Exelon Nuclear

Exelon Generation
Byron Generating Station
4450 North German Church Road
Byron, IL 61010-9794
Tel 815-234-5441

www.exeloncorp.com

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

References:
(1) Letter from R. M. Krich (Commonwealth Edison Company) to U.S. NRC, "Request for License Amendment to Permit Uprated Operations at Byron and Braidwood Stations," dated July 5, 2000

(2) Letter from George F. Dick, Jr. (U.S. NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Issuance of Amendments: Increase in Reactor Power, Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," dated May 4, 2001

On May 4, 2001, the NRC issued License Amendment 119 for Byron Station, Units 1 and 2, which allowed an increase in the maximum reactor power level from 3411 megawatts thermal (MWt) to 3586.6 MWt. A mid-cycle power ascension test program was subsequently performed for both Unit 1 and Unit 2.

The Byron Station Technical Requirements Manual, Section 5.3.a, "Startup Report," requires that a summary report of the plant startup and power escalation testing be submitted to the NRC for an amendment to the license involving a planned increase in power level. Attached is the subject Startup Report covering the power escalation testing conducted from May 7, 2001, through May 18, 2001. A supplemental Startup Report will also be submitted for Units 1 and 2 within 90 days of this letter to provide a summary of post power escalation testing activities that are currently still in progress.

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

Respectfully,

Richard P. Lopriore
Site Vice President
Byron Nuclear Generating Station

RPL/JL/dpk

Attachment

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

ATTACHMENT

BYRON STATION, UNITS 1 AND 2

MID-CYCLE POWER UPRATE ASCENSION

STARTUP REPORT

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

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Executive Summary

This mid-cycle Startup Summary Test Report is submitted to the NRC in accordance with the requirements of the Byron Station Technical Requirements Manual, Section 5.0, "Administrative Controls," Section 5.3.a, which requires the submittal of a Startup Report after an amendment to the license involving a planned increase in power level.

On May 4, 2001, the NRC issued License Amendment 119 for Byron Station, Units 1 and 2, which allowed an increase in the maximum reactor power level from 3411 megawatts thermal (MWt) to 3586.6 MWt. A mid-cycle power ascension test program was subsequently performed for both Unit 1 and Unit 2. The Byron Station mid-cycle Power Ascension Test Program was developed in accordance with the generic guidelines provided in Westinghouse Topical Report, WCAP-10263, "A Review Plan for Uprating the License Power of a PWR Power Plant," dated 1983, and incorporated lessons learned from similar power uprate test programs performed at other nuclear plants.

The power ascension methodology used at Byron Station was to increase power in two phases. During each phase, power was increased to a plateau where data was taken and system equipment performance evaluated to verify acceptable performance.

Power ascension on both Byron Station units was initiated during mid-cycle operations. Modifications to Unit 1 were completed during its tenth refuel outage (i.e., B1R10) in the Fall of 2000, and non-outage periods prior to power ascension. Similar modifications were completed for Unit 2 during its ninth refuel outage (i.e., B2R09) in the Spring of 2001, and non-outage periods prior to power ascension. These actions allowed both Unit 1 and Unit 2 mid-cycle power ascensions activities to begin upon receipt of the approved license amendments.

Unit 1 power ascension started May 7, 2001, and was completed on May 11, 2001. Power increases were planned in two steps to obtain the power level of 3586.6 MWt. However, during the second step of power ascension, the Main Turbine Governor Valve #4 went to a Valve Wide Open (VWO) condition at a power level of 3522.0 MWt and the anticipated power level of 3586.6 MWt could not be obtained.

Unit 2 power ascension started May 12, 2001, and was completed on May 18, 2001. Power increases were planned in two steps to obtain the power level of 3586.6 MWt. However, during the second stop of power ascension, the Main Turbine Governor Valve #4 went to a VWO condition at a power level of 3547.1 MWt and the anticipated power level of 3586.6 MWt could not be obtained.

After reaching the mid-cycle power uprate plateaus of 3522.0 MWt for Unit 1 and 3547.1 MWt for Unit 2, a Post Installation Electrical Output Test was acceptably performed on both units.

