Enclosure 9 to L-MT-08-018

Monticello Nuclear Generating Plant
Extended Power Uprate
Startup Test Plan

ENCLOSURE 9

MONTICELLO NUCLEAR GENERATING PLANT
EXTENDED POWER UPRATE STARTUP TEST PLAN

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1.0 Introduction

The following information supplements the Monticello Nuclear Generating Plant (MNGP) EPU License Amendment Request and provides additional information about startup testing using SRP 14.2.1 - Generic Guidelines for Extended Power Uprate Testing Programs, as a guide.

2.0 Purpose

2.1 Background

This document provides detailed information on the testing Nuclear Management Company (NMC) intends to perform following the Extended Power Uprate (EPU) implementation outages. The first implementation outage will be in 2009 and will upgrade plant equipment and load fuel sufficient to support operation at a maximum of 1870 MWt. The second implementation outage will be in 2011 and will upgrade plant equipment and load fuel sufficient to support operation at 2004 MWt.

Following each of these two implementation outages, NMC will conduct testing to ensure the safe operation of the plant. The tests that NMC intends to perform are described herein.

The required EPU startup testing for MNGP was determined using information from several sources:

- The startup and power ascension testing that was done during initial plant startup (1971). Information on this testing was obtained from the test plan and test procedure documents used at the time of initial startup.
- The testing that was done at the time of MNGP's stretch power uprate (1998). Information on this testing was obtained from the test plan and procedure documents used at the time.
- The guidance for extended power uprates in GE Topical Report NEDC 32424P-A "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate" (also referred to as ELTR1), including the NRC's Requests for Additional Information (RAIs) and GE responses, and the NRC's staff position on the ELTR1 documented in NRC letter dated February 8, 1996.
- The guidance for extended power uprates in GE Topical Report NEDC 32523P-A "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate" (also referred to as ELTR2), including Supplement 1, Volumes 1 and 2 and the NRC's staff position on the ELTR2 documented in NRC letter dated September 14, 1998.
- The guidance for constant pressure power uprates (CPPUs) in GE Topical Report NEDC 33004P-A "Constant Pressure Power Uprate" (also referred to as CLTR), including the NRC's RAIs and GE responses, and the NRC's safety evaluation of the CLTR documented in NRC letter dated March 31, 2003.

- Information and data from plant transients that have occurred during MNGP's lifetime, as applicable.

- The NRC Standard Review Plan (SRP), NUREG-0800, Section 14.2.1 "Generic Guidelines for Extended Power Uprate Testing Programs." (The NRC's Review Standard for Extended Power Uprates, RS-001, identifies SRP Section 14.2.1 as guidance for EPU power ascension and testing.)

- Experience from other BWR plants that have implemented EPUs.

The use of multiple GE Topical Reports (ELTR1, ELTR2 and CLTR) comes about as a result of the manner in which GE developed this information. The ELTR1 and ELTR2 were developed first and envisioned that EPUs would include an increase in reactor pressure. However, EPU implementation is simplified if reactor pressure is kept constant, and BWR EPUs to date in the US have used a CPPU approach. To clarify this approach, GE prepared the CLTR.

With regard to startup testing, a key NRC comment on the CLTR (as expressed in their safety evaluation) is that the need for "large transient" testing (such as Main Steam Isolation Valve (MSIV) closure tests and turbine trip/generator load rejection tests) needs to be addressed on a plant-specific basis rather than a generic basis. Accordingly, this document addresses large transient testing.

2.2 Objective

This Enclosure describes the startup testing that MNGP will conduct associated with implementation of its EPU, including justification for not performing some large transient testing. The information is organized in a manner similar to SRP Section 14.2.1.

3.0 Summary of Conclusions

Based on the discussions in Section 4 and Tables 1 and 2 of this enclosure, MNGP will perform EPU testing appropriate to show that it will operate safely after implementation of the EPU and that SSCs with safety-related requirements or functions will perform satisfactorily after implementation of the EPU.

<u>Initial Plant Startup Testing and Comparison to EPU Testing</u>
Table 1 to this enclosure shows the initial plant startup testing performed at Monticello and compares it to the EPU startup testing. The test activities in Table 1 of this enclosure identify all startup testing that was performed during the initial plant startup in 1971. Per the guidance of SRP 14.2.1, Table 1 to this enclosure identifies all of the tests that were performed during initial startup and the power levels at which the tests were performed. There were no tests at lower power levels that would be invalidated by EPU. For each initial startup test at power $\geq$ 80 percent Original Licensed Thermal Power (OLTP), Table 1 indicates how that test is addressed in EPU testing or indicates the justification for not performing that test.

For MNGP, large transient testing (MSIV closure and turbine trip/generator load rejection) is not needed or warranted. The justification for this conclusion is a combination of plant experience/data from past transients, analysis results that predict acceptable response for these transients with margin, the absence of new thermal-hydraulic phenomena or system interactions, guidance in GE Topical Reports, and risk evaluations. Importantly, plant response to these two large transients has been demonstrated by data from MNGP transients including a 2001 MSIV closure event (from 1740 MWt or 98% CLTP) and a 2002 generator load rejection (from 1773 MWt or 100% Current Licensed Thermal Power (CLTP)). The plant responded as expected during both events. For both events, the power level equivalent to EPU power (87 percent for the MSIV closure event and 88.5 percent for the generator load rejection) exceeds the percentage power (75 percent OLTP for the MSIV closure and 50 percent OLTP for the generator load rejection) during initial startup testing. As a result, the transients experienced in 2001 and 2002 bound testing that would be performed to repeat that conducted during initial startup testing.

This enclosure provides a detailed discussion of this conclusion and justification (Section 4.3).

Tests Associated with EPU Plant Modifications
Modifications associated with EPU are described in Enclosure 8 of the EPU License Amendment Request. Testing related to changes will be performed in accordance with the plant's modification program. The intent of the testing associated with each modification is to make sure that the structures, systems and components (SSCs) affected by the modification will perform satisfactorily after the modification is implemented.

The use of a constant pressure power uprate (CPPU) approach minimizes the changes in operating conditions that plant systems will experience with EPU. Further, this approach minimizes new interdependencies or interactions between systems. The guidance in the CLTR was utilized to determine the extent of testing associated with the EPU modifications.

EPU Testing
Table 2 summarizes the testing that will be performed for EPU.

4.0 Testing Evaluations

4.1 Comparison to MNGP Startup Test Program [SRP 14.2.1, III.A]

Table 1 to this enclosure identifies all startup testing that was performed during initial plant startup in 1971. The tests include all those that were performed with the vessel head off, during heat-up, and during power ascension. The tests performed during power ascension are then sub-divided into two groups; tests performed below 80 percent power, and those performed at or above 80 percent power.

Tests performed below 80 percent OLTP were reviewed to ensure that none of those tests will be invalidated by the EPU. Tests that were performed at or above 80 percent OLTP were evaluated to determine that a) the original tests are not invalidated, and b) EPU testing adequately addresses these tests.

Power ascension tests performed at <80 percent OLTP

In accordance with SRP 14.2.1, paragraph III.A.2, the startup tests of Table 1 of this enclosure were reviewed for tests that would potentially be invalidated by EPU. The following tests were performed exclusively below 80 percent OLTP: STP-3, STP-4, STP-6, STP-7, STP-8, STP-9, STP-10, STP-11, STP-12, STP-13, STP-17, STP-22, STP-31, and STP-37.

In accordance with SRP 14.2.1, paragraph III.A.2, the initial startup tests conducted at power levels below 80 percent OLTP were reviewed for tests that would potentially be invalidated by EPU. No such testing was identified for MNGP.

The MSIV Closure Test (STP-11) and the Generator Load Rejection Test (STP-17) were performed only at power levels less than 80 percent OLTP and are not invalidated by the EPU. Despite the fact that these tests were performed at <80 percent OLTP, they are large transient tests. The need for these tests as part of EPU startup testing is discussed later in Section 4.3.

