2009 FERC FORM 715

APPENDIX A

TRANSMISSION SYSTEM
PLANNING CRITERIA
AND
GUIDELINES

Transmission Planning and

System Protection Department

March 20, 2009

Transmission System Planning Criteria and Guidelines

- Index -

Objective for Transmission System Planning Criteria and Guidelines

Planning criteria provide a framework for system testing and for identifying potential areas of deficiency. This document describes the criteria utilized when analyzing NIPSCO's transmission system and serves as a guide for determining future transmission facility capital investments. These criteria are applied to the transmission system operating at 69 kV and above.

Demand growth from native load customers historically drove the primary need for investment in a utility company's transmission system. In more recent years additional investment has been needed because of participation in the Midwest ISO market and the development of independent power producers (IPP). As a result, certain transmission system upgrades may be accelerated to maintain proper voltage support and reliable service to customers in NIPSCO's service territory.

Planning criteria are utilized to determine the following objectives are met:

- Provide a transmission system that can adequately serve local and wholesale customer loads.
- Provide a transmission system that can withstand reasonable system disturbances on the bulk power system.
- Provide a transmission system that contributes to overall bulk system integrity and supports effective competition in the energy market.
- Provide a transmission system whose revenue requirements, capital and operating costs are minimized while being consistent with the above goals.

In general, the transmission system is designed to meet these goals utilizing the criteria described on the following pages.

Definitions for Transmission System Planning Criteria and Guidelines

The following list of terms and definitions is intended to provide a clearer understanding of the concepts and terms relating to this document.

Adequacy - Ability of the transmission system to supply the electrical power and energy requirements of its users at all times, taking into consideration scheduled and unscheduled outage of generation and transmission system components and facilities.

Contingency - A random forced outage of a generation or a transmission system component.

Control Area Load - The electric demand of all retail and wholesale customers located within NIPSCO's control area. NIPSCO's control area is the electric system owned and operated by NIPSCO in which internal generation is directly controlled to maintain interchange schedules and frequency regulation.

Distribution System - Lower voltage electric system operating at 12.5 kV and below, that transports power from transmission system and sub-transmission sources to NIPSCO customers.

Double Contingency Outage - Random forced outages resulting in the loss of two generation and/or transmission system components as a result of unexpected disturbances on the system.

Emergency Rating - The ampacity, voltage or power limit at which a system component is allowed to be loaded over the normal rating. A specified amount of consecutive hours or cumulative period of time can be associated with the utilization of this rating.

Forced Outage - An unplanned transmission system component failure that results in it being unavailable to perform its intended function for a period of time. A forced outage may or may not cause a loss of electrical service to customers.

Generation System – Power-producing source for the electrical system. The aggregate of NIPSCO generator units, which are electrically interconnected via the transmission system, forms what is described as the generation system.

Independent Power Producer (IPP) – A privately-owned producer of electrical energy which is not a public electric utility but which makes electric energy available for sale to utilities.

Internal Load - Control area load less wholesale load. It is the electric load located within the Company's control area and service territory that is supplied through NIPSCO-owned electric systems and whose power is supplied by NIPSCO through internal generation or purchased power transactions.

Native Load Customers - The customers whose total demand is associated with internal load.

Multiple Contingency Outage - Random forced outages resulting in the loss of more than two generation and/or transmission system components.

Nameplate Rating - The ampacity, voltage or power limit to which a system component is capable of being loaded continuously as indicated on the manufacturer's equipment nameplate.

NIPSCO Transmission System – High voltage electric system operating at 138 kV and 345 kV, that transports bulk power from internal generation sources and external power sources through interconnections with adjacent utility transmission systems, directly to large NIPSCO electric customers, NIPSCO sub-transmission and distribution systems, and adjacent utility transmission systems. This includes transmission lines, substations, and other associated equipment. Sections of the 69 kV system in the eastern and southern portions of the NIPSCO service territory that are operated in a network configuration are also considered in the analysis of the transmission system.

Normal Rating - The ampacity, voltage or power limit at which a system component can be continuously loaded without reduction in expected service life.

