UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 17, 2019

Vice President, Operations
Entergy Operations, Inc.
River Bend Station
5485 US Highway 61
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: CORRECTION OF A NON-CONSERVATIVE TECHNICAL SPECIFICATION FOR PRESSURE-TEMPERATURE LIMITS (EPID L-2018-LLA-0083)

Dear Sir or Madam:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 195 to Renewed Facility Operating License No. NPF-47 for the River Bend Station, Unit 1 (River Bend). The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated April 2, 2018, as supplemented by letter dated October 4, 2018.

The amendment revises the River Bend TS Figure 3.4.11-1, "Minimum Temperature Required vs. RCS [Reactor Coolant System] Pressure," for reactor heatup, cooldown, and critical operations as well as for inservice leak tests and hydrostatic tests. This change replaces the non-conservative curve, which is for 32 Effective Full Power Years (EFPY) with a new curve that is for 54 EFPY.

Enclosure 2 to this letter contains Proprietary information. When separated from Enclosure 3, this document is DECONTROLLED.

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

Sincerely,

/RA/

Lisa M. Regner, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosures:
1. Amendment No. 195 to NPF-47
2. Safety Evaluation (PROPRIETARY)
3. Safety Evaluation (NON-PROPRIETARY)

cc w/o Enclosure 2: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY LOUISIANA, LLC

AND

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-458

RIVER BEND STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 195
Renewed License No. NPF-47

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Operations, Inc. (EOI, the licensee), dated April 2, 2018, as supplemented by letter dated October 4, 2018, 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

   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 Renewed 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. 195 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed 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 J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility Operating
License No. NPF-47 and
Technical Specifications

Date of Issuance: January 17, 2019

ATTACHMENT TO LICENSE AMENDMENT NO. 195

RIVER BEND STATION, UNIT 1

RENEWED FACILITY OPERATING LICENSE NO. NPF-47

DOCKET NO. 50-458

Replace the following pages of the Renewed Facility Operating License No. NPF-47 and 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.

Renewed Facility Operating License

Remove	Insert
-3-	-3-

Technical Specifications

Remove	Insert
3.4-32	3.4-32

(2) EOI, pursuant to Section 103 of the Act and 10 CFR Part 50, to possess, use and operate the facility at the above designated location in accordance with the procedures and limitations set forth in this renewed license;

(3) EOI, pursuant to Section 103 of the Act and 10 CFR Part 70, to receive, possess and to use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as supplemented and amended;

(4) EOI, pursuant to Section 103 of the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(5) EOI, pursuant to Section 103 of the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(6) EOI, pursuant to Section 103 of the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and the rules, regulations and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

EOI is authorized to operate the facility at reactor core power levels not in excess of 3091 megawatts thermal (100% rated power) in accordance with the conditions specified herein.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 195 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed license. EOI shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