Power ascension startup tests performed at ≥ 80 percent of OLTP

Table 1 to this enclosure provides comparisons of initial startup tests and startup tests for the 6.3 percent uprate to 1775 MWt, to planned testing for CPPU startup. As seen in Table 1, the following tests were performed at 80 percent of OLTP or greater during initial startup: STP-1, STP-2, STP-5, STP-14, STP-15, STP-16, STP-18, STP-19, STP-20, STP-21, STP-23, STP-24, STP-25, STP-26, STP-27, STP-28, STP-29, STP-30, STP-32, and STP-34. Planned testing for CPPU is indicated in Table 1 for tests that are being repeated from the original plant testing, with additional details provided in Table 2, which includes a description of all tests that will be performed. Justifications for exemption from certain transient testing are provided in Section 4.3 below.

Power ascension transient tests performed at < 80 percent of OLTP

Table 1 to this enclosure provides a complete comparison of initial startup tests to the startup tests performed for the uprate to CLTP (1,775 MWt) and the tests planned for CPPU (2,004 MWt). The following large transient tests, shown in Table 2 of SRP 14.2.1, were not performed during MNGP initial startup at power levels equal to or greater than 80 percent.

Initial Transient Test	Test No.	Power Level (%OLTP)
MSIV Closure	STP-11	25% 50% 75%
Generator Trip	STP-17	15% 50%

None of these tests will be invalidated by the EPU, and it is not necessary to include these tests in the EPU startup testing, as documented in Table 1 of this enclosure and in Section 4.3.

Power ascension transient tests performed at ≥ 80 percent of OLTP

Table 1 to this enclosure provides a complete comparison of initial startup tests to the startup tests performed for the uprate to CLTP (1,775 MWt) and the tests planned for CPPU (2,004 MWt). As seen in Table 1 to this enclosure, the following table shows those startup transient tests performed at 80 percent of OLTP or greater.

Initial Transient Test	Test No.	Power Level (%OLTP)
Recirculation System • One Pump Trip • Two Pump Trip	STP-14	 100% 100%
Recirculation Flow Control	STP-15	88% 100%
Turbine Trip	STP-16	100%
Pressure Regulator • Set Point Change • Backup Regulator	STP-18	 88% 100% 100%
Bypass Valve	STP-19	88% 100%
Feedwater System • One Pump Trip • Set Point Change	STP-20	 100% 88% 100%

As shown in Table 1 to this enclosure, STP-18 and STP-20 (set point change only) will be included as part of the EPU startup testing. The turbine trip (STP-16), recirculation pump trip (STP-14), recirculation flow control (STP-15), bypass valve testing (STP-19), and feedwater pump trips (STP-20) will not be tested and are discussed in Section 4.3.

4.2 Post Modification Testing Requirements [SRP 14.2.1, III.B]

Enclosure 8 of the EPU License Amendment Request provides a listing of EPU implementation modifications that are currently anticipated and that are being prepared for implementation between 2009 and 2011. NMC plans to implement EPU over two fuel cycles. In view of this two step process, implementation of the design changes listed in Enclosure 8 of the EPU License Amendment Request will occur throughout the period.

Modification Aggregate Impact

As can be seen from inspection of the modifications list of Enclosure 8 of the EPU License Amendment Request, the aggregate impact of most of these modifications on plant operations is minimal. The majority of the modifications are minor changes that will be segmented over two refueling outages. There are some significant modifications (e.g. HP turbine replacement, LP turbine modifications, Bus 11 and 12 replacement) that have a minor impact on the reactor plant, both individually and in aggregate. With some of the changes that are more interrelated (e.g. piping changes in feedwater), the extent of the changes themselves are minor (piping changes or pipe support modifications). An overall aggregate impact of these changes is not anticipated.

Condensate system and feedwater system upgrades do represent significant plant modifications, such as replacement of condensate pumps and motors, replacement of reactor feedwater pumps and motors, and enlargement of condensate demineralizers. These modifications will have an aggregate impact on the plant. These changes will be adequately addressed during post modification testing and the aggregate impact will be addressed by feedwater system power ascension testing (See Table 2 for a description of the performance and functional testing). Aggregate impact of EPU plant modifications, setpoint adjustments, and parameter changes will be demonstrated by a test program established for BWR EPU in accordance with startup test specifications as described in Power Uprate Safety Analysis Report (PUSAR) Section 2.12. The startup test specifications are based upon analyses and GE BWR experience with uprated plants to establish a standard set of tests for initial power ascension for CPPU. These tests, which supplement the normal Technical Specification testing requirements, are summarized below:

- Testing will be performed in accordance with the Technical Specifications Surveillance Requirements on instrumentation that is recalibrated for CPPU conditions. Overlap between the IRM and APRM will be assured. Data will be taken at points from 90 percent up to 100 percent of CLTP so that system performance parameters can be projected for CPPU power before CLTP is exceeded. CPPU power increases will be made in predetermined increments of ≤5 percent power (the planned increment is ~2.5 percent). Operating data, including fuel thermal margins, will be taken and evaluated at each step. Routine measurements of reactor and system pressures, flows, and vibration will be evaluated from each measurement point, prior to the next power increment. Radiation measurements will be made at selected power levels to ensure the protection of personnel.
- Control system tests will be performed for the reactor feedwater/reactor water level controls, and pressure controls, as applicable. These operational tests will be

performed at the appropriate plant conditions for that test at each of the power increments, to show acceptable adjustments and operational capability.

- Steam dryer/separator performance will be confirmed within limits by determination of steam moisture content as required during power ascension testing.
- Vibration monitoring of main steam and feedwater piping will be performed to permit a thorough assessment of the effect of EPU on this piping.

Because steam pressure and maximum licensed core flow have not changed and recirculation flow may only slightly increase for CPPU, testing of system performance affected by these parameters is not necessary with the exception of the tests listed above.

Multiple Structure Systems and Components (SSC)

Functions important to safety that rely on integrated operation of multiple SSCs following plant events (such as plant load swings) will be adequately addressed for MNGP through the normal testing and modification processes and through EPU testing identified in this enclosure.

4.3 Justifications for Elimination of Power Ascension Tests [SRP 14.2.1, III.C]

For steady-state or small transient tests that were performed at ≥80 percent OLTP during initial startup testing, that will not be re-performed during EPU startup testing, the justification is summarized in Table 1. This approach applies to the following tests: STP-2, STP-15, STP-21, STP-23, STP-26, STP-27, STP-28, STP-29, STP-30, STP-32, and STP-34.

For large transient tests that were performed during initial startup, that will not be re-performed during EPU startup, the justification is summarized in Section 4.3. This applies to the following tests: STP-11, STP-14, STP-16, STP-17, STP-19, and STP-20.

Guidelines of SRP 14.2.1, Paragraph III.C.2

Paragraph III.C.2 of SRP 14.2.1 provides specific guidance to be considered to justify elimination of large transient testing. The following table provides a cross reference between the guidance of SRP Paragraph III.C.2 and this enclosure.

Paragraph III.C.2	Guidance Criteria	Discussion/Location in This Document
(a)	Previous operating experience	Contained in paragraph 4.3.1/2.a where applicable, considering MNGP experience and EPU industry experience.
(b)	New thermal hydraulic phenomena or system interactions	No new thermal hydraulic phenomena or new system interactions were identified as a result of MNGP CPPU, as discussed in paragraph 4.3.1/2.b.
(c)	Conformance with limitation of analytical method	MNGP has no unique limitations associated with conformance to analytical methods. Where analytical results support the justification for eliminating the test, this aspect is discussed in paragraph 4.3.1/2.c.
(d)	Plant staff familiarization with facility operation and EOPs	Contained in paragraph 4.3.1/2.d
(e)	Margin reduction in safety analysis for AOOs	Provided in paragraph 4.3.1/2.e for specific tests, where applicable. Discussed in the section on EPU analyses results.
(f)	Guidance in Vendor topical reports	Discussed in paragraph 4.3.1/2.f
(g)	Risk implications	Provided in paragraph 4.3.1/2.g

ELTR1 states MSIV closure test should be performed for EPU if the power uprate is more than 10% above any previously recorded MSIV closure transient. ELTR1 also states a generator load rejection test should be performed if the uprate is more than 15 percent above any previously recorded generator load rejection transient. ELTR1 applies to extended power uprates whether constant pressure or otherwise.