Normal System Condition - Operational status of the transmission system under which all components of the system are in service.

Single Contingency Outage - A random forced outage resulting in the loss of one generation or transmission system component.

Sub-transmission System - Medium voltage 34.5 kV electric systems, which generally transport power from networked transmission system sources to NIPSCO customers and lower voltage distribution systems. These facilities are typically operated as radial lines and are not included in the transmission system assessment.

System Disturbance - Any unplanned event that disrupts the system from the normal operating condition.

Transmission System Components - Electric facilities including transformers, breakers, buses, lines, cables, capacitors, reactors and associated equipment. Substation transformers and transmission lines are considered major system components.

Voltage Stability - The ability of the system to maintain adequate voltage levels during events involving rapid increases in load, system disturbances, or other system changes that can cause voltage to drop quickly. Voltage instability could lead to voltage collapse, possible cascading outages, and loss of customer load.

Wholesale Power Customers - Customers normally located in NIPSCO's control area, which purchase power from NIPSCO or another utility for resale to end use customers. Power is imported, or dispatched from internal generation, depending upon the associated contractual agreements. Municipalities and REMC are typical examples of this type of customer. Customers located outside NIPSCO's control area who purchase bulk power from NIPSCO are wholesale customers.

Transmission System Planning Philosophy

The primary goals of transmission planning are: to provide adequate continuous service to all control area customers; to operate a system that withstands system disturbances and contributes to the reliability of the interconnected system; and to provide service in an efficient, cost effective manner. The planning criteria presented in this document provide a guide for evaluating the system and developing necessary plans of action to meet or maintain established standards.

NIPSCO's electric transmission system operates at 345,000 volt and 138,000 volt levels. (See maps submitted as part of this filing). The transmission system also includes facilities operating at 69,000 volts. The 69 kV networked circuits named in Exhibit II (page 22) are included in various analyses since they form ties between higher voltage transmission sources. These circuits are located in the eastern and southern sections of the Company's electric service territory (see Figure 1).

NIPSCO SERVICE AREA

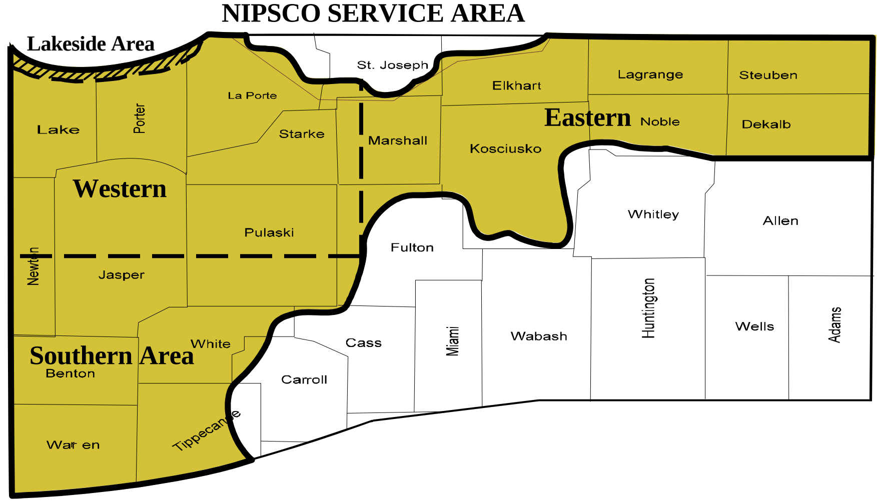

Figure 1

The transmission system should be periodically tested for adequacy using the criteria described below.

