NEW BRUNSWICK SYSTEM OPERATOR

System Planning Within New Brunswick

Transmission System Planning
Performance Requirements

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Document Approval

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References:

NBSO-TPR-001.0: Transmission Planning Methodology and Governance
NBSO/NBPT/NSPI/NMISA/MECL "Maritimes Area Technical Planning Committee"

NBSO-TPR-001.3: TTC/TRM Rationale for NB

NBSO Website: Ten-Year Assessment (view NBSO website at www.nbso.ca for the most recent version)

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1.0 Introduction

The reliability standards set forth herein have been adopted as appropriate for the New Brunswick bulk power system**.** Further, they are consistent with those established by the Northeast Power Coordinating Council (NPCC) for the "Basic Criteria for Design and Operation of Interconnected Power Systems" and "Bulk Power System Protection Criteria". They also comply with North American Electricity Reliability Corporation (NERC) Transmission Planning Standards.

The purpose of these New Brunswick Reliability Standards is to assure the reliability and efficiency of the New Brunswick **bulk power supply system** through coordination of system planning, design and operation. These standards apply to all entities comprising or using the New Brunswick **bulk power supply system**. By entering into connection Agreements (Attachment J of the NBSO Tariff) and implementing NBSO Market Rules Chapter 4 Technical and Connection requirements ensures facilities that are connected to the Transmission System must also comply with NERC and NPCC criteria, guides, requirements, and standards.

These Reliability Standards are intended to be used for planning and design of the New Brunswick **bulk power system**. Reliability criteria and procedures for operations are developed and maintained by the NBSO. Examples of reliability-related documents used in system dispatch and operations are:

RC-EOP-001	Re1liability Coordinator Actions for Maritime Contingencies
RC-EOP-002	Emergency and High Risk Operating States
RC-EOP-003	Actions during a Capacity or Energy Deficiency in NB
RC-EOP-003.1	Actions during a Capacity or Energy Deficiency in NS
RC-EOP-003.2	Guideline for Manual Loadshedding in NB
RC-EOP-004	IROL/SOL Methodology
RC-EOP-004.1	RC Actions for Predetermined IROL

RC-EOP-004.2	RC Actions for Predetermined SOL
TOP-EOP-020	Line Outage Guidelines
SOA-T01	Common Operating Practices between Plants and NBSO
SOA-T01A	Black Start Criteria
BAL-OP-001	Must Run Generation for Operation of Point Lepreau
RC-OP-003	OL and IROL Methodology
RC-OP-005	Criteria for Approving Outages in NB
SOP-T0007	Outage Coordination

The New Brunswick **bulk power supply system** shall be designed for a level of reliability such that the loss of a major portion of the system, or unintentional separation of any portion of the system, will not result from reasonably foreseeable **contingencies**. Therefore, the system is required to be designed to meet representative **contingencies** as defined in these Reliability Standards. Analyses of simulations of these **contingencies** should include assessment of the potential for widespread cascading outages due to overloads, instability or voltage collapse. The loss of small portions of the system may be tolerated provided the reliability of the overall interconnected system is not jeopardized.

The standards outlined hereinafter are not tailored to fit any one system or combination of systems but rather outline a set of guidelines for system design which will result in the achievement of the desired level of reliability and efficiency for the New Brunswick **bulk power supply system**.

2.0 Resource Adequacy

The NPCC Generation Reliability criterion can be found in NPCC Document A-2 “Basic Criteria for Design and Operation of Interconnected Power Systems.” The NPCC Generation Reliability criterion states that each Area’s probability (or risk) of disconnecting any firm load due to resource deficiencies shall be, on average, not more than one day in ten years. Compliance with this criterion shall be evaluated probabilistically, such that the loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies shall be within the stated average. This evaluation shall make due allowance for demand uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighbouring Areas and Regions, transmission transfer capabilities, and capacity and/or load relief from available operating procedures.