With regard to these specific ELTR1 requirements, MNGP recorded an MSIV closure event on October 23, 2001 and a generator load rejection event on January 21, 2002. Based on these events, the ELTR1 criteria apply to MNGP as follows:

Event	Date	Power Level	CPPU Power Level	Percent Increase to CPPU	Recommendation by ELTR1
MSIV Closure	10-23-2001	1740 MWt	2,004 MWt	15	Because the increase is >10%, new test should be performed.
Generator Load Rejection	1-21-2002	1773 MWt	2,004 MWt	13	Because the increase is <15%, new test is not needed.

4.3.1 MSIV Closure Event (STP-11)

The MSIV closure event startup test functionally checks the Main Steam Isolation Valves for proper operation at selected power levels, determines reactor transient behavior during and following simultaneous full closure of all MSIVs, determines isolation valve closure time and determines the maximum power at which a single valve closure can be made without a scram.

The MSIV closure tests for Monticello during initial startup were not performed at power levels above 80 percent. The maximum power full closure test was performed at 75 percent (1258 MWt) of OLTP. Above 75 percent, the MSIVs were only stroked partially to ensure the valve would stroke and that partial stroke testing did not result in a SCRAM.

During an MSIV closure, the reactor is "bottled up" as feedwater continues to enter the reactor, as regulated by the feedwater regulating valve. Feedwater will continue to enter the reactor until either the operators trip the feedwater pumps, or the pumps trip automatically on a high level. Due to decay heat, steam continues to be produced, and the safety relief valves lift cyclically to relieve pressure, until pressure is stabilized below the lowest SRV setpoint. This set of events is the basic pattern for the transient regardless of the power level at which the transient initiates.

(a) Previous operating experience:

Monticello Test/Operating Experience

STP-11 (1971)

All Acceptance Criteria for MSIV Closure Event startup testing were satisfied. Proper MSIV operation was demonstrated and proper closure times were measured during testing at selected power levels.

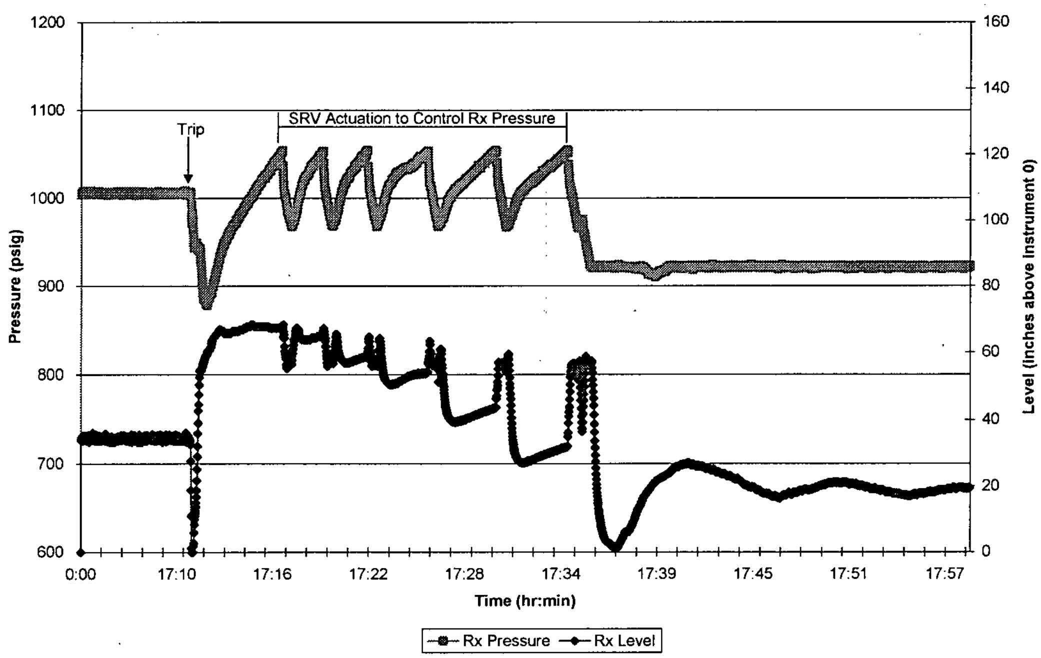
Functionally check MSIVs for Proper Operation at Selected Power Levels
During startup testing MSIVs were closed and tested individually during initial heatup at rated pressure, and during the test condition at approximately 75 percent power. Proper operation was demonstrated and closure times were within limits. Neutron flux, reactor pressure, heat flux, and steam flow margins to scram or isolation were calculated and results were within limits.

Determine Reactor Behavior (during and following full and simultaneous closure of all MSIVs
A full MSIV isolation was initiated from 75 percent power and the parameters of MSIV closing time and reactor pressure were recorded and compared to predicted values. The actual pressure rise experienced during this test was such that no safety/relief valves lifted.

SCRAM 112 – October 2001

On October 23, 2001, a full MSIV closure event occurred at 98 percent CLTP (or 87 percent of CPPU). The event was initiated by a plant technician inadvertently contacting a critical instrument rack while working in the Reactor Building. The vibration of the workers foot contacting the rack caused a Group I Isolation and subsequent Reactor Scram. Data recorded during the event demonstrated that the plant responded as expected and that resulting parameters were within guidelines and requirements. The following figure shows the plant response for reactor pressure and level. The expected behavior is observed, i.e., SRV actuation regulates pressure within a prescribed band, after an initial level surge, level gradually decreases until stable conditions are reached.

SCRAM 112 Reactor Pressure and Level



Note: Instrument 0 is 477.5 inches, which is 126 inches above top of active fuel.

The plant response following the MSIV closure transient was in accordance with expectations. Note that the power level for this transient (87 percent of CPPU) exceeds the percentage power (75 percent OLTP) during initial startup testing.

Other BWR (post-EPU) experience

A review of industry transient events that occurred at greater than original power levels at BWR-3/4 units that are similar in design to MNGP resulted in the following examples of plant response to MSIV closure events. As indicated in the example below, the plant responded as expected in accordance with its design features. No unexpected conditions were experienced nor were any latent defects uncovered in these events beyond the specific failures that actually initiated the events. The event provides further evidence that Large Transient Testing is unnecessary.

Dresden Nuclear Power Station – 17 Percent Approved Power Uprate

LER 2005-02

On March 24, 2005, at 0529 hours (CST), with Unit 2 at approximately 96 percent power, two unexpected control room alarms were received for exceeding the Electro-Hydraulic Control System maximum combined flow limit setpoint and open Turbine Bypass Valves. Several seconds later, high flow in the Main Steam System resulted in a signal to close the Main Steam Isolation Valves (MSIVs) that initiated an automatic reactor scram. All control rods fully inserted and all Group 1 Isolation Valves closed as designed. The Group 2 and 3 Isolation Valves closed as expected and the Isolation Condenser was manually initiated to control reactor pressure. All MSIVs fully closed within the required time.

The experience above indicates that other plants that have previously performed EPUs have successfully responded as planned to MSIV closure events. Based on the experience of other similar plants, it is likely that MNGP will perform similarly to these transients.