Condition	Criteria
System Normal	No overloaded facilities. No high or low voltages.
Single Line Outage	No facilities loaded beyond 'emergency' rating. No customer voltages below 'contingency' minimums.
Single transformer outage	No facilities loaded beyond 'emergency' rating. No customer voltages below 'contingency' minimums.
Substation single bus outage	No widespread voltage violations. No cascading outages. Loss of local load can occur.
Selected multiple contingency outages	No widespread voltage violations. No cascading outages. Loss of local load can occur.
Right-of-Way outage	No widespread voltage violations. No cascading outages. Loss of local load can occur.
Total Generating Station outage	No facilities loaded beyond 'emergency' rating. No customer voltages below 'contingency' minimums.
Outage of three largest generators or 20% of generation, whichever is larger	No facilities loaded beyond 'emergency' rating. No customer voltages below 'contingency' minimums. Transmission system should have adequate capacity to import required power.
Transmission system transfer Capability	Test for power transfer capability across the transmission system identify limiting elements.

Double outage contingencies are considered when evaluating the transmission system around a generating station to determine system adequacy during peak generator output. Capacity upgrade schemes may be needed to prevent possible cascading outages during a double outage contingency.

Transmission upgrades for double outage contingencies may also be considered if the impact affects a significant portion of the transmission system.

The criteria used for defining adequacy of service are relative to the specific area under review.

While multiple contingencies are not normally included in planning the transmission system, they are periodically reviewed to examine their effect on the transmission system. Although they can have dramatic effects on local adequacy and reliability, their low probability and high cost-to-benefit ratios tend to preclude actions that would require capital funding.

Transfer capability for various directional power transfers is calculated with single contingencies on a stable steady state system to determine the maximum power that can be carried in one direction before exceeding the voltage criteria or thermal emergency rating of any transmission facility. This method known as *FCITC* (First Contingency Incremental Transfer Capability), tests the system for loss of the most restricting single contingency for a given system transfer.

System improvements primarily involve upgrading or enhancing existing transmission lines and substations, and construction of additional facilities. Basic criteria for determining the need for such improvements are:

Transmission System Adequacy.

Periodically, the existing system is reviewed to insure that equipment ratings are not exceeded, that system voltage level limits are not violated, and that the system will perform in a stable manner under contingency conditions. Load growth and adjacent utility changes in operation and system configuration for instance, can place increased burden on the transmission system. By analyzing future transmission system models, potential inadequacies can be remedied before problems actually occur.

Reliability of Service.

Modifications and enhancements are made to the system to improve reliability when needed. Criteria such as load density, outage probability, load growth, historical data and customer impact are used in the analysis of reliability.

New Customer Services.

Significant increases in system load, resulting from major new customer loads or significant additions to existing customers' loads often require improvements or modifications to the system to maintain adequacy. Modifications may also be required to meet specific customer operating criteria or equipment needs.

Bulk Power System.

Provisions set forth among members of the Reliability*First* Corporation (RFC) include reliability criteria that act as a guide for evaluation of the bulk power system. These criteria were developed to avoid uncontrolled, area-wide power interruptions under contingency conditions. Planning and analysis of the NIPSCO transmission system consider the relevant NERC planning standards.

When improvements are required on the transmission system, all credible alternatives that correct the associated deficiencies are investigated and reviewed. Evaluation of alternative projects considers four major criteria as indicated below (listed in no particular order of preference):

- Ability of the project to correct the expected system deficiency.
  (The extent to which a deficiency is eliminated or postponed).
- Economic impact of the project on company assets.
  (Installation, operating and maintenance costs, losses).
- Viability of the project in relation to route or site.
  (Can a suitable site be procured)?

- The project's regional, public and customer impact.
  (Safety, aesthetics, and so on).

These criteria are consistent with the Federal Energy Regulatory Commission Order 890 requirement for a coordinated, open and transparent planning process captured in the Midwest ISO December 2007 compliance filing of its Attachment FF. As a member of the Midwest ISO, NIPSCO fully supports and participates in the planning process as filed.

Transmission System Planning Criteria and Guidelines

I. Equipment Thermal Loading Criteria

Overhead Conductors

Circuit load ratings utilized for design and operation of the transmission system are summarized in Exhibit III and Exhibit IV (pages 23-24). The listed ratings are based on design maximums in accordance with published Company Standards.

NIPSCO overhead conductor ratings currently fall into three categories based on type of construction. These classifications include:

- Overhead hard-drawn bare copper conductors.
- Overhead bare aluminum ACSR and AA designated conductors constructed prior to 1988.
- Overhead bare aluminum ACSR and AA designated conductors constructed in 1988 or later.

