United States of America
Federal Energy Regulatory Commission

FERC FORM 715
Annual Transmission Planning and Evaluation Report
Duke Energy Ohio and Duke Energy Kentucky
Part 4: Transmission Planning Reliability Criteria

Duke Energy Ohio and Duke Energy Kentucky adheres to any applicable NERC and RFC Reliability Standards.

Duke Energy Ohio and Duke Energy Kentucky is a member of the PJM Interconnection, LLC (PJM) Regional Transmission Organization (RTO). PJM manages a regional planning process for generation and transmission expansion to ensure the continued reliability of the electric system. PJM annually develops a Regional Transmission Expansion Plan (RTEP) to meet system enhancement requirements for firm transmission service, load growth, interconnection requests and other system enhancement drivers. The criteria PJM uses in developing the RTEP is set forth in PJM Manual 14B. PJM is designated as the Transmission Planner for Duke Energy Ohio and Duke Energy Kentucky.

Duke Energy Ohio and Duke Energy Kentucky also has its own detailed planning criteria, which are shown on the following pages. Violations of these criteria would result in one or several of the following actions: expansion of transmission system, operating procedures, or a combination of the two. Acceptance of operating procedures is based on engineering judgment with the consideration of the probability of violation weighed against its consequences and possibly other factors.

Voltage

Bus voltages are screened using the Transmission System Voltage Limits below. These Limits specify minimum and maximum voltage levels during both normal and single contingency conditions. Emergency Voltage Limits are defined as the upper and lower operating limits of each bus on the system.

The voltage limits are expressed as a percent of the nominal voltage.

Under conditions beyond single contingencies, voltages above or below these limits may occur. These conditions should be investigated to determine what actions, if any, are required so that they would not result in wide-spread outages. Should post-contingency transmission voltages in a general area drop below the emergency limits in the table below, closer examination is warranted to determine whether voltage collapse for such contingency conditions is likely.

Transmission System Voltage Limits

Nominal Voltage (kV)	Normal Voltage Limits		Emergency Voltage Limits	
	Minimum	Maximum	Minimum	Maximum
345	95%	105%	90%	105%
138	90.9%	102.8%	88.0%	105.2%
69	90.9%	102.8%	88.0%	105.2%

Thermal

The following guidelines shall be used to ensure acceptable thermal loadings:

a) Under normal conditions, no facility should exceed its continuous thermal loading capability.

b) For a single contingency no facility should exceed its emergency loading capability.

Stability

The stability of the Duke Energy Ohio and Duke Energy Kentucky systems and neighboring systems must be maintained for the contingencies specified in the applicable sections of the NERC and RF Reliability Standards. Generating units must maintain angular stability under various contingency situations. Many different contingencies are considered, and the selection is dependent on the location within the transmission system.

Fault Duty

All circuit breakers should be capable of interrupting the maximum fault current duty imposed on the circuit breaker.

Single Contingencies

The thermal and voltage limits should not be violated for either normal operations or under the loss of:

a) A single transmission circuit
b) A single transformer
c) A single generating unit
d) A single reactive power source or sink

Severe Contingencies

NERC Reliability Standards instruct transmission planners to evaluate extreme (highly improbable) contingency events resulting in multiple elements removed or cascading out of service. Severe contingencies are evaluated to determine the impact on the transmission system and on the surrounding interconnected transmission system. The severity of the consequences, availability of emergency switching procedures, probability of occurrence and the cost of remedial action will be considered in the evaluation of these contingencies.

For example double contingency line outages are considered in cases involving 138 kV underground cable feeders, which supply the West End and Charles substations in the Cincinnati, Ohio metropolitan area. For an outage of any other line with one such underground circuit out of service, the loading on all lines should be no higher than 100% of the emergency conductor rating and voltage should be 90% or higher at all points on the 138 kV system.

These planning criteria are not intended to be absolute or applied without exception. Other factors, such as severity of consequences, availability of emergency switching procedures, probability of occurrence and the cost of remedial action are also considered in the evaluation of the transmission system.