WABASH VALLEY POWER ASSOCIATION
d/b/a Wabash Valley Power Alliance

NERC COMPLIANCE DOCUMENT FAC-001 FACILITY INTERCONNECTION REQUIREMENTS

For Assets in the RF Region

Approved:

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1. INTRODUCTION

1.1. GENERAL PURPOSE

This document defines the requirements for connecting transmission, generation, or end user (load serving) facilities to the Wabash Valley Power Association (WVPA) regional transmission system. The requirements established in this document are intended to assure that facilities connected to the transmission grid do not have an adverse effect on reliability and to assure that public safety is maintained.

It is recognized that while this document provides guidance on the technical issues that must be considered it should not be considered as an all-encompassing set of requirements. Specific projects must be reviewed on an individual case by case basis. This document should not be considered as a design specification manual and therefore all final designs are subject to the approval of WVPA.

1.2. APPLICATION OF THIS DOCUMENT

The requirements set forth in this guide apply to WVPA as well as all other entities who wish to interconnect generation, transmission, or end-use facilities to the WVPA Regional Transmission System. It applies only to facilities that are connected to the transmission System at voltages 69 kV and above. Within this document, the entity requesting interconnection service is referred to as the “Interconnection Customer”.

1.3. GENERAL REQUIREMENTS

A Definitions

- Emergency – (NERC Definition) – Any abnormal system condition that requires automatic or immediate manual action to prevent or limit the failure of transmission facilities or generation supply that could adversely affect the reliability of the Bulk Electric System (BES).

- Facility – (NERC Definition) – A set of electrical equipment that operates as a single Bulk Electric System (BES) Element (e.g. a line, a generator, a shunt compensator, transformer, etc.).

- Generation Facility – Facility that provides generation.

- Generator/Generator Owner – (NERC Definition); Entity that owns and maintains generating Facilities.

- “Good Utility Practice” refers to any of the practices, methods, and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method or act to the exclusion

of all others, but rather to be acceptable practices, methods or acts generally accepted in the Region, including those practices required by the Federal Power Act, section 215(a)(4).

- Interconnection Agreement – Agreement defining the roles and responsibilities of the Interconnection Customer and WVPA at the Point of Interconnection to the WVPA transmission assets. "Party" or "Parties" refers to the Interconnection Customer and WVPA individually or collectively.

- "Interconnection Customer" means a requestor of a generation, transmission, or end-use connection to the WVPA Regional Transmission System.

- "Interconnection Facilities" refers to transmission additions or upgrades necessary to directly interconnect generation to the System.

- Local Balancing Authority: MISO and PJM are the Balancing Authorities for our load. A Balancing Authority is responsible for maintaining the electricity balance within its region. To assist in this responsibility, there are also Local Balancing Authorities (LBA). The Local Balancing Authorities for WVPA in the RF Region are: Duke Energy, NIPSCO, IPL/AES for MISO footprint and AEP for PJM footprint.

- MISO: Midcontinent Independent System Operator: MISO is the Reliability Coordinator (RC), Balancing Authority (BA), Planning Authority (PA), Planning Coordinator, and Transmission Service Provider (TSP) for the Region in which many WVPA assets reside.

- NERC - North American Electric Reliability Corporation – NERC's mission is to ensure the reliability of the Bulk Power System (BPS). NERC and the Regional Entities are part of the Electric Reliability Organization Enterprise (ERO), with a vision of a highly reliable and secure North American bulk power system.

- PJM: PJM is the Reliability Coordinator, Balancing Authority, Planning Authority, Planning Coordinator, and Transmission Service Provider for the Region in which WVPA assets reside in the AEP Local Balancing Authority area.

- "Point of Interconnection" means the point of interconnection to the System for new generation, transmission, or end- user facilities.

- Reliability First (RF) – Reliability First (RF) is one (1) of the Regional Entities that is part of the ERO with NERC. RF's mission is to ensure that the electric grid is reliable and secure, not only for today, but also for tomorrow. WVPA Member Cooperatives in Indiana are in the RF footprint.

- "System" as it pertains to this document means the WVPA owned transmission assets in the Indiana and Michigan area that interconnect to AEP.

- System Impact Study- Study of the System to determine the specific requirements for connecting to the System and the effect of system stability and transfer capability with the new facilities connected to the System.

- Transmission Operator – (NERC Definition): The Entity responsible for reliability of its "local" transmission system, and that operates or directs the operations of the transmission facilities.

- Transmission Owner – (NERC Definition): The Entity that owns and maintains transmission Facilities.

- Transmission Planner- MISO/PJM coordinates with WVPA to provide transmission planning for the System.

B Responsibilities

The Parties shall each assume responsibility for their own transmission and substation facilities connected to the System as specified in the Interconnection Agreement. The Parties are responsible to negotiate an appropriate Interconnection Agreement to coordinate operations at the point of interconnection. The recommendations made by WVPA in this document shall not relieve the Customer from complete responsibility for the adequate engineering design, construction and operation of the Interconnection Customer's equipment or from any liability for injuries to property or persons associated with any failure to perform in a proper and safe manner for any reason.

1.4. INTERCONNECTION STUDIES AND SPONSOR RESPONSIBILITIES

1.4.1. GENERAL

System Impact Studies must be performed to determine the feasibility of proposed interconnection and requirements that will be needed to connect the facility to the WVPA transmission system.

System Impact Studies are conducted to determine the specific requirements for connecting to the System. The connection of the facility to the System may result in modifications at the location of the connection point as well as at remote locations due to changes in such things as load flow or short circuit capability. The effect of system stability and transfer capability will be reviewed in these studies. System interconnection studies are normally done by performing a detailed System Impact Study.

The Customer is responsible for all costs associated with WVPA or its assigned agent performing studies to determine the feasibility of proposed interconnection and requirements for connecting to the System. In general, a deposit may be required for a System Impact Study. If the cost of the studies exceeds the deposit, the Interconnection Customer shall reimburse WVPA for those costs that the Interconnection Customer is responsible for paying. WVPA will refund any monies above the actual costs incurred. The cost of the studies can vary significantly depending upon the complexity of the proposed facility and the impact that it can have on the System. Generator interconnection requests over 5 MW must be coordinated with MISO/PJM. The Interconnection Customer is responsible for meeting the requirements of MISO's or PJM's generation interconnection process.

1.5. SYSTEM IMPACT STUDY / FACILITY STUDY

A System Impact Study is performed to determine the requirements for connecting to the System. Prior to beginning the System Impact Study the Interconnection Customer must contact WVPA to request an interconnection to the System. WVPA will use the FERC Large Generator Interconnection

Agreement and Large Generator Interconnection Process (LGIA/LGIP) as the basis for its interconnection process. Interconnection Customers requesting interconnection service will be required to submit a completed application as applicable before any study work will commence. It is critical at this juncture that complete information is received.