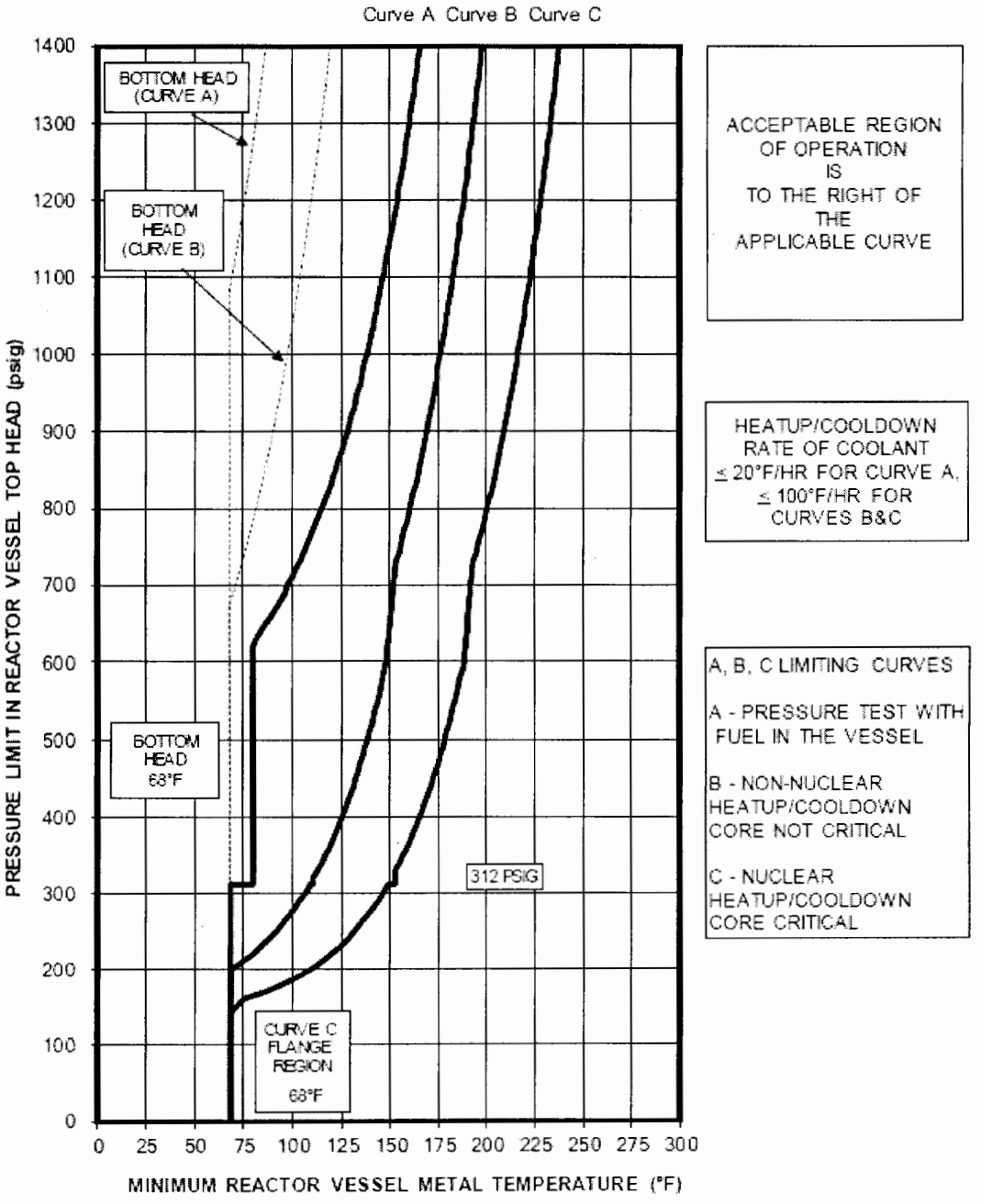

Figure 3.4.11-1 (page 1 of 1)
Minimum Temperature Required vs. RCS Pressure
Without Uncertainty for Instrumentation Error

ENCLOSURE 3

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 195 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-47

ENTERGY OPERATIONS, INC.

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

(**NON-PROPRIETARY**)

Proprietary information pursuant to Section 2.390 of Title 10 of the *Code of Federal Regulations* has been redacted from this document.

Redacted information is identified by blank space enclosed within double brackets.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 195 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-47

ENTERGY OPERATIONS, INC.

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

1.0 INTRODUCTION

By application dated April 2, 2018 (Reference 1), as supplemented by letter dated October 4, 2018 (Reference 2), Entergy Operations, Inc. (Entergy, the licensee), requested changes to the Technical Specifications (TSs) for the River Bend Station, Unit 1 (River Bend).

The proposed change would revise the River Bend TS Figure 3.4.11-1, "Minimum Temperature Required vs. RCS [Reactor Coolant System] Pressure," for reactor heatup, cooldown, and critical operations as well as for inservice leak tests and hydrostatic tests. The proposed change would replace the non-conservative curve, which is for 32 Effective Full Power Years (EFPY) with a new curve that is for 54 EFPY.

The supplemental letter dated October 4, 2018, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC or the Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on June 5, 2018 (83 FR 26115).

2.0 REGULATORY EVALUATION

2.1 Applicable System, Components, and Intended Functions

The licensee's license amendment request (LAR) applies to the reactor pressure vessel (RPV) and applicable nozzle appurtenances that are part of the reactor coolant pressure boundary (RCPB) in the plant design of River Bend. As defined in Section 5.2 of the River Bend Updated Safety Analysis Report, the components serve a RCPB intended function for the licensing basis and are designed, inspected and evaluated in a manner that ensures that the RCPB's intended function will be maintained throughout the licensed life of the facility.

