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FAC-001-2 V1.4
Facility Connection Requirements
UGI Utilities, Inc. Electric Division

Introduction

This document, referred to as the Facility Connection Requirements (FCR), describes UGI Utilities, Inc. Electric Division's (UGI) requirements for new connection and modification of existing connections to UGI's Bulk Electric System (BES) for:

- Generation facilities
- Transmission facilities
- End-user facilities

Where appropriate, FCRs unique to the type of interconnection (generation, transmission or end-user) are noted. All User new connections or modification to existing connections to the UGI owned BES must comply with this FCR. UGI reserves the right to modify and amend this FCR at any time.

Purpose

This FCR is published by UGI in response to NERC Reliability Standard FAC-001-2, "Facility Connection Requirements." The stated purpose of FAC-001-2 is "To avoid adverse impacts on reliability of the BES, Transmission Owners and applicable Generator Owners must document and make Facility interconnection requirements available so that entities seeking to interconnect will have the necessary information.

About UGI

UGI Utilities Inc. is a subsidiary of UGI Corporation, a distributor and marketer of propane, natural gas, and electricity, as well as related energy products and services. UGI Corporation is headquartered in Valley Forge, Pennsylvania, and is listed on the New York Stock Exchange.

UGI's Electric Division delivers electricity to approximately 62,000 customers in portions of Luzerne and Wyoming County. The utility operates and maintains more than 2,100 miles of electric transmission and distribution lines and 14 transmission substations.

About 53 percent of the Electric Division's annual sales volume comes from residential customers, 35 percent from commercial customers, and 12 percent from industrial customers. The Electric Division's service territory covers approximately 410 square miles and is shown on the map below.

UGI's system is within the PJM Interconnection, L.L.C (PJM) footprint.

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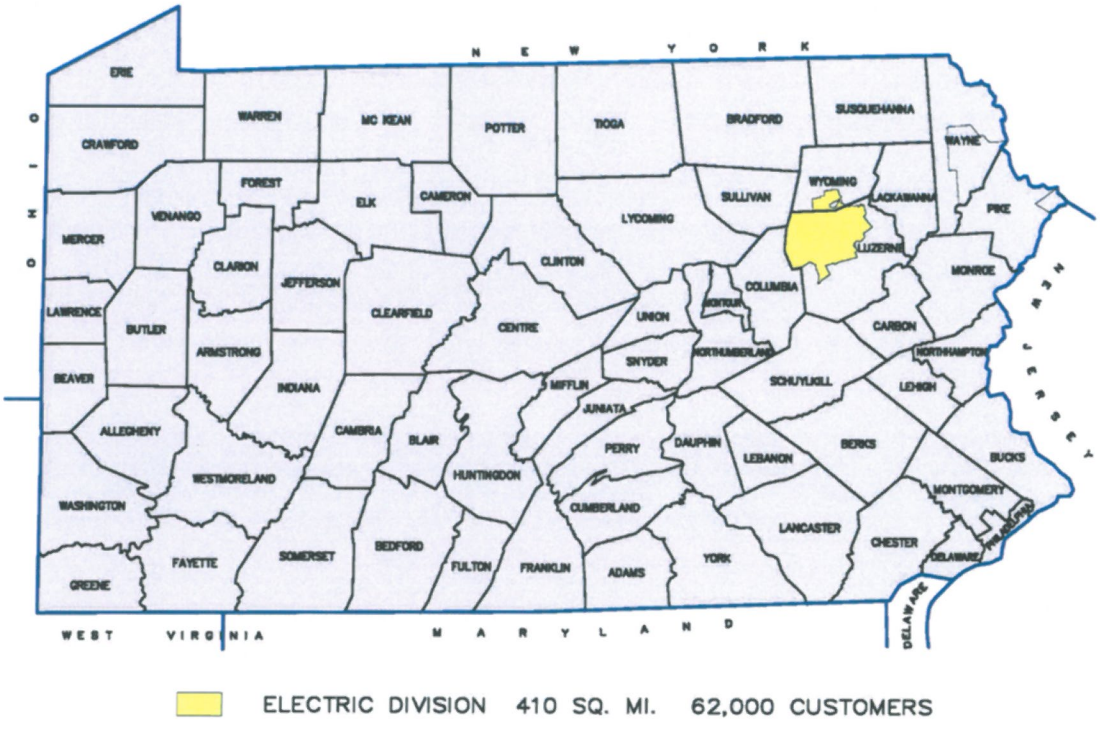
UGI's Electric Division Service Territory



