

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. XXX

TO FACILITY OPERATING LICENSE NO. NPF-47

ENTERGY OPERATIONS INCORPORATED

RIVER BEND STATION

DOCKET NO. 50-458

1.0 INTRODUCTION

By letter dated January 10, 1997, the licensee submitted changes related to the pressure-temperature (P-T) limits in the River Bend Station Technical Specifications (TS). The licensee revised the P-T limits to provide new limits that are valid to 12 effective full power years (EFPY).

The staff evaluates the P-T limits based on the following NRC regulations and guidance: Appendix G to 10 CFR Part 50; Generic Letters (GL) 88-11 and 92-01; Regulatory Guide (RG) 1.99, Rev. 2; and Standard Review Plan (SRP)

Section 5.3.2. Appendix G to 10 CFR Part 50 requires that P-T limits for the reactor vessel must be at least as conservative as those obtained by Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. GL 88-11 requires that licensees use the methods in RG 1.99, Rev. 2, to predict the effect of neutron irradiation on the adjusted reference temperature (ART) of reactor vessel materials. The ART is defined as the sum of initial nil-ductility transition reference temperature ( $RT_{NDT}$ ) of the material, the increase in  $RT_{NDT}$  caused by neutron irradiation, and a margin to account for uncertainties in the prediction method. The increase in  $RT_{NDT}$  is calculated from the product of a chemistry factor and a fluence factor.

The chemistry factor may be calculated using credible surveillance data, obtained by the licensee's surveillance program, as directed by Position 2 of Regulatory Guide (RG) 1.99, Rev. 2. If credible surveillance data are not available, the chemistry factor is calculated dependent upon the amount of copper and nickel in the vessel material as specified in Table 1 of RG 1.99, Rev. 2. GL 92-01 requires licensees to submit reactor vessel materials data, which the staff uses in the review of the P-T limits submittals.

SRP 5.3.2 provides guidance on calculation of the P-T limits using linear elastic fracture mechanics methodology specified in Appendix G to Section III of the ASME Code. The linear elastic fracture mechanics methodology postulates sharp surface defects that are normal to the direction of maximum

ATTACHMENT 1

stress and have a depth of one-fourth of the reactor vessel beltline thickness (1/4T) and a length of 1-1/2 times the beltline thickness. The critical locations in the vessel for this methodology are the 1/4T and 3/4T locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

## 2.0 EVALUATION

For the River Bend Station reactor vessel, the licensee determined that the most limiting material at the 1/4T and 3/4T locations is the axial weld that was fabricated using tandem electrodes. This weld was fabricated using weld wire heat 5P6756. The licensee calculated an ART of 72.3°F at the 1/4T location and 55.2°F at the 3/4T location at 12 EFPY. The neutron fluence used in the ART calculation was  $1.79 \times 10^{18}$  n/cm<sup>2</sup> at the 1/4T location and  $0.93 \times 10^{18}$  n/cm<sup>2</sup> at the 3/4T location. The initial RT<sub>NDT</sub> for the limiting weld was -50°F. The margin term used in calculating the ART for the limiting weld was 56°F.

The staff performed an independent calculation of the ART values for the limiting material using the methodology in RG 1.99, Revision 2. Based on these calculations, the staff verified that the licensee's limiting material for the River Bend Station reactor vessel is the axial weld that was fabricated using tandem electrodes (heat 5P6756). The staff's calculated ART value for the limiting material agreed with the licensee's calculated ART value.

Substituting the ART values for River Bend Station into equations in SRP 5.3.2, the staff verified that the proposed P-T limits satisfy the requirements in Paragraph IV.A.2 of Appendix G of 10 CFR Part 50.

In addition to beltline materials, 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. Based on the flange RT<sub>NDT</sub> of 10°F for River Bend Station, the staff has determined that the proposed P-T limits have satisfied the requirement for the closure flange region during normal operation and inservice leak and hydrostatic testing.