Rating parameters associated with the above three categories are as follows:

Overhead Bare Aluminum (ACSR) Built Prior to 1988		
Characteristic	**Summer Rating Bases***	**Winter Rating Bases****
Max. Normal Conductor Temp.	80 C^o (176^o F)	80 C^o (176^o F)
Outdoor Ambient Temp. (Average)	30 C^o (86^o F)	5 C^o (41^o F)
Conductor Temperature Rise	50 C^o (122^o F)	75 C^o (167^o F)
Max. Emergency Conductor Temp.	80 C^o (176^o F)	80 C^o (176^o F)
Wind Velocity	3 Feet/Second	3 Feet/Second
Coefficient of Emissivity	0.75	0.75
Coefficient of Absorption	0.75	0.75
Elevation Above Sea Level	1000 Feet	1000 Feet

* Summer Months = May through September

** Winter Months = October through April

Overhead Hard Drawn Bare Copper		
Characteristic	**Summer Rating Bases***	**Winter Rating Bases****
Maximum Normal Conductor Temp.	80 C^{o} (176^{o} F)	80 C^{o} (176^{o} F)
Outdoor Ambient Temp. (Average)	30 C^{o} (86^{o} F)	5 C^{o} (41^{o} F)
Conductor Temperature Rise	50 C^{o} (122^{o} F)	75 C^{o} (167^{o} F)
Max. Emerg. Conductor Temp.	80 C^{o} (176^{o} F)	80 C^{o} (176^{o} F)
Wind Velocity	3 Feet/Second	3 Feet/Second
Coefficient of Emissivity	0.75	0.75
Coefficient of Absorption	0.75	0.75
Elevation Above Sea Level	1000 Feet	1000 Feet

* Summer Months = May through September

** Winter Months = October through April

Overhead Bare Aluminum (ACSR) Built 1988 and After		
Characteristic	**Summer Rating Bases***	**Winter Rating Bases****
Maximum Normal Conductor Temp.	100 C^{o} (212^{o} F)	100 C^{o} (212^{o} F)
Outdoor Ambient Temp. (Average)	30 C^{o} (86^{o} F)	5 C^{o} (41^{o} F)
Conductor Temperature Rise	70 C^{o} (158^{o} F)	95 C^{o} (203^{o} F)
Max. Emerg. Conductor Temp.	130 C^{o} (266^{o} F)	130 C^{o} (266^{o} F)
Wind Velocity	3 Feet/Second	3 Feet/Second
Coefficient of Emissivity	0.75	0.75
Coefficient of Absorption	0.75	0.75
Elevation Above Sea Level	1000 Feet	1000 Feet

* Summer Months = May through September

** Winter Months = October through April

All of the above criteria apply to NIPSCO system conductors designed to operate at 345 kV, 138 kV and 69 kV voltage levels.

Higher conductor ratings for emergency conditions are only applicable to aluminum (ACSR) lines constructed after 1987, and aluminum (ACSR) circuits installed before 1988 that have been reviewed and upgraded where necessary for higher operating temperatures. All other lines operate utilizing ratings where the normal and emergency ratings are both based on maximum conductor temperature 80 C^{o}.

Aluminum (ACSR) conductor circuits installed before 1988 can be reviewed to determine the requirements for upgrading their ratings to the standards established for lines constructed after 1987. When line ratings are reviewed, line design and construction are investigated to determine if proper clearances can be maintained for circuit operation at higher operating temperatures.

All NIPSCO 345 kV lines constructed prior to 1988 that have been reviewed and presently utilize higher normal and emergency ratings as indicated under "Overhead Bare Aluminum (ACSR) Built 1988 and After". All 138 kV circuits are currently reviewed on a case-by-case basis. This review typically increases circuit capacity ratings by 19% and establishes a 24-hour emergency rating that is 42% higher than previous limits. As loading increases, limiting circuits are evaluated and modifications made where necessary to permit operation at higher conductor temperatures.

