Entergy

Entergy Operations, Inc.
River Bend Station
5485 U.S. Highway 61
P. O. Box 220
St. Francisville, LA 70775
Tel 225 336 6225
Fax 225 635 5068

Rick J. King
Director
Nuclear Safety Assurance

February 5, 2001

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

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

File Nos.: G9.5, G9.25.1.4

Reference:
1) Entergy Operations, Inc. (EOI) Letter to NRC, RBG-45077, dated July 30, 1999
2) Entergy Operations, Inc. (EOI) Letter to NRC, RBG-45337, dated May 9, 2000
3) Entergy Operations, Inc. (EOI) Letter to NRC, RBG-45428, dated July 18, 2000
4) Nuclear Regulatory Commission (NRC) Letter to EOI, RBC-49387 (TAC No. MA6185), dated October 6, 2000

RBF1-01-0023
RBG-45638

Ladies and Gentlemen:

In accordance with River Bend Station (RBS) Technical Requirements Manual TR 5.6.8, enclosed is the startup report for the flow only phase of the Power Uprate. The power escalation test program performed by Entergy Operations Inc. (EOI), implements the testing and equipment performance monitoring commitments made by References (1 and 3) as approved in Reference (4).

Phase One of the RBS Power Uprate Project was a flow only, zero reactor pressure increase (no increase in the reactor operating pressure) power uprate. Phase Two of the Power Uprate is scheduled to be completed following startup from Refueling Outage 10 scheduled for the fall of 2001.

IE26

The RBS power escalation started October 8, 2000, and was completed on November 6, 2000. Power was increased in one-percent steps until the uprate licensed power level of 3039 megawatts thermal (MWt) was reached. The power escalation test program was successfully completed with all acceptance criteria being satisfied. All equipment and system performance was in accordance with predictions.

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 Escalation 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
P. O. Box 1050
St. Francisville, LA 70775

U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

Mr. Prosanta Chowdhury
Program Manager – Surveillance Division
Louisiana Department of Environmental Quality
Office of Radiological Emergency Plan & Response
P. O. Box 82215
Baton Rouge, LA 70884-2215

Mr. Robert E. Moody, NRR Project Manager
U.S. Nuclear Regulatory Commission
M/S OWFN 7D1
Washington, DC 20555

ENCLOSURE

River Bend Station
Power Uprate Project

Phase One Implementation
"Flow Only Uprate"

Power Escalation Testing Report

River Bend Station
Power Escalation Testing Report

Table of Contents

Executive Summary

This report is submitted to the Nuclear Regulatory Commission (NRC) in accordance with the requirements of the River Bend Station Technical Requirements Manual Section TR 5.6.8.

The Power Escalation Test Program, performed by Entergy Operations Inc. at River Bend Station, implements the testing and equipment performance monitoring commitments contained within Licensing Topical Report, "Generic Guidelines for General Electric BWR Generic Power Uprate," NEDC-31897P-A, Class III, May 1992 (LTR-1), and the letter from EOI to the USNRC dated August 1, 1999, "Request for License Amendment for Power Uprate Operation."

Phase One of the River Bend Station Power Uprate Project was a zero reactor pressure increase (no increase in the reactor operating pressure) power uprate. This phase was accomplished by increasing reactor power, which results in an increase in feedwater and steam flow. As a result, dynamic transient testing associated with a pressure increase uprate was not required to be performed at River Bend Station during this implementation phase. Phase Two of the Power Uprate will include those modifications necessary to support a reactor pressure increase of up to 30 psia. The Phase Two testing is scheduled to be completed during startup and power operation following Refueling Outage (RF) 10 in the fall of 2001.

Phase One power escalation was completed during mid cycle operations. Modifications to the plant were completed during RF08 (spring 1999) and RF09 (spring 2000), thus allowing power escalation to the licensed power level of 3039 MWt without a plant outage.

Power escalation testing started October 8, 2000, and was completed November 6, 2000. Power was increased in one percent steps, followed by a monitoring period, until the uprated licensed power level of 3039 MWt was reached. The uprate power escalation test program was successfully completed with all acceptance criteria being satisfied. All equipment and system performance was in accordance with predictions.