Resources will be planned and installed allowing for factors such as:

- the possibility that load forecasts may be exceeded as a result of weather variations;
- immature and mature **equivalent forced outage rates** appropriate for generating units of various sizes and types, recognizing partial and full outages;
- due allowance for scheduled outages and deratings;
- seasonal adjustment of **resource** capability;
- proper maintenance requirements;
- available operating procedures;
- the reliability benefits of interconnections with systems that are not Governance Participants; and
- such other factors as may from time-to-time be appropriate.

3.0 Area Transmission Requirements

The New Brunswick **bulk power supply system** shall be designed with sufficient transmission capacity to integrate all **resources** and serve **area** loads such that:

- stability of the interconnected power system shall be maintained in normal pre-contingency operation as well as during and following all design contingencies on equipment within the NBSO controlled grid, with due regard to reclosing and any automatic control actions which may occur. The stability of the interconnected power system will be considered acceptable if all oscillations (voltage, current, angle) are adequately damped as not to cause any equipment damage and any unplanned equipment tripping;
- adequate reactive power resources with reserves and appropriate controls shall be installed to maintain voltages within normal limits for pre-disturbance conditions, and within **applicable emergency** limits as specified in NPCC Basic Criteria for Design and Operation of Interconnected Power Systems;

- line and equipment loadings shall be within normal limits for pre-disturbance conditions and within **applicable emergency limits** for the system load and generation conditions that exist following contingencies as specified in NPCC Basic Criteria for Design and Operation of Interconnected Power Systems; and
- equipment capabilities are adequate for fault current levels with all transmission and generation facilities in service for all potential operating conditions.

These requirements will also apply after any critical generator, transmission circuit, transformer, phase angle regulating transformer, HVDC pole, series or shunt compensating device has already been lost, assuming that the area resources and power flows are adjusted between outages, using all appropriate reserve resources available in ten minutes and where applicable, any phase angle regulator control, and HVDC control.

With due allowance for generator maintenance and forced outages, design studies will assume power flow conditions with applicable transfers, load, and resource conditions that reasonably stress the system. Transfers of power to and from another Area, as well as within New Brunswick, shall be considered in the design of inter-Area and intra-Area transmission facilities.

Transmission transfer capabilities will be based on the load and **resource** conditions expected to exist for the period under study for normal transfers and for emergency transfers as specified in NPCC Basic Criteria for Design and Operation of Interconnected Power Systems

All reclosing facilities will be assumed in service unless it is known that such facilities have been or will be rendered inoperative.

In applying these criteria, it is recognized that it may be necessary to restrict the output of a generating station(s) and/or HVDC terminal(s) following the loss of a system **element**. This may be necessary to maintain system stability or to maintain line loadings within appropriate thermal ratings in the event of a subsequent outage. But, the system design must be such that, with all transmission facilities in service, all **resources** required for reliable and efficient system operation can be dispatched.

Special Protection Systems (SPS) may be employed in the design of the interconnected power system. All SPS proposed for use on the New Brunswick system must be reviewed by the NPCC and the NBSO. Some SPS may also require acceptance by NPCC. The requirements for the design of SPS are defined in the NPCC "Bulk Power System Protection Criteria" and the NPCC "Special Protection System Criteria". Approval guidelines for SPS used on the NBSO controlled grid are contained in Appendix 7.0 of this document.

4.0 Transmission Transfer Capability

The New Brunswick **bulk power supply system** shall be designed with adequate inter-Area and intra-Area transmission transfer capability to minimize system reserve requirements, facilitate transfers, provide emergency backup of supply resources, permit economic interchange of power, and to assure that the conditions specified in “NPCC Basic Criteria for Design and Operation of Interconnected Power Systems” can be sustained without adversely affecting the New Brunswick system or other Areas. Anticipated transfers of power from one area to another, as well as within areas, should be considered in the design of inter-Area and intra-Area transmission facilities. Therefore, design studies will assume applicable transfers and the most severe load and resource conditions that can be reasonably expected.

Firm transmission transfer capabilities shall be determined for Normal and Emergency transfer conditions as specified in “NPCC Basic Criteria for Design and Operation of Interconnected Power Systems”. Normal transfer conditions are to be assumed except during an emergency. In determining the emergency transfer capabilities, a less conservative margin is justified.