2.2 Proposed Technical Specification Change

In the LAR, the licensee provided updated pressure-temperature (P-T) limit curves for TS Figure 3.4.11-1. The current P-T limit curves in TS Figure 3.4.11-1 that are applicable to the licensing basis are effective until 32 EFPY and were approved in License Amendment No. 120 (Reference 3). The licensee requested approval of the following P-T limit curves that were included in Attachment 2 of the letter dated April 2, 2018:

- An update of the existing P-T limit curve for the RPV beltline region under Service A loading conditions effective through 54 EFPY. For this curve, the licensee maintained a maximum allowable restriction on RCS heatup or cooldown rate changes of 20 degrees Fahrenheit per hour (ºF/hr).

- An update of the existing P-T limit curve for the RPV beltline region under Service B loading conditions effective through 54 EFPY. For this curve, the licensee maintained a maximum allowable restriction on RCS heatup or cooldown rate changes of 100 ºF/hr.

- An update of the existing P-T limit curve for the RPV beltline region under Service C loading conditions effective through 54 EFPY. For this curve, the licensee maintained a maximum allowable restriction on RCS heatup or cooldown rate changes of 100 ºF/hr.

- A new P-T limit curve for the RPV bottom head under Service A loading conditions effective through 54 EFPY. For this curve, the TS set a maximum allowable restriction on RCS heatup or cooldown rate changes of 20 ºF/hr.

- A new P-T limit curve for the RPV bottom head under Service B loading conditions effective through 54 EFPY. For this curve, the TS set a maximum allowable restriction on RCS heatup or cooldown rate changes of 100 ºF/hr.

The licensee's proposed pressure-temperature (P-T) curves account for the impacts that increased neutron irradiation will have on the adjusted reference temperatures of the reactor pressure vessel (RPV) components through 54 Effective Full Power Years (EFPY), and the applied stress-related impacts that nozzle components adjoined to the RPV may have on the safety margins incorporated into P-T limit curves. The P-T limit curves also incorporate the minimum temperature requirements or lowest service temperature requirements specified in Table 1 of Title 10 of the *Code of Federal Regulations* Part 50, Appendix G, "Fracture Toughness Requirements," and the results of the licensee's integrated RPV material surveillance program.

P-T monitoring is required by the surveillance requirements (SR) in either Technical Specification (TS) 3.4.11.1 or 3.4.11.2, depending on the loading conditions, and is required to be within the limits set in the applicable P-T limit curve (i.e., TS 3.4.11.1 for Service A or B loading conditions, or TS 3.4.11.2 for Service C loading conditions).

The P-T limit curves for Service A loading conditions are associated with heatup or cooldown of the reactor during inservice hydrostatic pressure or leak rate pressure testing of the reactor coolant pressure boundary (RCPB) when fuel is in the reactor core. Service B loading conditions are associated with non-nuclear heatup or cooldown of the reactor before the reactor

has been taken to a critical condition. Service C loading conditions are associated with nuclear heatup or cooldown of the reactor after the reactor has been taken to a critical condition.

The LAR dated April 2, 2018, included General Electric-Hitachi Company (GEH) Proprietary Topical Report No. NEDC-33882P, Revision 1 (Reference 4).

2.3 Applicable Regulations, Licensing Basis Information, and Guidance

The regulation in Title 10 of the *Code of Federal Regulations* (CFR) Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 31, "Fracture prevention of reactor coolant pressure boundary," requires, in part, that light-water reactor (LWR) RCPBs be designed with sufficient margin to ensure that the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized when RCPB is stressed under operating, maintenance, testing, and postulated accident conditions. GDC 31 also requires that the design reflect the uncertainties in determining the effects of irradiation on material properties.

The regulation in 10 CFR 50.90, "Applications for amendment of license, construction permit, or early site permit," provides the Commission's regulation for submitting changes to plant operating licenses (including TS contained in the license), construction permits or early site permits as plant-specific LARs for NRC staff approval. Renewed Facility Operating License No. NPF-47 for River Bend includes the TS requirements.

The regulations in 10 CFR 50.36, "Technical specifications," provide the requirements that must be included in plant-specific TSs. Paragraph 50.36(c)(2)(ii)(B) of 10 CFR 50.36, requires the TS limiting conditions of operation (LCOs) to include P-T limits for reactor operations because the limits constitute a "process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." The regulation in 10 CFR 50.36(c)(3) requires the TS to include surveillance requirements (SRs) for those systems, structures or components that are subject to the TS LCO requirements.