River Bend Station Uprate Power Escalation Startup Test Report

1. Purpose

This startup report is submitted to the Nuclear Regulatory Commission pursuant to TR 5.6.8, which requires:

- "A summary report of plant startup and power escalation shall be submitted following ... (2) Amendment to the license involving a planned increase in power level..."
- "shall 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."
- "Any corrective actions that were required to obtain satisfactory operation shall also be described."
- "Any additional specific details required in license conditions based on other commitments shall also be included in this report."
- "Startup reports shall be submitted within 90 days following completion of the startup test program ..."

2. Uprate Power Escalation Program Scope

2.1 Program Development

The River Bend Station Power Escalation Test Program was developed in accordance with the generic guidelines provided in Licensing Topical Report (LTR) NEDC-31897P-A, Generic Guidelines for General Electric Boiling Water Reactor Power Uprate, the License Amendment Request including the Safety Analysis Report for River Bend 5% Power Uprate, NEDC-32778P, and its supplement, Changes for a Flow Increase Only Power Uprate. 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 Uprate Power Escalation Test Program.

The Uprate Power Escalation 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 is within acceptable limits.
- The feedwater heater drains and level control system is stable.
- The MSR drains and level control system is stable.
- Reliable system operation is maintained.
- Radiation levels are acceptable and stable.

2.2 Prerequisites to Power Escalation Testing

Prior to the commencement of power escalation 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.
- Plant activities were reviewed to verify that no plant modifications were being implemented which could impact the uprate test program.
- Temporary Modifications logs and GL91-18 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 90, 95, and 100% of the initial licensed core thermal power.
- Commitments which were the result of the Power Uprate Safety Analysis Report (SAR), Power Uprate License Amendment, the NRC Power Uprate Safety Evaluation Report (SER), and actions resulting from Power Uprate Project Task Report review, were verified as either completed, included in the power escalation program or evaluated as not impacting power escalation.

2.3 Uprate Power Escalation Testing

Power Escalation was performed in accordance with a River Bend Station Special Test Procedure ER97-0548, ERT-01. Operator Training and Infrequently Performed Test or Evolution (IPTE) briefings were completed prior to each power escalation. Additionally, shift briefings were held for each Operations shift during the implementation period, to

ensure adequate communication of current plant conditions, anticipated plant response, and shift management authorization for continued implementation testing.

Power Escalation occurred in nominal 1% power increments, each including a period of data collection and evaluation. These power escalations were each planned between the hours 0800 and 1400. With approximately 24 hours between power increases, it was possible to observe the plant response to the daily changes in ambient temperature, characteristic to the plant location.

Following each power increase, testing and equipment performance data was collected and evaluated in accordance with established acceptance criteria. At each incremental step in power Escalation, the following activities were performed:

- Core Thermal Performance data was evaluated.
- Reactor pressure control system stability and variation in incremental regulation performance data was evaluated.
- Reactor water level control and the variation in incremental regulation performance data were evaluated.
- Electro-Hydraulic Control (EHC) System and Turbine control valve oscillation data was evaluated.
- Feedwater heater level control performance data was evaluated.
- MSR drain system level control performance was 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, evaluated and predictive performance at the next power level determined.
- Radiation surveys were performed and evaluated after Escalation to the new licensed thermal limit.
- Main generator stator internal temperature and stator water temperature data was collected and evaluated.

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 Updated Safety Analysis Report (USAR), the outputs of the Uprated NSSS heat balance, and the Safety Analysis Report for River Bend 5% Power Uprate, NEDC-32778P, and its supplement, Changes for a Flow Increase Only Power Uprate. The

River Bend Station original Startup Test Program, Regulatory Guide 1.68 and LTR 31987 P-A were also used as inputs.

Following each step 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.

Plant parameters during power Escalation 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 was 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 Escalation 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 that this testing can be performed with minimal 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 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 two (2) percent of rated steam flow.