Additional efforts to increase power levels on each Unit have been taken or are being evaluated. These include the bypassing of feedwater flow around the high pressure heaters for both Units and evaluating the feasibility of raising Reactor Coolant System (RCS) average temperature on Unit 1.

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

1.0 Purpose

This Power Uprate Startup Report is submitted to the NRC to satisfy the reporting requirements of the Byron Station's Technical Requirements Manual, paragraph 5.3.a, "Startup Report," which requires this report to address the following items.

1. Address each of the tests identified in the Updated Final Safety Analysis Report.

2. Include a description of the measured values of the operating conditions or characteristics obtained during the test program and a comparison of these values with design predictions and specifications.

3. Describe corrective actions required to obtain satisfactory operation.

4. Include any additional specific details required in license conditions based on other commitments.

2.0 Power Uprate Ascension Program Scope

2.1 Program Development

The development of the power uprate test recommendations and acceptance criteria was based on the review of similar power uprate test programs performed at other nuclear plants, and the generic guidelines provided in Westinghouse Topical Report, WCAP-10263, "A Review Plan for Uprating the License Power of a PWR Power Plant," dated 1983. The power uprate master Design Change Package (DCP) for each unit specified the modification testing requirements for the plant setpoint scaling change request (SSCR) required for implementation of the power uprate program.

The mid-cycle Power Uprate Ascension Test Program verified the following items.

- Plant systems and equipment affected by power uprate are operating within design limits.

- Nuclear fuel thermal limits are maintained within expected margins.

- The feedwater heater drains and level control system is stable.

- Radiation levels are acceptable and stable.

- Chemistry parameters are below the "Action" levels.

2.2 Prerequisites to Mid-Cycle Power Ascension Testing

Prior to the commencement of the mid-cycle power ascension testing, special test procedures required the completion of numerous activities. These activities included the following items.

- The applicable plant operating procedures, administrative procedures, surveillance test procedures, calibration procedures, chemical and radiological procedures and other similar procedures were reviewed and revised as necessary.
- The applicable plant instrumentation setpoint changes or recalibrations were completed as determined by the power uprate master DCP.
- Plant modifications were reviewed to assure they were completed as required and had no issues which could affect the uprate test program.
- The Out of Service Log and the Operation Configuration Change Log were reviewed to assure there were no conflicts with power uprate testing.
- Baseline data was taken at the 3411 MWt power level (i.e., the pre-uprate power level).
- Review of the NRC's Safety Evaluation approving the proposed power uprate license amendment and associated Technical Specification (TS) changes.

2.3 Mid-Cycle Power Uprate Ascension Testing

Mid-cycle power ascension was performed in accordance with a Byron Station Special Procedure (SPP) for each unit. Operator training and heightened level of awareness (HLA) briefings were completed prior to power ascension.

Initial power ascension occurred in two power increments for both units, each including a hold period for data collection and evaluation. Following each power increase, testing and equipment performance data was collected and evaluated in accordance with the established test acceptance criteria. At each predetermined step in the power ascension, the following activities were performed.

- Reactor fuel parameters were evaluated.
- Feedwater and main steam parameters for turbine-driven feedwater pump speed, feedwater control valve position, feedwater pump, condensate pump and condensate booster pump suction pressure net positive suction head requirements, and steam generator water level control were evaluated.
- Feedwater heaters level control performance data was evaluated.
- A selected set of equipment performance data (e.g., control room readings, local readings, and process computer information) was collected, evaluated and predictions made for performance at the next power level.

- Chemistry evaluations were conducted.
- Main generator stator internal temperature data was collected and evaluated.
- Radiation surveys were performed and evaluated at key points in the power ascension sequence.
- Secondary plant and turbine/generator system performance was evaluated.
- Automatic controls systems were evaluated.

After the power ascension to 3522 MWt for Unit 1 (3547.1 MWt for Unit 2) was concluded, a Post Installation Electrical Output Test was performed. The results of this test will be compared with the Pre Installation Electrical Output Test that was previously performed at 3411 MWt (i.e., the pre-uprate power level). The difference in electrical generation between the post-installation test and the pre-installation test data will determine the gain in electrical output attributable to uprating each of the units.