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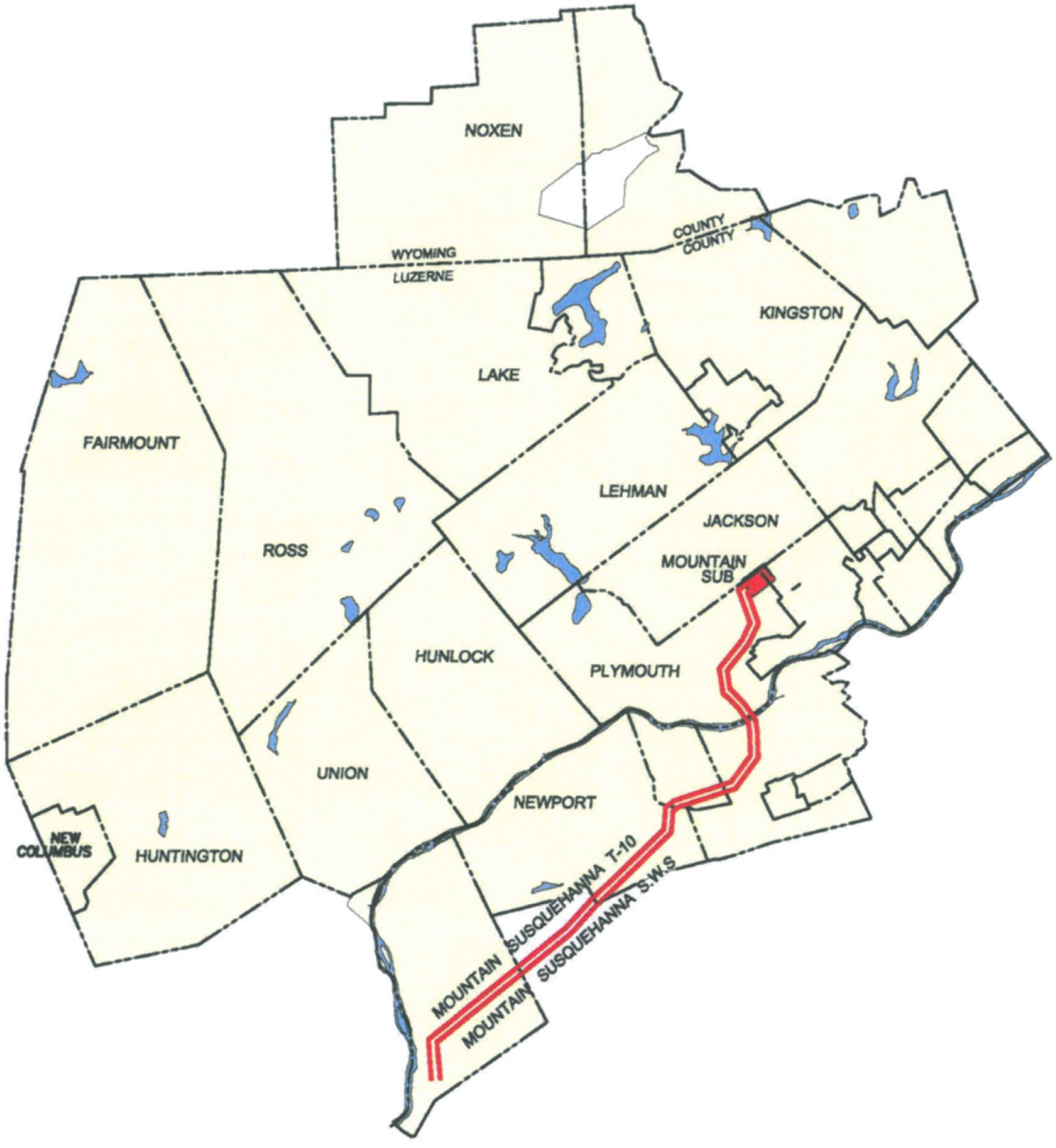
UGI BES is approximately 16 miles of double circuit 230kV transmission line. The map below shows the general location of the 230kV line within UGI's electric service territory.