Maximum operating temperatures on copper conductor lines will not be increased due to the annealing characteristics of copper. As such, these lines will not be reviewed for increased loading capabilities.

Transformers

NIPSCO transmission system transformers operate with a high side voltage of 345,000 volts or 138,000 volts. NIPSCO criteria for transformer thermal and load ratings are based on manufacturers' nameplate ratings. Both normal and emergency load ratings are limited to the transformer's highest specified nameplate rating. These ratings are typically based on a 55^{o} C. or 65^{o} C. rise value in transformer winding temperature. Maximum nameplate ratings are utilized in order to avoid the potential for a reduction in equipment life as a result of inadvertent stress and overheating.

Other Transmission System Components

Transmission system components other than circuit conductors and power transformers include the following equipment:

- Breakers
- Current Transformers
- Circuit Switchers
- Potential Transformers
- Capacitors
- Wave Traps
- Reactors
- Substation Power Buses
- Disconnect Switches
- Substation Power Cables

Ratings for these "other" system components are based on NIPSCO published standard specifications that are based on manufacturers' nameplate ratings and current ANSI standards and recommendations.

II. Transmission System Voltage Criteria

Voltage level criteria for the transmission system are indicated below.

All substation 345/138 kV transformers operate with fixed taps or with load tap changers disabled. The majority of sub-transmission substations and all distribution substations utilize voltage-regulating equipment. The minimum acceptable transmission system substation primary voltage level is 92% of nominal voltage. Acceptable levels are also limited to a high of 105% of nominal in order to avoid over voltage problems for transmission equipment. NIPSCO customer service voltage requirements, which are based on ANSI C84.1 standards, are maintained through a combination of the limits listed below, and the voltage regulation and re-regulation that occur at the sub-transmission and distribution system substations. Due to wider voltage swings and the lack of voltage regulation at customer substations, minimum 69 kV system voltage levels are set at 94% of nominal.

Voltage variations in excess of those specified, which are caused by the operation of equipment on customer premises and result in large inrush currents, are unavoidable, usually infrequent, and of short duration. These variations are not considered a violation of the system's steady-state voltage limits.

Location	Normal Condition		Contingency Condition	
	Minimum Value	Maximum Value	Minimum Value	Maximum Value
345 kV Transmission Substation Bus Voltage	92%	105%	90%	105%
138 kV Transmission Substation Bus Voltage	92%	105%	90%	105%
69 kV Transmission Substation Bus Voltage	94%	105%	92%	105%

Voltage criteria for large industrial customers taking service at 138 kV are displayed below.

Location	Normal Condition		Contingency Condition	
	Minimum Value	Maximum Value	Minimum Value	Maximum Value
138 kV Transmission Customer Substation Bus Voltage	95%	105%	90%	110%

Dynamic voltage variation, or flicker, as a result of customer equipment operations is normally not significant on the transmission system. However some large customers served directly from the 138 kV system do utilize very large motors and arc furnaces in their operations, which have the potential for creating objectionable voltage variations on the 138 kV system. These loads are subject to power quality standards. NIPSCO's current power quality standard is based on "IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems" guidelines. Objectionable power quality conditions such as customer induced excessive voltage flicker, excessive voltage and current harmonics, when found, are normally relieved by working with the customer to bring power quality to an acceptable level. Remediation typically takes place through the addition of equipment (i.e., reactors, static var compensators, filter capacitors) and/or a change in customer operating characteristics. Failure of the customer to comply with established service standards can result in termination of service to the equipment or facility involved.

III. Transmission System Voltage Stability Criteria

The transmission system is designed to survive credible operating contingencies without experiencing voltage instability. During contingency conditions, adequate voltage levels must be maintained on the remaining in-service transmission components and loads. Loss of transmission lines, system interconnections, capacitors, and generation, all contribute to a lowering of voltage levels. As capacitors are added to the system to supply loads and maintain appropriate voltage levels, the transmission system must be checked to determine if any point(s) of voltage instability exists.

