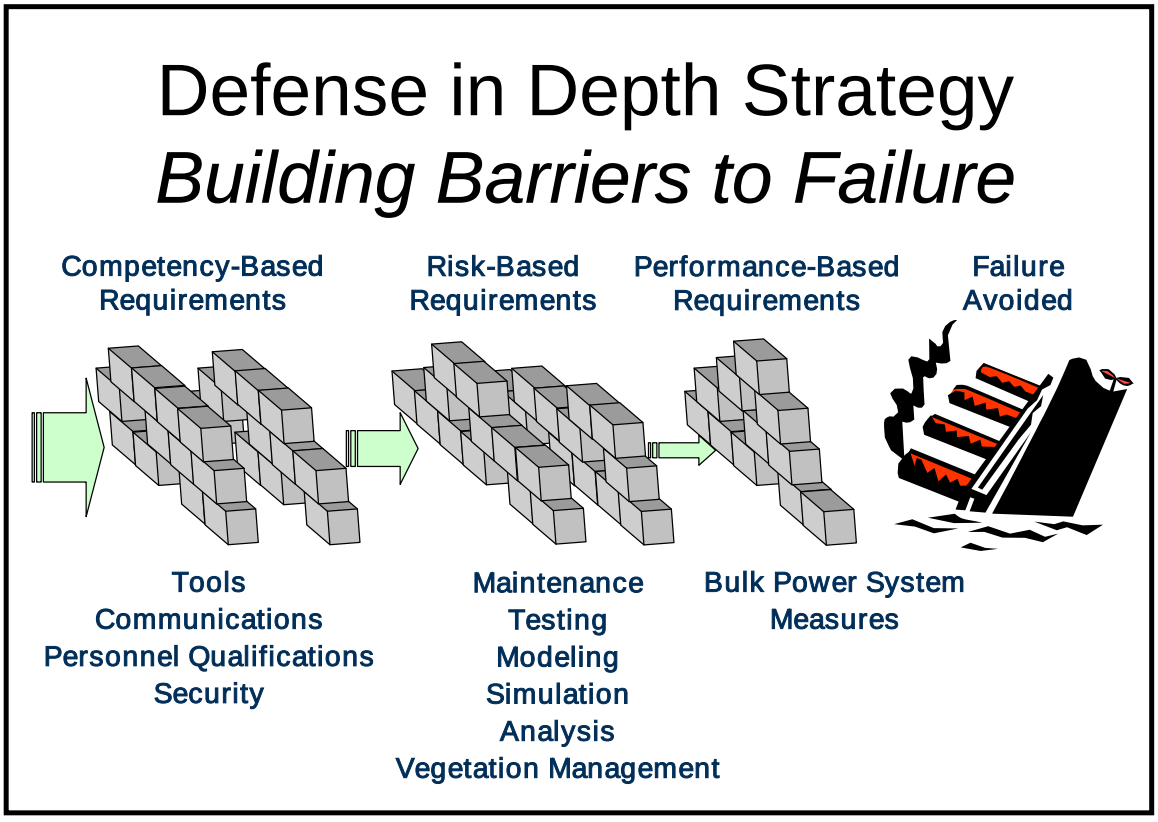

Figure 1 Defense in Depth

[1] NERC *Reliability Criteria and Operating Limits Concepts*

As a simple example, a High-risk item puts the Interconnection one credible contingency away from cascading. A Medium risk item measurably burdens others or risks damage to major facilities, while Lower risk items currently include everything else. This does not mean a Lower risk item is not important, just that it is not likely to lead directly to cascading, instability, uncontrolled separation, or other extreme outcomes. It takes repetitive or many violations of Lower risk requirements to lead to a significant event.

To further illustrate, an important administrative requirement such as reviewing a plan or document by a specific date would not likely lead to reliability problems unless many other violations took place at the same time or the delay was excessive.

Risk should not be confused with importance, and VRFs should not be used as measures of importance. The defense-in-depth philosophy means there are many layers of requirements protecting the BES, and that proper categorization results in an effective way to focus appropriate resources on the many things that we do as an industry that are important, but failure to do that important thing one time (or be late doing it) does not individually jeopardize the Interconnection or cause a cascading failure.