Connection Configuration

UGI requires that all User connections to its BES be at a switching station or substation. If no such station exists at the point of connection, one must be constructed. Direct connection or flying tap connections to the BES are not permitted. The station must be configured such that there are at least two terminal bays to allow UGI's existing line to be looped through the station and a third terminal bay for the new facility connection. The station shall be configured as either a "breaker and a half" or "ring bus" design. UGI will designate which design is needed during the application process.

(R1) Each Transmission Owner shall document Facility interconnection requirements, update them as needed, and make them available upon request. Each Transmission Owner's Facility interconnection requirements shall address interconnection requirements for:

Generation Protection (R1.1)

Protection requirements for generators shall include at a minimum:

- Overvoltage/undervoltage
- Overload
- Phase and ground fault
- Open circuit
- Phase unbalance and reversal
- Over frequency/under frequency
- Loss of source
- Isolated operating conditions
- Prevention of dead line reclosing

Loss of excitation and out of step protection may also be required at the sole discretion of UGI.

The Applicant shall provide a circuit breaker at the high side of the generator step up transformer prior to the point of connection. The Applicant shall be solely responsible for disconnecting the generator

from the system if system conditions are such that continued connection to the system would damage the generator.

Transmission line and End Use Protection (R1.2 & R1.3)

Acceptable transmission line and end use protective relaying schemes are:

- Differential relaying using high speed communications between ends of the line for primary and back up relaying.
- Impedance relaying (Zone 1, Zone 2, and Zone 3) with permissive over reach, stuck breaker transfer trip for primary and back up relaying.
- Directional over current and directional ground over current for back up protection.

The end use stepdown transformer may be included in the differential zone at the connection station. The Applicant must provide a circuit breaker on the low side of the transformer to isolate faults beyond the stepdown transformer. Stuck breaker protection for the low side circuit breaker must be provided as specified by UGI. Reclosing of overhead transmission lines may be allowed as determined solely by UGI.

R2. Each applicable Generator Owner shall document Facility interconnection requirements and make them available upon request within 45 calendar days of full execution of an Agreement to conduct a study on the reliability impact of interconnecting a third party Facility to the Generator owner's existing Facility that is used to interconnect to the Transmission system.

R3. Each Transmission Owner shall address the following items in its Facility interconnection requirements:

Application Process (R3.1), (R3.2)

UGI is a member of the PJM RTO and a signatory of the PJM Operating Agreement. As such UGI participates in and relies on the PJM RTEP process to assure that UGI's BES facilities are adequate to achieve the system performance required over the RTEP planning horizon. PJM performs this function pursuant to the RTEP process set forth in Schedule 6 of the PJM Operating Agreement. The results of the RTEP process are published in the annual Regional Transmission Expansion Plan Report.

To that end, all applications for a new connection or a modification of an existing connection to the UGI BES from a Generation or Merchant Transmission Developer (Developer) are made to PJM and must

follow the process defined by PJM. This process is described in the PJM Operating Agreement, Schedule 6, the PJM Open Access Transmission Tariff, Part IV, and in PJM Manuals 14A, 14B, 14C, 14D, and 14E. These manuals describe the application process and the procedures the Applicant is to follow from beginning to end on a step by step basis.

UGI does not provide for the interconnection of generation or transmission facilities to the UGI BES outside of the PJM process. UGI as a Transmission Owner is obligated under the above documents to cooperate with PJM and the Developer to ensure a successful and reliable interconnection process.

Once an application for interconnection is made, PJM as the Regional Transmission Organization administers the interconnection process and determines the impact of the proposed connection on the entire BES including that owned by UGI. The process and the studies performed to evaluate the impact are identified in the PJM Open Access Transmission Tariff, Part IV, and in PJM Manual 14A.

PJM will notify and involve UGI; and, to the extent needed, others in the study process to develop costs of construction and assure all parameters unique to the area of the BES being impacted by the User's connection are included in the study.