Upon receipt of the interconnection request or application, WVPA or its assigned agent will schedule a kick-off call with all the necessary parties. WVPA or its assigned agent will then direct the performance of a System Impact Study and if needed, a more thorough Facility Study. These studies will identify all the requirements and conditions for the Customer to interconnect to the System including upgrades required on the existing System. A detailed review of short circuit (fault duty), stability, load flow, and transfer capability analyses may be required. WVPA will develop and provide cost estimates for the facilities required to interconnect with the System to the Interconnection Customer.

The load flow and short circuit studies performed will use base cases from the RF/MISO/PJM annual model update process, while the stability analysis will utilize models that are developed for members of RF/MISO/PJM. These studies will be conducted according to NERC Reliability Standards and will consider outages and impacts on the System and possibly to the surrounding systems.

The typical time-line for a System Impact Study completion is ninety (90) days but this can vary depending on the complexity of the project.

It is understood that the Interconnection Customer is responsible for all costs associated with making the improvements identified by the System Impact Study/Facility Study if the project moves forward.

1.6. NOTIFICATION OF MATERIAL MODIFICATIONS

Any changes to generation, transmission, or end-user facilities, which are to be made subsequent to the in-service date must be submitted to WVPA for review, prior to the modifications being included in the construction. Material modifications include changes to the protection scheme or settings and changes in the metering setup. Increases in fault levels due to system changes must also be provided. Any planned modification to the existing generation, transmission, and/or end-user facilities shall be provided in writing to WVPA with no less than forty-five (45) days to review the impact of the proposed changes.

1.7. DATA ACQUISITION

The Interconnected Customer will securely provide real time telemetry of equipment load and status information back to WVPA using WVPA approved interface or protocol. WVPA may relay this information to its Member Cooperative, Interconnecting Partner, and/or MISO/PJM as needed to ensure reliability of the WVPA Regional Transmission System. The Interconnection Customer will work with WVPA to establish, secure, and maintain the accuracy of the real time telemetry. Any costs incurred to establish, secure, and maintain the real time telemetry by WVPA may be charged back to the Interconnection Customer. It is the responsibility of the Interconnection Customer to ensure accurate telemetry of requested data is provided to WVPA. The Interconnection Customer shall provide a secure real time telemetry link that is consistent with WVPA specifications and business

requirements. The customer shall provide its real time telemetry system plans to WVPA for review prior to installation. WVPA shall have the right to require modifications to the real time telemetry system.

Typical data requirements include but are not limited to the following:

- Status of interrupting devices
- MW flow
- MVAR flow
- Amps – three phase and per phase
- Power factor
- Voltage at interconnection point
- System fault indications

1.8. TELEMETERING AND METERING

WVPA shall specify, own, and maintain all meters and metering devices (including remote terminal units) used to measure the delivery and receipt of energy for payment purposes. If a meter should fail, WVPA will use a metering estimation process to determine the usage. Meters in service will be tested by WVPA on no less than a bi-annual basis, or as requested by any lawfully constituted authority having jurisdiction over meter accuracy.

At a minimum, metering data requirements shall include the following:

- kW
- kWh
- kVAr, leading and lagging
- kVAr-hour

1.9. COMMUNICATIONS DURING NORMAL AND EMERGENCY CONDITIONS

Complete, precise, and timely communication is an essential element for maintaining reliability and security of a power system. WVPA, or its designee and the Interconnection Customer shall establish a point of contact that shall have the authority and capability to operate Interconnection Customer facilities according to the instructions of the appropriate operating entity. Under normal operating conditions, the major link of communication with various interconnects shall be by telephone lines or email as appropriate. WVPA and the Interconnection Customer shall maintain communications with the appropriate operating entity which shall include, but not be limited to, system paralleling or separation, scheduled or unscheduled shutdowns, equipment clearances, periodic load reports, maintenance schedules, tagging of interconnection interrupting devices, meter tests, relay tests, billing, and other routine communication. All Customers who are interconnecting generation facilities shall have provisions to obtain approval from the operating entity prior to starting generation and connecting it to the System. All Interconnection Customers who are interconnecting transmission facilities shall have provisions to obtain proper clearances from WVPA and the Transmission Operator prior to commencing work on the Interconnected Customer facility. In case of

emergency or abnormal operating conditions, various communication channels may be used depending on the interconnect category as described in Sections III, IV, and V. Emergency telephone numbers must be agreed upon by all parties prior to the actual connect date. In case of general widespread area announcements, WVPA, Member Cooperatives, or MISO/PJM may also use public announcements through radio and television stations.

1.10. VOLTAGE AND POWER FACTOR CONTROL

The interconnection shall not result in any condition where the voltage excursion shall exceed NERC, RF or WVPA requirements. Voltage limits observed on the System transmission facilities are between +/- 5.0% of normal, except in the case that specific equipment may be identified as more restrictive.

1.10.1. NETWORK SCHEDULE VOLTAGE

All generators are expected to maintain the voltage schedule as required by the Transmission Operator within the reactive capability of the generating units. To satisfy applicable NERC Reliability Standard(s), NERC requires all generator owners/operators to keep detailed records of as to when each generating unit does not comply with the Transmission Operator's voltage schedule. The generator owner/operator shall be responsible for providing detailed reports on voltage deviations from the acceptable voltage ranges for a specified time period when requested by, RF or NERC or the Transmission Operator (within 30 days of the request).

1.10.2. TAP SETTINGS OF GENERATOR STEP-UP AND AUXILIARY TRANSFORMERS

Generator step-up and auxiliary transformers shall have their tap settings coordinated with the WVPA's Transmission System voltage requirements. Anytime the generator plans to replace any of the step-up or auxiliary transformers, the generator shall supply data relating to the transformer (e.g. size and type, available tap settings, impedance data, loss data etc.) to WVPA for the purpose of determining the optimum tap setting. Any material changes to the impedance may require a System Impact Study be completed. When tap changes are necessary, the Transmission Operator shall provide the generator with a report that justifies the required tap setting changes and technical justification for these changes.

As required by applicable NERC Reliability Standards, the generator shall maintain detailed records of each generator step-up transformer and auxiliary transformer that shall include type of transformer, rating, nominal voltages, existing and available taps, impedance and loss data. It shall be the responsibility of the generator owner/operator to provide the above information on step-up and auxiliary transformers (within five business days) when requested by MISO/PJM, WVPA, RF, TOPs, or NERC.

1.10.3. DESIGN AND OPERATIONAL REQUIREMENTS

WVPA requires generators to meet the following design and operational requirements described in NERC Reliability Standard FAC-001 and its corresponding RF Criteria. Design data requirements include the following:

- The internal plant electrical system design (e.g., transformers, tap settings, motors & other loads, generator/exciter, voltage regulator) should not restrict any mode of project operation within System's voltage range and regulation.

- Transmission interconnected equipment should have the tap ranges and self-regulation necessary to operate within System's voltage range.

- Voltage regulator load compensation, if required, to control voltage at a point beyond the generator terminals.