Even though risk should not be confused with importance, the current assignment of VRFs has, to some extent, done just that. The original assignment of VRFs was done via a mass survey which likely skewed the assessed risk values based on importance to the respondents.

Accident theory has found that the distribution of contributing events to mishaps follows a pyramid shape, where there are relatively few medium risk actions (or omissions) compared to low risk items, and even fewer high risk items[2]. The present distribution of VRFs in the NERC Standards implies we have either not identified many lower and medium risk problems or the current process has a tendency to inflate the VRFs.

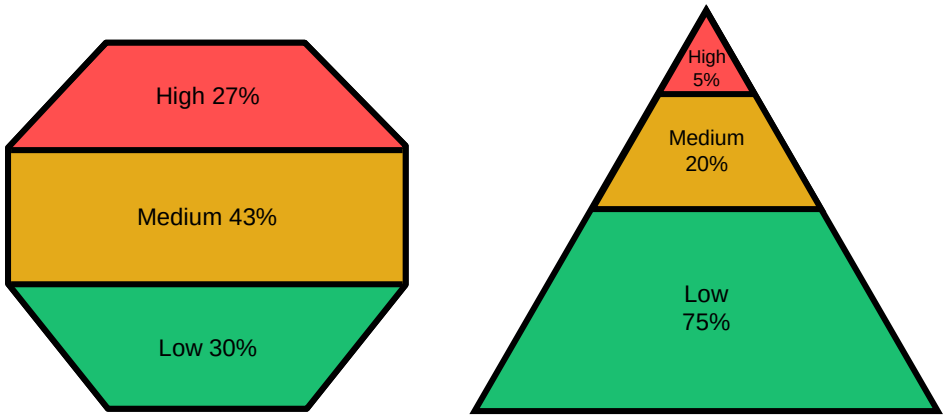

Figure 2 Present vs. Theoretical Distributions of Risk Factors

[2] Heinrich, H., 1959, Industrial Accident Prevention, McGraw Hill, London

The industry has recently observed an upward ratcheting effect in the assignment of VRFs. Standard drafting teams are being told that the FERC will not look favorably on a standard that only contains Lower VRFs. When the standard is filed, generally several of the VRFs are elevated due to importance regarding reliability or consistency with other standards. The "ratcheted" VRFs then become the benchmark against which future standards are compared.

In a world of limited resources, it is important to reliability that we focus the attention of the industry on events and behaviors that pose the greatest risk. When everything is a "number 1" priority, nothing gets special attention.

While it is conceivable to develop scenarios where violation of almost any requirement in the standards could lead to significant events, evaluation of VRFs should be done assuming no other requirement is violated. As noted in almost any system disturbance report, many things have to go wrong to cause the unfortunate outcome, and under the ERO, multiple violations would be assessed.

It should be noted that theoretical pyramid distribution of risk applies to the entire spectrum of requirements and violations. A particular standard may only have High risk VRFs, while another that has less impact on reliability has only Medium and Lower requirements.

Relationship to Violation Severity Levels

Violation Severity Levels (VSLs) are the factors that escalate a sanction based on how badly an entity performed or more specifically the degree by which a requirement was not achieved relative to full compliance.

Driving 5 mph over the speed limit is not as severe as going 30 mph over the limit. Speeding carries a greater risk than a parking infraction. Going through a red light or a railroad semaphore carries a greater risk than speeding. A violation can be severe (being 30 days late paying a ticket) without posing a significant risk.

VSLs do not determine what level of VRFs should be assigned to a particular requirement. While the compliance enforcement processes use both, it is not proper to influence or bias the VRF assignment based on the VSLs.

Proposed Definitions and Examples

As noted previously, the current VRF definitions were never vetted through the industry. Processing the definitions through the industry would have forced the drafters to provide additional clarity and examples. Clearer definitions and examples will help the industry better assign risk, which will focus attention on those things in proportion to their impact on reliability.