2.4 Test Acceptance Criteria for Units 1 and 2

General Discussion

The development of the power uprate test recommendations and acceptance criteria was based on the review of similar power uprate test programs performed at other nuclear plants and the power uprate master DCP.

Following the initial step increases in power level, test data recorded during the power ascension was evaluated and compared to the performance acceptance criteria (i.e., design predictions or limits). If the test data satisfied the acceptance criteria, then system and component performance were determined to comply with their design requirements.

Plant parameters during mid-cycle power ascension were evaluated using two levels of acceptance criteria. The criteria associated with plant safety were classified as Level 1. The criteria associated with design expectations were classified as Level 2. The following paragraphs describe the actions taken if an individual criterion was not satisfied.

Level 1 Acceptance Criteria

Level 1 acceptance criteria normally relate to the values of process variables for components and systems determined during the design of the plant. If a Level 1 test criterion is not satisfied, the plant must be placed in a safe "hold" condition. Plant operating or test procedures or the Technical Specifications may guide the decision on the appropriate actions to be taken. Resolution of the problem must be immediately pursued by equipment adjustments or through engineering evaluation, as appropriate. Following resolution, the applicable test steps must be repeated to verify that the Level 1 acceptance criterion is satisfied. A description of the problem must be included in the test report documenting successful completion of the test.

For the Byron Station power uprate, the following specific Level 1 acceptance criteria were established.

- The Reactor Coolant System (RCS) average temperature is automatically maintained within ± 1.5°F of its reference temperature during steady state operations when the control rods are in the automatic mode of control.

- The chemical and volume control system can maintain RCS system volume and a steady RCS boron concentration during steady state power level and routine power changes without excessive operator intervention.

- The Reactor core parameters and indications do not exceed any limitations stated in the Core Operating Limits Report (COLR).

- No turbine runback and control rod stop signals generated from the Overpower Delta Temperature or Overtemperature Delta Temperature setpoints after completion of setpoint scaling changes.

- Steam generator feedwater flow and steam generator water level satisfactorily maintained in automatic control.

- The Turbine Driven Main Feedwater Pumps speed during steady state conditions do not exceed 5500 RPM.

All the above Level 1 criteria were met for both Units 1 and 2.

Level 2 Acceptance Criteria Equipment Performance

If a Level 2 acceptance criteria limit is not satisfied, then startup testing may proceed after an investigation by testing, engineering, and operations personnel. The limits stated in this category are usually associated with expectations of system performance whose characteristics can be improved by equipment adjustments.

For the Byron Station Power Uprate, the following specific Level 2 acceptance criteria were established.

System and Equipment Performance

- System and Equipment Level 2 acceptance limits are identified in various attachments of the appropriate SPP. Any limits that are exceeded will require a documented evaluation in the SPP Test Report. The Level 2 parameters that were outside the Level 2 acceptance limits in the SPP are described in Section 3.3, "Unit 1 – System and Equipment Performance Results," and Section 4.3, "Unit 2 – System and Equipment Performance Results." The Level 2 limits are usually associated with expectations of system performance whose characteristics can be improved by equipment adjustments.

- Water cooling systems exhibit stable full power operating characteristics.

Turbine Generator Temperature Monitoring System (TGTMS)

- TGTMS Data within Acceptance Limits
- Turbine Supervisory Vibration Data within Acceptance Limits

Plant Instrumentation

- Delta Temperature power and calorimetric power are within plus or minus 2% of the plant process computer (PPC) indication.
- Nuclear instrumentation and calorimetric power are within plus or minus 2%.
- Post-uprate PPC values, for RCS flow, are within plus or minus 2% of the Pre-uprate PPC values.
- Post-uprate PPC values, for Steam Flow / Feed Flow Mismatch, are within plus or minus 2% of the Pre-uprate PPC values.
- RCS pressure remains stable with no unexpected operation of pressurizer backup heaters during steady state power operation.

2.5 Differences Between Unit 1 and Unit 2

2.5.1 Differences in Scaling Changes

The operating RCS average temperature is 586°F for Unit 1 and 581°F for Unit 2. The difference is based on a more restrictive administrative limit of a RCS core exit temperature for the Unit 2 D5 steam generators.

