

September 14, 2001

Mr. Randall K. Edington
Vice President - Operations
Entergy Operations, Inc.
River Bend Station
P. O. Box 220
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: REVISION
TO REACTOR VESSEL PRESSURE/TEMPERATURE (P-T) LIMITS
(TAC NO. MB1153)

Dear Mr. Edington:

The Commission has issued the enclosed Amendment No. 120 to Facility Operating License No. NPF-47 for the River Bend Station, Unit 1 (RBS). The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated January 24, 2001, as supplemented by letters dated July 2, and August 6 and 20, 2001.

By application dated January 24, 2001, as supplemented by letters dated July 2, and August 6 and 20, 2001, Entergy Operations, Inc. (the licensee) requested changes to the TSs (Appendix A to Facility Operating License No. NPF-47) for RBS. The proposed changes would revise the reactor vessel pressure/temperature (P-T) limits specified in TS 3.4.11, "RCS [Reactor Coolant System] Pressure and Temperature (P/T) Limits," for reactor heat-up, cool-down, and critical operation, as well as for in-service leak and hydraulic tests for the RCS. The proposed changes replace RCS P-T Limits in TS Figure 3.4-11, "Minimum Temperature Required Vs. RCS Pressure," with recalculated RCS P-T limits based, in part, on an alternate methodology. The alternate methodology uses American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code (Code) Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T Limit Curves for ASME B&PV Code Section XI, Division 1," for alternate reference fracture toughness for reactor vessel materials in determining the P-T limits. Issuance of this amendment, will require an exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.60. The exemption is being handled concurrently with this amendment request, but as a separate action.

A copy of our related Safety Evaluation is enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Robert E. Moody, Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosures: 1. Amendment No. 120 to NPF-47
2. Safety Evaluation

cc w/encls: See next page

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Docket No. 50-458

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** See previous concurrence

ACCESSION NO.: ML012280403

* No significant change from original SE input

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ENERGY GULF STATES, INC.**

AND

ENERGY OPERATIONS, INC.

DOCKET NO. 50-458

RIVER BEND STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 120
License No. NPF-47

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Entergy Gulf States, Inc.* (the licensee) dated January 24, 2001, as supplemented by letters dated July 2, and August 6 and 20, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

* Entergy Operations, Inc. is authorized to act as agent for Entergy Gulf States, Inc, and has exclusive responsibility and control over the physical construction, operation and maintenance of the facility.

**Entergy Gulf States, Inc., has merged with a wholly owned subsidiary of Entergy Corporation. Entergy Gulf States, Inc. was the surviving company in the merger.

- E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment; and Paragraph 2.C.(2) of Facility Operating License No. NPF-47 is hereby amended to read as follows:
- (2) Technical Specifications and Environmental Protection Plan
- The Technical Specifications contained in Appendix A, as revised through Amendment No. 120 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. EOI shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
3. The license amendment is effective as of its date of issuance and shall be implemented within 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: September 14, 2001

ATTACHMENT TO LICENSE AMENDMENT NO. 120

FACILITY OPERATING LICENSE NO. NPF-47

DOCKET NO. 50-458

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by Amendment number and contain marginal lines indicating the areas of change.

Remove

3.4-32

Insert

3.4-32

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 120 TO FACILITY OPERATING LICENSE NO. NPF-47

ENTERGY OPERATIONS, INC.

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

1.0 INTRODUCTION

By application dated January 24, 2001, as supplemented by letters dated July 2, and August 6 and 20, 2001, Entergy Operations, Inc. (the licensee) requested changes to the Technical Specifications (TSs) (Appendix A to Facility Operating License No. NPF-47) for the River Bend Station, Unit 1 (RBS). The proposed changes would revise the reactor vessel pressure /temperature (P/T or P-T) limits specified in TS 3.4.11, "RCS [Reactor Coolant System] Pressure and Temperature (P/T) Limits," for reactor heat-up, cool-down, and critical operation, as well as for in-service leak and hydraulic tests for the RCS. The proposed changes replace RCS P-T Limits in TS Figure 3.4-11, "Minimum Temperature Required Vs. RCS Pressure," with recalculated RCS P-T limits based, in part, on an alternate methodology. The alternate methodology uses American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code (Code) Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T Limit Curves for ASME B&PV Code Section XI, Division 1," for alternate reference fracture toughness for reactor vessel materials in determining the P-T limits. Issuance of this amendment will require an exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.60. The exemption is being handled concurrently with this amendment request, but as a separate action.