- Voltage regulator droop compensation, if required, for generators whose terminals are directly connected (i.e., cross-compound, hydro)

- Coordination of excitation system settings with WVPA.

- Transmission interconnection impact on adjacent areas' voltage or reactive compensation devices.

The following operational requirements must be adhered to:

- Load and/or generation operation to be within the acceptable voltage range and regulation as specified by WVPA, and/or the Transmission Operator.

- Generator voltage regulator to be operated in automatic modes.

- Generator to maintain voltage schedules on transmission as required by the Transmission Operator or the Reliability Coordinator.

- Any static reactive compensation devices to be coordinated with WVPA.

1.11. EQUIPMENT RATINGS

All current carrying equipment and devices shall be designed to carry the maximum loads that are predicted and used in load flow analysis. Facility loading exceeding “nameplate” or “normal” design capacities is only acceptable when allowed by manufacturers design documentation or standard industry practices. WVPA shall have the right to review Interconnection Customer design and specifications to verify that equipment ratings are consistent with WVPA criteria.

Equipment ratings must meet requirements identified in system studies, latest industry standards (ANSI, NEMA, IEEE), NERC Reliability Standards, and WVPA equipment specifications. Specific requirements are listed below.

Power Transformers

Power transformers shall be designed, built, and tested in accordance with the latest version of ANSI 57 series, IEEE, NEMA, or any other applicable industry standard, except any specific requirements stated below.

Coolant

The transformer shall contain a dielectric fluid (mineral oil) that is non-polychlorinated biphenyl (PCB). This shall be certified on the transformer test report, and on a label permanently affixed to the transformer, near the nameplate.

Taps

De-energized tap voltages shall be in accordance with the following:

Voltage Class	Tap Voltage				
69 kV	63400	65200	67000	68800	70600
138 kV	131100	134550	138000	141450	144900
161 kV	153000	157000	161000	165000	169000
345 kV	327750	336375	345000	353625	362250

CT Ratios

The current transformers shall have taps as follows:

600:5		1200:5		2000:5	
X2-X3	50/5	X2-X3	100/5	X3-X4	300/5
X1-X2	100/5	X1-X2	200/5	X1-X2	400/5
X1-X3	150/5	X1-X3	300/5	X4-X5	500/5
X4-X5	200/5	X4-X5	400/5	X2-X3	800/5
X3-X4	250/5	X3-X4	500/5	X2-X4	1100/5
X2-X4	300/5	X2-X4	600/5	X1-X3	1200/5
X1-X4	400/5	X1-X4	800/5	X1-X4	1500/5
X3-X5	450/5	X3-X5	900/5	X2-X5	1600/5
X2-X5	500/5	X2-X5	1000/5	X1-X5	2000/5
X1-X5	600/5	X1-X5	1200/5		
3000:5		4000:5			
X3-X4	500/5	X3-X4	1000/5		
X1-X2	1000/5	X1-X2	2000/5		
X2-X3	1500/5	X1-X3	3000/5		
X2-X4	2000/5	X1-X4	4000/5		
X1-X3	2500/5				
X1-X4	3000/5				

Accessories

- Liquid level indicator
- Top oil thermometer
- Winding hot spot thermometer
- Pressure/vacuum gauge
- Cooling equipment

Circuit Breakers

- The circuit breaker shall meet or exceed the fault duty requirements found in the latest studies and the application of circuit breakers shall be in accordance with ANSI/IEEE C37 Standards, latest revision. If the new transmission, generation, or end user interconnection increases the available fault current above 90% of the nameplate interrupting current rating of the existing circuit breakers, the circuit breaker shall be upgraded.

High Voltage Switches Standards

- High voltage switches shall be designed, manufactured, and tested in accordance with the latest revision of ANSI C37.35 and shall be a design approved by the Transmission Owner (such as load break applications, gang operated device sufficient to parallel and unparalled.

Switch Designations

- All switches used in the substation shall meet the operating, sizing, and functionality requirements as defined by the IEEE or any other applicable industry standard.

Instrument Transformers

- Test reports and certification records shall be maintained and made available to WVPA and Member Cooperatives upon request. Instrument transformers include wound type voltage and current transformers, and capacitive coupled voltage transformers.

Standards

- Instrument Transformers shall be designed, manufactured and applied in accordance with IEEE Std. C57.13 with a thermal rating factor of 2.0.

Accuracy

- The burdens placed on instrument transformers shall be within the limits required to ensure the accuracy required by the application. Metering accuracy shall be 0.3%.

Surge Arrestors

Design Philosophy

- WVPA's standard is to shield substations and transmission lines from direct lightning impulses and to provide line entrance arresters at transmission line terminals. Surge arresters are also applied at major components and systems.

Connections

- The high voltage terminal of the surge arrestor is to be connected to the terminal of the protected equipment by the shortest and most direct path possible. The ground terminal of the surge arrestor is to be connected to the grounded portion of the protected equipment by the shortest and most direct path. The grounded portion of the protected equipment is to be connected directly to the grounding electrode.

Sizing

- All grounding conductors and connectors shall be of low impedance and ample current carrying capacity.

Station Service

- Station service power shall be provided to operate the substation equipment, various pieces of test and maintenance equipment, and station lighting. A distribution panel shall be included that provides coordinated overcurrent protection from the secondary of the station service transformers to each individual A.C. load. There shall be a means of establishing a visible air gap between the distribution panel and the source.

D.C System

- The D.C. system shall be comprised of an appropriately sized station battery (125 Volts D.C. nominal or 48 Volts D.C. nominal), a battery charger, electrical disconnect devices, and a D.C. distribution panel.

Standards

- Batteries shall be sized, installed, and maintained in accordance with the latest version of IEEE Std. 485, ANSI/IEEE Std. 450, and ANSI/IEEE Std. 484.

Reliability

- Batteries shall be maintained in the fully charged state by being continuously connected to a suitably sized charger that derives its energy from a highly reliable AC source.

Distribution Panel

- A D.C. distribution panel shall be included that provides coordinated overcurrent protection from the battery to each individual D.C. load. The protective devices shall be rated for D.C. use. There shall be no cross connections between D.C. circuits.

Capacitor Banks Standards

- The capacitor bank, and all its components, shall be designed, installed, and maintained in accordance with the latest versions of:
  - IEEE Std 18, IEEE Standard for Shunt Power Capacitors
  - IEEE Std 1036, IEEE Guide for Application of Shunt Power Capacitors
  - IEEE C37.99, IEEE Guide for the Protection of Shunt Power Capacitor Banks
  - ANSI C2, National Electrical Safety Code

Connections

- Capacitor banks installed on the transmission system, whether utilized for VAR support or voltage control, shall be connected wye or double-wye, and may be grounded or ungrounded.

Fuses

- Individual capacitor units can be of either the externally fused, internally fused or fuseless type.