5.0 Extreme Contingency Assessment

Extreme **contingency** assessment recognizes that the New Brunswick **bulk power system** can be subjected to events which exceed in severity the contingencies as specified in "NPCC Basic Criteria for Design and Operation of Interconnected Power Systems".

Planning studies will be conducted to determine the effect of the following extreme contingencies on New Brunswick bulk power supply system performance as a measure of system strength. Plans or operating procedures will be developed, where appropriate, to reduce the probability of occurrence of such contingencies, or to mitigate the consequences that are indicated as a result of the simulation of such contingencies as:

a) loss of the entire capability of a generating station;

b) loss of all transmission circuits emanating from a generating station, switching station, dc terminal or substation;

c) loss of all transmission circuits on a common right-of-way;

d) permanent three-phase fault on any generator, transmission circuit, transformer or bus section, with **delayed fault clearing** and **with due regard to reclosing**. This **delayed fault clearing** could be due to circuit breaker, relay system or signal channel malfunction;

e) the sudden dropping of a large load or major load center;

f) the effect of severe power swings arising from disturbances outside of New Brunswick;

g) failure of a **Special Protection System** to operate when required following the normal **contingencies;**

h) the operation or partial operation of a **Special Protection System** for an event or condition for which it was not intended to operate; and

i) common mode failure of the fuel delivery system that would result in the sudden loss of multiple plants (i.e. gas pipeline **contingencies**, including both gas transmission lines and gas mains).

6.0 Extreme System Conditions Assessment

The New Brunswick **bulk power supply system** can be subjected to a wide range of other than normal system conditions that have low probability of occurrence. One of the objectives of extreme system conditions assessment is to determine through planning studies, the impact of these conditions on expected steady-state and dynamic system performance. This is done in order to obtain an indication of system robustness or to determine the extent of a widespread adverse system response.

Analytical studies will be conducted to determine the effect of design contingencies under the extreme system conditions in accordance with NPCC document C-18 “Procedures for Testing and Analysis of Extreme Contingencies”.

APPENDIX 1

LOAD FORECASTING USED FOR TRANSMISSION STUDIES

1.0 Introduction

The in-province load forecast provides year by year prediction of loads at existing and future substations down to the 69 kV transmission level. Impacts from "Demand Side Management" and conservation efforts are addressed in the forecast.

1.1 Load Mix

As major transmission requirements are related to the balance of loads (aggregate mix of industrial, commercial and residential) and generation in a geographic region, the first step in planning is to allocate loads and generation to regions. Such regions or transmission planning areas are defined on the basis of general load concentrations. The five regions in New Brunswick for major transmission planning purposes are:

- **Northern** including, Miramichi, Bathurst, Caraquet, Belledune, Eel River and Dalhousie;
- **Western** including Edmundston, Iroquois, Saint Andre, Grand Falls, Beechwood, and Woodstock;
- **Central** including Keswick, Fredericton, Millville, Grand Lake, Marysville, and Mactaquac;
- **Southern** including Saint John, Courtenay Bay, Pennfield, Oak Bay, Coleson Cove, Norton, Point Lepreau; and
- **Eastern** including Salisbury, Moncton, Memramcook and Murray Corner.

The loads and generating capabilities are allocated to the above regions annually during the planning period and the balance, positive or negative, is a measure of transmission capability required into the region to meet load demand or out of the region to transmit surplus generation. This balance is calculated not only for the annual peak hour demand, but also for intermediate load levels.

The regional balances give an indication of the magnitude of transmission requirements and provide an appreciation of the long-term variation of such requirements.

1.2 Non Coincident Peaks

Load information is compiled on individual substation peak loads that may or may not occur at the time of system peak.

The prediction of sales to and purchases from neighbouring areas is an important aspect of the forecast.

APPENDIX 2

MODELING INFORMATION

1.0 Introduction

In the process of transmission planning, the geographic location of loads and generating stations play a role equally important to that of the magnitude of load and capacity of generating stations. Moreover, the planning methodology has to address imbalances between load and generation in any region as well as dynamics (e.g. fault conditions, stability) in order to provide reliable supply to customers.