(b) New thermohydraulic phenomena or system interactions:

No new thermohydraulic phenomena or system interactions have been identified as a result of the EPU. Additionally, PUSAR Section 2.2.2.1 indicates that the generic evaluation for MSIV closure identified in ELTR2 is applicable to Monticello and is bounding. The MSIV maximum flow and pressure conditions are unchanged from the current licensed power. Based on the results of the generic evaluation in ELTR2 and the limits placed on the maximum steam flow by the flow restrictors, the MSIVs are determined to be acceptable for EPU conditions.

(c) Conformance with limitations of analytical methods:

N/A.

(d) Plant staff familiarization with facility operation and EOPs:

The EPU will not change any plant operations or EOP actions. Since the dome pressure will not change, no SRV set point changes are required. The inboard MSIV closure time is assisted by the increased steam flow. The closing times will be readjusted to ensure that the MSIV closure times satisfy plant technical specifications. However, these changes do not change the operation of the plant to address increased steam flow.

(e) Margin reduction in safety analysis for Anticipated Operational Occurrences (AOOs):

Analysis indicates that the predicted peak dome pressure for limiting events increases by up to 40 psi. The analysis is updated each fuel reload. Adequate margins exist to accommodate cycle specific variances and to ensure that all ASME Code requirements continue to be satisfied.

(f) Guidance in vendor topical report:

PUSAR Section 2.2.2.1 indicates that the generic evaluation for MSIV closure identified in ELTR2, Section 4.7 is applicable to Monticello and is bounding. ELTR2, Section 4.7 uses a pressure increase of 75 psi; however, Monticello is performing a CPPU, which will result in a full power steam flow increase of 15 percent without a corresponding pressure increase. Based on the guidance in ELTR2, MSIV closure testing is not recommended.

(g) Risk Implications:

MNGP conducted an assessment of the risk impact of performing an MSIV isolation transient test at EPU conditions.

The MNGP EPU PRA was used to estimate the additional risk of testing by determining the Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) associated with the individual tests. These values represent the additional probabilities given that the test has occurred. The CCDP values for Core Damage Frequency (CDF) were calculated by multiplying the base CDF by the PRA Fussell-Vesely risk importance measure of the initiating event and then dividing that result by the initiator frequency. The CLERP for Large Early Release Frequency (LERF) is calculated similarly.

The PRA results are presented in the tables below.

PRA Model	CDF	LERF
Base EPU PRA	7.89E-06	3.94E-7

PRA Initiating Event	Fussell-Vesely* CDF	Fussell-Vesely* LERF	Initiating Event Frequency (/yr)
Isolation event (MSIV Closure)	1.22E-03	7.98E-03	3.80E-02

Results		
Initiator	CCDP	CLERP
MSIV Isolation test	2.53E-7	8.27E-8

The results indicate a small but non-trivial increase in core damage and large early release probabilities. The increase in risk does not justify the need to perform the tests for demonstration purposes only, since no new information, that cannot otherwise be obtained, will be gained from the test.

(h) Conclusion:

MNGP has reviewed the initial startup testing, recent operating experience, and plant experience from other BWRs, as well as analysis and PRA results. The plant response to a MSIV closure event has been previously demonstrated by plant transient data. Supporting analysis included as part of the EPU and fuel reload analyses also demonstrate the continued safe operation and expected plant behavior to the MSIV closure event after the EPU. Lastly, the power level for the MSIV closure event (87 percent of CPPU) exceeds the percentage power (75 percent OLTP) during initial startup testing. Therefore the objective of this test is satisfied without requiring new or additional plant transient testing.

4.3.2 Generator Load Rejection (STP-17)

The startup testing for Generator Load Rejection demonstrates the response of the reactor and turbine overspeed following a generator trip. The startup tests for Turbine Trip (STP-16) and Generator Load Rejections (STP-17) at MNGP, in addition to recent plant transients at CLTP, adequately demonstrated this response and further testing is not considered necessary.

During a generator load rejection, the turbine will speed up due to the loss of the load provided by the generator. Upon receiving a load rejection signal, the turbine control valves will close, and the reactor will receive a SCRAM signal. Excess steam will be automatically bypassed to the main condenser by the bypass system, which is automatically controlled. If the pressure increases above the lowest SRV setpoint, the SRV will open to relieve pressure to the suppression pool.

A turbine trip is similar to a generator load rejection, with the exception that the turbine speed increase will not occur.

(a) Previous operating experience:

Monticello Test/Operating Experience

STP-17

A generator load rejection was performed from a maximum power level of 50 percent. All Acceptance Criteria for the generator load rejection startup testing were satisfied.

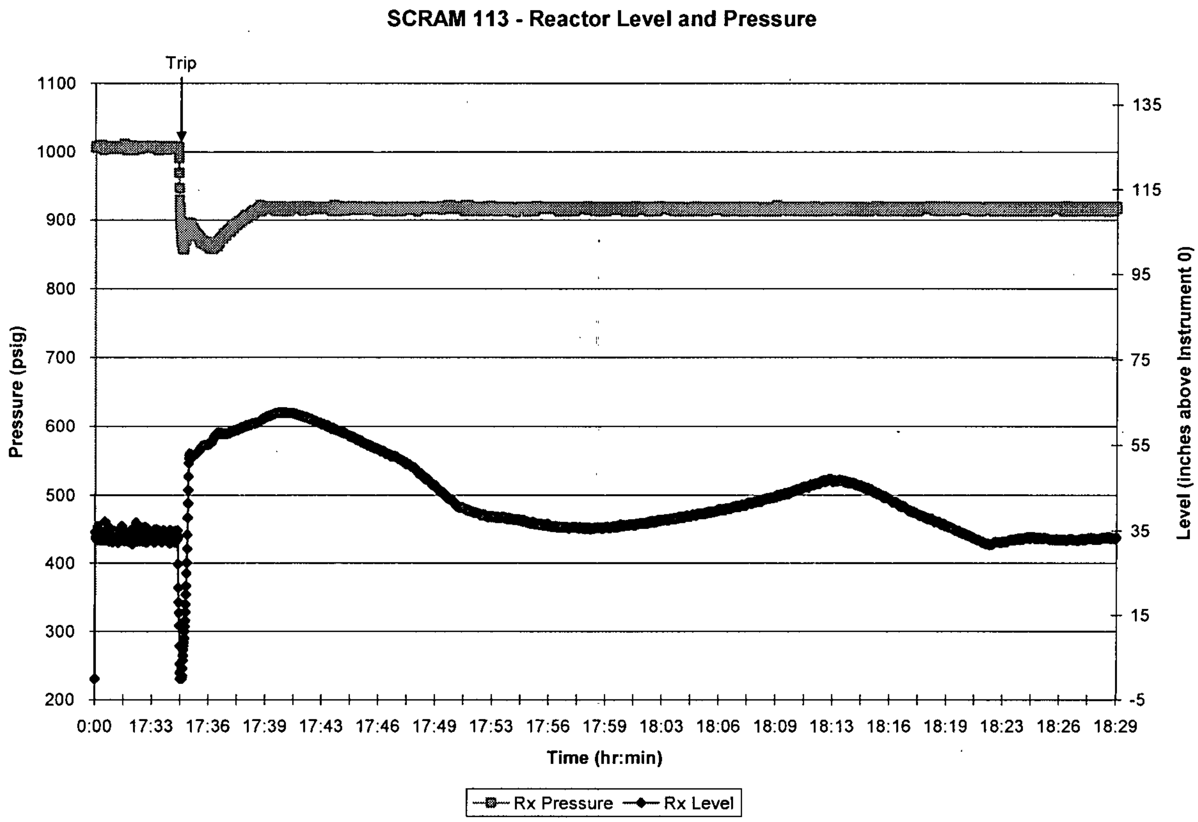
SCRAM 113 – January 21, 2002

On January 21, 2002, a generator load rejection event occurred. While operating at 100 percent CLTP a turbine control valve fast closure (load rejection) signal resulted in a reactor scram. All rods fully inserted and all safety systems functioned as designed. A

Group II containment isolation occurred, as expected, on a reactor low water level signal following the scram.