IV. Transmission System Transient Stability Criteria

Generator stability is checked whenever there is a major change in system configuration in the area of existing generating stations or generator addition. When warranted, studies are performed to verify that generators do not experience instability under the following conditions:

- Permanent three phase fault on any system element, under normal fault clearing conditions and slow fault clearing conditions.

- Permanent single phase, two phase or three phase fault on any system element, with another system element out of service, under normal fault clearing conditions and slow fault clearing conditions.

- Permanent single phase, two phase or three phase fault on any system element with any single generating unit out of service under normal fault clearing conditions and slow fault clearing conditions.

V. Reactive Power Criteria

Reactive resources should be planned and designed such that adequate reactive power reserves are available in the form of dynamic reserves at synchronous generators, synchronous condensers, and static VAR compensators in anticipation of system disturbances. Reactive loads should be served by fixed and mechanically switched shunt compensation to the extent practical. Reactive power dynamic reserves at generators and SVC should help minimize the impact of system disturbances and unusual operating conditions.

Distribution stations (and customers where practical), connected directly to the transmission system should plan and design their systems to operate close to unity power factor to minimize reactive power burden on the transmission systems.

Reactive power compensation should be installed close to the area of high reactive power consumption or production.

Sources of reactive power on NIPSCO's system include static capacitors, station generators, and capacitive line charging on high voltage lines. When system conditions require additional reactive power supply, substation switched shunt-type capacitors are installed in the area requiring reactive power support.

In some specific instances, when economically justified, other mitigating techniques can be utilized. Static VAR compensators or synchronous condensers may be used to accommodate widely varying VAR loads resulting from some customers' loads where operation of certain equipment can have detrimental effects on adequate and reliable power delivery.

Additional benefits gained through application of reactive sources include: loss reductions, reduced power flows, system capacity release and potential deferral of some capital investments.

VI. Fault Current Criteria

Three phase and single phase to ground fault current values associated with transmission system buses are reviewed to check equipment adequacy. Transmission facilities are rechecked as needed to determine that all equipment can withstand available fault duty. These checks include fault interrupting capacities, fault withstand capacities both electrical and mechanical, and grounding checks.

VII. Independent Power Producers – IPP

Independent power producer or privately - owned generation should operate to maintain "Normal Condition" bus voltages at its point of interconnection to the transmission system as specified in section, "II. Transmission System Voltage Criteria".

The NIPSCO Control Area generator power factor requirements at the point of interconnection to the NIPSCO transmission grid specify the range of acceptable power factors for a generator with less than 20 megawatt output as 0.95 lag and 0.95 lead. The range of acceptable power factors for a generator with 20 megawatt or greater output is 0.90 lag and 0.95 lead. The generator reactive power output into the transmission grid should be adjusted within the specified power factor requirements to maintain the transmission bus voltages as indicated in section, "II. Transmission System Voltage Criteria".

The independent power producer generator must maintain an output of megawatts and megavars that does not exceed the transmission system equipment thermal loading criteria as stated earlier in section, "I. Equipment Thermal Loading Criteria". The generator power output may need to be scheduled by the NIPSCO Control Area.