The variation in incremental regulation (ratio of the maximum to minimum value of the quantity, "incremental change in pressure control signal/incremental change in steam flow" for each flow range) should meet the following criteria:

% of Steam Flow Obtained with Valves Wide Open (VWO)	Variation
85% to 99%	$\leq$ 5:1

Reactor Water Level and Feedwater (FW) Control

The variation in incremental regulation (ratio of the maximum to the minimum value of the quantity, "incremental change in feedwater flow demand signal/ incremental change in feedwater flow" for each flow range) should not exceed 2:1.

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 $\pm$ 1.5 inch.

Generator Stator Temperatures

All operable generator slot RTD's shall be read before exceeding 2894 MWt to establish a current set of baseline temperature data before increasing the load on the generator.

The maximum allowable RTD temperature limit is 168.8 degrees F. All operable stator cooling outlet thermocouples shall be read before exceeding 2894 MWt to obtain a set of current baseline data before increasing generator load.

The responsible test engineer evaluated the above readings (based upon historical performance data of temperature spread and maximum temperatures) to determine that the

maximum allowable temperature would not be exceeded as power level was increased to the next level as required by the test procedure.

3. Summary of Uprate Testing and Equipment Performance Results

3.1 Key Events

Power Escalation Chronological Sequence of Events

No.	Event Description	Date
1	NRC authorization granted to start uprate implementation	10-06-00
2	Down power to establish rod pattern for power Escalation	10-07-00
3	Perform testing at 2605 MWt (90% original)	10-08-00
4	Perform testing at 2749 MWt (95% original)	10-09-00
5	Perform testing at 2894 MWt (100% original)	10-09-00
6	Perform testing at 2923 MWt	10-14-00
7	Perform testing at 2952 MWt	10-15-00
8	Perform testing at 2981 MWt	10-16-00
9	Perform testing at 3010 MWt	10-18-00
10	Place Main Steam Reheaters (MSRs) into Optimized* configuration	10-20-00
11	Perform testing at indicated 3039 MWt, prior to Leading Edge Flowmeter (LEFM) correction	10-21-00
12	Place LEFM into service and ascend to 3039 MWt, corrected. (this Escalation was performed in 2 steps)	10-23-00
12a	Perform testing at 3029 MWt, LEFM correction	10-23-00
12b	Perform testing at 3039 MWt, LEFM correction	10-24-00
13	Complete Phase One Implementation Testing	11-08-00

*Optimization describes balancing main steam flow between the MSR and the High Pressure Turbine for maximum generator output.

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	Satisfied	Satisfied	No

** Main Steam Flow to the MSR's was throttled (optimized) to provide level control margin to the "A" third point level control valve. No level control adjustments required.

Equipment Performance Results

The following systems and selected equipment most affected by uprate within 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	TPCCW System (CCS)	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.

Radiation and Chemistry Results

Radiation surveys were performed at 2894 MWt and again at 3039 MWt with no significant change in plant radiation levels from pre-uprate, full power operating conditions.

Chemistry monitoring (reactor water, condensate water and off gas) continued throughout the uprate power Escalation test program. The only notable impact from power uprate on chemistry is an increase in the levels of reactor coolant activated metals, mainly Cobalt.

Net Gross Electrical Output Gain From Uprate

The net electrical output increased approximately 57 MWe from the phase 1, flow only uprate, as a result of increasing reactor thermal power from 2894 to 3039 MWt. The pre-uprate value was obtained before the new High Pressure turbine was installed in RF-08.

3.3 Exceptions

Equipment and Test Exceptions

All Level 1 and 2 acceptance criteria were satisfied and equipment and system performance behaved in accordance with predictive expectations at the final uprated power level. During the initial power increase to 3039 MWe, flow capacity concerns were noted with HDL-LV4A (third point feedwater heater level control valve). At that point the MSRs were optimized (reheater tube side main steam supply was throttled) thereby reducing the mass flow rate through HDL-LV4A & B. Power was subsequently increased to 100% without any further complications. With the plant in the optimized MSR condition at 100% power, sufficient margin was exhibited in each Feedwater Heater level controller. Operating procedures were amended to accommodate the noted plant condition.

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

4.1 General Discussion

The River Bend Station Updated 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 report addresses this requirement with respect to the Power Uprate Project. The USAR 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 variety of requirements to:

- Insure proper installation and testing in accordance with manufactures instructions and Architect Engineering drawings and specifications.
- Satisfy code requirements.
- Comply with FSAR requirements.