The supplemental letters dated July 2, and August 6 and 20, 2001, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC or Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 21, 2001 (66 FR 15920).

2.0 BACKGROUND

2.1 Requirements for Generating P-T Limits

The NRC has established requirements in Appendix G of Part 50 to Title 10, *Code of Federal Regulations* (10 CFR Part 50, Appendix G) to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The staff evaluates the P-T limit curves based on the following NRC regulations and guidance: 10 CFR Part 50, Appendix G; Generic Letter (GL) 88-11; GL 92-01, Revision 1 (Rev. 1); GL 92-01, Rev. 1, Supplement 1; Regulatory Guide (RG) 1.99, Revision 2 (Rev. 2); and Standard Review Plan (SRP) Section 5.3.2. GL 88-11 advised licensees that the NRC staff would use RG 1.99, Rev. 2, to review P-T limit curves.

(RG) 1.99, Revision 2 (Rev. 2); and Standard Review Plan (SRP) Section 5.3.2. GL 88-11 advised licensees that the NRC staff would use RG 1.99, Rev. 2, to review P-T limit curves. RG 1.99, Rev. 2, contains methodologies for determining the increase in transition temperature and the decrease in upper-shelf energy resulting from neutron radiation. GL 92-01, Rev. 1, requested that licensees submit their reactor pressure vessel (RPV) data for their plants to the NRC staff for review. GL 92-01, Rev. 1, Supplement 1, requested that licensees provide and assess data from other licensees that could affect their RPV integrity evaluations. These data are used by the NRC staff as the basis for their review of P-T limit curves and as the basis for the review of pressurized thermal shock assessments (10 CFR 50.61 assessments). Appendix G to 10 CFR Part 50 requires that P-T limit curves for the RPV be at least as conservative as those obtained by applying the methodology of Appendix G to Section XI of the ASME B&PV Code.

SRP Section 5.3.2 provides an acceptable method of determining the P-T limit curves for ferritic materials in the belt-line of the RPV based on the linear elastic fracture mechanics methodology of Appendix G to Section XI of the ASME B&PV Code. The basic parameter of this methodology is the stress intensity factor K_I , which is a function of the stress state and flaw configuration. Appendix G requires a safety factor of 2.0 on stress intensities resulting from reactor pressure during normal and transient operating conditions, and a safety factor of 1.5 for hydrostatic testing curves. The methods of Appendix G postulate the existence of a sharp surface flaw in the RPV that is normal to the direction of the maximum stress. This flaw is postulated to have a depth that is equal to 1/4 thickness (1/4T) of the RPV belt-line thickness and a length equal to 1.5 times the RPV belt-line thickness. The critical locations in the RPV belt-line region for calculating heat-up and cool-down P-T curves are the 1/4T and 3/4 thickness (3/4T) locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

The Appendix G ASME B&PV Code methodology requires that licensees determine the adjusted reference temperature (ART or adjusted RT_{NDT}). ART is defined as the sum of the initial (unirradiated) reference temperature (initial RT_{NDT}), the mean value of the adjustment in reference temperature caused by irradiation (ΔRT_{NDT}), and a margin (M) term.

The ΔRT_{NDT} is a product of a chemistry factor and a fluence factor. The chemistry factor is dependent upon the amount of copper and nickel in the material and may be determined from tables in RG 1.99, Rev. 2, or from surveillance data. The fluence factor is dependent upon the neutron fluence at the maximum postulated flaw depth. The margin term is dependent upon whether the initial RT_{NDT} is a plant-specific or a generic value and whether the chemistry factor was determined using the tables in RG 1.99, Rev. 2, or surveillance data. The margin term is used to account for uncertainties in the values of the initial RT_{NDT} , the copper and nickel contents, the fluence, and the calculational procedures. RG 1.99, Rev. 2, describes the methodology to be used in calculating the margin term.

