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United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and 50-455

Subject: Supplemental Startup Report for Byron Station, Units 1 and 2 – Mid-Cycle Power Uprate

Reference: Letter from Richard P. Lopriore (Exelon Generation Company, LLC) to U.S. NRC, "Startup Report for Byron Station, Units 1 and 2 – Mid-Cycle Power Uprate" dated August 8, 2001

In the referenced letter we submitted a mid-cycle startup report in accordance with the requirements of the Byron Station, Technical Requirements Manual, Section 5.0, "Administrative Controls," Section 5.3.a. Section 5.3.a requires the submittal of a startup report within 90 days following resumption of commercial power operations after an amendment to the license involving a planned increase in power level. When this startup report was submitted, all power ascension testing was not complete. All power ascension testing is now complete. The attached supplemental startup report provides a summary of the results of the testing activities not previously submitted in the referenced letter.

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If you have any questions or require additional information concerning this report, please contact Mr. B. Grundmann, Regulatory Assurance Manager, at (815) 234-5441, extension 2800.

Respectfully,

Richard P. Lopriore
Site Vice President
Byron Nuclear Generating Station

RPL/JL/dpk

Attachment A: Byron Station, Units 1 and 2, Mid-Cycle Power Uprate Ascension Supplemental Startup Report

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Byron Station
NRC Project Manager – NRR – Byron Station

ATTACHMENT A

BYRON STATION, UNITS 1 AND 2

MID-CYCLE POWER UPRATE ASCENSION

SUPPLEMENTAL STARTUP REPORT

Byron Station, Units 1 and 2
Mid-Cycle Power Uprate Ascension Startup Report

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Executive Summary

In a letter from Richard P. Lopriore (Exelon Generation Company, LLC) to the U.S. NRC, "Startup Report for Byron Station, Units 1 and 2 – Mid-Cycle Power Uprate," dated August 8, 2001, we submitted a mid-cycle startup report in accordance with the requirements of the Byron Station, Technical Requirements Manual, Section 5.0, "Administrative Controls," Section 5.3.a. Section 5.3.a requires the submittal of a startup report within 90 days following resumption of commercial power operations after an amendment to the license involving a planned increase in power level. When this startup report was submitted, all power ascension testing was not complete. All power ascension testing is now complete. The attached supplemental startup report provides a summary of the results of the testing activities not previously submitted in the August 8, 2001, letter.

As discussed in the August 8, 2001, Startup Report, post installation "Electrical Output Tests" were acceptably performed on both units; however, the evaluation of the post-installation electrical output test and pre-installation electrical output test data was not complete. The results of this evaluation are included in this supplemental report. In addition, this supplemental Startup Report provides a summary of two additional tests, noted below, that were performed on Unit 2.

- In July 2001, Special Procedure (SPP) 01-013, "Byron Unit 2 Pre-Heater Bypass Flow Measurement and Pre-Heater Flow Determination," was performed. Test results met the test acceptance criteria verifying that the amount of feedwater entering Unit 2 SGs through the main feedwater nozzle was below the maximum upper limit used in the power uprate analysis.

- In October 2001, SPP 01-007, "Byron Power Uprate Project Unit 2 Moisture Carryover Test," was performed. Based on test data collected the average moisture carryover (MCO) was calculated to be 0.12%. This value met the design limit of less than or equal to 0.25%. Operation at the current MCO level is considered satisfactory.

Byron Station, Units 1 and 2 Power Uprate Ascension
Supplemental Startup Report

1.0 Purpose

This supplemental Startup Report describes the test activities not yet complete when the initial Startup Report was submitted on August 8, 2001.

These test activities include: (1) results of the "Electrical Output Tests" on both units, (2) description and results of the "Pre-Heater Flow Determination Test" performed on Unit 2, and (3) description and results of the "Moisture Carryover Test" performed on Unit 2.

2.0 Power Uprate Testing Activities

2.1 Electrical Output Tests

The objective of the Byron Station Power Uprate initiative was to optimize electrical power production by implementing an approximate 5% increase in reactor power. In conjunction with the reactor power uprate, turbine hardware changes were made to increase each unit's turbine-generator output. Four electrical output tests were performed to collect plant data to calculate the electrical output of each unit. A "Pre-Uprate Electrical Output Test" and a "Post-Uprate Electrical Output Test" were conducted on each unit in order to determine the change in electrical output of each unit's turbine generator. Testing was performed in accordance with Special Procedure (SPP) 01-003, "Byron Power Uprate Project Pre and Post Installation Electrical Output Test," and SPP 00-006 for the "Unit 1 Pre Installation Electrical Output Test."