1.1 SS37

A computer model of the base year for the existing system is required that includes generation, loads, transmission lines and substations.

This model simulates generating unit capacities, load concentrated at load centers, transmission lines and transformers with their transmission characteristics and capabilities. This model, commonly referred to as the load flow model, is used to test the system for satisfactory transmission capability.

Base Case models are developed yearly through the participation on the NPCC Modeling Working Group, SS-37.

The SS-37 Working Group includes direct representation from the entities within NPCC, as well as an NPCC staff-member as Chairman. The Working Group is charged with the responsibility for developing and maintaining a power flow base case model library including the dynamics data for their member systems for the benefit of NPCC members.

NPCC, and most Area member utilities, use the Power Technologies Inc. (PTI) Power System Simulator (PSS/E) software.

The primary purpose of the SS-37 Working Group is to coordinate, in a timely manner, the development of designated power flow base case models including the dynamics data, which realistically simulate bulk electric system behaviour. To achieve this purpose, the Group has established a set of common objectives and encourages common timetables for the development of data submission. Generally, the Group develops a library of planning power flow models, for the use of NPCC and NERC members for reliability and transfer capability studies.

SS-37 produces the following base cases on a yearly basis and these base cases are used as a starting point when setting up operational base cases for Load Flow studies associated with the Next Day Analysis:

Summer Peak Load — is defined as the summer peak demand expected to be served, reflecting load reductions for *peak shaving*. Summer interchange schedules should reflect transactions expected to be in place on July 15th. Planned summer maintenance of generation and transmission should be reflected in the operating year case.

Winter Peak Load — is defined as the winter peak demand expected to be served, reflecting load reductions for *peak shaving*. Winter interchange schedules should reflect transactions expected to be in place on January 15th. Planned winter maintenance of generation and transmission should be reflected in the operating year case.

Light Load — is defined as a typical early morning load level in April modeling near-minimum load conditions. Dispatchable hydro units should generally be modeled off- line, with run-of-river hydro on line. Generation dispatch and interchange schedules should be commensurate with the experience of the Regions during such load periods, not just including firm transactions. Planned spring maintenance of generation and transmission should be reflected in this case. Summer or appropriate equipment ratings should be used.

Shoulder Peak Load (Spring/Fall) — is defined as 70% to 80% of summer peak load conditions. Dispatchable hydro units should generally be modeled on-line.

SS37 also develops long term planning cases 5 years into the future consisting of a Winter Peak case, a Summer Peak Case, and a Light Load case.

Whenever any additions or changes are made to the transmission system, the operational base case load flow models are updated annually.

Whenever any changes are made to customer load levels, the operational base case load flow models are updated to reflect the changes.

Typical generation dispatch for the appropriate time frame is used for operational base case models.

1.2 Short-term/operational study models

Short-term and operational study base cases are developed by the NBSO Power System Engineering group by using the cases developed by SS-37 as a starting point, and updating the base case model as follows:

1.2.1 Transmission data

Whenever any additions or changes are made to the transmission system, the operational base case load flow models are updated to reflect the additions or changes.

For the next day analysis, the transmission system in the operational base case model is configured to reflect the expected conditions for the next day based on the information received from operating entities.

1.2.2 Load Data

Whenever any changes are made to customer load levels, the operational base case load flow models are updated to reflect the changes.

For the next day analysis, the system loading in the operational base case model is configured to reflect the expected conditions for the next day based on the information received from the operating entities.

1.2.3 Generation dispatch data

Typical generation dispatch for the appropriate time frame is used for operational base case models.

For the next day analysis, the generation dispatch in the operational base case model is configured to reflect the expected conditions for the next day based on the information received from the operating entities.

1.2.4 EMS Real-time Models

For the EMS real-time model, the transmission equipment model constants (impedances and topology) are kept up to date by the NBSO Power System Engineering group. The generator dispatch and equipment status is updated either from real-time information via the SCADA system or by operator input. The load data is updated by the state estimator program.