2.2 Licensee Submittal

The licensee submitted material data and detailed methodologies for generating P-T limits for 32 effective full power years (EFPY) for the belt-line, upper vessel, and bottom head material for the RBS RPV. The material information includes the initial RT_{NDT} values for all materials in the three geometric classifications mentioned above. For the belt-line material, the licensee determined that the most limiting material for P-T curves is the axial weld that was

manufactured with the weld wire of heat 5P6756 and Linde 124 flux. The licensee employed the methodology in RG 1.99, Rev. 2 and calculated an ART of 102 °F at the 1/4T fluence of $0.57E19$ n/cm² (32 EFPYs) for this limiting material based on a ΔRT_{NDT} value of 96 °F, an initial RT_{NDT} of -50 °F, and a margin term of 56 °F ($\sigma_l = 0$ °F and $\sigma_\Delta = 28$ °F). The ΔRT_{NDT} value for this material was determined using the chemistry table of RG 1.99, Rev. 2. The licensee did not perform similar calculations for the limiting upper vessel and bottom head material because these non-beltline materials only experienced insignificant fluence.

Based on the ART of 102 °F for the limiting belt-line material and the highest initial RT_{NDT} value of 10 °F for both the upper vessel and the bottom head materials, the licensee used the methodology of Appendix G in the 1995 Edition of Section XI of the ASME B&PV Code, as modified by Code Case N-640, to calculate the P-T limits for the RBS RPV. For the bottom head P-T limits, the licensee's Appendix G analyses used the results from a detailed stress analysis for a generic 251-inch Boiling Water Reactor (BWR)/6 vessel. For the upper vessel P-T limits, the licensee's WRC-175 analyses used the Appendix G stress formula for the pressure test curves and results from the detailed stress analysis for a generic 251-inch BWR/6 vessel for the heat-up and cool-down curves. The results for the generic vessel were then adjusted for the initial RT_{NDT} values and the vessel geometry of the RBS RPV.

3.0 EVALUATION

3.1 Evaluation of Neutron Fluence

In Section 4.2.1.2 of the January 24, 2001, submittal, the licensee used a 32 EFPY fluence value from the 5% power uprate report in GE-NE-A22-00081-12, Revision 0 (Rev. 0), "105% Power Uprate Evaluation Report for Entergy Operations, Inc. River Bend Station," February 1999. However, the original fluence determination did not satisfy the recommendations of RG 1.190. The licensee reevaluated the pressure vessel fluence and submitted the results for NRC staff review in a supplemental letter dated July 2, 2001. The letter requested NRC staff approval for the proposed P-T curves, subject to the limitation for up to 16 EFPYs.

The staff finds that the proposed fluence value (and the resulting P-T curves) to be conservative because: (1) By the end of the requested period of applicability, the vessel will have accumulated about 16 EFPYs while the pressure temperature curve calculation assumed the estimated 32 EFPY fluence. This results in a conservative factor of about or greater than 2. (2) The increased neutron leakage due to the 5% power uprate has been accounted for in GE-NE-A22-00081-12, Rev. 0. Depending on the assumptions in this calculation, the conservatism factor of 2 may stay the same or may decrease by a small amount. In either case, the conservatism is adequate for a staff finding of reasonable assurance of safety. Therefore, based upon the evaluation of neutron fluence, the NRC staff finds the proposed P-T curves to be acceptable subject to the limitation of 16 EFPYs.

3.2 P-T Limit Evaluation

The licensee's proposed methodology for determining the P-T limits includes an assessment of the RPV beltline, upper vessel, and bottom head materials. The licensee's proposed methodology includes Code Case N-640 and two plant-specific deviations. The plant-specific deviations are discussed in the evaluations for beltline materials and the bottom head that follow.