2.5.2 Differences in Test Acceptance Criteria

Listed below are the major differences in Level 1 test acceptance criteria between Unit 1 and Unit 2.

- RCS temperatures
- Steam Generator narrow range levels

Listed below are the major Level 2 test acceptance criteria differences between Unit 1 and Unit 2.

- Condensate pump suction pressure
- RCS temperature alarms and setpoints
- Steam generator narrow range levels

3.0 Unit 1 – Summary of Mid-Cycle Uprate Testing and Equipment Performance Results

3.1 Unit 1 Power Ascension Chronological Sequence of Events

No.	Event Description	Date
1	Completed Unit 1 Pre-Installation Electrical Output Test	08-17-00
2	Authorization granted to commence Power Uprate ascension testing per SPP 00-020 Byron Unit 1 Power Uprate On-Line Implementation Procedure	05-04-01
3	Completed SPP 00-020 Prerequisites	05-07-01
4	Completed Heighten Level of Awareness (HLA) Brief	05-07-01
5	Commenced Setpoint and Scaling Implementation	05-08-01
6	Commenced first ramp to 100% Venturi Flow and installed new feedwater flow measurement constants which lowered indicated power to 96.8%	05-10-01
7	Completed second ramp to 3522 MWt with Governor Valve #4 reaching VWO with indicated reactor power at 98.2%	05-11-01
8	Started Post-Installation Electrical Output Test	06-21-01

3.2 Unit 1 – Control Systems Performance Results

Control Systems most affected by increasing reactor power were monitored to assure acceptable performance and compliance with their specific Level 1 and 2 acceptance criteria. The following table summarizes these control systems.

No.	Control System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Tuning Adjustments Required
1	RCS (Pressurizer) Pressure	Satisfied	Satisfied	None
2	Pressurizer Level Control	Satisfied	Satisfied	None
3	Rod Control	Satisfied	Satisfied	None
4	Steam Generator Level Control System	Satisfied	Satisfied	None
5	Feedwater Pump Speed Control	Satisfied	Satisfied	None
6	Feedwater Heater Level Control System	Satisfied	Satisfied	None
7	DEHC Control System	Satisfied	Satisfied	None

3.3 Unit 1 – System and Equipment Performance Results

The following systems and selected equipment within these systems most affected by increasing reactor power were closely monitored to assure that equipment performed as predicted and that they operated within their design requirements.

No.	System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Predicted Performance
1	Condensate System	Satisfied	Satisfied	Acceptable
2	Condenser	Satisfied	Satisfied	Acceptable
3	Condensate Booster System	Satisfied	Satisfied	Acceptable
4	Feedwater System	Satisfied	Satisfied (1)	Acceptable
5	Heater Drain System	Satisfied	Satisfied	Acceptable
6	Reactor	Satisfied	Satisfied	Acceptable
7	Reactor Coolant System	Satisfied	Satisfied	Acceptable
8	Main Steam System	Satisfied	Satisfied	Acceptable
9	Main Turbine	Satisfied	Satisfied (2)	Acceptable
10	Main Transformer	Satisfied	Satisfied	Acceptable
11	Auxiliary Transformers	Satisfied	Satisfied	Acceptable
12	Generator Cooling System	Satisfied	Satisfied	Acceptable
13	Generator Condition Monitoring	Satisfied	Satisfied	Acceptable
14	Main Generator and Exciter Field	Satisfied	Satisfied	Acceptable
15	Isophase Bus Cooling	Satisfied	Satisfied	Acceptable
16	Reheater Systems	Satisfied	Satisfied	Acceptable

Unexpected Conditions

(1) A Level 2 Acceptance Criterion was exceeded when an unexpected low alarm temporarily existed for Feedwater Pump Net Positive Suction Head (NPSH) during the first ramp to indicated 100% feedwater venturi flow. An engineering review determined that the NPSH low alarm setpoint was conservatively set higher than necessary to protect the feedwater pumps from cavitation. Based on this review, the feedwater pump NPSH alarm setpoint was lowered via the setpoint scaling change request process. The final ramp to 3522 MWt did not cause the NPSH low alarm to re-alarm.