Following the scram, No. 11 Reactor Feedwater Pump (RFP) was manually tripped in accordance with plant procedures. Before No. 12 RFP could be manually tripped, an automatic trip on high reactor water level occurred. The No. 12 RFP was restarted, the feedwater block valves closed, and reactor water level was controlled using the low flow feedwater regulating valve. Operator actions were determined to be timely, consistent with procedures, and reflected an appropriate sensitivity to operating conservatism. All major plant and substation equipment functioned as designed in response to the scram.

The following figure shows the plant response for reactor pressure and level.



Note: Instrument 0 is 477.5 inches, which is 126 inches above top of active fuel.

The plant response for the transient was consistent with expectations. The power level for the transient is equivalent to 88.5 percent of EPU power.

Other BWR (post-EPU) experience (Includes Turbine Trips and Generator Load Rejections)

A review of industry transient events that occurred at greater than original power levels at BWR-3/4 units that are similar in design to MNGP resulted in the following examples of plant response to generator load rejection and turbine trip events. As indicated in the examples below, the plants responded as expected in accordance with its design features. No unexpected conditions were experienced nor were any latent defects uncovered in these events beyond the specific failures that actually initiated the events. These events provide further evidence that Large Transient Testing is unnecessary.

Dresden Nuclear Power Station – 17 Percent Approved Power Uprate

<u>LER 2004-002</u>

On January 30, 2004, the Shift Manager decided to swap the Unit 3 Main Turbine Lube Oil Coolers as the Turbine Oil Continuous Filter Differential Pressure had been increasing for several days. On January 30, 2004, at 1155 hours (CST), with Unit 3 at 97 percent power in Mode 1, an automatic scram occurred due to a Main Turbine trip from low lube oil pressure. The event occurred during a swapping of lube oil coolers. Immediately following the scram, the position of the Feedwater Regulating Valves (FRVs) increased from 56 percent open to 63 percent. The increase in the position of the FRVs, combined with the post-scram decreasing reactor pressure, caused an increase in total feedwater flow that led to the trip of the "B" Reactor Feedwater Pump (RFP) on low suction pressure. Additionally, subsequent FRVs response to increasing reactor vessel level was not fast enough to prevent the level from reaching the RFP High Level trip set point and resulted in the tripping of the "A" and "C" RFPs. Reactor water level was subsequently restored to normal and the RFPs were restarted. All rods inserted and other than the feedwater response, all other system responded as expected to the automatic scram.

Edwin I. Hatch Nuclear Plant – 13 Percent Approved Power Uprate

<u>LER 99-05</u>

On May 5, 1999, Hatch Unit 2 was at 98.3 percent of rated power (2,716 CMWT). The main generator tripped on a ground fault, followed by a turbine trip. The reactor scrammed and the reactor recirculation pumps tripped automatically on turbine control valve fast closure caused by the turbine trip. The reactor feed water pumps maintained water level higher than eight inches above instrument zero. No safety system actuations on low level were received nor were any required. Pressure reached a maximum value of 1,124 psig. Plant and system responses were as expected.

<u>LER 2001-02</u>

On March 28, 2001, Plant Hatch Unit 1 was at 100 percent rated thermal power. At that time, the reactor automatically scrammed on turbine control valve fast closure caused by a main turbine trip. The main turbine tripped when actuation of phase two and phase three differential relays monitoring a unit auxiliary transformer resulted in actuation of a lockout relay. Actuation of this lockout relay generated a direct turbine trip signal and the main turbine tripped per design.

Reactor Feedwater Pumps recovered reactor vessel water level within 30 seconds of the scram. As a result, the HPCI and RCIC system low water level initiation signals cleared before either system could inject makeup water to the reactor vessel. Vessel pressure reached a maximum value of 1,127 psig after receipt of the scram. All systems functioned as expected and per their design given the water level and pressure transients caused by the turbine trip and reactor scram. Vessel water level was maintained well above the top of the active fuel throughout the transient.

Brunswick Steam Electric Plant – 20 Percent Approved Power Uprate

<u>LER 2003-04</u>

On November 4, 2003, Brunswick Steam Electric Plant Unit 2 was operating at approximately 96 percent of rated thermal power when a loss of generator excitation caused a generator and turbine trip. The generator/turbine trip resulted in RPS actuation. The voltage transient also resulted in PCIS Valve Group I (MSIVs, Main Steam Line Drain valves, and Reactor Recirculation Sample valves), Group 3 (Reactor Water Cleanup isolation valves), and Group 6 (Containment Atmosphere Control/Dilution, Containment Atmosphere Monitoring, and Post Accident Sampling System isolation valves) isolations.

All control rods fully inserted into the core. Plant response to the transient also resulted in High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) System actuations on low reactor pressure vessel (RPV) coolant level, with injection into the RPV. All four Emergency Diesel Generators (EDGs) automatically started but did not load because electrical power was not lost to the emergency buses.

The experience above indicates that other plants that have previously performed EPUs have successfully responded as planned to generator load rejections and turbine trips. Based on the experience of other similar plants, it is likely that MNGP will perform similarly to these transients.

(b) <u>New thermohydraulic phenomena or system interactions:</u>

No new thermohydraulic phenomena or system interactions have been identified as a result of the EPU.

(c) <u>Conformance with limitations of analytical methods:</u>

N/A.

(d) <u>Plant staff familiarization with facility operation and EOPs:</u>

The EPU will not change any plant operations or EOP actions.

(e) Margin reduction in safety analysis for Anticipated Operational Occurrences (AOOs):
A generator load rejection is not a limiting event and does not result in a reduction to the margin of safety.

(f) Guidance in vendor topical report:

Full load reject testing is not required under the guidelines of ELTR1 as shown below:

Event	Date	Power Level	CPPU Power Level	Percent Increase to CPPU	Recommendation by ELTR1
Generator Load Rejection	1-21-2002	1773 MWt	2,004 MWt	13	Because the increase is <15%, new test is not needed.

(g) Risk Implications:

MNGP conducted an assessment of the risk impact of performing a turbine trip transient test at EPU conditions (which would be representative of a load rejection transient).

The MNGP EPU PRA was used to estimate the additional risk of testing by determining the Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) associated with the individual tests. These values represent the additional probabilities given that the test has occurred. The CCDP values for Core Damage Frequency (CDF) were calculated by multiplying the base CDF by the PRA Fussell-Vesely risk importance measure of the initiating event and then dividing that result by the initiator frequency. The CLERP for Large Early Release Frequency (LERF) is calculated similarly.

The PRA results are presented in the table below.

PRA Model	CDF	LERF
Base EPU PRA	7.89E-06	3.94E-7

PRA Initiating Event	Fussell-Vesely* CDF	Fussell-Vesely* LERF	Initiating Event Frequency (/yr)
Non-isolation event (Turbine Trip)	4.00E-02	2.21E-01	9.90E-01

Results		
Initiator	**CCDP**	**CLERP**
Turbine trip test	3.19E-7	8.80E-8

The results indicate a small but non-trivial increase in core damage and large early release probabilities. The increase in risk does not justify the need to perform the tests for demonstration purposes only, since no new information, that cannot otherwise be obtained, will be gained from the test.

(h) Conclusion:

MNGP has reviewed the initial startup testing, recent operating experience, and plant experience from other BWRs, as well as analysis and PRA results. The plant response to a generator load rejection has been previously demonstrated by plant transient data. Supporting analysis included as part of the EPU and fuel reload analyses also demonstrate the continued safe operation and expected plant behavior to the generator load rejection after the EPU. Lastly, the power level for the generator load rejection (88.5 percent of CPPU) exceeds the percentage power (50 percent OLTP) during initial startup testing. Therefore the objective of this test is satisfied without requiring new or additional plant transient testing.