For beltline materials, the NRC staff compared the licensee's material information in Table 4.4 of the submittal with that in the NRC's reactor vessel integrity database (RVID) and found that, except for the initial RT_{NDT} values for plates C-3054-2 and C-3138-2 and the chemistry data for weld 5P6756 (the limiting material), the material data for the reactor vessel is consistent with those in the RVID. The NRC staff determined that the Charpy test data in Table 4-1 of the submittal had provided sufficient justification for the revision of the initial RT_{NDT} values for plates C-3054-2 and C-3138-2 from 2°F and 9°F to 10°F and 0°F, respectively. Also, the copper and nickel values of 0.084% and 0.938% from the Certified Materials Test Report (CMTR) are acceptable because the licensee uses a more conservative chemistry factor than that based on the best-estimate copper and nickel values from BWRVIP-46, "Update of Bounding Assessment of BWR/2-6 Reactor Pressure Vessel Integrity Issues." The NRC staff performed an independent calculation of the ART value for the limiting beltline material using the methodology in RG 1.99, Revision 2, and verified the licensee's identification of the limiting material and its ART value for 32 EFPYs for RBS. In addition to Code Case N-640, the licensee's P-T limit methodology contains a plant-specific deviation from the Appendix G methodology, which applies to all P-T limits. In this deviation, the licensee employed an approximate approach to generate the heatup P-T limits. Instead of performing an analysis at 3/4T, the licensee performed a thermal gradient analysis at 1/4T using the ART at 1/4T and treating compressive stresses at this location as tensile stresses. The NRC staff examined K_{It} values at 1/4T and 3/4T due to a typical heatup thermal gradient and confirmed that the absolute value of K_{It} at 1/4T is always larger than the K_{It} at 3/4T during a heatup period of 5 hours. Considering this and the fact that the licensee also uses the much higher fluence at 1/4T in calculating the ART at 3/4T, the NRC staff determined that the licensee's approximate approach for beltline heatup curves is more conservative than the corresponding part of Appendix G and therefore the resulting beltline P-T limits satisfy regulatory requirements.

For the upper vessel, the licensee used the highest initial RT_{NDT} value for the upper vessel materials and the NRC approved WRC-175 methodology for analyzing upper vessel nozzles using stresses from the detailed stress analysis for a generic 251-inch BWR/6 vessel to supplement the Appendix G methodology. The NRC staff finds this approach for the upper vessel P-T limits is rigorous and acceptable.

For the bottom head, the licensee's P-T limit methodology is not as rigorous as those for the upper vessel and beltline P-T limits. The bottom head P-T limits for pressure testing were derived specifically for pressure and did not include the thermal stresses associated with the 20°F/hr heatup/cooldown. Further, the bottom head P-T limits for heatup and cooldown were derived indirectly from the bottom head P-T limits for pressure testing and may not be conservative for heatup and cooldown conditions. This is the second deviation from the Appendix G methodology. The NRC staff has evaluated the information in the original submittal and the response to NRC staff's request for additional information and determined that the

information is not sufficient for the NRC staff to accept the methodology outright. However, the NRC staff approves the proposed P-T limits in the RBS TS since the proposed limits are based on the beltline P-T limits which are more limiting than the upper vessel and bottom head P-T limits by a margin large enough to bound the uncertainties associated with the licensee's methodology for calculating the bottom head P-T limits. Since the beltline P-T limits conform to Appendix G requirements, the P-T limits in the RBS TS meets Appendix G requirements.

Appendix G of 10 CFR Part 50 also imposes a minimum temperature at the closure head flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120 °F for normal operation and by 90 °F for hydrostatic pressure tests and leak tests. When the pressure is less than or equal to 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the highest reference temperature of the material in the closure flange region. Based on the flange RT_{NDT} of -10 °F, the staff has determined that the straight-line segments for the beltline P-T curves, 80 °F (-10 °F+90 °F) line for pressure test and 110 °F (-10 °F+120 °F) line for heatup and cooldown, have satisfied the requirement for the closure flange region during normal operation and inservice leak and hydrostatic testing. The straight-line segment of 68 °F for the P-T limits is not required by Appendix G. However, it is a more conservative limit that is based on a water temperature of 68 °F that is assumed in the licensee's calculation of the shutdown margin for when the head is off while fuel is in the vessel.

3.3 Evaluation Summary

Subject to the limitation of 16 EFPYs, the NRC staff concludes that the licensee's proposed P-T limits for heatup, cooldown, hydrotest, and criticality, which are derived using a methodology based on Appendix G of the Code, as modified by Code Case N-640 and two plant-specific deviations, satisfy the underlying purpose of Appendix G of 10 CFR 50. The proposed P-T limit curves also satisfy GL 88-11, because the method in RG 1.99, Rev. 2 was used by the licensee to calculate the ART.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Louisiana State Official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (66 FR 15920, published March 21, 2001). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no

environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: L. Lois
 S. Sheng

Date: September 14, 2001

River Bend Station

cc:

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April 2001