(2) A Level 2 Acceptance Criterion was initially exceeded during the first power ramp when the Number 4 Governor on the main turbine reached the valve wide-open position. The feedwater flow instrumentation was adjusted and valve margin was regained. After the second power ramp, the final position of Governor Valve #4 again reached the valve wide open position at the final power uprate plateau level of 3522 MWt. The Turbine manufacturer has confirmed that the VWO operating condition is an acceptable operating condition. The manufacturer indicated that other sites have operated safely in this configuration. Consequently, this condition was reviewed and accepted.

3.4 Unit 1 – Review and Approval of Testing at the Mid-Cycle Power Uprate Plateau of 3522 MWt

1. Reactor Fuel Parameters: No adverse trends or conditions were observed with reactor operation at the final power uprate plateau of 3522 MWt. Quadrant Power Tilt Ratios (QPTR) and axial flux difference trends are normal. The Nuclear Instrumentation System (NIS) RCS Delta Temperature and Calorimetric Power indications were all normal with no problems observed.

2. Automatic Control Systems: All automatic control systems were acceptable for continued operation at the final power uprate plateau of 3522 MWt.

3. Feedwater and Main Steam Parameters: The Turbine Driven Feedwater Pump speed, feedwater control valve position, and steam generator water level met their acceptance criteria. Feedwater pump, condensate pump and condensate booster pump suction pressures exceeded NPSH requirements. Feedwater Heater Level Control performance data was taken and evaluated to be acceptable. Equipment performance was determined to be acceptable for continued operation at 3522 MWt.

4. Chemistry Approval: RCS, Condensate and Feedwater chemistry did not exceed Chemistry Action Levels.

5. Main Generator Parameters: Generator stator temperatures and bus bar temperatures satisfy their Level 2 acceptance limits at operation at the mid-cycle uprated power level of 3522 MWt. Generator conditions were satisfactory for continued operation at the mid-cycle uprated power level of 3522 MWt.

6. Radiation Protection Approval: Plant areas were surveyed and found to be acceptable for operations at uprated power levels.

7. Secondary Plant and Turbine/Generator Systems Approval: System and Equipment data required by System Engineering has been collected and performance found acceptable.

3.5 Unit 1 – Exceptions

Equipment and Test Exceptions

All Level 1 and 2 Acceptance Criteria were satisfied and equipment and system performance behaved in accordance with predicted expectations with the exception of Governor Valve #4 indicating VWO at the final power level. The condition was reviewed and accepted by the appropriate plant personnel.

4.0 Unit 2 – Summary of Mid-Cycle Uprate Testing and Equipment Performance Results

4.1 Unit 2 Power Ascension Chronological Sequence of Events

No.	Event Description	Date
1	Completed Unit 2 Pre-Installation Electrical Output Test	03-07-01
2	Authorization granted to commence Power Uprate ascension testing per SPP 00-019 Byron Unit 2 Power Uprate On-Line Implementation Procedure	05-10-01
3	Completed SPP 00-019 Prerequisites	05-11-01
4	Completed Heighten Level of Awareness (HLA)	05-12-01
5	Commenced Setpoint and Scaling Implementation	05-12-01
6	Commenced first ramp to 100% Venturi Flow and installed new feedwater flow measurement constants which lowered indicated power to 97.4%	05-15-01
7	Completed second ramp to 3547.1 MWt with Governor Valve #4 reaching VWO with indicated reactor power at 98.9%	05-16-01
8	Started Post-Installation Electrical Output Test	07-11-01

4.2 Unit 2 – Control Systems Performance Results

Control systems most affected by power uprate were monitored to assure acceptable performance and compliance with their specific Level 1 and 2 acceptance criteria. The following table summarizes these control systems.