Seasonal variations and plant operating conditions affect electrical power output. As a result, electrical output may be higher or lower than the value indicated on heat balance drawings. To account for variations in conditions, calculations were performed to normalize electrical output consistent with the conditions noted on the baseline heat rate drawings. These calculations were performed by the turbine vendor and reviewed by Exelon Generation Company (EGC), LLC.

Test Objective

Collect data for determining the corrected electrical output at the baseline heat-rate condition at pre-uprate and at post-uprate power levels.

Plant Conditions or Prerequisites

The reactor and turbine power levels were stable. Operation was near full power with the Reactor Coolant System (RCS) temperature within 1°F of the programmed reference temperature. Steam generator (SG) blowdown and main condenser hotwell makeup systems were isolated. The main generator reactive load was adjusted between 300 and 350 Mega Volt-Amps Reactive (MVARS). Test equipment was installed for data collection.

Test Summary

The test method was based on the American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME), "Steam Turbines, Performance Test Code, PTC-6, Alternate Method." The plant configuration was controlled by the test procedure. Each test collected two data sets with the plant at steady state conditions.

Acceptance Criterion

The corrected heat rate for the two data sets was within 0.25% satisfying the procedure acceptance criteria. If the heat rate difference were greater than 0.25% an additional data collection would have been required.

2.1.1 Unit 1 Electrical Output Test Results

Using test data, the electrical output was corrected to pre-Uprate and post-uprate heat rate conditions. Results are presented in the table below.

Pre-Uprate		Post-Uprate		
Data Set	**Corrected Electrical Output** (MWe)	**Data Set**	**Corrected Electrical Output** (MWe)	**Gain in Electrical Output** (MWe)
1	1173.718	1	1257.563	
2	1174.028	2	1257.255	
Avg.	1173.873	**Avg.**	1257.409	83.536

2.1.2 Unit 2 Electrical Output Test Results

Using test data, the electrical output was corrected to pre-uprate and post-uprate heat rate conditions. Results are presented in the table below.

Pre-Uprate		Post-Uprate		
Data Set	**Corrected Electrical Output** (MWe)	**Data Set**	**Corrected Electrical Output** (MWe)	**Gain in Electrical Output** (MWe)
1	1176.090	1	1217.835	
2	1173.760	2	1219.136	
Avg.	1174.925	**Avg.**	1218.486	43.561

2.2 Pre-Heater Flow Determination Test – Unit 2

Pre-heater flow was determined in accordance with SPP 01-013, "Byron Unit 2 Pre-Heater Bypass Flow Measurement and Pre-Heater Flow Determination."

Test Objective

Collect data and perform calculations to: (1) verify that pre-heater flow to each SG is below the maximum analyzed flow rate, and (2) verify the scaling accuracy of elbow tap flow meters used to indicate pre-heater bypass flow rate.

Plant Conditions or Prerequisites

The reactor and turbine power levels were stable. Operation was near full power. Test equipment was installed for measuring feedwater parameters.

Test Summary

This procedure determined pre-heater feedwater flow to each SG on Byron Station, Unit 2. Because a direct measurement of pre-heater flow could not be obtained due to piping layout and location, pre-heater bypass flow was measured and subtracted from an upstream flow value, which was a combination of pre-heater and pre-heater bypass flow, to determine the pre-heater flow value. This combined upstream flow to a SG was measured with the permanent plant venturi flow meter. Flow through the pre-heater bypass line was measured using special test equipment.