1.3 Model Comparisons

Any modeling exercises to compare simulation results with actual disturbance recordings have not indicated the need for any significant changes to the models being used. Comparisons of this nature were carried out by NPCC working groups COSS-1 and COSS-2 as well as by NB Power following a multiple contingency loss of the Mactaquac hydro station while at full output.

APPENDIX 3
RELIABILITY CRITERIA

1.0 Introduction

To ensure an adequate level of reliability in the northeast part of the continent and across North America, criteria have been established to guide utilities in the design, operation and maintenance of their power systems. Member areas of NPCC agree to abide by guidelines and criteria that have been established by experience over the years. It is these guidelines that form the basis for operation and maintenance of the bulk power system in New Brunswick.

The essential requirement is to provide service continuity to customers, and to avoid jeopardizing the reliability of neighbouring power systems in the event of loss of a major transmission component, line or transformer, or loss of a generating unit. This is commonly referred to as the 'single contingency' planning criterion.

1.1 Transmission Classifications:

Elements of the high voltage transmission network are classified as the ‘Bulk Power System” by applying the methodologies described in NPCC document “A-10 Classification of Bulk Power System Elements”. System studies are carried out on the “Bulk Power System” in accordance with NPCC Criteria and the NERC Standards. An intermediate transmission review is carried out annually and a comprehensive review (including dynamics) is done every three years.

The interconnected New Brunswick system is divided into several classifications, each of which is governed by different design criteria.

These classifications are as follows:

- Bulk Power System (BPS) Transmission (transmission facilities on which faults or disturbances can have a significant adverse impact outside of the local area).

- Transmission (serves mainly to interconnect generation with sub transmission at major load centres).
- Sub transmission (be that part of the system, which primarily serves as a source for transformation to the distribution level).
- Transformation

APPENDIX 4

DESIGN CRITERIA

1.0 Introduction

The system is studied under normal system conditions which are defined to include all of the following:

- Any load condition - this includes the full range of annually forecasted loads.
- All transmission facilities in service - no line or transformer maintenance.
- Economically scheduled and dispatched generation allowing for planned generator maintenance outages - non-firm generation not included as economically dispatched generation.
- All system voltages within 0.95 and 1.05% of nominal.
- All system elements within thermally limited ratings.

A single contingency is defined as an event leading to the loss of one or more transmission components. Examples – any fault resulting in the loss of a transmission line (single contingency), loss of two lines when lightning strikes double circuit structure (still a single contingency), or single breaker failure taking out two elements. The NB transmission system must be able to withstand a single contingency.

Following the contingency, the system elements remaining in service must be within thermal ratings, voltage and frequency limits. Under normal operating an acceptable system voltage shall range between 1.05 and 0.95 per unit. Following a single contingency, the voltage should remain above 0.925 per unit on the BPS and 0.90 per unit on the sub-transmission. Transformers can be loaded to 119% of their forced cooled 65 degree C rating when the ambient temperature does not exceed zero degrees C.

Following a single contingency resulting in the loss of a tie transformer, the capability must exist to provide 100% back-up of the peak demand of the unit forced out of service.

One method to control the existing 138/69 kV Tie Transformer loading so there is 100% back-up is to convert 69 kV substations to 138 kV. This practice was selected as the best economic solution to keep 69 kV transmission line construction to a minimum and control the load level of 138/69 kV transformers (allowing 100% back-up).

1.1 The Design Criteria for BPS is as follows:

- From normal systems conditions, the BPS Transmission shall be able to withstand the loss of any one-system element following a three-phase fault cleared in prime time.
- From normal systems conditions, the BPS Transmission shall be able to withstand the loss of any one system element following a line-to-ground fault cleared in delayed time.
- From normal system conditions following loss of any one-system element, all system elements shall be within their thermally limited ratings.
- From normal system conditions, for the loss of any one system element, as a general guideline no BPS Transmission system voltage shall be less than 90% following a steady state settling out of the system nor shall any bus experience a voltage change from pre-fault to post-fault condition greater than 10%.
- As far as possible, provision should be made to ensure that no fault is left permanently on the system in case of failure of a primary protective device.