No.	Control System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Tuning Adjustments Required
1	RCS (Pressurizer) Pressure	Satisfied	Satisfied	None
2	Pressurizer Level Control	Satisfied	Satisfied	None
3	Rod Control	Satisfied	Satisfied	None
4	Steam Generator Level Control System	Satisfied	Satisfied	None
5	Feedwater Pump Speed Control	Satisfied	Satisfied	None
6	Feedwater Heater Level Control System	Satisfied	Satisfied	None
7	DEHC Control System	Satisfied	Satisfied	None

4.3 Unit 2 – System and Equipment Performance Results

The following systems and selected equipment within these systems most affected by power uprate were closely monitored to assure that equipment performed as predicted and that they operated within their design requirements.

No.	System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Predicted Performance
1	Condensate System	Satisfied	Satisfied	Acceptable
2	Condenser	Satisfied	Satisfied	Acceptable
3	Condensate Booster System	Satisfied	Satisfied	Acceptable
4	Feedwater System	Satisfied	Unsatisfied (1)(3)	Unacceptable
5	Heater Drain System	Satisfied	Satisfied	Acceptable
6	Reactor	Satisfied	Satisfied	Acceptable
7	Reactor Coolant System	Satisfied	Satisfied (4)	Acceptable
8	Main Steam System	Satisfied	Satisfied (1)	Acceptable
9	Main Turbine	Satisfied	Satisfied (2)(5)	Acceptable
10	Main Transformer	Satisfied	Satisfied	Acceptable
11	Auxiliary Transformers	Satisfied	Satisfied	Acceptable
12	Generator Cooling System	Satisfied	Satisfied	Acceptable
13	Generator Condition Monitoring	Satisfied	Satisfied	Acceptable
14	Main Generator and Exciter Field	Satisfied	Satisfied	Acceptable
15	Isophase Bus Cooling	Satisfied	Satisfied	Acceptable
16	Reheater Systems	Satisfied	Satisfied	Acceptable

(1) A Level 2 acceptance criterion for Steam Flow / Feed Flow Mismatch less than 2% change between the Pre-Uprate Plant Process Computer Points (PPCs) and Post-Uprate PPCs was not met. This mismatch has been evaluated. The subject instrument loop performs a control function, but not a protection function. With the extent of the mismatch, the control function will perform as required. The design change to eliminate the mismatch is being tracked by action tracking item 52683, sub assignment 02 for resolution.

(2) A Level 2 acceptance criterion was temporarily exceeded after the first power ramp for the Turbine Generator Temperature Monitoring System (TGTMS), Turbine Generator Bearing Number 1 Metal Temperature alarm setpoint. A plan to change the setpoint was reviewed and approved by Engineering and Operations. The alert setpoint was changed from 95°C to 99°C in Byron Operating Abnormal Procedure, 2 BOA TG-2, "TGTMS Trouble Unit 2." The TGTMS alarm setpoint was not exceeded at the uprated power plateau of 3547.1 MWt.

(3) An unexpected low alarm temporarily existed for Feedwater Pump NPSH while swapping condensate/condensate booster pumps per plant procedures at the uprated power level of 3547.1 MWt. An engineering review determined that the NPSH low alarm setpoint was conservatively set higher than necessary to protect the feedwater pumps from cavitation. Based on this review, the feedwater pump NPSH alarm setpoint was lowered via the setpoint scaling change request process. The NPSH low alarm did not re-alarm at the final power uprate plateau of 3547.1 MWt.

(4) An unexpected alarm temporarily existed for the Pressurizer Spray Line Low Temperature Alarm while operating at the uprated power level of 3547.1 MWt. Plant operations cleared the alarm by adjusting the Pressurizer Spray Line Flow. The Temperature Alarm did not re-alarm at the uprated power level of 3547.1 MWt.

(5) A Level 2 Acceptance Criterion was initially exceeded during the first power ramp when the Number 4 Governor on the main turbine reached the valve wide-open position. The feedwater flow instrumentation was adjusted and valve margin was regained. After the second power ramp, the final position of Governor Valve #4 again reached the valve wide open position at the final power uprate plateau level of 3547.1 MWt. The Turbine manufacturer has confirmed that the VWO operating condition is an unacceptable operating condition. The manufacturer indicated that other sites have operated safely in this configuration. Consequently, this condition was reviewed and accepted.