EXHIBIT I
NIPSCO INTERTIE CIRCUIT RATINGS

Areas Tied	Tie Location @	Voltage kV	Summer Normal MVA	Summer Emergency MVA	Winter Normal MVA	Winter Emergency MVA
NIPS–AEP	Dekalb-Auburn Line	138 kV	45	45	45	45
	F.G. Hiple - East Elkhart Line	345 kV	1,409	1,434	1,434	1,434
	F.G. Hiple - Collingwood Line	345 kV	1,409	1,434	1,434	1,434
	Howe – Sturgis Line	69 kV	47	47	51	51
	Maple – New Carlisle Line	138 kV	136	137	180	191
	Maple – Springville Line*	69 kV	47	47	59	59
	Michigan City – Laporte Line	138 kV	156	156	191	191
	Northeast – Columbus Line	138 kV	136	143	143	143
	Northeast – Kline Line	138 kV	168	246	221	280
	Northport – Albion Line	138 kV	159	184	200	215
	Reynolds Sub.	345 kV	318	318	318	318
	Stillwell – Dumont Line	345 kV	1,409	1,598	1,697	1,793
	Trail Creek –New Carlisle Line	138 kV	143	143	143	143
NIPS-AEP	Total Intertie Capability	➢	5,535	5,885	6,0573	6,2384
NIPS-CE	St. John - Crete Line	345 kV	1,091	1,091	1,195	1,195
	St. John - Green Acres Line**	345 kV	1,091	1,091	1,310	1,310
	Green Acres - Olive Line	345 kV	971	1,091	1,195	1,195
	Munster – Burnham Line	345 kV	973	1,069	1,053	1,143
	Roxana–State Line Gen Line	345 kV	253	253	287	287
	Sheffield – Burnham Line	345 kV	973	1,069	1,053	1,143
	Sheffield – State Line Line	345 kV	1,195	1,195	1,195	1,195
	Wolf Lake – State Line Line	138 kV	305	344	358	408
NIPS-CE	Total Intertie Capability	➢	5,761	6,112	6,336288	6,5666670
NIPS-AMRN	Morrison Ditch – Watseka Line	138 kV	239	239	239	239
NIPS-AMRN	Total Intertie Capability	➢	239	239	239	239
NIPS-ITC	Barton Lake –Kinderhook Line	138 kV	273	273	273	273
NIPS-ITC	Total Intertie Capability	➢	273	273	273	273
NIPS-DEM	Leesburg – Deedsville Line	345kV	734	780	780	780
	Monticello – Springboro Line	138 kV	287	287	287	287
	Rochester Tap -Rochester Line	69 kV	45	45	59	59
	S. Prairie – Westwood Line	138 kV	129	129	161	161
NIPS-DEM	Total Intertie Capability	➢	1,195	1,241	1,287	1,287

*- Maple – Springville 69KV Line is normally open
**- St. John – Green Acres Line not included in Total NIPS-CECO Intertie Capability

EXHIBIT II

69 kV Networked Circuits Included In Transmission Planning Analyses
**** Eastern Service Area ****
Angola - Dekalb 69 kV Line
Angola - Barton Lake 69 kV Line 1
Angola - Barton Lake 69 kV Line 2
Angola - Lagrange 69 kV Line 1
Angola - Lagrange 69 kV Line 2
Angola - Wolcottville 69 kV Line
Barton Lake - Lagrange 69 kV Line
Hiple - Northport 69 kV Line
Northport - Wolcottville 69 kV Line
**** Southern Service Area ****
Goodland - Remington 69 kV Line
Monticello - Honey Creek 69 kV Line
Monticello - Oakdale 69 kV Line
Oakdale – South Prairie 69 kV Line
South Prairie – Remington - Honey Creek 69 kV Line

Exhibit III

NIPSCO TRANSMISSION SYSTEM
LINE CONDUCTOR THERMAL RATINGS
(Summer Ratings – May Through September)

345KV VOLTAGE LEVEL (SUMMER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@345KV	AMPERES	MVA@345KV	AMPERES	MVA@345KV	AMPERES	MVA@345KV
2-900 KCM ACSR (45X7)	2,422	1,447	2,422	1,447	2,422	1,447	2,868	1,714
2-954 KCM ACSR (45X7)	2,648	1,582	2,648	1,582	2,648	1,582	3,178	1,899
2156 KCM ACSR (45X7)	2,199	1,314	2,199	1,314	2,199	1,314	2,665	1,592

138KV VOLTAGE LEVEL (SUMMER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@138KV	AMPERES	MVA@138KV	AMPERES	MVA@138KV	AMPERES	MVA@138KV
336.4 KCM ACSR (18X1)	569	136	678	162	569	136	806	193
336.4 KCM ACSR (26X7)	580	139	691	165	580	139	821	196
397.5 KCM ACSR (30X7)	653	156	780	186	653	156	929	222
300 KCM CU (19X1)	660	158	660	158	660	158	660	158
400 KCM CU (19X1)	790	189	790	189	790	189	790	189
900 KCM (45X7)	1,060	253	1,277	305	1,060	253	1,534	367
954 KCM ACSR 945X7)	1,099	263	1,324	316	1,099	263	1,589	380
1590 KCM (45X7)	1,500	359	1,820	435	1,500	359	2,199	526
2156 KCM ACSR (45X7)	1,808	432	2,199	526	1,808	432	2,665	637
2-1590 KCM ACSR 945X7)	3,001	717	3,639	870	3,001	717	4,398	1,051