Prime time clearance is defined to be the time to clear an in-zone fault. Actual clearance times for bulk transmission are in the 4 to 6 cycles (67 to 100 milliseconds) range for both three-phase and line-to -ground faults.

Back-up clearance is defined to be the time to clear an out-of-zone fault. Actual clearance times are in the 15 to 18 cycles (250 to 300 milliseconds) range for both three-phase and line-to-ground faults for bulk transmission.

Breaker Back-up: Breaker back up is defined to be protection against local breaker failure to trip for any reason. Breaker back up will be applied to all BPS Transmission and most of the “Transmission” system.

1.2 Transmission System

Prime time clearances are in the range of 6 to 9 cycles (100 to 150 milliseconds) for both three-phase and line-to-ground faults.

Back-up clearances are in the range of 20 to 30 cycles (333 to 500 milliseconds) for both three-phase and line-to-ground faults.

The Design Criteria is as follows:

- From normal systems conditions, the Transmission system shall be able to withstand the loss of any one-system element following a three-phase fault cleared in prime time.
- From normal systems conditions, the Transmission system shall be able to withstand the loss of any one system element following a line-to-ground fault cleared in delayed time.
- From normal system conditions following loss of any one-system element, all system elements shall be within their thermally limited ratings.
- From normal system conditions, for the loss of any one system element, as a general guideline no Transmission system voltage shall be less than 90% following a steady state settling out of the system nor shall any bus experience a voltage change from pre-fault to post-fault condition greater than 10%.
- As far as possible, provision should be made to ensure that no fault is left permanently on the system in case of failure of a primary protective device.

1.3 Sub Transmission

The Design Criteria is as follows:

- Sub transmission system loading shall be within the thermally limited ratings.
- Sub transmission system voltages shall not be less than 95% or greater than 105% of nominal
- From normal system conditions, for the loss of any one sub transmission system element which is part of a section of the system which remains connected, no transmission system bus voltage shall be less than 92.5% following a steady state settling out of the system nor shall any bus experience a voltage change from pre-fault to post-fault condition greater than 10%.
- As far as possible provision, should be made to ensure that no fault is left permanently on the system.

1.4 Transformation

Reinforcement is required in all cases when for single contingency there will result either, thermal damage to equipment in attempting to continue to supply the load or, inability to meet the daily load requirements in whole or in part after due consideration is given to the following:

- The capacity of the underlying interconnections with another supply points when applicable.
- Out-of-merit running of generation when applicable.
- Loading of remaining station(s) transformer(s) to their (or their associated equipment) thermally limited rating.
- Largest available suitable mobile transformer loaded to its nameplate rating.

In special circumstances, such as single contingency situations where some means of reducing the overload exists, a thermal rating based on a loss of life of 2-1/2% may be applied, with the use of engineering judgment. The loss of life permitted is measured over the time required to reduce the loading on the transformers. This may be done by switching low voltage circuits or relieving load by use of a mobile transformer.

APPENDIX 5

TOTAL TRANSFER CAPABILITY

1.0 Introduction

The Import and Export capabilities of the interfaces are calculated by NBSO following the principles found in the NERC Document of June 1996 titled "Available Transfer Capability Definitions and Determination" as well as in the draft NPCC Document titled "NPCC C-44 NPCC Regional Methodology and Procedures for Forecasting TTC and ATC.

Please refer to document “NBSO-TPR-001.3 TTC/TRM Rationale for NB” for actual interface transfer limits.

The process to calculate the TTC on interfaces is as follows (Attachment C of the NB Open Access Transmission Tariff):

- The Total Transfer Capability (TTC) of an interface is a best engineering estimate of the total amount of electric power, measured in MW that can be transferred over an interface in a reliable manner for a given time frame.
- The TTC of an interface is determined by performing power flow and stability studies under seasonal system conditions. Normal operation (all elements in service) and first contingency (N-1) scenarios are studied using summer and winter base case models to determine the summer and winter TTC of each interface. For the Non-Simultaneous TTC values, these studies are done on a single interface at a time, with power flows on all other interfaces equal to 0 MW. For Simultaneous TTC values, these studies are done taking into account all acceptable power flows which may occur simultaneously on the other interfaces. Simultaneous TTC values will be used as in the calculation of Available Transfer Capability for OASIS posting purposes when real-time conditions warrant.