4.3.3 Recirculation Pump Trips (STP-14)

As part of the CPPU, the recirculation flow rate to provide 100 percent core flow is only slightly increased. The increase is approximately 1.7 percent of the CLTP recirculation rate. Due to the small increase in recirculation flow rate, the plant response to recirculation flow rate changes is not significantly affected. No testing is required.

4.3.4 Recirculation Flow Control (STP-15)

The recirculation pump motor generators will be upgraded. The recirculation flow will be increased by 1.7 percent of the OLTP as a result of the EPU. Due to the small increase in recirculation rate, the plant response is not significantly affected. No testing is required.

4.3.5 Turbine Trip (STP-16)

A turbine trip is similar to a generator load rejection (see Section 4.3.2). Additionally, turbine trips with and without bypass are considered and evaluated as appropriate for each fuel reload. The reload analysis is then added as part of the revised safety analysis report.

4.3.6 Bypass Valve (STP-19)

The bypass valves are not being modified or replaced as part of the EPU. The flow rate under normal operating conditions will remain as 0.97 Mlb/hr (13.3 percent of the current steam flow, or 11.6 percent of the post EPU steam flow). Additionally, the bypass valves are non-safety related and are not required under accident conditions. Accordingly, no startup testing of the bypass valves is warranted.

4.3.7 Feedwater Pump Trips (STP-20)

For the loss of feedwater (LOFW) event, adequate transient core cooling is provided by maintaining the water level inside the core shroud above the top of active fuel. A plant-specific analysis was performed for Monticello at EPU conditions. This analysis assumed failure of the HPCI system and used only the RCIC system to restore the reactor water level. Because of the extra decay heat from EPU, slightly more time is required for the automatic systems to restore water level. Operator action is only needed for long-term plant shutdown. The results of the LOFW analysis for Monticello show that the minimum water level inside the shroud is 77 inches above the top of active fuel at EPU conditions. After the water level is restored, the operator manually controls the water level, reduces reactor pressure, and initiates RHR shutdown cooling. This sequence of events does not require any new operator actions or shorter operator response times. Therefore, the operator actions for an LOFW transient do not significantly change for EPU.

The results of the Monticello LOFW analysis also showed that the RCIC system restores the reactor water level while avoiding the level at which the Emergency Operating Procedures (EOPs) require the operator to initiate ADS.

Since there are no adverse impacts on the ability of the plant to adequately control reactor vessel level, and no changes to the plant operation are required, transient testing of the feedwater system (other than that identified in Table 2) is not necessary.

5.0 Operator Training/Large Transient Simulations

For EPU, MNGP will benchmark the Monticello simulator against the EPU analyzed transients and to subsequently perform testing to confirm the adequacy of simulation of the various transients. Once the simulator is benchmarked, MNGP operators will be trained on various plant upset conditions, from postulated accident conditions to anticipated transients. In this way, plant operators will be prepared for the nature, timeline, and extent of the plant response to simulated transients.

ENCLOSURE 9

Table 1 – Comparison of MNGP Initial Startup Testing and Planned EPU Testing

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-1	Chemical and Radiochemical: Chemical and radiochemical tests were conducted to establish water conditions prior to initial operation and to maintain these throughout the test program.	<15% 15% 25% 50% 75% 88% 100%	None	Yes EPU Test 1A	Test will be performed. See Table 2 for details.		X	X	X	X	X	X	X
N/A	Steam Dryer: The purpose of this test is to measure moisture content in main steam.	Not performed	None	Yes EPU Test 1B	Dryer performance monitoring. See Table 2 for details.		X	X	X	X	X	X	X
STP-2	Control Rod Drive: The purpose of this test is (1) Demonstrate that the hydraulic system and CRDs operate properly over the full range of primary coolant temperatures and pressures from ambient to operating, and particularly that thermal expansion of core components does not bind or significantly slow control rod movement, (2) Determine the initial operating characteristics of the entire system.	<15% 25% 50% 100%	None	None	Not necessary to retest. No changes in temperature or pressure will occur as a result of the EPU.								
STP-3	Fuel Loading: To load fuel safely and efficiently to the full core size	<15% Note 1	None	None	Fuel loading is performed in accordance with standard procedures.								
STP-4	Shutdown Margin: To demonstrate that the reactor is adequately shutdown with the strongest single control rod fully withdrawn	<15% Note 1	None	None	Shutdown margin is determined as part of every reload.								
STP-5	Radiation Measurement: The purpose of this test is to determine gamma and neutron radiation levels in the plant environs prior to operation and at selected power levels to ensure the protection of personnel.	<15% 15% 25% 50% 88% 100%	106.3% Determine gamma and neutron radiation levels in the plant environs	Yes EPU Test 2	Test will be performed. See Table 2 for details		X	X	X	X	X	X	X
STP-6	Control Rod Sequence: The purpose of this test is to verify the acceptability of the specified control rod withdrawal sequence	<15% Note 1	None	None	Control rod sequences are developed in accordance with approved procedures.								
STP-7	SRM Performance: The purpose of this test is to provide data to demonstrate that the operational sources, Source Range Monitoring instrumentation, and rod withdrawal sequences provide adequate information to the operator during normal startup	<15% Note 1	None	None	Not necessary to retest. Normal surveillances provide assurance.								
STP-8	IRM Calibration: The purpose of this test is to calibrate the IRM system to read percent of core thermal power.	<15% Note 1	None	Yes EPU Test 10	Adjust IRM to APRM overlap during first controlled shutdown following APRM calibration at EPU								

ENCLOSURE 9

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-9	<u>Reactor Vessel Temperature:</u> The purpose of this procedure is to obtain RPV temperature during rapid heatup and cooldown to confirm thermal analysis model	<15% Note 1	None	None	The operating temperature and pressure for the EPU is the same as pre-EPU conditions.								
STP-10	<u>System Expansion:</u> The purpose of this test is to verify that the (1) reactor drywell piping system is free and unrestrained in regard to thermal expansion and that suspension components are functioning in the specified manner (2) provides data for calculation of stress levels in nozzles and weldments.	<15% Note 1	None	None	The operating temperature and pressure changes associated with the EPU are insignificant for these components								
STP-11	<u>Main Steam Isolation Valves:</u> The purpose of this test is to (1) Functionally check the main steam isolation valves for proper operation at different power levels, (2) Demonstrate the capability to perform isolation valve test closures without threatening reactor safety or causing a reactor scram, (3) Determine reactor transient behavior following simultaneous full closure of all MSIV, (4) Determine isolation valve closure times	25% 50% 75%	None	None	See PUSAR Section 2.2.2.1 for MSIV closure analysis and Section 4.3.1 of the enclosure for justification of elimination.								
STP-12	<u>RCIC:</u> The purpose of this test is to demonstrate the ability of the RCIC system to provide the required flow at various turbine steam supply and pump discharge pressures and to start from cold standby conditions	<15% Note 1	None	None	Since there is not a change in dome pressure, additional startup testing of the RCIC system is not necessary.								
STP-13	<u>HPCI:</u> The purpose of this test is to demonstrate the ability of the HPCI system to provide the required flow at various turbine steam supply and pump discharge pressures and to start from cold standby conditions	<15% 50%	None	None	Since there is not a change in dome pressure, additional startup testing of the HPCI system is not necessary.								
STP-14	<u>Recirculation System:</u> The purpose of this test is to (1) Evaluate the recirculation flow and power level transients following trips of one or both of the recirculation pumps, (2) Calibrate the reactor core flow measurement system, (3) Measure the reactor core flow by performing mass and energy balances on the reactor downcomer	25% 50% 75% 100%	106.3% Calibrate the reactor core flow measurement system. Functional testing Note 2	None	The increase in recirculation flow rate is approximately 1.7% from CLTP. Due to the small increase in recirculation rate, the plant response to a recirculation pump trip is not significantly affected.								