4.4 Unit 2 – Review and Approval of Testing at the Mid-Cycle Power Uprate Plateau of 3547.1 MWt

1. Reactor Fuel Parameters: QPTR, axial flux, NIS indications were within expected ranges. No abnormalities noted.

2. Automatic Control Systems: All automatic control systems were acceptable for continued operation at the uprated power level of 3547.1 MWt.

3. Feedwater & Main Steam Parameters: The Turbine Driven Feedwater Pump speed, feedwater control valve position, and steam generator water level met their acceptance criteria. Feedwater pump, condensate pump and condensate booster pump suction pressure exceeds NPSH requirements. Feedwater Heater Level Control performance data was taken and evaluated to be acceptable. Equipment performance was determined to be acceptable for continued operation at the final power uprate plateau of 3547.1 MWt.

4. Chemistry Approval: RCS, Condensate and Feedwater chemistry did not exceed Chemistry Action Levels.

5. Main Generator Parameters: Generator stator temperatures and bus bar temperatures satisfy their Level 2 acceptance limits at the uprated power level of 3547.1 MWt. Generator conditions are satisfactory for continued operation at the uprated power level of 3547.1 MWt.

6. Radiation Protection Approval: Plant Areas were surveyed and found to be acceptable for operations at uprated power levels.

7. Secondary Plant and Turbine/Generator Systems Approval: System and Equipment Data required by System Engineering has been collected and performance found acceptable.

4.5 Unit 2 – Exceptions

Equipment and Test Exceptions

All Level 1 and 2 Acceptance Criteria were satisfied with two exceptions: the Level 2 Acceptance Criteria specifying that the Post-uprate PPC values for Steam Flow / Feed Flow Mismatch are within plus or minus 2% of the Pre-uprate PPC values was not met; and the Governor Valve #4 reached the VWO position at the final power level. The Governor Valve position issue was reviewed and accepted by the appropriate plant personnel.

5.0 Application of the UFSAR Initial Startup Test Program to the Byron Power Uprate Project

5.1 General Discussion

The development of the power uprate test recommendations and acceptance criteria is based on the review of similar test programs performed at other nuclear plants; Westinghouse Topical Report, WCAP-10263, "A Review Plan for Uprating the License Power of a PWR Power Plant", dated 1983, and Section 7, "Output Determination," of the Westinghouse "Revised Proposal for Power Uprate," dated August 23, 1999. WCAP-10263 recommends that a test program be developed on a plant specific basis addressing the significance of the hardware modifications and the magnitude of the power uprate. The Byron Station hardware upgrades were limited to instrument setpoint scaling changes, replacement of the high pressure turbine during the preceding refueling outages, and minor equipment modifications that were completed as part of the modification process.

The Updated Final Safety Analysis Report (UFSAR) Chapter 14, "Initial Test Program," addresses the Byron Station initial test program. The initial test program included both preoperational and initial startup testing. Each of these programs is discussed in the following paragraphs.

5.1.1 Preoperational Tests

Preoperational testing consisted of system performance tests performed prior to core load on completed systems prior to final acceptance. These tests demonstrated the capability of structures, systems and components to meet safety related performance requirements.

This category of tests is conducted as part of the post modification testing process. Power Uprate modifications tests were successfully completed as part of the modification process and work control process.

5.1.2 Initial Startup Tests

Initial startup testing consisted of those single and multi-system tests that occurred during or after fuel loading and which demonstrated overall plant performance. This included such activities as precriticality tests, low-power tests (i.e., including criticality tests), and power ascension tests. This testing confirmed adequacy of the design bases and demonstrated, where possible, that the plant is capable of withstanding the design transients and postulated accidents.

This category of tests was reviewed for applicability in developing the Byron Station Uprate Power Ascension Test Program to determine the initial data needed to be re-verified. It was determined that minimal data required re-verification based on the scope of the mid-cycle power ascension power uprate program.

5.1.3 Comparison of UFSAR Startup Tests to Power Uprate Ascension Tests

The following table addresses each of the initial power ascension tests and their applicability to the Byron Station Mid-Cycle Uprate Power Ascension Test Program. Tests identified with a 'Yes' were incorporated in to the Byron Uprate Test Program unless credit was taken for another activity (e.g., surveillance tests), that satisfies the requirement.