- The TTC value (simultaneous and non-simultaneous) for a given interface is defined as the lowest of the transfer limits as defined by the thermal, voltage, or stability limit.

TTC calculations are done by the NBSO Power System Engineering group. TTC is calculated on a seasonal basis for each interface using PSSE load flow studies. The seasonal TTC values are posted on the OASIS by default. The OASIS system ATC Calculator computes ATC using TTC, existing reservations, schedules, and TRM as inputs.

Planned outages are studied for effects on TTC. If they affect TTC, they are classified as a category 1 outage. Planned outages are entered into the OSCAR program along with any resulting TTC changes due to the outage (for category 1 outages). OSCAR overwrites the default TTC on the OASIS with the TTC applicable for the outage, for the timeframe of that outage.

The TTC data base is also used to automatically update the TTC/ATC map located on the NPCC website on an hourly basis. http://www.nerro.org/flash/npcc.asp

APPENDIX 6

COMMON FACILITY RATINGS

1.0 Introduction

NBSO and its neighbouring BA/TOP use the same facility ratings as determined/confirmed on a yearly basis by the NPCC Modeling Working Group SS-37.

APPENDIX 7

Special Protection Scheme Approval Guidelines

1.0 Introduction

A Special Protection System (SPS) is defined as a protection system designed to detect abnormal system conditions, and take corrective action other than the isolation of faulted elements. Such action may include changes in load, generation, or system configuration to maintain system stability, acceptable voltages or power flows. With respect to this guide the following is not considered an SPS:

- Automatic under frequency load shedding, as defined in the NPCC *Emergency Operation Criteria* (Document A-3) is not considered an SPS.
- A Voltage controlled shunt device is not considered SPS.
- Undervoltage load shedding is not considered an SPS. Undervoltage load shedding is used for those locations that operate in an almost radial condition where a loss of one transmission line can result in a lower than acceptable voltage.

Criteria for design and operation concerning transmission capability for North-eastern North America, including conditions specific to SPSs, are established in the NPCC *Basic Criteria for Design and Operation of Interconnected Power Systems* (Document A-2). In addition to providing criteria for the design, testing and operation of SPSs, the NPCC Directory #7 *Special Protection System* categorizes SPSs according to the criteria fault for which it is designed and the impact its failure would have on the network.

2.0 Purpose

The above criteria focus on the effects of proper and improper operation of SPSs, generally leading to a determination of need for individual SPS for security and reliability. They provide no direction regarding situations in which an SPS might be appropriate or inappropriate in its application or functionality, or if particular design choices might result in unacceptable risk or complexity in operations. Such factors are included in these SPS application guidelines.

3.0 Defining Acceptable Risk

Practically, the "radial" nature of the Maritimes Area requires the use of Type I SPS and for those to be active most of the time.

The New Brunswick - New England interface is the Maritimes Area's AC connection to the Eastern Interconnection. The Maritimes Area, with respect to SPS implementation and impacts, may be considered radial load and generation tied to New England. Considering the small size of the Maritimes, a Type I SPS between the Maritimes and New England may in some respects be considered a Type III SPS. For reliability Type I design requirements are required as well consideration of both Areas reliability standards.

5.0 Guidelines

Each SPS will be evaluated based on these guidelines and consideration of the potential impacts on system operations and reliability. Exceptions to these guidelines may be permitted in limited circumstances, based on an assessment of such factors as the extent of the deviation from the guidelines and the impact of such deviation on any associated reliability or security risk or the complexity of system operations. Conversely, consideration of such factors and alternatives, including upgrading the transmission system, may result in an SPS being judged unacceptable even though it adheres to the guidelines.

For Each Type I SPS

- NPCC defines Type I SPSs to be those that are associated with conditions resulting from design and operating contingencies for which failure or miss operation has the potential for significant adverse impact outside of the local area (typically New England).
- Consultation with New England (and to a lesser degree Hydro-Québec due to the asynchronous HQ-NB HVDC interface) on acceptable impacts of an SPS (failure to operate or miss operation) is necessary.
- Exposure to operations may be continuous and permanent.
- Arming may be manual with alarms when conditions exist for selection or arming, or otherwise automatic.
- Additional IROL alarming upon detection of inappropriate or insufficient arming regardless if the SPS is armed manually or automatic.