Insulation

- The basic impulse insulation levels (BIL) of standard capacitor bank installation on WVPA's system shall be as follows:

	Capacitor Bank BIL (kV)	
Voltage Class Phase-to-Phase	Ungrounded Units	Grounded Units
69kV	350	550
138 kV	540	650

Sizing

- The capacitor shall be sized so that when energized, the maximum voltage rise on the bus to which the capacitor bank is connected shall be limited to the value for that voltage class as approved by WVPA.

Monitoring

- Capacitor banks will be monitored by suitable protective devices that will provide a trip output to the disconnecting device when the voltage applied to any constituent unit of the bank exceeds 110 percent of its rating. If SCADA is installed, an alarm output will be provided to the SCADA system that will operate before the 110 percent limit is exceeded.

Switching Devices

- Capacitor bank switching devices shall have either pre-insertion resistors or synchronized closing, in order to provide an effective means of reducing transients associated with switching operations of capacitor banks.

Insulation Levels

- The following chart provides **minimum insulation levels** for material and equipment for the various system voltages on the System:

Substation Voltage KV*	Sub. Equip.	Transformers BIL		Breaker BIL	Switches BIL	Bus Insulators BIL	**Surge Arrestors	
		Power	Auto				Duty Cycle	MCOV
69	Bushing	350	---	350	350	350	60	48
	Winding	350	---					
138	Bushing	650[1]	650	650	650	650	120	98
	Winding	550[2]	550					
161	Bushing	750[1]	750[1]	750	750	750	144	115
	Winding	650[2]	650[2]					
345	Bushing	1300	1300	1300	1300	1300	312	245
	Winding	1050[2]	1050[2]					

1 IEEE C57.12.00-2015 Table 4 Dielectric Insulation for Class II Power Transformers, Column 10.

2 IEEE C57.12.00-2015 Table 4 Dielectric Insulation for Class II Power Transformers, Column 9.

* The preferred practice is to provide substation equipment at full BIL ratings. In certain limited cases, environmental or regulatory limitations or impacts on existing sites or structures, reduced BIL levels can be utilized only after insulation coordination and transient network analysis studies justify their use.

**Protection levels between the arrestor rating and the transformer winding provide for a minimum margin of protection that exceeds 30% for all levels. IEEE C62.22 recommends the minimum protective margin, which should exist for each of three comparisons as follows:

1. For the front-of-wave impulse protective level and the lightning impulse protective level, the minimum protective margin should be 20%.

2. For the switching impulse protective level, the minimum protective margin should be 15%.

Control House

- Seismic design of substation control houses shall meet the requirements of 7 CFR Part 1792 and are designed for Seismic Zone 3.

1.12. REACTIVE POWER REQUIREMENTS

Unless otherwise agreed, the Interconnection Customer is required to maintain a power factor within the same range as the System pursuant to Good Utility Practices. The details regarding reactive power requirements for Transmission, Generator and End User are covered under each respective section.

1.13. SHORT CIRCUIT CONDITIONS

All Facilities must equal or exceed the fault duty capability necessary to meet system short circuit requirements as determined through short circuit analyses and should fully comply with the latest ANSI/IEEE standards for circuit breakers, switch gear, substations, and fuses.

WVPA requires the generators to meet the following design requirements described in NERC Reliability Standard FAC-001 and RF Criteria:

- Each Party is responsible for the short circuit capabilities of their own current carrying elements.
- Each Party is responsible for the ratings of their own interrupting devices. It is the responsibility of the Interconnection Customer to coordinate their relays and devices with the WVPA requirements for the System.
- Each Party shall supply the other existing and planned future fault current levels when requested.
- It is the responsibility of the Interconnection Customer to notify WVPA of any changes in their facilities that may cause an increase in fault currents (Generator and Transmission Customers).

1.14. SYSTEM PROTECTION AND CONTROLS

The Customer is responsible for providing a protection system that will protect its equipment against disturbances on the System and minimize the effects of disturbances from its facilities on the System's equipment

Operating voltage and proximity to a generating unit will be major considerations in the selection of the basic type of protection system relay units that will be required for protecting a transmission line that connects to the System.

These considerations, in conjunction with the particular stability classification determined during facility tests, will determine the extent to which protection schemes are to be incorporated in a transmission line's protection scheme. WVPA substation transmission buses should be provided with differential protection wherever a high-speed fault-clearing scheme is not already in place. Such differential relaying may be either voltage-based or current-based; however, voltage-based relaying may not be feasible where equipment with differing full winding CT ratios is applied. Fault clearing times for bus faults are not to exceed 0.2 seconds.

1.15. PROTECTION FOR 69 KV THROUGH 345 KV SYSTEMS

New protective relay schemes shall have two relay systems, called Primary and Backup, with microprocessor based relays:

- For 69 kV line protective relay schemes, overcurrent and/or distance relaying elements shall be used as appropriate.
- For 138 kV or above line protective relay schemes, current differential and/or distance based pilot elements shall primarily be used. Overcurrent elements shall only be used for special applications.
- For 138 kV or above line protective relay schemes, the Primary line protective relay scheme shall have communications between both ends of the line. This will ensure high speed clearing for all line faults, thus limiting equipment damage.
- For transformer relay protective schemes on transformers 22.4 MVA or above, the Primary relay scheme shall use differential elements for high speed clearing of faults. The Backup relay scheme may use differential elements and/or overcurrent elements.

For transformer relay protective schemes on transformers below 22.4 MVA, fuses or microprocessor relay systems may be used.

1.16. PROTECTION SYSTEM COMPONENTS

The "protection system" arrangement selected by the Interconnection Customer must be compatible with the protection system used by WVPA to protect the System. Compatibility will include protection philosophy, operating speed, types of communication media (power line carrier or fiber optic) and communication (carrier) frequency.

1.17. SYNCHRONIZING FACILITIES

Transmission breakers are closed to connect two energized lines only after the phase angle across the breaker is verified. This is accomplished by one of two methods. In the first method, manual closing utilizes a sync permissive switch. The switch must be turned on to allow breaker closing. Turning on the switch energizes a synchro scope, which shows the phase angle between the lines to be tied together.

This method requires the operator to determine that the angle is within limits. The Interconnection Customer shall be responsible for the synchronization of generation with the transmission system.

If a transmission outage occurs that does not separate the generation from the transmission system, then a second method of synchronization is used that will allow automatic reclosing relays to re-connect, the control scheme initiates a close only after a synchro-verifier relay determines that the angle and voltage are within preset limits.

1.18. SYSTEM GROUNDING

The facility interconnecting substation must have a ground grid designed to meet the requirements of ANSI/IEEE 80, the IEEE Guide for Safety in AC Substations and ANSI/IEEE C2. All metallic structures and non-energized metallic equipment shall be solidly grounded to the grid and this shall include the transmission line overhead ground wire.

