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RBG-46145

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U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Subject: River Bend Station - Unit 1
Docket No. 50-458
Power Uprate Startup Report

Reference:
1) Entergy Operations, Inc. Letter to NRC, RBG-45951, May 14, 2002
2) Licensing Topical Report, "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimizations, NEDC-32938P, November 2002"
3) River Bend Station, Issuance Of Amendment Re: 1.7 Percent Increase In Licensed Power Level (TAC No. MB5094), January 31, 2003

Ladies and Gentlemen:

In accordance with River Bend Station (RBS) Technical Requirements Manual TR 5.6.8, enclosed is the startup report for the Appendix K Power Uprate Project (PUP). The power escalation test program performed by Entergy Operations Inc. (Entergy), implements the testing and equipment performance monitoring commitments made by References (1 and 2) as approved in Reference (3).

The RBS power escalation was completed on May 10, 2003. Power was increased in one step from the previous licensed power level of 3039 megawatts thermal (MWt) to the uprate licensed power level of 3091 MWt. The power escalation test program was successfully completed with all acceptance criteria being satisfied. The equipment and system performance was in accordance with predictions.

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All test data was reviewed in accordance with the applicable test procedures, and exceptions to any results were evaluated to verify compliance with Technical Specification limits and to ensure the acceptability of subsequent test results. The enclosed River Bend Station Unit 1 Power Uprate Startup Report summarizes the startup test program and results. There are no commitments in this letter.

Should you have any questions concerning this letter, please contact Mr. B. Burmeister at (225) 381-4148.

Sincerely,

RJK/BMB
enclosure

cc: NRC Resident Inspector
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File Nos.: G9.5, G9.25.1.4
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ENCLOSURE

River Bend Station
Power Uprate Startup Report

River Bend Station Appendix K Power Uprate Startup Report

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Executive Summary

This Power Uprate Startup Report is submitted to the Nuclear Regulatory Commission (NRC) in accordance with the requirements of the River Bend Station Technical Requirements Manual Section 5.6.8, Administrative Controls, which requires the submittal of a Startup Report.

The power ascension test program performed by Entergy Operations Inc. (Entergy) River Bend Station implements the testing and equipment performance monitoring commitments contained within Licensing Topical Report, "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimizations, NEDC-32938P, November 2002," and the letter from Entergy to the USNRC dated May 14, 2002, "Request for License Amendment for Appendix K Power Uprate Operation."

The River Bend Appendix K Power Uprate requested an increase in licensed reactor power of 1.7%, from a pre-uprate licensed power level of 3039 MWt to a post-uprate power level of 3091 MWt. As described in LER 2003-05, RBG-46151 dated August 1, 2003, during implementation of the Appendix K Uprate it was discovered that River Bend had, in the past, operated at power levels in excess of its license. Additional information is contained in this LER. The dynamic testing portion of the 5% Power Uprate implementation was determined to be adequate to support operation at the resulting post-5% uprate power levels. No additional dynamic testing was performed as a result of the Appendix K Power Uprate.

Power ascension was performed on May 10, 2003. Power was increased in one step, from 3039 to 3091 MWt. The uprate power ascension test program was successfully completed with all acceptance criteria being satisfied. All equipment and system performance was as expected.

1. Purpose

This Power Uprate Startup Test Report is submitted to the Nuclear Regulatory Commission pursuant to the Technical Requirements Manual paragraph 5.6.8, Startup Report, which requires that a summary report of plant startup and power escalation testing be submitted following amendment to the license involving a planned increase in power level. The startup report is to be submitted within 90 days following completion of the startup test program.

This report is submitted in response to implementation of Amendment 129 which was issued on January 31, 2003.

2. Appendix K Power Uprate Ascension Program Scope

2.1 Program Development

The River Bend Station Power Uprate Ascension Test Program was developed in accordance with the generic guidelines provided in Licensing Topical Report (LTR) "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimizations, NEDC-32938P, November 2002," the License Amendment Request including the Safety Analysis Report and various Power Uprate Project Task Reports. The power ascension test program included testing or equipment monitoring recommendations from many Task Reports. According to section 5.11.9 of NEDC-31897P-A, Power Uprate Testing, "Large transient tests (e.g., isolation) will not be required for uprates within 5% power. Initial plant testing and experience during plant operation is considered to be sufficient." Consequently, no large transients were included within the River Bend Station Appendix K Power Uprate Ascension Test Program.