Guidelines and Technical Basis

Each Transmission Owner and applicable Generator Owner should consider the following items in the development of Facility interconnection requirements:

Voltage Level and MW and MVAR Capacity or Demand at Point of Interconnection:

As stated in PJM Manual 14A: Generation and Transmission Interconnection Process, Attachment F Generation Interconnection Feasibility Study Data ,and Attachment G, System Impact Study Data , the Applicant shall provide the voltage level and MW and MVAR capacity or demand at the point of connection. This data is required to perform the power flow and short circuit analysis necessary for the Feasibility and System Impact studies.

Breaker Duty and Surge Protection:

The available fault current (symmetric and asymmetrical) and required AC high voltage circuit breaker operating time will be identified during the connection study. All connection equipment shall be sized at a commercial rating that exceeds the maximum available fault current by at least 20%.

The Applicant shall specify the AC high voltage circuit breaker interrupting current in accordance with ANSI/IEEE Standard C37 series for breakers rated on a "Symmetrical Current Basis." When calculating breaker duty, asymmetrical fault current and other factors will be taken into account in accordance with ANSI/IEEE C37 standards. The required AC high voltage operating time and duty cycle will be determined as part of the connection study.

All of the Applicant's equipment must be designed to withstand temporary overvoltage caused by ground faults. The permissible level and duration of such overvoltage will be determined as part of the connection study. The Applicant's equipment must capable of removing ground faults from the system such that no equipment exceeds its ability to withstand the expected overvoltage.

System Protection and Coordination:

The Applicant's facilities shall meet the minimum design standards and requirements for protection systems associated with the BES within PJM as specified in PJM Manual M-7: "PJM Protection Standards" plus any additional relaying and fault clearing systems as specified by UGI. All protective relays must meet or exceed ANSI/IEEE Standard C37.90. The Applicant's protective relaying shall be designed in such a manner that it does not decrease the load carrying capability or the reliability of UGI's 230 kV transmission line.

All major pieces of equipment shall be protected in their own protection zone with redundant, independent (primary and secondary) protection systems. The power system adjoining UGI (i.e. PPL Utilities) may share a common protection zone with the Applicant (jointly owned transmission line). The Applicant is required to use relaying compatible with all existing relaying within a common protection zone regardless of ownership. This may require the Applicant to provide for the upgrade the existing relaying within the protection zone to achieve compatibility.

All BES equipment is to have primary protective relaying that operates with no intentional time delay for 100% of the specified zone of coverage. A secondary high-speed protection system with a specified time delay is also required. On transmission lines, both of these schemes are accomplished through the use of communications channels between line terminals.

Back-up protective systems are required to provide additional coverage for breaker and relay failure outside the primary zone. This is accomplished through direct tripping of adjacent devices.

At least one power source for tripping and control must be provided at substations by a DC storage battery. The battery is to be sized with enough capacity to operate all tripping devices after eight hours without a charger. An under voltage alarm must be provided for remote monitoring by the Applicant who shall take immediate action upon the receipt of an alarm to restore power to the protective

equipment. UGI may require the Applicant to provide redundant battery systems and redundant breaker trip coils so as not to degrade the reliability of its 230 kV line.

UGI, the Applicant; and, if impacted, neighboring utilities shall work together to perform system coordination studies and set protection system relays in accordance with the current version NERC Standard PRC-001 and its successors and supplements. UGI shall review and approve an Applicants protection system design of any interconnection prior to its installation.

Metering and Telecommunications:

UGI will install the required metering equipment prior to commissioning the facility into operation and shall own, operate, test, and maintain all such equipment. For End Use customers, UGI will test and maintain the accuracy of such metering equipment as specified by its Electric Service Tariff. For Transmission line and Generator connections, UGI will test and maintain the accuracy of such metering equipment in accordance with PJM Manual 01 "Control Center and Data Exchange Requirements." Loss compensation to the connection point is required where the connection point and the metering point are different.

UGI will provide the Applicant mutually agreed upon metered quantities upon request. All metered data will be sent electronically to a location designated by the Applicant and in a format agreed upon by the Applicant and UGI. This data will be the official measurement of the amount of energy delivered to or withdrawn from the system by the Applicant.

The Applicant shall provide for standard voice and facsimile communications between the Applicant and UGI using separate telephone lines.