The regulations in 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," provide the requirements for calculating the P-T limits that need to be included as design limits in the LCOs. The rule sets minimum safety margin requirements that must be incorporated into the calculation of P-T limits. The rule also requires that the P-T limits must account for the impacts of radiation throughout the service life of the plant and must incorporate the material test results from the licensee's implementation of the 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," that apply to the licensing basis of the facility.

The regulations in 10 CFR Part 50, Appendix H, require implementation of the licensee's reactor vessel integrated surveillance program (ISP).

The licensee uses the criteria in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), Section XI, Division 1 (ASME Code Section XI), Appendix G (Reference 5), as part of the basis for the updated P-T limit curves. This ASME appendix provides ASME's prescribed methodology for calculating P-T limits based on the component-specific material property values and the temperature-dependent stress intensity factors for the components. The methods include additional margins of safety that are required

to be applied to the P-T limit calculations. This ASME appendix is referenced as part of the regulatory basis for meeting the fracture toughness requirements defined and specified in 10 CFR Part 50, Appendix G.

The licensee also used the following NRC staff or industry guidelines as part of its basis for the developing the P-T limit curves proposed in the LAR:

- Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials" (Reference 6);

- Section 5.3.2, Revision 1 "Pressure-Temperature Limits," of NUREG-0800, "Standard Review Plan for Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (Reference 7);

- Branch Technical Position (BTP) 5.3, Revision 2, "Fracture Toughness Requirements," of NUREG-0800 (Reference 7); and

- Welding Research Council (WRC) Bulletin No. 175, "PVRC [Pressure Vessel Research Committee] Recommendations on Toughness Requirements for Ferritic Materials" (Reference 8).

3.0 TECHNICAL EVALUATION

3.1 Existing Licensing Basis for P-T Limits and P-T Monitoring

The licensee's LICENSING BASIS was established to comply with the requirements in 10 CFR 50.36(c)(2)(ii)(B) and 10 CFR 50.36(c)(3) through the inclusion of the LCOs and SRs for P-T monitoring in TS Section 3.4.11, "RCS Pressure and Temperature (P/T) Limits." This TS section includes TS Figure 3.4.11-1, which currently includes the following 10 CFR Part 50, Appendix G, mandated P-T limits for the licensing basis:

- The P-T limits for the beltline region of the RPV that are applicable during system leak rate or hydrostatic pressure testing of the RCPB when uranium enriched fuel is located in the reactor (i.e., during plant Service Loading A Conditions);

- The P-T limits for the beltline region of the RPV that are applicable during non-nuclear heatup or cooldown of the reactor when the reactor has yet to be taken critical (i.e., during plant Service Loading B Conditions); and

- The P-T limits for the beltline region of the RPV that are applicable during nuclear heatup or cooldown of the reactor when the reactor has been taken critical (i.e., during plant Service C loading conditions).

The current P-T limit curves in TS Figure 3.4.11-1 were approved in License Amendment No. 120 for River Bend and are valid through 32 EFPY of plant operations.

3.2 Basis for Submitting P-T Limit Curves Changes

In the LAR dated April 2, 2018, Entergy identified that the existing P-T limits for Curves B and C at 32 EFPY were determined to be non-conservative based on a GEH assessment. The licensee stated that the P-T limit curves for 32 EFPY approved in License Amendment No. 120, inadvertently omitted the effects of the **[[ ]]** discontinuity on the stress intensity factors for assessed RPV beltline components in the year 2000 P-T limits submittal. The licensee stated that the updated P-T limit curves for 54 EFPY, submitted in the application, propose to resolve the non-conservatism. The licensee took this action in accordance with the NRC staff position in NRC Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications Insufficient to Assure Plant Safety" (Reference 9). This AL provides the NRC staff position on the discovery of non-conservative TS requirements in the licensing basis, and the corrective actions that may be applied by a licensee. The long term corrective action to be taken by the licensee upon the discovery of a non-conservative or non-conforming TS requirement is to submit an LAR to the NRC.

3.3 Methodology for Determining RPV Component-Specific Fluence Values Used in the P-T Limit Analysis for 54 EFPY

In the LAR dated April 2, 2018, the licensee stated that the RPV component-specific neutron fluence values for 54 EFPY, used in the P-T limit analysis, were based on the neutron fluence methodology in GEH Proprietary Report NEDC-32983-P-A, Revision 2, "General electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations" (Reference 10). The NRC staff noted that this is the same RPV neutron fluence methodology used by the licensee in Section 4.2 of the licensee's license renewal application. The NRC staff reviewed this methodology and finds it acceptable. A complete description of the method and the NRC staff's review may be found in Section 4.2.1 of the "Safety Evaluation Report Related to the License Renewal of River Bend Station, Unit 1" (Reference 11).