The Process Subcommittee of the NERC Standards Committee proposes to add two additional VRF categories (Severe and Administrative), to clarify the existing categories (High, Medium, and Lower), and to include a detailed explanation of the relationship between impact of a

violation, the probability of a violation occurring, and time horizons, as well as a process for determining VRFs.

Evaluating Outcomes and Probabilities

Violation Risk Factors (VRFs) are a measure of the impact that a violation of a requirement has on BES reliability, and are used by Compliance when determining sanctions. VRFs are developed based on a combination of three factors: Risk Outcomes, Risk Probabilities, and Time Horizons. The risk outcomes suggested below are based on the NERC definition of "Adequate Level of Reliability" and the Reliability Objectives defined within NERC's Rules of Procedure.

Risk Outcomes

NERC Violation Risk Factors are partially determined based on five potential Risk Outcomes. These Risk Outcomes are scenarios that may result from the violation of a requirement and represent an undesirable result from a reliability perspective.

Risk Outcome 1: The interconnection is one credible contingency away from cascading, uncontrolled separation, or instability.

Risk Outcome 2: Load is dropped on an involuntarily or uncontrolled basis.

Risk Outcome 3: Components of the Bulk Electric System have been damaged.

Risk Outcome 4: The ability to restore the system following an event has been hindered.

Risk Outcome 5: The reliability of another entity has been negatively impacted.

Risk Probabilities

NERC Violation Risk Factors are partially developed based on Risk Probabilities. These Probabilities represent the likelihood that a violation will lead to a given Risk Outcome.

High: A violation has a high probability of leading to a given Risk Outcome.

Potential: A violation could, but probably will not, lead to a given Risk Outcome.

Contributing: A violation, if combined with other violations of the NERC Reliability Standards, could, but not necessarily will, lead to a given Risk Outcome.

Time Horizons

NERC Violation Risk Factors are partially developed based on Time Horizons. These Time Horizons represent the time frame during which a violation occurs. Violations that occur in Real-Time present a greater risk that those that occur in other Time Horizons, as real-time is generally the last line of defense in a risk management strategy. The Time Horizons are:

- **Real-Time**: Current hour operations.
- **Same Day**: Beyond current hour, up to the end of the current operating day.
- **Operations Assessment**: Follow-up evaluations and reporting of real time operations.
- **Operations Planning and Support**: From next-day up to one year.
- **Planning:** From one year and beyond.

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Determining Violation Risk Factors

NERC is proposing moving from a 3-tiered VRF approach to 5-tiers. The FERC gave NERC the discretion to increase the number of VRFs in Order No. 693. Added granularity is expected to benefit due process (many people have recommended a "traffic ticket" approach for minor infractions). It will also allow the Industry and NERC to focus on those things that have the greatest impact on reliability. The five proposed Violation Risk Factors are defined below.

Violation Risk Factors

Severe Risk

A severe risk violation is an action or omission in real-time that by itself places the interconnection one credible contingency away from cascading, uncontrolled separation, or instability, or other severe Risk Outcomes.

Examples of severe-risk violations may include:

- Failure to correct an IROL within its Tv.
- Failure to follow a Reliability Coordinator's directive during a system emergency
- Failure to issue a directive to remedy an emergency situation
- Failure to coordinate and maintain protective relaying systems on critical BES facilities
- Failure to address a common-mode failure vulnerability in Critical Infrastructure Protection that could directly lead to a severe Risk Outcome.

High Risk

A High risk violation is an action or omission that has significant impact on reliability of the BES, but cannot by itself place the interconnection one credible contingency away from cascading, uncontrolled separation, or instability.

Examples of high risk violations include:

- Failure to have a methodology for determining SOLs
- Failure to conduct an operational assessment

Medium Risk

A Medium risk violation is an action or omission that has a moderate impact on reliability of the BES, but cannot by itself place the interconnection one credible contingency away from cascading, uncontrolled separation, or instability.