ENCLOSURE 9

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-15	Flow Control: This test will determine (1) the plant response to changes in the recirculation flow, (2) Demonstrate plant load following capability	50% 75% 88% 100%	90% 98% Functional testing Note 2	None	The recirculation pump motor generators will be upgraded. The increase in recirculation flow rate is approximately 1.7% from CLTP. Due to the small increase in recirculation rate, the plant response to a recirculation flow change is not significantly affected.								
STP-16	Turbine Trip: The purpose of this test is to determine the response of the reactor system to a turbine trip. The parametric responses of particular interest are the peak values and rate of change of both reactor power and reactor steam dome pressure.	50% 75% 100%	None	None	None. Turbine trips with and without bypass are limiting transients for fuel reloads and are addressed in the reload analysis.								
STP-17	Generator Trip: The purpose of this test is to determine and demonstrate reactor response to generator trip, with particular attention to the rates of changes and the peak values of reactor power level, dome pressure and turbine speed.	15% 50%	None	None	See Section 4.3.2 of the enclosure for justification of elimination.								
STP-18	Pressure Regulator: The purpose of this test is to (1) Determine the reactor and pressure control system response to pressure regulator setpoint changes, (2) Demonstrate the stability of the reactivity-void feedback loop to pressure perturbations, (3) Demonstrate the control characteristics of the load limiter, (4) Demonstrate the take-over capabilities of the backup pressure regulator, (5) Optimize the pressure regulator setpoint	15% 25% 50% 75% 88% 100%	90% 98% Functional testing Note 2	Yes EPU Test 22	Test will be performed. See Table 2 for details	X	X	X		X		X	X
STP-19	Bypass Valves: The purpose of this test is (1) Demonstrate the ability of the pressure regulator to minimize the reactor pressure disturbance during a small step change in reactor steam flow, (2) Demonstrate that the bypass valve can be tested for proper functioning at rated power without causing a high flux scram.	15% 50% 75% 88% 100%	None	None	Not necessary to retest. No modifications are being made to the bypass valve as part of the EPU or to the pressure conditions at the bypass valve. See Section 4.3.6.								

ENCLOSURE 9

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-20	Feedwater System: The purpose of this test is to determine the effect of changes in subcooling on reactor power and steam pressure, and to demonstrate that reactor response to changes in subcooling are stable at all power levels. This test also includes feedwater pump trips.	15% 25% 50% 75% 88% 100%	90% 98% 104% Functional testing NSP committed to the following prior to testing: - area ambient temperatures will be monitored to confirm that design temperatures are not exceeded - confirm that the level in the high pressure and high intermediate pressure feedwater heaters is adequate to prevent bypassing of steam into the subcooling zone of the feedwater heaters - walkdown will be performed to verify that there is no unexpected flow induced vibration or motion of feedwater and condensate lines including small bore branch connections - measure feed and condensate pump motor currents to verify load study assumptions	Yes EPU Test 23	Functional and Performance tests will be performed. See Table 2 for details. Pump trip testing will not be performed. See Section 4.3.7.	X	X	X		X		X	X
STP-21	Flux Response to Rods: The purpose of this test is to demonstrate the relative stability of the power-reactivity feedback loop with regard to small perturbations in reactivity caused by rod movement with increasing power.	15% 25% 50% 75% 88% 100%	None	None	Reactor core is loaded in accordance with approved procedures. No changes have been made to reactor internals that would invalidate previous tests.								
STP-22	Relief Valves: The purpose of this test is to (1) Demonstrate the operability of the primary system relief valves, (2) Verify the capacity of the relief valves, (3) Demonstrate leak tightness of the relief valves after operation.	25%	None	None	SRV setpoints are not being changed as part of the EPU. Therefore, there is no effect on functionality.								
STP-23	LPRM Calibration: The purpose of this test is to calibrate the local power range monitor system.	15% 25% 50% 75% 100%	None	None	Tests performed in accordance with the surveillance program.								
STP-24	APRM Calibration: The purpose of this test is to present the methods for calibrating the Average Power Range Monitor Channels.	<15% 15% 25% 50% 75% 88% 100%	Flow biased scram setpoints and rod withdrawal Note 2	Yes EPU Test 12	Test will be performed. See Table 2 for details		X						
STP-25	Core Performance Evaluation: The purpose of this test is to evaluate the core and thermal hydraulic performance.	15% 25% 50% 75% 88% 100%	90% 100% 102% 104% 106.3% Note 2	Yes EPU Test 19	Test will be performed. See Table 2 for details	X	X	X	X	X	X	X	X

ENCLOSURE 9

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-26	Calibration of Rods: The purpose of this test is to obtain the effect on reactor power of control rod motion for typical rod movements.	15% 50% 75% 88%	None	None	Reactor core is loaded in accordance with approved procedures. No changes have been made to reactor internals that would invalidate previous tests.								
STP-27	Axial Power Distribution: The purpose of this test is (1) obtain axial power distributions at various conditions of rod patterns, power levels, recirculation flow rate, and subcooling, (2) Verify the reproducibility of each TIP system, (3) Determine power distribution symmetry of octant-symmetric control rod patterns.	25% 50% 75% 88% 100%	None	None	Reactor core is loaded in accordance with approved procedures. No changes have been made to reactor internals that would invalidate previous tests.								
STP-28	Rod Pattern Exchange: The purpose of this test is to perform a representative change in basic rod pattern at a higher reactor power level.	100%	None	None	Reactor core is loaded in accordance with approved procedures. No changes have been made to reactor internals that would invalidate previous tests								
STP-29	Process Computer: The purpose of this test is to verify the performance of the process computer under plant operating conditions.	<15% 15% 25% 50% 75% 88% 100%	None	None	No changes are being made to the process computer that would invalidate original test.								
STP-30	Electrical Output and heat Rate: The purpose of this test is to demonstrate that the requirements of the Net Plant Electrical Outlet Warranty and the Net Plant Heat Rate Warranty are satisfied.	Warranty Test	None	None	No warranty test is planned. Provisions for performance are included in the contract with the vendor.								
STP-31	Loss of Turbine Generator and Offsite Power: The purpose of this test is to demonstrate that the reactor can safely with stand a loss of the turbine-generator and all off-site power.	25%	None	None	The EPU modifications do not change the ability of the safety systems to initiate and function properly nor change the ability of the EDGs to function properly.								
STP-32	Vibration Test: The purpose of the vibration tests is to (1) Measure the response of key reactor internal components as well as the recirculation pumps and piping to dynamic forces, (2) Demonstrate the mechanical integrity of the system to vibratory motion.	<15% 50% 75% 100%	None	None	No tests will be performed. The full power core flow range will change, but the maximum licensed core flowrate (60.5 Mlb/hr) will remain unchanged.								
STP-34	LPRM Response: The purpose of this test is to demonstrate the response characteristic of the LPRM chambers to typical flux levels encountered in operation and to the neutron flux near the maximum steady state heat flux limit.	50% 75% 100%	None	None	Reactor core is loaded in accordance with approved procedures. No changes have been made to reactor internals that would invalidate previous tests								

ENCLOSURE 9

Orig. Test No.	Original Test Description	Startup Test Power % OLTP	1775 MWt Rerate Testing (Expressed in %OLTP) (Note 2)	Test Planned for CPPU	Evaluation Justification Notes	CPPU Test Conditions Percent of 1775 MWt (% CLTP)							
						≤90	100	102.5	105	107.5	110	112.5	EPU
STP-37	Recirculation Loop Control: The purpose of this test is to determine the "as built" characteristics of the recirculation control system (i.e., Drive Motor, Fluid Coupler, Generator, Drive Pump and Jet Pumps) and to adjust control systems parameters for optimum performance.	<15% 50%	None	None	The as-built characteristics of the Recirculation System are not changing.								
N/A	Main Steam and Feedwater Piping Vibration: The purpose of this test is to monitor vibration in the Main Steam and Feedwater System.	N/A	100% 102% 104% 106.3% Visual inspection of Feedwater and Steam Piping	Yes EPU Test 100	Test will be performed. See Table 2 for details. Main Steam and Feedwater system piping both inside and outside of containment		X	X		X		X	X
N/A	Plant Parameter Monitoring and Evaluation: The purpose of this test is to compare Power-dependant parameters that will be calculated using accepted methods to ensure current licensed and operational practices are maintained	N/A	90% 98% 100% 102% 104% 106.3%	Yes EPU Test 101	Power dependent performance parameters of systems and components remain within limits	X	X	X		X		X	X

Note 1: These tests were performed with the vessel open or during initial heat-up (prior to power testing).