They include but are not limited to test such as: hydrostatic pressure tests, electrical megger tests, load tests, cleanliness inspections, rotational tests, or alignment tests.

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

As applied to the Power Uprate, this category of test demonstration is conducted as part of the modification process. These tests, where required for Power Uprate modifications, were successfully completed as part of the modification implementation and testing process.

4.3 Preoperational Tests and Operational Demonstrations

Preoperational test (safety-related) are those tests conducted prior to fuel loading to demonstrate that the plant has been properly designed and constructed, and that the safety-related structures, systems and components meet safety-related performance requirements.

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.

Power Uprate modifications were successfully completed as part of the modification implementation and testing process.

4.4 Startup Tests and Operational Demonstrations

USAR 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 escalation tests that ensure fuel loading in a safe manner, confirming the design bases, demonstrating where practical that the plant is capable of withstanding the anticipated transients and postulated accidents, and ensuring that the plant is safely brought to rated capacity and sustained power operation.

River Bend Station Power Uprate Startup Program Development

The following method, as described in the next two paragraphs, 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 USAR, the outputs of the Nuclear Steam Supply System heat balance and power flow map tasks, the River Bend Station Startup Tests. From the total population of tests identified in the preceding programs, a set of tests was 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 were examined. If the test was potentially impacted by power uprate, it was then evaluated for applicability and inclusion within the River Bend Station Uprate Power Escalation Test Program. This evaluation resulted in a final set of test recommendations to be performed during the initial escalation and operation at full 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 were 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 Power Uprate and allowed by the USAR, system transient and control system dynamic response testing to demonstrate acceptable system performance was performed as a part of Power Uprate Power Escalation Testing (post modification testing for ER 97-0548). All test data was reviewed to assure compliance with the acceptance criteria for power Escalation testing for uprate affected equipment.

Comparison of Power Uprate Tests to USAR Power Escalation Tests

As required by the USAR, the following Table addresses each of the initial power Escalation tests and their applicability to the River Bend Station Uprate Power Escalation 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 USAR Initial Startup Testing Evaluation
For Inclusion In The Uprate Power Escalation Test Program

Test No.	Start-up Power Escalation Test Description	Required In Uprate Test Procedure(1)	Acceptance Criteria Same as FSAR
1	Chemical and Radiochemical	Yes (1)	Yes
2	Radiation Measurements	Yes	Yes
3	Fuel Loading	No	NA
4	Full Core Shutdown Margin	No	NA
5	Control Rod Drive System	No	NA
6	SRM Performance and Control Rod Sequence	No	NA

Test No.	Start-up Power Escalation Test Description	Required In Uprate Test Procedure(1)	Acceptance Criteria Same as FSAR
10	Intermediate Range Monitor Performance	No	NA
11	Local Power Range Monitor Calibration	No	NA
12	Average Power Range Monitor Calibration	Yes	Yes
13	Process Computer	Yes	Yes
14	Reactor Core Isolation Cooling System	No	NA
16A	Selected Process Temperatures	Yes	Yes
16B	Water Level Measurements	No	NA
17	System Expansion	No	NA
19	Core Performance	Yes	Yes
20	Steam Production	Yes	Yes
22	Pressure Regulator	Yes	Yes
23	Feedwater Control System	Yes	Yes
24	Turbine Valve Surveillance	No	NA
25	Main Steam Isolation Valves	No	NA
26	Relief Valves	No	N/A
27	Turbine Stop Valve Trips and Generator Load Rejections	No	NA
28	Shutdown From Outside The Control Room	No	NA
29	Recirculation Flow Control System	No	NA
30	Recirculation System	No	NA
31	Loss Of Turbine Generator and Offsite Power	No	NA
35	Recirculation System Flow Calibrations	No	NA
70	Reactor Water Cleanup System	No	NA
71	Residual Heat Removal System	No	NA
33	Drywell Piping Vibrations	No	NA
103	Drywell Atmosphere Cooling	No	N/A
105	Penetration Temperatures	No	N/A

Note (1) Credit Taken For Surveillance Monitoring Program