The Uprate Power Ascension Test Program was developed to verify the following:

- Plant systems and equipment affected by power uprate are operating within design limits.
- Nuclear fuel thermal limits are maintained within expected margins.
- The response of the main steam pressure control system is stable, with adequate control margin to allow for anticipated transients.
- The response of the reactor water level control system is stable, with adequate control margin to allow for anticipated transients.
- The response of the reactor core flow control system is stable and bi-stable core flow is within acceptable limits.
- The feedwater heater drains and level control system is stable.
- The Main Steam Reheat (MSR) drains and level control system is stable.
- Reliable system operation is maintained.
- Radiation levels are acceptable and stable.

2.2 Prerequisites to Power Ascension Testing

Prior to the commencement of power ascension testing, the test procedure required the completion of numerous activities, which included:

- 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 required.
- Computer software programs were reviewed and revised as required to support the power uprate test program.
- The applicable plant instrumentation setpoint changes or recalibrations were completed.
- All plant modifications were reviewed to assure they were completed as required and had no exception which could affect the uprate test program.
- Temporary Modifications logs and Generic Letter (GL) 91-18 applicable degraded conditions were reviewed to assure there was no impact on the ability of the effected equipment to support uprate, and that uprate would not have an adverse impact on any existing degraded condition.
- Baseline data was taken as required by the procedure, at power levels corresponding to 95 and 100% of the initial licensed core thermal power.
- Commitments which were the result of the Appendix K Power Uprate Safety Analysis Report (SAR), Appendix K Power Uprate License Amendment, the NRC Power Uprate Safety Evaluation (SE), and actions resulting from Appendix K Power Uprate project Task Report review, were verified as either closed, included in the power ascension program or evaluated as not impacting power ascension.

2.3 Appendix K Uprate Power Ascension Testing

Power Ascension was performed in accordance with a River Bend Station Special Test Procedure ER-RB-2000-0490-000, ERT01. Operator Training and Infrequently Performed Test or Evolution (IPTE) briefings were completed prior to the power ascension.

Power ascension occurred in one power increment of nominally 1.7%, including a period of data collection and evaluation. This power ascension was made at approximately 1500 hours, which represents the highest daily temperature. In this way it was possible to observe the plant response near the maximum ambient temperature, characteristic to the plant location. This data, therefore, represents the minimum margin to the alarm limit for those parameters for which there exists a maximum acceptable temperature.

Following the power increase, testing and equipment performance data was collected and evaluated in accordance established acceptance criteria. The following activities were performed:

- Core Thermal Performance data evaluated.
- Reactor pressure control system stability, steam flows limit cycling, and variation in incremental regulation performance data evaluated.
- Reactor water level control and the variation in incremental regulation performance data evaluated.
- Electro-Hydraulic Control (EHC) System oil pressure to the Turbine control valve oscillation data evaluated.
- Feedwater heater level control performance data evaluated.
- MSR drain system level control performance was evaluated.
- Bistable reactor recirculation flow data evaluated.
- Reactor Recirculation Core flow / Drive flow relationship was evaluated.
- A complete set of equipment performance data (e.g., control room readings, local readings, process computer, and Emergency Response Information System (ERIS) computer data) was collected, and evaluated.
- Radiation surveys were performed and evaluated after ascension to the new licensed thermal limit.
- Main Generator parameters were determined to be acceptable.

2.4 Test Acceptance Criteria

General Discussion

The development of the power uprate test recommendations and acceptance criteria was based on the review of similar test programs performed at other plants, Chapter 14 of the River Bend Station Final Safety Analysis Report (FSAR), the outputs of the uprated NSSS heat balance, and numerous RBS specific General Electric Nuclear Energy (GENE) Task Reports. The River Bend Station original Startup Test Program , Regulatory Guide 1.68 and License Topical Report (LTR) 31897 P-A were also used as inputs.

Following the increase in power level, test data was evaluated against its performance acceptance criteria (i.e., design predictions or predictions which resulted from extrapolations of actual plant performance). If the test data satisfied the acceptance criteria, then system and component performance were determined to comply with their design requirements.

During power ascension, plant parameters were evaluated with two levels of acceptance criteria. The criteria associated with safe and reliable plant operation are classified as Level 1. The criteria associated with performance expectations, either derived from design or actual performance history, are classified as Level 2. The following paragraphs describe the actions required to be taken if an individual criterion is not satisfied.