## 3.0 CONCLUSION

The staff has performed an independent analysis to verify the licensee's proposed P-T limits. The staff concludes that the proposed P-T limits for heatup, cooldown, inservice leak and hydrostatic testing and core criticality are acceptable to 12 EFPY since the limits conform to the requirements of Appendix G of 10 CFR Part 50 and GL 88-11. Hence, the proposed P-T limits may be incorporated in the River Bend Station Technical Specifications.

#### 4.0 REFERENCES

1. Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2, May 1988
2. NUREG-0800, Standard Review Plan, Section 5.3.2: Pressure-Temperature Limits
3. Code of Federal Regulations, Title 10, Part 50, Appendix G, Fracture Toughness Requirements
4. Generic Letter 88-11, NRC Position on Radiation Embrittlement of Reactor Vessel Materials and its Impact on Plant Operations, July 12, 1988
5. ASME Boiler and Pressure Vessel Code, Section III, Appendix G for Nuclear Power Plant Components, Division 1, "Protection Against Nonductile Failure"
6. January 10, 1997, Letter from J. R. McGaha, Jr. to USNRC Document Control Desk, Subject: River Bend Station Unit 1 Licensee Amendment Request 96-09, Change to Technical Specifications 3.4.11, "RCS Pressure and Temperature (P-T) Limits," Figure 3.4.11-1, "Minimum Temperature Required vs. RCS Pressure"
7. October 22, 1996, Letter from G. Stevens (Structural Integrity Associates) to E. J. Zoch (Entergy Operations, Inc.) Subject: Revised (12 EFPY) P-T Curves for River Bend Station.

## SALP INPUT

FACILITY NAME: River Bend Station

### SUMMARY OF REVIEW ACTIVITIES

The staff reviewed the licensee's proposed changes to pressure-temperature (P-T) limits in the River Bend Station Technical Specifications. Generic Letter (GL) 88-11 recommends that licensees use Regulatory Guide 1.99, Rev. 2, to calculate the adjusted nil-ductility reference temperature, ART, which is a parameter used in establishing the P-T limits. The staff verified the licensee's calculated ART of the limiting beltline material. The staff verified the licensee's P-T limits using Standard Review Plan 5.3.2. and the limiting ART.

### NARRATIVE DISCUSSION OF LICENSEE PERFORMANCE-FUNCTIONAL AREA SAFETY ASSESSMENT/QUALITY VERIFICATION

The licensee's submittal adequately described the Technical Specification (TS) changes, and provided the appropriate information to technically support the P-T limits evaluation. The submittal was well prepared and concise.

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415-2735

ATTACHMENT 2

MEMORANDUM TO: William D. Beckner, Project Director  
Project Directorate IV-1  
Division of Reactor Projects, III & IV

FROM: Keith R. Wichman, Section Chief  
Material Integrity Section  
Materials and Chemical Engineering Branch  
Division of Engineering

SUBJECT: RIVER BEND STATION: PRESSURE TEMPERATURE LIMITS EVALUATION

License: Entergy Operations Incorporated  
TAC No.: M97834  
Review Status: Complete

By letter dated January 10, 1997, the licensee submitted changes related to the pressure-temperature (P-T) limits in the River Bend Station Technical Specifications (TS). The licensee revised the P-T limits to provide new limits that are valid to 12 effective full power years (EFPY).

Based on our evaluation of the submittal, we conclude that the proposed P-T limits for heatup, cooldown, inservice leak and hydrostatic testing and core criticality are acceptable to 12 EFPY, and may be incorporated in the River Bend Station TS.

Our evaluation is submitted as Attachment 1 and our SALP input is submitted as Attachment 2. This completes our efforts for TAC NO. M97834.

Docket No.: 50-458

Attachment: As stated

cc: D. Wigginton  
J. Strosnider

CONTACT: A.D. Lee, NRR

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