69KV VOLTAGE LEVEL (SUMMER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@69KV	AMPERES	MVA@69KV	AMPERES	MVA@69KV	AMPERES	MVA@69KV
2/0 ACSR (6X1)	302	36	351	42	302	36	406	48
2/0 AA (7X1)	324	39	384	46	324	39	456	55
4/0 ACSR (6X1)	395	47	458	55	395	47	529	63
2/0 CU (7X1)	394	47	394	47	394	47	394	47
4/0 AA	434	52	517	62	434	52	615	74
4/0 CU (7X1)	528	63	528	63	528	63	528	63
336.4 KCM ACSR (18X1)	569	68	678	81	569	68	806	96
336.4 KCM ACSR (26X7)	580	69	691	83	580	69	821	98
477 KCM ACSR (18X1)	-	-	848	101	-	-	1,011	122

Exhibit IV

NIPSCO TRANSMISSION SYSTEM
LINE CONDUCTOR THERMAL RATINGS
(Winter Ratings – October Through April)

345KV VOLTAGE LEVEL (WINTER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@345KV	AMPERES	MVA@345KV	AMPERES	MVA@345KV	AMPERES	MVA@345KV
2-900 KCM ACSR (45X7)	2,840	1,697	2,840	1,697	2,840	1,697	3,190	1,906
2-954 KCM ACSR (45X7)	3,105	1,855	3,105	1,855	3,105	1,855	3,534	2,112
2156 KCM ACSR (45X7)	2,588	1,546	2,588	1,546	2,588	1,546	2,967	1,773

138KV VOLTAGE LEVEL (WINTER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@138KV	AMPERES	MVA@138KV	AMPERES	MVA@138KV	AMPERES	MVA@138KV
336.4 KCM ACSR (18X1)	711	170	794	190	711	170	897	214
336.4 KCM ACSR (26X7)	725	173	809	193	725	173	914	218
397.5 KCM ACSR (30X7)	817	195	913	218	817	195	1,033	247
300 KCM CU (19X1)	823	197	823	197	823	197	823	197
400 KCM CU (19X1)	987	236	987	236	987	236	987	236
900 KCM (45X7)	1,331	318	1,497	358	1,331	318	1,706	408
954 KCM ACSR 945X7)	1,381	330	1,552	371	1,381	330	1,767	422
1590 KCM (45X7)	1,895	453	2,136	511	1,895	453	2,444	584
2156 KCM ACSR (45X7)	2,287	547	2,588	619	2,287	547	2,967	709
2-1590 KCM ACSR 945X7)	3,790	906	4,272	1,021	3,790	906	4,888	1,168

69KV VOLTAGE LEVEL (WINTER RATING)								
	NORMAL RATING				EMERGENCY RATING			
	LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER		LINES BUILT PRIOR TO 1988		LINES BUILT IN 1988 & LATER	
CONDUCTOR SIZE	AMPERES	MVA@69KV	AMPERES	MVA@69KV	AMPERES	MVA@69KV	AMPERES	MVA@69KV
2/0 ACSR (6X1)	376	45	410	49	376	45	452	54
2/0 AA (7X1)	403	48	450	54	403	48	508	61
4/0 ACSR (6X1)	492	59	537	64	492	59	588	70
2/0 CU (7X1)	491	59	491	59	491	59	491	59
4/0 AA	541	65	605	72	541	65	685	82
4/0 CU (7X1)	658	79	658	79	658	79	658	79
336.4 KCM ACSR (18X1)	711	85	794	95	711	85	897	107
336.4 KCM ACSR (26X7)	725	87	809	97	725	87	914	109
477 KCM ACSR (18x1)	-	-	994	119	-	-	1,124	134