Examples of medium risk violations include:

- Failure to verify facility capability or model data for reliability analyses
- Failure to conduct a long term assessment
- Failure to periodically review and update a training program

Lower Risk
A Lower risk violation is an action or omission that has limited impact on reliability of the BES, but cannot by itself place the interconnection one credible contingency away from cascading, uncontrolled separation, or instability.

Examples of lower risk violations may include:

- Failure to provide data or documents (excludes data needed for real-time operations) within a specified date
- Failure to develop a database
- Failure to participate in a conference call or meeting to coordinate operational plans

Administrative
In Order No. 693, the FERC left it to the ERO's discretion[3] whether or not to create an "administrative" category of VRF. Such a category could provide additional distinction in the standards, similar to the division between misdemeanors and felonies in our justice system. For the purposes of this discussion, this includes the violation of any requirement in any time frame that is procedural or administrative in nature, or whose risk is otherwise sufficiently diminished based on Risk Probability or Time Horizon.

Examples include:

- Action or omission that pertains to the provision of data and documentation (except that required in the real-time to operations planning time frames)
- After-the-fact reporting, and database development and maintenance
- Requirements that explain other requirements
- An action or omission of action that pertains to support activities that facilitate market operation

NERC Violation Risk Factors are a combined set of the Risk Outcome, Risk Probability and Time Horizon factors identified above. If a violation of a requirement can lead to multiple Risk Outcomes in multiple Time Horizons and multiple Risk Probabilities, the VRF is based on the combinations resulting in the highest VRF.

Any Requirements that have no High, Potential, or Contributing Risk Probability for any Risk Outcome in any Time Horizon are considered Administrative.

Special Rule for Contributing VRFs

[3] Mandatory Reliability Standards for the Bulk-Power System (Issued March 16, 2007), Docket No. RM06-16-000; Order No. 693, p 78

If a Violation Risk Factor has been established based on a Contributing Risk Probability, and a violation would directly cause the violation of another requirement with a higher VRF, the VRF of the contributing requirement is raised by one level (e.g., from "Lower" to "Medium.")

Approach for Assigning VRFs

NERC and a group of Industry volunteers are field-testing a tool that leads drafting team members through a series of questions based on the definition of "Adequate Level of Reliability". The responses to the questions generate one of five possible VRFs based on impact to the BES. Using a common tool helps achieve the FERC guidelines to have consistency of VRFs among standards and consistency of VRFs within standards.

The tool is designed to generate both a 3-tier and a 5-tier VRF. The tool will also create a permanent, transparent record of the drafting team's response to the questions. Creating both 3-tier and 5-tier VRFs will allow the tool to be "test driven" until NERC's Rules of Procedure can be modified to allow five VRFs. The permanent record will allow the work of drafting teams creating VRFs in the interim to be easily converted once the 5-tier approach is approved.

Implementation Plan

NERC will survey the industry on definitions outlined in this document and the approach to assigning 5-tiered VRFs. The tentative timeline is outlined below.

Task	Date
Standards Interface Subcommittee and its Compliance Elements Drafting Resource Pool (CEDRP) field test two tool options	Complete
Update tool based on comments and CEDRP field test	Complete
Present Implementation Plan and Survey to Standards Committee Process Subcommittee for endorsement	Complete
Present plan, document and tool to the NERC Compliance and Certification Committee (CCC) and the CCC Standards Interface Subcommittee	Complete
Obtain SC Endorsement and approval to post survey	Complete
Post Industry Survey, document and tool questions for comment	April 2010
Hold WebEx	April 2010
Update document and tool questions based on comments	May 2010
Repost document and tool	June 2010
Obtain SC endorsement to present to BOT	June 2010
Submit to the NERC BoT for approval	TBD
Provide tool* to drafting teams for continued field test	June 2010
File changes to the Rules of Procedure (Definitions and Sanctions Matrix)	TBD

* The VRF Tool will be capable of creating both 3-tier and 5-tier VRFs. Three-tier VRFs will be used until a change is made to the Rules of Procedure.

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References

Heinrich, H., 1959, Industrial Accident Prevention, McGraw Hill, London

NERC Definition of "Adequate Level of Reliability"

NERC Reliability Criteria and Operating Limits Concepts

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