Level 1 Acceptance Criteria

Level 1 acceptance criteria normally relate to the values of process variables assigned in the design of the plant, component systems or associated equipment. If a Level 1 test criterion is not satisfied, the plant must be placed in a hold condition that is judged to be satisfactory and safe, based upon prior testing. Plant operating or test procedures or the Technical Specifications may guide the decision on the direction to be taken. Tests consistent with this hold condition may be continued. Resolution of the problem must be immediately pursued by equipment adjustments or through engineering evaluation, as appropriate. Following resolution, the applicable test portion must be repeated to verify that the Level 1 requirement is satisfied. A description of the problem must be included in the report documenting successful completion of the test.

Level 1 acceptance criteria for power ascension included requirements that reactor feedwater flow, reactor water level, reactor pressure and other reactor systems are expected to exhibit stable full power operating characteristics. This Level 1 acceptance criterion of requiring all plant systems to exhibit normal high power level operating behavior (i.e., stable reactor water level control, and feedwater flow, with acceptable limit cycling if any) is to assure that this testing can be performed with acceptable risk.

Level 2 Acceptance Criteria Equipment Performance

If a Level 2 test criterion is not satisfied, plant operating or test plans would not necessarily be altered. The limits stated in this category are usually associated with expectations of system transient performance whose characteristics can be improved by equipment adjustments. An investigation of the related adjustments, as well as the measurement and analysis methods would be initiated.

If all Level 2 requirements in a test are ultimately met, there is no need to document a temporary failure in the test report; unless there is a lessons learned benefit involved. Following resolution of temporary Level 2 test criterion failures, the applicable test portion must be repeated to verify that the Level 2 requirement is satisfied.

For the River Bend Station Appendix K Power Uprate, specific Level 2 acceptance criteria were established as detailed in the following paragraphs.

EHC/Reactor Pressure Control

Pressure control system deadband, delay, etc., shall be small enough that steady state limit cycles (if any) shall produce steam flow variations no larger than ± 0.5 percent of rated steam flow.

Reactor Water Level and Feedwater (FW) Control

Feedwater control system deadband, delay, etc., shall be small enough that steady state limit cycles (if any) shall not produce narrow range water level variations that exceed ± 1.5 inch.

Generator Stator Temperatures

The maximum allowable temperature limit is 168 degrees F. All operable stator cooling outlet thermocouples shall be read before exceeding 3039 MWt to obtain a set of current baseline data before increasing generator load. The maximum allowable thermocouple reading was 160 degrees F, and the maximum actual reading was 157.3 degrees F.

The responsible test engineer shall evaluate the above readings (based upon historical performance data of temperature spread and maximum temperatures) to determine that the maximum allowable temperature will not be exceeded as power level is increased as required by this procedure.

Turbine Stop, Control and Combined Intercept Valve (CIV) Testing

As a result of the conditions identified in LER 2003-05, the absolute power levels at which RBS Turbine Stop, Control and CIV tests will be performed were not changed for Power Uprate. The margins to the neutron flux trip and bypass valve open events were not affected; therefore, these tests were not performed.

3. Summary of Uprate Testing and Equipment Performance Results

3.1 Key Events

Power Ascension Chronological Sequence of Events

No.	Event Description	Date
1	Perform testing at 2887 MWt (95% original)	04-23-03
2	Authorization granted to commence uprate power ascension testing	05-10-03
3	Perform testing at 3039 MWt (100% original)	05-10-03
4	Perform testing at 3091 MWt	05-10-03

3.2 Testing and Equipment Performance Results

Control Systems Performance Results

Control Systems most affected by 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.