When the interconnecting facility is within the WVPA substation fence, the interconnecting facility will be incorporated into the design and construction of the WVPA ground grid. When the facility is outside of the WVPA substation fence, the interconnecting facility shall have its own independent ground grid. When the WVPA substation and the interconnecting facility are adjacent to each other, the grids shall be connected together. The specifics for coordination of the interties between ground grids are discussed at pre-design meetings. The ground grid to be interconnected with the WVPA ground grid shall be of compatible design.[1]

Studies must be performed to guarantee transferred voltages, and step and touch potentials, are limited to safe levels. Furthermore, testing must be performed to verify the integrity of the installed system.

1.19. INSULATION COORDINATION

Insulation coordination is the selection of insulation strength. Insulation coordination must be done properly to ensure electrical system reliability and personnel safety. Basic Surge Level (BSLs), surge arrester, conductor spacing and gap application, substation and transmission line insulation strength, protection, and shielding shall be documented and submitted for evaluation as part of the interconnection plan.

WVPA's standard is to shield substations and transmission lines from direct lightning strokes and to provide line entrance arresters at transmission line terminals. Surge arresters are also applied at major components and systems.

Interconnection facilities to be constructed in areas with contamination (e.g. soil) shall be properly designed to meet or exceed the performance of facilities not in a contamination area with regard to contamination caused outages.

1.20. RESPONSIBILITIES DURING EMERGENCY CONDITIONS

The Transmission Operator, Local Balancing Authority, and/or Reliability Coordinator may direct WVPA or its delegates, consistent with Good Utility Practice, MISO/PJM Emergency Procedures or NERC Reliability Standards, to take whatever action or inaction with regard to the System is deemed necessary during an emergency condition in order to: (i) preserve public health and safety; (ii) preserve the reliability of the Bulk Electric System; (iii) limit or prevent damage; and (iv) expedite restoration of service. WVPA has a 'Power Supply Emergency Plan' which is used during emergency conditions to communicate necessary information.

In case of emergency or abnormal operating conditions, various communication channels may be used depending on the interconnect category as described in Sections III, IV, and V. In case of general widespread area announcements, MISO/PJM, TOPs, or RF may also use public announcements through radio, internet and television stations.

1.21. ABNORMAL FREQUENCY AND VOLTAGE OPERATION

WVPA requires its Interconnection Customers to meet the design requirements described in NERC FAC-001 Planning Standard and its RF Criteria.

When an Interconnection Customer desires to interconnect a transmission, generation or end-user facility to the System, the general protection settings must be submitted to WVPA for review. WVPA reviews and ensures that the proper coordination between WVPA, the Transmission Operator, Distribution Provider and Interconnection Customer exists. WVPA also ensures that the Interconnection Customer frequency protection meets System requirements and that the proper metering is in place to monitor abnormal voltage conditions.

1.22. INSPECTION REQUIREMENTS

Each Party shall perform routine inspection and testing of its facilities and equipment, including secondary low voltage control systems, in accordance with Good Utility Practice as may be necessary to ensure the continued interconnection of the facility with the System in a safe and reliable manner.

Each Party shall, at its own expense, have the right to observe the testing of any of the other Party's facilities and equipment whose performance may reasonably be expected to affect the reliability of the observing Party's facilities and equipment. Each Party shall notify the other Party in advance of its performance of tests of its facilities and equipment, and the other Party may have a representative attend and be present during such testing. If a Party observes any deficiencies or defects on, or becomes aware of a lack of scheduled maintenance and testing with respect to, the other Party's facilities and equipment that might reasonably be expected to adversely affect the observing Party's facilities and equipment, the observing Party shall provide notice to the other Party that is prompt under the circumstance, and the other Party shall make any corrections required in accordance with Good Utility Practice.

1.23. POWER QUALITY

Any connection of a generator, transmission facility or end user load to the System should not compromise or degrade the power quality of the existing interconnected Customers. A permanent digital fault recorder or other monitoring equipment may be deemed necessary and installed by WVPA at the point of common coupling to insure that power quality standards are met and maintained, and power quality events are captured and measured. The connection facility shall also meet any FERC, NERC, or RF reporting and reliability standards.

Power quality may include but not be limited to the following:

- Voltage Unbalance
- Voltage Flicker
- Voltage Fluctuation
- Harmonic Distortion
- Transient over voltage
- Temporary over voltage
- Temporary under voltage
- Operating frequency
- Power factor range
- Interruption / Outage frequency as may be required by Regulatory Standards

Temporary Over/Under Voltage

- Assuming that temporary is longer than 5 to 10 seconds, then the RTU scan rate of 2-6 seconds will capture appropriate changes.

Power Factor Range

- For loads, a minimum of 0.95 leading to 0.95 lagging power factor is required at the time of the system peak. Depending on the evaluation of the interconnection request a more restrictive range may be required.
- For generators, Generators usually have voltage schedules and these policies and practices indicate the power factor and reactive support required at each location. The required power factor will be evaluated as part of the interconnection request.

1.23.1 FLICKER REQUIREMENTS

Voltage Flicker is considered an urgent power quality problem that can affect motor starting, temperature rise, overloading of generators, motors, and may cause health risks. Problems due to annoying light flicker which is a consequence of voltage fluctuation, in addition, electronic equipment may shut down and measurement and monitoring instrumentation may register improper values.

Common causes of voltage fluctuations are pulsating reactive loads, such as arc welders, which may be found in industrial and residential settings and generally affect a single service, or large arc furnaces, which are found in many industrial settings and can affect an entire distribution system. Voltage fluctuation can also occur during random and continuous start-up of large induction motors, the switching of capacitor banks in steps and on systems with integrated fixed speed wind generators.

Flicker will be assessed at the point of common coupling (pcc) using an instrument in compliance with iec 1000-4-15, except that the weighting curve used to represent the response of the light bulb shall be based on the 120 volt lamp characteristics as recommended in uie 96-10.

The flicker measured at the pcc shall be 0.8 or less for the short-term flicker (pst) and 0.6 or less for the long- term flicker (plt). The pst and plt values measured shall not be exceeded more than 1% of the time based on a probability distribution calculated for a one-week period.

1.23.2 HARMONIC AND INTER-HARMONIC REQUIREMENTS

Harmonic levels will be assessed at the PCC with an instrument that can take individual samples of voltage and current waveforms and determine the probability distribution of the individual harmonic levels for both the current and the voltage.

Harmonic distortion levels at the PCC shall meet the requirements of IEEE Standard 519 1992 with respect to the harmonic current components. Background harmonic voltage distortion levels at the PCC should be in compliance with the recommendations in IEEE 519-1992.

In addition, the individual inter-harmonic currents shall be limited to 25% of the values in IEEE 519-1992 and the THD calculation shall include the inter-harmonic components. The Inter-harmonics shall be calculated in 10 Hz increments. The current distortion levels specified in IEEE 519-1992 shall not be exceeded by more than 5% of the time based on a probability distribution calculated for a one-week period.