Note 2: NMC (NSP at the time) committed to performing power ascension testing in accordance with the generic power uprate guidelines provided in NEDC-32424P. This testing is designed to verify the following:

Plant systems affected by the power rerate are within design limits.
Nuclear fuel thermal limits are maintained within expected margins.
The response of the main steam pressure control system is stable.
The response of the reactor water level control system is stable.
The reactor core flow is within design limits and stable.

The power increase to the rerate power level was made along a constant rod line by increasing reactor recirculation flow. Steady state conditions were established after each increment of power increase, and test data was obtained to confirm the response of plant parameters and system performance. The power ascension consisted of three power increase increments of approximately 35 MWt or 2.1%. The incremental increases provide for a controlled approach to the rerate power level. The power increase increments are listed below.

Increment 1 1670 MWt to 1705 MWt
Increment 2 1705 MWt to 1740 MWt
Increment 3 1740 MWt to 1775 MWt

Table 2 – Planned EPU Power Ascension Testing

Title	Test Number	Test Description
Chemical and Radiochemical	Initial STP-1, EPU Test 1A	Samples will be taken and measurements will be made at selected EPU power levels to determine 1) the chemical and radiochemical quality of reactor water and reactor feedwater and 2) gaseous release.
Steam Dryer/Separator Performance	EPU Test 1B	Samples will be taken and measurements will be made at selected EPU power levels to determine steam dryer/separator performance (i.e., moisture carryover). For this testing main steam line moisture content is considered equivalent to the steam separator-dryer moisture carryover. Sampling and analysis will be in accordance with existing plant procedures.
Radiation Measurements	Initial STP-5 EPU Test 2	At selected EPU power levels, gamma dose rate measurements and, where appropriate, neutron dose rate measurements will be made at specific limiting locations throughout the plant to assess the impact of the uprate on actual plant area dose rates. USAR radiation zones will be monitored for any required changes.
IRM Performance	Initial STP-8 EPU Test 10	After the APRM calibration for EPU, the IRM gains will be adjusted as necessary to assure the IRM overlap with the APRMs.
APRM Calibration	Initial STP-24 EPU Test 12	Each APRM channel reading will be adjusted to be consistent with the core thermal power, referenced to the LPU level, as determined from the heat balance.

Title	Test Number	Test Description
Core Performance	Initial STP-25 EPU Test 19	Routine measurements of reactor parameters are taken near 90% and 100% of CLTP along a constant flow control line to be used to increase to maximum EPU power. Power increase is along this constant rod pattern line in incremental steps of 5% or less to ensure a careful, monitored approach to maximum EPU power. Measure reactor parameters and calculated core performance parameters are utilized to project those values at the next power level step. Core thermal power and core performance parameters are calculated using accepted methods to ensure current license and operational practices are maintained. Each test condition's actual parameters will be evaluated against their projected values and operational limits before increasing power to the next step and the final increase to maximum EPU power.
Pressure Regulator	Initial STP-18 EPU Test 22	The pressure regulator requires only the following changes for EPU: 1) Those settings identified in the Turbine Generator Performance Evaluations 2) Pressure Control System, (i.e. Pressure Regulator Setpoint), 3) Confirming the dynamic tuning parameters. Before EPU, while the plant is shutdown, the pressure regulator will be tested and dynamically calibrated. The Control and Transient Safety Report (C&TSR), NEDC-10069, and GE Service Information Letter (SIL) 589 discuss the settings for the dynamic parameters for the pressure regulator. Pressure control system response to pressure set point change is tested at various test conditions. Testing the system requires a 5 psi down set point change followed by a 5 psi up set point change when conditions stabilize. Following the 5 psi pressure change the same testing is performed for a 7 psi pressure change. Pressure regulators are tested individually and sequentially.
Feedwater System	Initial STP-20 EPU Test 23	The feedwater control system response to reactor water level set point changes (for level set point change tests) are evaluated in the indicated control mode (i.e., three element, single element). At each test condition, level set point change testing is performed by first making an up set point value change, which effects the level set point change desired, followed

Title	Test Number	Test Description
		by a down set point value change of the same value, after conditions stabilize, in accordance with the following set point change sequence. 1) + 2 inches · 3) + 3 inches · 5) + 4 inches 2) – 2 inches · 4) – 3 inches · 6) – 4 inches The 2 and 3 inch level set point steps are informational and recommended to demonstrate the level control response prior to performing the formal level set point steps (i.e., 4 inches). The results from the informational level set point steps are utilized to anticipate the responses to the formal demonstration test steps, so that effects on the reactor of the 4 inch steps may be anticipated (i.e., power increases, level alarms). The normal feedwater control system mode is three-element control, with single element control being used primarily during plant startup and under certain degraded conditions. The feedwater control system in three-element control mode should be adjusted, not only for stable operational transient level control (i.e., decay ratio), but also for stable steady-state level control (i.e., minimize reactor water limit cycles). In single element control mode, the system adjustments must achieve the operational transient level control criteria, but for steady state level control the temporary backup nature of this mode should be considered. For tests calling for manual flow step changes, at each test condition the feedwater control system is placed in a manual/auto configuration (i.e., one feedwater flow control valve (FCV) in manual and the other in automatic controlling water level). Preferably the flow step changes are made by inserting the step demand change into the feedwater FCV controller in manual or alternately by changing the set point of that controller in accordance with the following set point change sequence expressed in percent of rated EPU feedwater flow. After completion of testing on one controller, the manual/auto configuration is switched and

Title	Test Number	Test Description
		the sequence is repeated on the other controller. 1) Increase 5% 2) Decrease 5% 3) Increase 10% 4) Decrease 10% The 5% flow step changes are informational and recommended to demonstrate the feedwater turbine response prior to performing the formal test flow step changes (i.e., 10%). The results from the smaller informational flow steps are utilized to anticipate the responses to the formal demonstration test, so that any effects on the reactor may be anticipated (i.e., level changes, power increases).
Main Steam and Feedwater Piping Vibration	Initial STP-N/A EPU Test 100	During the EPU power ascension, designated main steam and feedwater piping points (i.e., locations and directions) will be monitored for vibration. Vibration monitoring points will be designated based on EPU piping vibration analysis and engineering judgment. Monitoring points may be coincidental with those in the initial startup piping vibration test or be selected as those points with the highest predicted vibration. Alternately, vibration monitoring points can be coincidental with exposed piping attachments provided that acceptance criteria is established for those points based on piping system vibration analysis. Vibration measurements taken above CLTP will permit a thorough assessment of the effect of the EPU in comparison to any previous piping vibration analysis or evaluation.

Title	Test Number	Test Description
Plant Parameter Monitoring and Evaluation	Initial STP-N/A EPU Test 101	Routine measurements of the power-dependent parameters from systems and components, affected by the EPU, are taken at 90% and 100% CLTP on a constant flow control line that will be used to increase to maximum EPU power. Power increase is along this constant rod pattern line in incremental steps of 5% or less to ensure a careful, monitored approach to maximum EPU power. Power-dependant parameters that are calculated will be calculated using accepted methods to ensure current licensed and operational practices are maintained. Measured and calculated power-dependant parameters are utilized to project those values at the next power level step prior to increasing to the next EPU test condition. Each step's projected values will be evaluated to have satisfactorily confirmed the actual values before advancing to the next step and the final increase to maximum EPU power.