Control System Performance Results

No.	Control System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Tuning Adjustments Required
1	Reactor Water Level Control System	Satisfied	Satisfied	No
2	EHC and Reactor Pressure Control System	Satisfied	Satisfied	No
3	Feedwater Heater Level Control System	Satisfied	Satisfied	No
4	Rx. Recirculation and Bi-Stable Flow	Satisfied	Satisfied	No

Equipment Performance Results

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

Equipment Performance Results

No.	System Description	Level 1 Acceptance Criteria	Level 2 Acceptance Criteria	Predictive Performance Results
1	Condensate System	Satisfied	Satisfied	Acceptable
2	Feedwater System	Satisfied	Satisfied	Acceptable
3	Heater Drain System	Satisfied	Satisfied	Acceptable
4	MSR Drain System	Satisfied	Satisfied	Acceptable
5	Main Generator and Alternator	Satisfied	Satisfied	Acceptable
6	Nuclear Boiler	Satisfied	Satisfied	Acceptable
7	Reactor Recirculation System	Satisfied	Satisfied	Acceptable

8	Main Turbine	Satisfied	Satisfied	Acceptable
10	Main Transformer	Satisfied	Satisfied	Acceptable
11	Stator Cooling System	Satisfied	Satisfied	Acceptable
12	Isophase Bus Cooling	Satisfied	Satisfied	Acceptable
13	TBCCW System	Satisfied	Satisfied	Acceptable

Reactor and Core Performance Results

1. Core thermal hydraulic parameters were verified to be within Technical Specification limits.

2. Margins to fuel thermal limits were verified to be acceptable.

3. Reactor Recirculation flow (drive flow) performed as expected at the uprated power level.

4. Reactor operation was stable and the core operated in a manner consistent with expectations at the uprate full power operating conditions.

Radiation and Chemistry Results

Radiation surveys were performed at 3091 MWt with no measurable change in plant radiation levels from pre-uprate full power operating conditions. The changes in radiation levels were bounded by the difference between operating with and without hydrogen water chemistry in service.

Chemistry monitoring (reactor water, condensate water and offgas) continued throughout the uprate power ascension test program with no significant change from prior full power operating conditions.

3.3 Exceptions

Equipment and Test Exceptions

None. All Level 1 and 2 acceptance criteria were satisfied and equipment and system performance behaved in accordance with expectations.

Administrative Exceptions

None.

4. Application of the FSAR Initial Startup Test Program to the Power Uprate Project

4.1 General Discussion

The River Bend Station Safety Analysis Report section 10.4, Required Testing requires "This report will include ...brief discussions as to why it was not necessary to repeat specific tests listed in USAR Section 14, during the power uprate test program." This section of the Uprate Startup Test report addresses this requirement with respect to the Power Uprate Project (PUP). FSAR Section 14 addresses the River Bend Station initial startup test program. The initial startup test program was divided into three main parts. They are: Construction test and Equipment Demonstrations, Preoperational and System Demonstrations, and Startup Tests and Operational Demonstrations. Each of these programs is discussed in the following paragraphs with respect to the River Bend Station Power Uprate Project.

4.2 Construction Tests and Equipment Demonstrations

Construction tests (safety related) are those tests, which demonstrate that safety-related equipment meets functional operability requirements. These tests cover a wide variety of checks to assure that components are properly installed and adjusted according to manufacturers instructions, Architect Engineering drawings and specifications, satisfy code requirements, comply with FSAR requirements, and etc. They include but are not limited to test such as: hydrostatic pressure tests, electrical megger tests, load tests, cleanliness inspections, rotational tests, alignment tests, etc.

Equipment demonstrations (non-safety-related) are those tests used to demonstrate that non-safety-related equipment meets functional operability performance requirements.

As applies to the PUP, this category of test demonstration is conducted as part of the modification process. These tests are included within the installation directions and are included in the modification (software) package. Required construction tests for PUP modifications were successfully completed as part of the modification closure process.

4.3 Preoperational Tests and Operational Demonstrations

System demonstrations (non-safety-related) consist of those tests conducted to demonstrate that non-safety-related system and components function as required to meet normal plant operating requirements.

This category of test demonstration is conducted as part of the post modification testing process. The Power Uprate modifications were successfully completed as part of the modification closure process.

4.4 Startup Tests and Operational Demonstrations

FSAR Requirements

Startup Tests are safety-related tests and consist of such activities as fuel loading, pre-critical tests, critical and low power tests and power ascension tests that ensure fuel loading in a safe manner, confirm the design bases, demonstrates where practical that the plant is capable of withstanding the anticipated transients and postulated accidents, and ensure that the plant is safely brought to rated capacity and sustained power operation.

River Bend Station Appendix K Power Uprate Startup Program Development

The following method as quoted in the next two paragraphs, (PUP means Appendix K Power Uprate) was used in establishing uprate testing requirements.