1.24. MAINTENANCE

1.24.1. MAINTENANCE REQUIREMENTS

Interconnection Customer shall be responsible for the design, construction, installation, maintenance, synchronization of generation with the transmission system and ownership of all interconnection facilities located on its side of the Point of Interconnection. WVPA or its designee shall be responsible for the design, construction, installation, maintenance, and ownership of all Interconnection Facilities located on the WVPA's side of the Point of Interconnection.

In order to perform certain maintenance, testing, and repair activities, WVPA's transmission line(s) must be de-energized. Under this condition, station service power may be interrupted to the Interconnection Customer. WVPA will require periodic transmission line(s) outages to perform protective relay maintenance. WVPA or its designee will coordinate protective system checks during these outages with the Interconnection Customer.

WVPA's circuit breaker(s) are required to be opened periodically in order to exercise the breaker mechanism. In instances where the breaker has not been operated for an extended period, WVPA or its designee may manually operate the breaker. WVPA or its designee will coordinate this and any other circuit breaker maintenance with the Interconnection Customer.

WVPA, or the Interconnection Customer may request, from time to time, routine switching of each other's equipment. In such cases, the Party will provide reasonable notice to the other Party of any equipment switching that affect electrical service to the other Party. The parties will be responsible for coordinating any switching with Transmission Operator.

1.24.2. MAINTENANCE COORDINATION

Complete, precise, and timely communication is an essential element for maintaining reliability and security of a power system.

WVPA and the Interconnection Customer shall maintain communications which shall include, but not be limited to, system paralleling or separation, scheduled or unscheduled shutdowns, equipment clearances, periodic load reports, maintenance schedules, tagging of interconnection interrupting devices, meter tests, relay tests, billing, and other routine communication. Communications can be made by email, text or voice calls. The contacts will be identified in the interconnection agreement along with the process to update the contact information. Any operations will be coordinated with the Transmission Operator.

The Parties shall coordinate inspections, planned outages, and maintenance of their respective equipment, facilities and systems so as to minimize the impact on the availability, reliability and security of both Parties' systems and operations.

Each Party shall provide the other with reasonable notification for routine maintenance, operational tests, inspection activities and revenue meter tests. For such activities that do not require major equipment or system outages, the Party performing the maintenance shall provide the other Party with at least twenty-four (24) hours prior written notice. For such activities that will require major equipment or system outages, the Party performing the maintenance shall provide the other Party with not less than five (5) business days prior written notice. All transmission switching will be coordinated through WVPA or designee and the Transmission Operator for scheduled and unscheduled maintenance.

1.25. PROVISIONS FOR MATERIAL FUTURE CHANGES

Either Party shall notify the other in advance of any changes in their respective facilities, which reasonably can be expected to affect the proper coordination of protective devices of either party.

In no event shall WVPA be obligated to pay all or any part of the costs resulting from any relocation or rearrangement of the Interconnection Facilities, which is initiated by the Interconnection Customer. WVPA and Interconnection Customer shall discuss proposed relocation and rearrangement of the Interconnection Facilities prior to the commencement of such relocation or rearrangement. The Interconnection Customer shall pay for or perform, or shall cause to have paid for or performed, such relocation or rearrangement, provided that nothing herein shall deprive WVPA any right it has to challenge the necessity of any such relocation or rearrangement prior to commencement.

The Interconnection Customer shall provide, at its expense, all protective devices required by WVPA to conform to Good Utility Practices and NERC Reliability Standards.

2. TRANSMISSION INTERCONNECTION REQUIREMENTS

2.1. INTERCONNECTIONS WITH OTHER UTILITIES

Transmission interconnections are planned such that the transmission system will be adequate to withstand the most severe single contingency condition and maintain an acceptable level of reliability.

The North American Electric Reliability Corporation (NERC) and RF, have established planning criteria which must be met to assure reliable electric service. In addition to the NERC Reliability Standards for transmission planning (TPL) and the RF Supplements, the following criteria are used by WVPA in planning the transmission system. These criteria apply to conditions of expected firm power transfers among WVPA and neighboring power systems and to the official company load forecasts that are based on “normal” weather and projected, prevailing economic conditions. WVPA is also a transmission owner in MISO and PJM, and as such transmission interconnections are coordinated through the MISO or PJM, and will adhere to the MISO ‘Business Practice Manual 020 Transmission Planning’ and other procedures required by MISO, and PJM Manual 14 Series, Manuals 14A through 14G. Manual 14E covers “Upgrades and Transmission Interconnection Projects”.

As with generating capacity, reserve capacity must also be provided in the transmission system to recognize the effects of deviations from normal weather and of load forecast uncertainty. In the application of the following criteria an allowance of 6% should be made in circuit loading and 1% in voltage drop to provide this reserve.

2.2. TRANSMISSION PLANNING CRITERIA

The transmission system should be planned to meet NERC Reliability Standard TPL-001 through TPL-004 with (i) all transmission facilities in service or (ii) with one transmission circuit or transformer out of service and one generator out of service.

Under these conditions, the maximum continuous rating of any remaining transmission facility should not be exceeded.

2.3. SYSTEM STABILITY

A stability study is required for all proposed generating units to be connected with the System. The unit modeling data and equipment testing requirements are covered under NERC Reliability Standards and the RF Supplements, as minimum requirements.

2.4. SYSTEM PROTECTION - TRANSMISSION

Operating voltage and proximity to a generating unit will be major considerations in the selection of the basic type of primary and backup relay units that will be required for protecting a transmission line that connects to the WVPA transmission grid. These considerations, in conjunction with the particular stability classification (critical or non-critical) determined during the Facility Tests, will determine the extent to which backup coverage is to be incorporated in a transmission line's protection scheme. Protection requirements for protecting lines classified as critical and non-critical are covered in the General Requirements section of this document.

2.5. COMMUNICATIONS - TRANSMISSION

Operational issues such as maintenance outages, generator start-ups, etc. are handled by email and phone between the Interconnection Customer, the TOP and WVPA or its designee as outlined in the “Operations Procedure and Communication Protocol”.

2.6. NOTIFICATION OF NEW OR MATERIALY MODIFIED FACILITIES – TRANSMISSION

New or materially modified facilities notification requirements for transmission Interconnection Customers are covered in the General Requirements section of this document.

2.7. SYSTEM GROUNDING – TRANSMISSION

System grounding requirements for transmission Interconnection Customers are covered in the General Requirements section of this document.

2.8. VOLTAGE AND POWER FACTOR CONTROL – TRANSMISSION

Voltage and power factor requirements for transmission Interconnection Customers are covered in the General Requirements section of this document.

2.9. POWER QUALITY – TRANSMISSION

Power quality requirements for transmission Interconnection Customers are covered in the General Requirements section of this document.

2.10. INSPECTION REQUIREMENTS – TRANSMISSION

The transmission Interconnection Customer shall grant WVPA or their designee right of access to their facility for purposes of conducting inspections, observing tests, and auditing records required by NERC Reliability Standards and established reporting procedures. Inspection requirements for transmission Interconnection Customers are also covered in the General Requirements section of this document.