For Each Type II SPS

- The Maritimes does not currently utilize Type II SPS.

For Each Type III SPS

- NPCC defines Type III SPSs to be those that have potential for local area (Maritimes).
- Impacts only the Maritimes Area with consideration of the reliability standards of neighbouring Areas.
- Generation Rejection must not exceed the largest Maritimes Area contingency.
- Load rejected must not exceed 250 MW.
- Exposure to operation may be continuous and permanent.
- Arming may be manual with alarms when conditions exist for selection or arming, or otherwise automatic

- Type III SPS to be reviewed periodically to determine if, due to system changes, they have become Type I or Type II.

References

NBSO - TPR - 001.1:	NBSO Transmission System Planning Performance Requirements
NPCC Directory #7:	Special Protection Systems
NPCC Document A-2:	Basic Criteria of the Design and Operation of Interconnected Power Systems
NPCC Directory #3:	Maintenance Criteria for BPS Protection
NBSO Market Rules:	Section 4.6 Special Protection Systems

APPENDIX 8

NBSO/NBPT Planning Responsibilities

Activity	NBSO Responsibility	NBPT Responsibility	Comments
Developing Methodology and Tools	**X**	X	Both NBSO and NBPT maintain and develop methodologies and tools for the analysis and simulation of the transmission systems in the evaluation and development of transmission expansion plans and the analysis and development of resource adequacy plans
			NBPT- Maintain transmission system models (steady state, dynamics, and short circuit) to evaluate bulk power system performance.
SPS Ownership		X	NBSO and NBPT jointly agree on SPS development
			NBPT owns and maintains SPS schemes. Define system protection and control needs and requirements, including SPS to meet Reliability Standards.
Evaluating Resource Adequacy	X		NBSO assesses resource plans for NB NBSO collects data for interim and comprehensive reports to NPCC
			NBPT uses non co-incident peak load projections and expected interconnection flows to develop 10 Year Transmission Plan
Carrying out Reliability Studies and Classifying Bulk Transmission	X	X	NBSO has capability through the PSSE program to validate BPS submitted by NBPT. NBSO as PC must demonstrate a valid assessment (TPL-001-0 R1)
			NBPT plans and designs the transmission system to meet NERC Standards and NPCC Criteria (including determining Bulk)

APPENDIX 8 (Cont'd)

Activity	NBSO Responsibility	NBPT Responsibility	Comments
Establishing Load Shedding Programs	X	X	Each TOP and BA shall establish plans for Automatic L/S. NBSO should establish the plan for coordination of the Maritimes Area. NBSO develops manual loadshedding plans for NB. NBPT – Establishes UFLS and UVLS for NB. The Distribution Provider must select identify priority loads and maintain UF relays it owns. GO also have to maintain.
Planning for Post Contingency Operations day ahead and realtime	X		
Conduct Feasibility Reviews	X	X	NBSO is responsible to conduct Feasibility Reviews NBPT assist the NBSO in conducting Feasibility Reviews
Conducting System Impact Studies	X	X	NBSO is responsible to perform System Impact Studies The NBSO can enter into an agreement with a Transmitter for such studies NBPT assist the NBSO with System Impact Studies
Maintaining Connections Application Queue	X		
Conducting Facilities Study		X	
Entering into Connection Agreements		X	
Producing Ten-Year Transmission Plan		X	
Producing Ten-Year Assessment	X		

APPENDIX 8 (Cont'd)

Activity	NBSO Responsibility	NBPT Responsibility	Comments
Participation in NPCC Planning Groups	X	X	NBSO and NBPT each insure appropriate representation on various NPCC Planning Committees
Facility Ratings		X	
Limits	X	X	NBSO produces SOL and IROL limits partly based on NBPT rating submission
			NBPT supplies facility rating and stability limits it identifies