By letter dated August 13, 2018 (Reference 12), the licensee identified an error in the fluence calculation methodology used for the River Bend neutron fluence calculations. The licensee stated that the error was caused by a numerical transposition, which caused a 0.72 EFPY error in the cumulative elapsed time for operating Cycles 10 and 11. In the licensee's letter dated March 26, 2018 (Reference 13), the licensee also stated that the neutron fluence values reported for 54 EFPY included a safety margin for future operating cycles to ensure the reported values in the March 2018 letter were conservative.

The NRC staff verified that the RPV neutron fluence values reported for 54 EFPY in the LAR included the safety margin referenced in Entergy's letter dated August 13, 2018. The NRC staff also verified that the safety margin was of a sufficient magnitude to ensure that the reported RPV neutron fluence values remain valid and bounding, even if the error in the cumulative elapsed time for Cycles 10 and 11 is in the 54 EFPY projection basis. Therefore, the NRC staff concludes that the RPV neutron fluence values reported for 54 EFPY do not need to be amended further by the licensee, because they are bounding for the 54 EFPY projection basis.

3.4 Bases for Incorporating RPV Component-Specific RT_{NDT} Values, Stresses, and RPV Integrated Surveillance Program Results into the P-T Limit Calculations

The NRC staff noted that the licensee used cooldown of the reactor to establish the P-T limits curves for heatup and cooldown of the reactor under Service Level A, B, or C loading conditions through 54 EFPY. The NRC staff verified that the calculation basis conservatively assumed the most limiting primary and bending stresses (including thermal stresses) that may be applied to the components during these types of loading conditions. The NRC staff finds this acceptable because P-T limit points in reactor cooldown curves are based on the limiting 54 EFPY fluence values and thermal stress levels for the 1/4T (one-quarter component thickness) location of the RPV, which always yield more limiting P-T points than those for corresponding RPV heatup curves (which are based on the more limiting combination of fluence and thermal stress level combinations for either the 1/4T and 3/4T locations of the RPV).

The NRC staff verified that the licensee's P-T limits analysis for 54 EFPY incorporated the most limiting adjusted reference temperature values (i.e., RT_{NDT} values) for the RPV components and the results of the licensee's Boiling Water Reactor (BWR) Vessels Internals Program (BWRVIP) ISP in the RT_{NDT} calculations for the components. For those RPV components located in beltline or extended beltline of the RPV, the component-specific RT_{NDT} analyses are limited by the surveillance data-based RT_{NDT} calculation for the RPV Shell 2 axial welds made from Heat No. 5P6756, with the applicable ISP data reported in the following non-proprietary BWRVIP reports:

- BWRVIP-87NP, Revision 1, "BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules D, G, and H" (Reference 14);

- BWRVIP-111NP, Revision 1, "BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules E, F, and I" (Reference 15);

- BWRVIP-113NP, "BWR Vessel and Internals Project, River Bend 183 Degree Surveillance Capsule Report" (Reference 16); and

- BWRVIP-169NP, BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules A, B, and C" (Reference 17).

The NRC staff also verified that the RPV component-specific initial RT_{NDT} values used in the RT_{NDT} calculations were either based on methods for determining initial RT_{NDT} in the ASME Code Section III, or else in accordance with the NRC staff's alternative methods for establishing initial RT_{NDT} value in BTP 5-3, Revision 2, of NUREG-0800. Thus, for this aspect of the review, the NRC staff verified that that the licensee applied the following limiting RT_{NDT} values through 54 EFPY as the basis for developing the composite P-T limit curves included in TS Figure 3.4.11-1:

- A limiting 1/4T RT_{NDT} of 110.1 ºF for the RPV beltline that is based on the assessment of the three axial welds in RPV Shell #2 made from Weld Heat No. 5P6756, and the use of all BWRVIP ISP data currently available for this weld heat;

- An RT_{NDT} of 78.1 ºF for the portion of the RPV Shell #2 plate containing the **[[ ]]**;

- An RT_{NDT} of 0.7 ºF for the **[[ ]]**;
- An RT_{NDT} of -20.0 ºF for the **[[ ]]**; and
- An RT_{NDT} of 10.0 ºF for the limiting RPV bottom head material.