Test No. (1)	Startup Test Title	Required in Power Uprate Test Procedure	Acceptance Criteria Same as UFSAR
14.2-62	Initial Core Load	No	NA
14.2-63	Control Rod Drives	No	NA
14.2-64	Rod Position Indicators	No	NA
14.2-65	Reactor Trip Circuit	No	NA
14.2-66	Rod Drop Measurements	No	NA
14.2-67	Incore Flux Monitor System	No	NA
14.2-68	Nuclear Instrumentation	No	NA
14.2-69	Reactor Coolant System Pressure	No	NA
14.2-70	Reactor Coolant System Flow	No	NA
14.2-71	Pressurizer Effectiveness	No	NA
14.2-72	Water Chemistry	Yes (2)	Yes
14.2-73	Radiation Surveys	Yes (3)	Yes
14.2-74	Effluent Radiation Monitors	No	NA
14.2-75	Initial Criticality	No	NA
14.2-76	Power Ascension	Yes (4)	Yes
14.2-77	Moderator Temperature Reactivity Coefficient Measurement	No	NA
14.2-78	Control Rod Reactivity Worth Measurement	No	NA
14.2-79	Boron Reactivity Worth Measurement	No	NA
14.2-80	Flux Distribution Measurement	No	NA
14.2-81	Pseudo Rod Ejection	No	NA
14.2-82	Power Reactivity Coefficient Measurement	No	NA
14.2-83	Core Performance Evaluation	No	NA
14.2-84	Flux Asymmetry Evaluation	No	NA
14.2-85	Full-Power Plant Trip	No	NA
14.2-86	Shutdown from Outside the Control Room	No	NA
14.2-87	Loss of Offsite Power	No	NA
14.2-88	10% Load Swing	No	NA
14.2-89	50% Load Reduction	No	NA
14.2-90	RTD Cross-Calibration	No	NA
14.2-91	Turbine Trip from 25% Power	No	NA

Notes: (1) UFSAR Chapter 14 table numbers
(2) Water Chemistry at uprate power IAW Chemistry Action Levels
(3) Areas surveyed and found acceptable for uprated power operations
(4) Special Test Procedure at uprate power was completed and reviewed

6.0 Full Power Capability

6.1 General Discussion

Units 1 and 2 at Byron Station were unable to achieve the full license power uprate of 3586.6 MWt due to the #4 Governor Valves going to the full open position. This condition would not allow the required volumetric flow through the high pressure turbines to achieve the license level of 3586.6 MWt. An interim measure to increase the MWt output was implemented by partially bypassing the High Pressure Feedwater Heaters using approved station procedures. Partially bypassing of the High Pressure Feedwater Heaters increased turbine output; however, still ended up with the #4 Governor Valves obtaining a full open position prior to reaching maximum reactor power.

6.2 Unit 1

Following completion of the Units 1 Power Uprate Ascension Test on June 2, 2001, activities were initiated to partially bypass the #17 High Pressure Feedwater Heaters using approved station procedures in an attempt to obtain full licensed output of 3586.6 MWt; however, only 3539.4 MWt was achieved. The future plan to obtain full licensed output of 3586.6 MWt is to increase the RCS average temperature from 586°F to 588°F during the upcoming Spring 2002 refueling outage. Raising RCS average temperature will increase turbine throttle pressure to full load heat balance conditions which will allow an increase in thermal power output. Upon completion of the RCS temperature increase, an additional review of test data will determine if any additional plans to modify the high pressure turbine will be required.

6.3 Unit 2

Following completion of the Unit 2 Power Uprate Ascension Test on June 2, 2001, activities were initiated to partially bypass the #27 High Pressure Feedwater Heaters using approved station procedures in an attempt to obtain full licensed output of 3586.6 MWt; however, only 3568.7 MWt was achieved. Raising RCS average temperature is currently not an option for Unit 2 because this action will challenge the administrative limit of 611°F on the hot leg temperature of the Westinghouse D5 Steam Generators. A review of the Post Installation Electrical Output Test will determine if any additional plans to modify the high pressure turbine will be required.