"The development of the power uprate test recommendations and acceptance criteria is based on the review of similar test programs performed at other plants, Chapter 14 of the River Bend Station FSAR, the outputs of the NSSS heat balance (PUP Task Report 100) and power flow map (PUP Task Report 201) tasks, the River Bend Station Startup Test Program Summary Report, November 1984 and the PUP LTR1 (Reference 1). From the total population of tests identified in the preceding programs, a set of tests were selected for further evaluation and incorporation into the River Bend Station uprate test program. The effect of the power uprate at River Bend Station on the operational parameters, performance characteristics and acceptance criteria of these tests was examined. If the test was potentially impacted by power uprate, it was then evaluated for applicability and inclusion within the River Bend Station Power Uprate Ascension Test Program. This evaluation resulted in a final set of test recommendations to be performed during the initial ascension and operation at full 105% uprated power."

"The recommendations are the result of a test selection process that is based upon a review of the original startup test program and changes resulting from the power uprate of the River Bend Station plant. The tests and equipment performance monitoring included in these recommendations fall into the following categories:

a. tests involving control systems with specific performance expectations assumed in the power uprate transient analyses and specific performance expectations for operational considerations,

b. tests affected by power uprate

c. tests required based on engineering judgement, and

d. performance monitoring of equipment impacted by power uprate

In general, most of these tests can be satisfied by completion of existing surveillance or functional tests, performance of instrumentation calibration and equipment setup, evaluation of the results of post modification testing, or through steady state data collection as part of normal system monitoring."

Transient Testing

As applies to the Power Uprate and allowed by the SAR, system transient and control system dynamic response testing to demonstrate acceptable system performance was performed during the implementation of the 5% Power Uprate. As discussed previously, the power level at which the plant operated since that time bounds the power level at which the plant is now operated as a result of the Appendix K Power Uprate.

Comparison of Power Uprate Tests to FSAR Power Ascension Tests

As required by the SAR, the following Table addresses each of the initial power ascension tests and their applicability to the River Bend Station Appendix K Uprate Power Ascension Test Program. Tests identified with a yes were incorporated in the River Bend Station Uprate Test program unless credit was taken for another activity (i.e., surveillance test), that satisfies the requirement.

Results of FSAR Initial Startup Testing Evaluation

For Inclusion In The Uprate Power Ascension Test Program

Test No.	Power Ascension Test Description	Required In Uprate Test Procedure	Acceptance Criteria same as FSAR
101	Chemical and Radiochemical	Yes (1)	Yes
102	Radiation Measurements	Yes	Yes
103	Fuel Loading	No	NA
104	Full Core Shutdown Margin	No	NA
105	Control Rod Drive System	No	NA
106	SRM Performance and Control Rod Sequence	No	NA
107	Water Level Measurements	No	NA
108	Intermediate Range Monitor Performance	No	NA
109	Local Power Range Monitor Calibration	No	NA

110	Average Power Range Monitor Calibration	Yes	Yes
111	Process Computer	Yes	Yes
112	Reactor Core Isolation Cooling System	No	NA
113	Selected Process Temperatures	Yes	Yes
114	System Expansion	No	NA
115	Core Power Distribution	Yes	Yes
116	Core Performance	Yes	Yes
117	Steam Production	Yes	Yes
118	Core Power-Void Mode Response	No	NA
119	Pressure Regulator	Yes (2)	Yes
120	Feedwater Control System	Yes (2)	Yes
121	Turbine Valve Surveillance	Yes (1)	Yes
122	Main Steam Isolation Valves	No	NA
123	Relief Valves	No	NA
124	Turbine Stop Valve Trips and Generator Load Rejections	No	NA
125	Shutdown From Outside The Control Room	No	NA
126	Recirculation Flow Control System	No	NA
127	Recirculation System	No	NA
128	Loss Of Turbine Generator and Offsite Power	No	NA
129	Deleted	NA	NA
130	Vibration Measurements	No	NA
131	Deleted	NA	NA
132	Recirculation System Flow Calibrations	No	NA
133	Reactor Water Cleanup System	No	NA
134	Residual Heat Removal System	No	NA
135	Control Rod Sequence Exchange	No	NA
136	Drywell Piping Vibrations	No	NA
137	Off-Gas System	No	NA

Note (1) Credit Taken For Surveillance Monitoring Program

(2) Credit Taken for 5% Power Uprate Testing