If the Applicant is a generator, the Applicant will also provide voice communications between itself and PJM in accordance with PJM Manual 01 "Control Center and Data Exchange Requirements." Such communications system shall be in accordance with NERC Standards COM-001 and COM-002 and its successor documents and supplements.

The Applicant will provide a remote terminal unit (RTU) at the point of delivery compatible with UGI's Supervisory and Data Acquisition (SCADA) system. The RTU must be installed and fully functional prior to commissioning the connection to UGI's system into service. The RTU must be connected to UGI's SCADA through UGI's fiber telecommunications network. The measured quantities and equipment status monitored via the RTU will be specified by UGI during the connection facility design.

Grounding and Safety Issues:

The Applicant's connection facility shall conform in all ways with all applicable government and industry standards included but not limited to the National Electrical Safety Code, OSHA Standards, National Electrical Code, IEEE Guides and Standards, ANSI Standards, NERC Standards, and UGI safety and construction standards. The Applicant must adhere to UGI's "De-energizing Equipment for Employee Protection Standard." Under no circumstances shall the Applicant attempt to energize its equipment unless agreed to in advance with UGI's System Operator. This does not prohibit automatic reclosing of overhead transmission lines as mentioned in the System Protection and Coordination section above in this FCR.

Insulation and Insulation Coordination:

The minimum basic impulse level (BIL) of all equipment attached to UGI's 230 kV system is 900KV. Higher BIL equipment may be required if insulation coordination studies indicated it is warranted. Station class surge arrestors are required at all termination points. All insulation and insulation coordination must conform to IEEE Standards 1313.1 and 1313.2.

Voltage, Reactive and Power Factor Control:

Generation and Transmission connections to UGI's 230 kV system must be capable of operating in conformance with the current version NERC Standards VAR-001 and VAR-002; it successors and supplements; and, PJM Manuals 03 "Transmission Operations" and 14D "Generator Operational Requirements." If the installation does not perform within these limits the Applicant will have to install reactive compensation to cause the BES to perform no worse than before the connection was made.

End Use connections shall be operated in accordance with UGI's Electric Service Tariff. End Users must be able to correct to unity power factor during peak load at the point of connection. End User equipment must be capable of accepting service off UGI's 230 kV system at the maximum and minimum voltages that can be experienced on the 230 kV system within the PJM control areas as specified in PJM Manual 03 "Transmission Operations."

Power Quality Impacts:

The Applicant's facility shall not degrade the quality of the BES's voltage or current and shall operate within limits as established by the following standards and guidelines:

- Continuous Voltage Variation - ANSI C844.1
- Harmonics – IEEE Standard 519

- Voltage Flicker – IEC 61000-2-2 and IEEE1453
- Voltage Balance, Negative Sequence Voltage and Current – ANSI/ NEMA MG1, IEEE 112 and ANSI C84.1
- Switching Transients – Within the applicable limits of surge arrestors and insulation as determined through study

Harmonics studies, transient studies and other additional analysis or actual field measurements may be necessary to determine whether these power quality criteria are met. The Applicant may need to install additional equipment as part of the connection to bring its facility within these criteria.

Equipment Ratings:

Generator step up transformers shall be sized to deliver the capacity of the generator to the system under all expected operating conditions. End Use facilities shall be sized to the Applicants expected energy consumption. Transmission connections shall be rated a minimum of 20% above the maximum loading determined by the studies for a 10 year planning horizon.

In each case, the Applicant's connection shall not reduce or limit the capability of UGI's system in any way. The Applicant will remediate any situation where the Applicant's connection limits the capability of UGI's system to less than it was prior to the connection being made. UGI will disallow any such connections up to and including disconnection of the Applicant's equipment.

The Applicant shall develop a rating methodology and rate its equipment consistent with the current version of NERC Standard FAC-008, its successors and supplements.

Synchronizing of Facilities:

The Applicant is responsible for properly synchronizing its equipment to UGI's BES. All synchronization shall be at circuit breakers on the Applicant's side of the connection. Under no circumstances shall UGI's circuit breakers be used as a synchronizing point.