Acceptance Criteria

1. Pre-heater flow for each SG (i.e., 2A, 2B, 2C, and 2D SGs) is less than or equal to 3.672×10^6 lbm/hr.

   All four SG generators met this criterion. The calculated pre-heater flows are presented in the following table:

Steam Generator	Pre-Heater Flow
2A	3.429×10^6 lbm/hr
2B	3.492×10^6 lbm/hr
2C	3.567×10^6 lbm/hr
2D	3.527×10^6 lbm/hr

2. Process computer indicated bypass flow and measured bypass flow agree within 5% for SGs 2A, 2B, 2C, and 2D.

SGs 2C and 2D met this criterion. SGs 2A and 2B did not meet this criterion. Pre-heater bypass indicated flows and associated errors, as compared to the measured values, are presented in the following table:

Steam Generator	Computer Point	Process Computer Indicated Bypass Flow	Measured Bypass Flow	Percent Span Error
2A	F0408	388.78×10^3 lbm/hr	439.28×10^3 lbm/hr	-10.50 %
2B	F0428	419.57×10^3 lbm/hr	457.62×10^3 lbm/hr	-7.93 %
2C	F0448	429.42×10^3 lbm/hr	442.94×10^3 lbm/hr	-2.82 %
2D	F0468	441.11×10^3 lbm/hr	459.39×10^3 lbm/hr	-3.81 %

The large errors associated with Computer Points F0408 and F0428, (i.e., SG 2A Bypass Flow and SG 2B Bypass Flow) were the only discrepancies at the completion of this test.

These computer flows readings are taken from permanent installed transmitters. Outputs from these permanent transmitters are not used in calorimetric calculations, control functions or protective trip features. The output from these transmitters provides computer flow indication and is used to generate an annunciator alarm. The errors from these transmitters make indicated flows read lower than actual flows. These errors have the effect of making the annunciator alarm setpoint more conservative.

Condition Report B2001-03342 was written to document this issue. Resolution of this issue is being tracked by the plant's corrective action program.

2.3 Moisture Carryover Test – Unit 2

MCO was determined in accordance with SPP 01-007, "Byron Power Uprate Project Unit 2 Moisture Carryover Test".

Test Objective

Determine the average moisture content of steam leaving the SGs at uprated power conditions.

Plant Conditions or Prerequisites

The reactor and turbine power levels were stable. Operation was at full power (i.e., >99%). SG blowdown was minimized and diverted to the monitor tanks; condensate polishing demineralizers were removed from service; and main condenser hotwell makeup was isolated. Test equipment was installed for injecting a radioactive tracer into the system.

Test Summary

The testing method was conducted in accordance with ASME Performance Test Code PTC 6, and used the isotope sodium-24 (Na^{24}) as the radioactive tracer.

Moisture carryover was determined by testing with Unit 2 at full power. During the test, a radioactive tracer (i.e., sodium-24) was injected into the feedwater system and carried to the steam generators with the feedwater flow. Since the radioactive tracer does not evaporate with the generation of steam, all of the tracer isotope should remain in the steam generators except for a small amount contained in entrained water droplets (i.e., the moisture carryover). Following radioactive tracer injection, samples of returning condensate and feedwater were tested for tracer concentration. The amount of tracer detected in samples as compared to the amount retained in the steam generators is a measure of moisture carryover. The scope of this test procedure included receiving the tracer, transporting the tracer into the turbine building, connecting test equipment, aligning plant systems, performing a dry test run, injecting the tracer, sampling for the tracer, and restoring the plant systems back to normal conditions.

Acceptance Criterion

The average measured steam generator MCO for Unit 2 is less than or equal to 0.25%.

This acceptance criterion was met with the unit at uprated full power. The average MCO was calculated to be 0.12%. As expected, MCO has increased as a result of power uprate, but was still well within design limits. Plant calorimetric calculations are corrected for actual MCO. The current value used in the calorimetric is less than the determined value, which results in a conservative (i.e., higher) indication of reactor thermal power.

Condition Report 00079685 was written to document the new MCO value, and to track the updating of the plant calorimetric.

3.0 Full Power Capability

3.1 General Discussion

Units 1 and 2 at Byron Station are unable to achieve the uprated full license power level of 3586.6 Mega-watt thermal (MWt) due to the turbines going to the "valve wide open" condition. This condition does not allow the required volumetric flow through the high-pressure turbines to achieve the license power level of 3586.6 MWt. Planned power escalation testing activities for Byron Station Units 1 and 2 is complete. Although no modifications or additional plant configuration changes are planned for the current fuel cycle on either unit that would raise thermal power, action plans continue to be developed to attain full uprated reactor power in future fuel cycles.

3.2 Problems and Open Issues

The results of the startup test program indicate that the plant can safely operate at the current uprated power levels. Identified uprate problems and issues have been identified, evaluated, and tracked, as documented in the plant's corrective action program.