

Definition: Adequate Level of Reliability for the Bulk Electric System

Definition¹

Adequate Level of Reliability (ALR) is the state that the design, planning, and operation of the Bulk Electric System (BES) will achieve when the following reliability performance and assessment objectives are met:

ALR Performance Objectives

1. The BES does not experience instability, uncontrolled separation, Cascading,² or voltage collapse under normal operating conditions and when subject to predefined Disturbances.³

The performance outcomes are:

- *Stable frequency and voltage within predefined ranges*
- *No instability, uncontrolled separation, Cascading, or voltage collapse*

2. BES frequency is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.

The performance outcomes are:

- *Stable frequency within predefined range*
- *BES equipment limits satisfied*
- *Frequency oscillations experience positive damping*

The “predefined Disturbances” in Performance Objectives 1-3 and Assessment Objectives 1 and 2 are the more probable Disturbances to which the power system is planned, designed, and operated. These Disturbances have a higher probability of occurring than other severe, low probability events; BES facilities are designed and operated to withstand these Disturbances. An example of a predefined Disturbance is the loss of a transmission circuit due to a lightning strike.

¹ Adequate level of reliability is a term used in Section 215 (i)(2,3) of the Federal Power Act specifying what standards the electric reliability organization (ERO) can develop and enforce. Section 215 specifically does not authorize the ERO to develop standards related to adequacy and safety. However, this definition is meant to encompass all the duties of the ERO including obligations to perform assessments of resource and transmission adequacy. Provisions marked with an asterisk (*) denote objectives not related to NERC's standards development and enforcement activities.

² NERC's Glossary of Terms defines Cascading as: “The uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies.”

³ NERC's Glossary of Terms defines Disturbance as: “1. An unplanned event that produces an abnormal system condition; 2. Any perturbation to the electric system; 3. The unexpected change in ACE that is caused by the sudden failure of generation or interruption of load.”

3. BES voltage is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.

The performance outcomes are:

- *Stable voltage within predefined range*
- *BES equipment limits satisfied*
- *Voltage oscillations experience positive damping*

4. Adverse Reliability Impacts⁴ on the BES following low probability Disturbances (e.g., multiple contingences, unplanned and uncontrolled outages, cyber security events, malicious acts) are managed.

The performance outcome is that the propagation of frequency, voltage, or angular instability, uncontrolled separation, or Cascading is managed.

5. The integrity of the BES is restored in a controlled manner after major system Disturbances, such as blackouts and widespread outages.

The performance outcome is to recover the BES and restore available resources and load to a stable interconnected operating state expeditiously after a major system Disturbance.

The Disturbances in Performance Objectives 4 and 5 cannot be predefined. For these less probable severe events, BES owners and operators may not be able to apply any economically justifiable or practical measures to prevent or mitigate their Adverse Reliability Impact on the BES despite the fact that these events can result in Cascading, uncontrolled separation or voltage collapse. For this reason, these events generally fall outside of the design and operating criteria for BES owners and operators. Less probable severe events would include, for example, losing an entire right of way due to a tornado or hurricane, or simultaneous or near simultaneous multiple transmission facilities outages due to geomagnetic Disturbances.

ALR Assessment Objectives

“Adequate level of reliability” is a term used in Section 215 (i)(2,3) of the Federal Power Act specifying what standards the electric reliability organization (ERO) can develop and enforce. Section 215 specifically does not authorize the ERO to develop standards related to adequacy and safety. However, this definition of ALR is meant to encompass all the duties of the ERO, including obligations to perform assessments of resource and transmission adequacy.

⁴ NERC’s Glossary of Terms defines Adverse Reliability Impact as “The impact of an event that results in Bulk Electric System instability or Cascading.”

A target to achieve adequate transmission transfer capability and resource capability to meet forecast demand is an inherent, fundamental objective for planning, designing, and operating the BES. Without that as an objective, the electricity supply business would not have been required in the first place.

The assessment objectives do not imply or suggest that NERC Reliability Standards mandating that transmission or generation additions be developed. They are intended to serve as a framework for standards development, but not every objective will require the development of a standard, nor does each reliability objective prescribe how the objective is to be achieved.

1. Sufficient BES transmission capability is available to meet required BES demands during normal operating conditions and when subject to predefined Disturbances.

The outcome is that assessment results are available to provide situational awareness for appropriate actions.

2. Sufficient resource capability is available to the BES to meet required BES demands during normal operating conditions and when subject to predefined Disturbances.

The outcome is that assessment results are available to provide situational awareness for appropriate actions.

Time Periods and Performance Outcomes

In the associated technical report supporting this definition, performance outcomes associated with each reliability objective are addressed in further detail based in four time frames:

Steady State – Time period before a Disturbance occurs. It is a stable pre-event condition for the existing system configuration, which includes all existing BES elements, including elements on maintenance, planned, or unplanned outage.

Transient – Transitional time period beginning after a Disturbance in which high-speed automatic actions occur in response to the Disturbance. This time period starts at the time of the Disturbance and can continue for seconds or until a new steady state is achieved.

Operations Response – Time period after a Disturbance during which some automatic devices and operators act to minimize the impact of Disturbances and return the BES to a new steady state, if possible. This state may begin seconds after the Disturbance and continue for hours.

Recovery and System Restoration – Time period after a widespread outage or blackout occurs, through the initial restoration to a sustainable operating state, and recovery to a new steady state that meets reliability objectives established by the circumstances of the Disturbance.

Technical Report Supporting Definition of Adequate Level of Reliability

The associated technical report describes the relationship among reliability and assessment objectives, performance outcomes, and Disturbances in greater detail. The report also provides some examples of means to meet reliability objectives. Reviewed together, these items provide the tools for both understanding and achieving an adequate level of reliability.

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