The connection of all operating machinery the Applicant intends operate synchronously with UGI's system shall be supervised by at least one functional synchronizing relay (IEEE Device 25) that supervises the connection and prevents asynchronous connection of the Applicant's machinery to UGI's BES.

Maintenance Coordination:

The Applicant is solely responsible for all maintenance of its equipment. The Applicant shall maintain its system protection equipment in accordance with current version of NERC Reliability Standards PRC-005 and its successors and supplements. The Applicant shall maintain all other connection equipment in conformance with good utility practice. The Applicant that installs and owns an overhead 230 kV transmission line shall have a Vegetation Management Program that conforms to the current version of NERC Reliability Standard FAC-003 and its successors and supplements.

The Applicant shall schedule maintenance of Transmission and Generation equipment in accordance with PJM Manual 03 "Transmission Operations." The Applicant shall schedule maintenance of End Use equipment involving operation of UGI equipment for clearance with UGI system operations at least three days in advance of such need.

UGI may alter any scheduled maintenance outage of the Applicant's equipment when studies indicate such outage reduces the capacity of UGI's 230 kV transmission system below its expected needed capability at the time such outage.

Operational Issues (Abnormal Frequency and Voltages):

The Applicant's equipment must be able to operate within voltage excursions as specified in PJM Manuals 13 "Emergency Operations" and 14D "Generator Operational Requirements" and frequency excursions as specified in PJM Manual 14D "Generator Operational Requirements" for the 230 kV system without sustaining damage or disconnecting from the system. The Applicant must take precaution to protect its equipment from being damaged for voltage and frequency excursions outside the limits specified in the above PJM Manuals which may include disconnection of the Applicant's equipment from the system.

The Applicant must not operate its equipment is such a manner to cause voltage excursions on UGI's transmission beyond the limits specified in PJM Manual 03 "Transmission Operations," IEC 61000-2-2 and IEEE1453.

The Applicant's generating facilities must be capable of remaining on line undamaged for faults on the BES within close proximity to the point of connection with normal protection system clearing time. Voltage at the point of connection may approach zero volts for six cycles during such an event.

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Inspection Requirements for Existing or New Facilities:

UGI shall have the right but not the obligation to inspect any or all of the Applicants existing or new facilities that in any way may impact the reliable operations of UGI's 230 kV transmission system. This includes the protection systems, lines, circuit breakers, switches, and appurtenances there to or parts there of. The Applicant must make such facilities available to UGI to inspect upon due notice. The Applicant must correct any deficiencies found during such inspections within a reasonable time. UGI has the right to disconnect Applicant's facilities from UGI's 230 kV transmission system when it finds deficiencies on the Applicants system that are an imminent threat to the reliability of UGI's BES.

Communications and Procedures during Normal and Emergency Operating Conditions:

A Generation or Transmission Applicant must follow the direction of Transmission Operator (PJM) during normal and emergency operations as contained in PJM Manuals 03 "Transmission Operations," 13 "Emergency Operations" and 36 "System Restoration." End Use customers must the follow directions of the UGI System Operator during normal and emergency operations.

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Version #	Date	Revision	Responsible Party	Initial/Date
0	October 15, 2007	Version 0		
0	October 15, 2008	Annual Review		
0	October 20, 2009	Annual Review. Updated the PJM hyperlinks		
1.0	November 22, 2010	Annual Review. Added language relative to PJM's involvement in the interconnection process in R2.1. Defined "Annual"		
1.0	November 18, 2011	Annual Review	Eric Sorber	
1.1	December 3, 2012	Annual Review. Added reference to PJM M-7 in section R2.1.5.	Eric Sorber	
1.2	August 8, 2013	Added R1 Requirement	Eric Sorber	
1.3	November 21, 2013	Annual Review. Updated to reflect changes to Standard FAC-001-1.	Eric Sorber	
1.3	December 1, 2015	Annual Review. Revised Compliance Plan to reflect new version FAC-001-2.	Eric Sorber Vince DeGiusto Jr.	Eric 12/10/15 Vince 12/09/15

This document shall be reviewed at least annually during the same calendar quarter each year (October-November-December) by the UGI Electric Division Planning Department and updated as necessary. The latest version can be found on the PJM website at: http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx or PJM - Transmission Owner Engineering & Construction Standards