2.11. BREAKER DUTY AND SURGE PROTECTION – TRANSMISSION

Breaker duty and surge arrester requirements for transmission Interconnection Customers are covered in the General Requirements section of this document.

3. GENERATOR INTERCONNECTION REQUIREMENTS

This section addresses issues that are specific to connecting generating facilities to operate in parallel with WVPA's System. In those cases where the generation is standby only it is assumed that appropriate interlocks and/or switches have been installed to prevent parallel operation.

3.1 All generators, that are not behind the meter generation, must be submitted to the MISO, PJM, or generation interconnection queue to be studied by MISO or PJM. MISO or PJM will coordinate with WVPA and the Interconnection Customer to evaluate requirements as defined in the 'Business Practice Manual 015 – Generation Interconnection' and 'Business Practice Manual 020 Transmission Planning'. Any costs for studies, equipment and upgrades will be borne by the Interconnection Customer. In the PJM area, PJM Manual 14 Series, Manuals 14A through 14G encompass the Interconnection Process. Manual 14G specifically covers "Generator Interconnection Requests".

3.2 Small Generators 5 MW or under may use the fast track process in the interconnection queue connecting to the MISO tor PJM Transmission system.

3.1. DATA ACQUISITION - GENERATION

Prior to any operation of a generator facility, an RTU or equivalent data collection and transfer equipment acceptable to WVPA shall be installed by the generator Interconnection Customer, or WVPA at the Interconnection Customers expense, to gather accumulated and instantaneous data to be telemetered to a location(s) designated by WVPA. The data acquisition requirements are covered in the General Requirements Section of this document.

3.2. SYSTEM PROTECTION - GENERATION

The type, size, and location of the generation will determine the specific requirements. The system protection requirements are covered in the General Requirements section of this document.

3.3. ISLANDING

Should the generator connect to a transmission line having other tapped load, there will be an additional requirement to prevent islanding. For the purpose of this document, islanding is defined as a generator being isolated such that it is the only source of power to a utility customer. The Interconnection Customer's protection system should be responsible for sensing abnormal frequency and trip its own generator to isolate from the System.

3.4. TRANSMISSION LINE CONNECTIONS

WVPA will recommend the transmission line tap and associated substation equipment that is appropriate for the interconnecting small generator. The recommendation will include assessment of impacts on the System related to relay protection, interruption on the transmission system and other appropriate transmission interconnection planning criteria.

The Interconnection customer should reserve property for constructions of the WVPA owned inter-connect station.

3.43 SUBSTATION INTERCONNECTION REQUIREMENTS

All generation interconnection substation designs will include all switches and devices required to permit maintenance of all breakers and transmission lines without the loss of the ability to use the generation capacity when required.

3.4.4. TRANSMISSION INTERCONNECTION BREAKERS

If new transmission lines are required by the addition of generator capacity at a new or existing power station, the breaker arrangement at the existing substation will determine both the number of breakers and the breaker arrangement required for the interconnection. Line terminations that result in a six breaker or less ring bus are acceptable. If more than a six breaker ring bus is required, a breaker and a half arrangement would be used for reliability considerations.

3.4.5. GENERATION INTERCONNECTION BREAKERS

An Interconnection Customer owned interconnection terminal breaker is required if the generating station is located remotely from the interconnection station.

3.4.6. GENERATION INTERCONNECTION BREAKERS

All generation interconnection substation designs will include all switches and devices required to permit maintenance of all breakers and transmission lines without the loss of the ability to use the generation capacity when required.

3.4.7. TRANSMISSION INTERCONNECTION BREAKERS

If new transmission lines are required by the addition of generator capacity at a new or existing power station, the breaker arrangement at the existing substation will determine both the number of breakers and the breaker arrangement required for the interconnection. Line terminations that result in a six breaker or less ring bus are acceptable. If more than a six breaker ring bus is required, a breaker and a half arrangement would be used for reliability considerations.

3.4.8. GENERATION INTERCONNECTION BREAKERS

An Interconnection Customer owned interconnection terminal breaker is required if the generating station is located remotely from the interconnection station.

3.5. SYSTEM STABILITY

The generator Interconnection Customer shall operate its facilities with the appropriate safeguards and stabilization systems and other protective equipment necessary to protect and prevent damage to the System.

A stability analysis is required for all proposed generating units to be connected with WVPA's transmission system. The NERC Reliability Standards, under System Adequacy and Security (TPL-002), describe various requirements that are summarized in that Standard. The unit modeling data and equipment testing requirements are covered in the MOD NERC Reliability Standards. WVPA has accepted these NERC Reliability Standards, and the follow-up measures defined by RF, as minimum requirements.

The requirement for reactive power and generation equipment data will be described in the generator's Interconnection Agreement.

WVPA will provide standard model/data sheets for the vendor to supply various generator equipment data during the initial stages of a project. It is recognized that this type of detail data may not be readily available in the final form during preliminary stages of a project. In that case, estimated, typical or preliminary data is acceptable for a preliminary study. However, unit specific data is necessary to determine Customer's requirements and the preliminary study must be updated when appropriate data is made available. Operating restrictions may be placed based on the final, updated study results. Also, it is the generator owner's responsibility to perform required tests to verify various generating equipment models and data as required by the NERC Reliability Standards.

3.6. GENERATION CONTROLS

All generators connected to the System operate in automatic voltage regulation; power factor limits are described in the generator's Interconnection Agreement with MISO or PJM and WVPA generator voltage regulator is required to be in service and in automatic mode whenever the generator is synchronized to the system. Unless otherwise directed by the Transmission Operator, the automatic voltage regulator shall control the voltage output within the reactive capabilities of the generator to maintain the nominal voltage of the connected transmission system.

A speed governor system is required on all generators to regulate the output of the generator as a function of the system frequency. The speed governor system must respond to system frequency changes to help maintain the stability of the power System. The speed governor system shall have a speed regulation (droop) characteristic settable between three and seven percent and typically set to five percent.

3.7. COMMUNICATIONS – GENERATORS

Communications with generation Interconnection Customers are covered in the General Requirements section of this document.

3.8. OBLIGATION TO SUPPLY REACTIVE POWER

Generator facilities connecting directly to the System at 69 kV or higher voltages will comply with all applicable NERC Reliability Standards, RF Supplements, Transmission Operator standards, WVPA standards, and the generator's Interconnection Agreement with WVPA and/or MISO/PJM as such documents may be amended from time to time, with regard to voltage support and supply of reactive power to the System. All generators connecting to the System at 69 kV or higher voltages shall operate in automatic voltage regulation. A generator voltage regulator is required to be in service and in automatic mode whenever the generator is synchronized to the System. The automatic voltage regulator shall, within the reactive capabilities of the generator, control the voltage output pursuant to the voltage schedule prescribed by the Transmission Operator.

The Transmission Operator shall have the right to alter the voltage schedule as the system operating conditions may require from time to time and must be communicated.

3.8.1. REACTIVE POWER GENERATION

Generator shall supply reactive power to the System or absorb reactive power from the System in accordance with Good Utility Practice, MISO/PJM, and Transmission Operator Standards, the generator's Interconnection Agreement, applicable operational and/or reliability criteria, protocols, and directives, including those of NERC/RF and Applicable Laws and Regulations and this Agreement. The generator shall respond to requests from the Transmission Operator to increase or decrease generator reactive power output in a manner consistent with generator's obligation to operate and control the facility. The generator facility shall supply or absorb such reactive power in accordance with the voltage schedule or reactive levels prescribed the Transmission Operator, but not in excess of the amount available from the facility's equipment in operation at the time and within the manufacturer's design limitations of the facility. The Transmission Operator or MISO/PJM shall provide the voltage schedule to the generator owner/operator.

WVPA requires the generators to meet the design and operational requirements described in NERC Reliability Standards and RF Supplements:

3.9. MAINTENANCE - GENERATION

WVPA shall have the right, but shall have no obligation or responsibility to:

I. Observe generator's tests and/or inspection of any of generator's system protection facilities and other protective equipment,

II. Review the settings of the generator's system protection facilities and other protective equipment, and,

III. Review Generator's maintenance records relative to the facility, generator interconnection facilities, and/or the generator's system protection facilities and other protective equipment.

WVPA shall maintain its facilities and equipment, to the extent they might reasonably be expected to have an impact on the operation of the facilities in a safe and reliable manner, in accordance with Good Utility Practice, NERC Reliability Standards, and in accordance with the provisions of this document. The generator's Interconnection Customer shall maintain its facilities and equipment, to the extent they might reasonably be expected to have an impact on the operation of the System in a safe and reliable manner, in accordance with Good Utility Practice, NERC Reliability Standards, and in accordance with the provisions of the Interconnection Agreement.

Maintenance requirements are also covered in the General Requirements section of this document.

3.10. METERING – GENERATION

Metering is covered in the General Requirements section of this document.

3.11. RESPONSIBILITIES DURING EMERGENCY SITUATION – GENERATION

Each Party agrees to comply with MISO/PJM, NERC and RF emergency condition procedures/standards and WVPA and generator owner emergency condition procedures, as applicable, with respect to emergency conditions. WVPA has a Power Supply Emergency Plan for communication during emergency conditions. Emergency communications are covered in the General Requirements section of this document.

3.12. INSPECTION REQUIREMENTS – GENERATION

Inspection Requirements are covered in the General Requirements section of this document.

3.13. NOTIFICATION OF NEW OR MATERIALLY MODIFIED FACILITIES – GENERATION

New or materially modified facilities notification requirements for generation Interconnection Customers are covered in the General Requirements section of this document.

3.14. BREAKER DUTY AND SURGE PROTECTION – GENERATION

Breaker duty and surge arrester requirements for generation Interconnection Customers are covered in the General Requirements section of this document.

3.15. SYSTEM GROUNDING – GENERATION

System grounding requirements for generation Interconnection Customers are covered in the General Requirements section of this document.

3.16. POWER QUALITY – GENERATION

Power quality requirements for generation Interconnection Customers are covered in the General Requirements section of this document.

4. ELECTRICITY END-USER INTERCONNECTION EQUIREMENTS

4.1. LOAD GUIDELINES

Transmission facilities may be used for providing service to commercial, industrial, municipal, cooperative and cogeneration Interconnection Customers when the use of distribution feeders is not practicable. Generally, the use of transmission facilities should be considered for the following conditions:

- All loads and generation over 20 MVA;
- Locations remote from distribution facilities;
- Remote locations where distribution facilities are not adequate;
- Loads with nonstandard voltage requirements;
- Loads having large surge requirements.

The feasibility of serving Interconnection Customers direct from transmission requires a comprehensive study and coordination. Factors to be considered prior to agreeing on an Interconnection Customer connection is as follows:

- Economics of alternates;
- Parallel generation;
- Transmission line tap or loop length;
- Transformer characteristics;
- Load switching;
- Effect on protective relaying at remote terminals;
- Problems of large through power on looped lines;
- Extent of Interconnection Customer facilities.

4.2. POWER QUALITY – END USER

Power quality requirements for end-user Interconnection Customers are covered in the General Requirements section of this document.

4.3. REACTIVE POWER REQUIREMENTS – END USER

Reactive power requirements are covered in the General Requirements section of this document.

4.4. STABILITY STUDIES

If an industrial load Interconnection Customer has internal generation, a stability study may be required. The Interconnection Customer must supply a detailed description of the load characteristics, internal distribution system representation, generating equipment models and data, etc. The Interconnection Customer will reimburse any and all expenses incurred by WVPA in performing such a study. Details regarding stability studies for generators are included in the Generator Connection Requirements section of this document.

4.5. SYSTEM PROTECTION AND OTHER CONTROLS

The end user is responsible for providing a protection system that will protect its equipment against disturbances on the System and minimize the effects of disturbances from its facilities on WVPA equipment and System. For facilities larger than 100 MW, the end-user Interconnection Customer shall provide WVPA its planned protection system for review to ensure proper coordination of the protection schemes. System Protection is covered in the General Requirements section of this document and must comply with NERC Reliability Standards.

4.6. NOTIFICATION OF NEW OR MODIFIED FACILITIES – END USER

New or modified facilities notification requirements for end user Interconnection Customers are covered in the General Requirements section of this document.

4.7. BREAKER DUTY AND SURGE PROTECTION – END USER

Breaker duty and surge arrester requirements for end user Interconnection Customers are covered in the General Requirements section of this document.

4.8. SYSTEM GROUNDING – END USER

System grounding requirements for end use Interconnection Customers are covered in the General Requirements section of this document.

4.9. SYNCHRONIZING FACILITIES – END USER

Synchronizing facilities requirements for end use Interconnection Customers are covered in the General Requirements section of this document.

4.10. INSPECTION REQUIREMENTS – END USER

The end use Interconnection Customer shall grant WVPA or designee right of access to their facility for purposes of conducting inspections, observing tests, and auditing records required by NERC/RF standards and established reporting procedures. Inspection requirements for end use Interconnection Customers are also covered in the General Requirements section of this document.

4.11. COMMUNICATIONS DURING NORMAL AND EMERGENCY CONDITIONS-END USER

Communications during normal and emergency conditions requirements for end use Interconnection Customers are covered in the General Requirements section of this document.

5. PLANNING

5.1. PLANNING GUIDELINES

GENERAL CRITERIA

WVPA endeavors to maintain a degree of reliability in electric service that satisfies the customer's service requirements at a reasonable cost. This is documented in the "WVPA MISO Local Planning Criteria" document and the "AEP Transmission Planning Criteria and Guidelines". The AEP document is available via the PJM Open Access Same-Time Information System (OASIS). The associated PJM Manual is m14b- PJM Region Transmission Planning.

WVPA has adopted the AEP Criteria for WVPA facilities located in the AEP zone.