The NRC staff finds the conservatisms in the calculation basis to be acceptable, and they demonstrate that the P-T limit curves have been developed using NRC-accepted methods including an analysis of the limiting RT_{NDT} values.

3.5 Proposed Changes to the P-T Limit Curves

In the application dated April 2, 2018 (Reference 1), the licensee requested NRC staff approval of updated P-T limit curves for TS Figure 3.4.11-1 effective to 54 EFPY.

The NRC staff reviewed the proposed changes to these P-T limit curves in accordance with the requirements in 10 CFR Part 50, Appendix G, in order to ensure that the changes to the P-T limit curves would be at least as conservative as those that would be generated if the rules in Appendix G of the ASME Code Section XI were used, and that the licensee incorporated the minimum temperature requirements of Appendix G required to be assessed for inservice hydrostatic pressure or system leak rate testing conditions, or normal operating conditions, including times when the reactor is in a critical condition.

The NRC staff also reviewed the proposed P-T limit curves for 54 EFPY, in accordance with the following NRC guidelines or NRC staff-approved methodologies adopted by the licensee, as part of its basis for updating the P-T limit curves through 54 EFPY: (a) BTP 5-3, Revision 1; (b) RG 1.99, Revision 2; (c) the methodology for performing P-T limit calculations in the 2010 Edition of the ASME Code Section XI, Appendix G; (d) the staff-approved methodology for performing neutron fluence projections in GEH Report No. NEDC-32983P-A, Revision 2; and (e) the NRC staff-approved generic methodology for performing P-T limit calculations in GEH Proprietary Report No. NEDC-33178P-A, Revision 1, “GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves” (Reference 18), as amended (if necessary) by plant-specific methodology changes in GEH Proprietary Report No. NEDC-33882P, Revision 1 (Reference 4).

The NRC staff observed that the revision to TS Figure 3.4.11-1 included a statement that the P-T limit curves were developed “**[[ ]]**.” The NRC staff requested the licensee to account for **[[ ]]** for 54 EFPY.

In the letter dated October 4, 2018 (Reference 2), the licensee stated that the treatment of **[[ ]]** will be addressed in an update of River Bend Procedure STP-050-0700, “RCS Pressure/Temperature Limits Verification,” which will be tracked through an item in the licensee’s Paperless Condition Reporting System (PCRS). The NRC staff finds this approach to be an acceptable alternative regarding the treatment of **[[ ]]** for 54 EFPY.

The NRC staff also reviewed the impact of the P-T curve changes on the adequacy of the LCOs and SRs in TS Section 3.4.11 that relate to P-T limits or P-T monitoring requirements in the licensing basis. For times when the licensee is required to perform plant-specific P-T monitoring activities during RCS heatup and cooldown operations or inservice leak-rate or hydrostatic pressure tests of the RCPB, the SR in TS Section 3.4.11.1 requires the licensee to perform these monitoring activities against the limits specified in TS Figure 3.4.11-1. Similarly, for times when the licensee is withdrawing control rods for the purpose of bringing the reactor into a critical condition, the SRs in TS Section 3.4.11.2 require the licensee to perform its plant-specific P-T monitoring activities against the specific P-T curve limits in TS Figure 3.4.11-1 for core critical operations (i.e. against the P-T Curve C limits for the RPV beltline components in Figure 3.4.11-1). The NRC staff verified that the proposed changes to the P-T limit curves in TS Figure 3.4.11-1 would not necessitate a need for updating TS Section 3.4.11.2 because: (a) the existing SR already appropriately references that the P-T monitoring activities will be performed in comparison to the P-T limit curve in TS Figure 3.4.11-1 for the RPV beltline under Service Level C conditions, and (b) any proposed changes to the curve would not impact the SR's basis for cross-referencing to this specific P-T limit curve in TS Figure 3.4.11-1.

However, the NRC staff observed that by adding new P-T limit curves for the RPV bottom head into TS Figure 3.4.11-1, the specific SR statements in TS 3.4.11.1 could become unclear because the TS SR section does not define how or when the licensee should perform specific types of P-T monitoring activities against the new P-T limit curves for the bottom head (i.e., those for Service A and B loading conditions) versus those for the RPV beltline region under Service A and B loading conditions.

In the letter dated October 4, 2018, the licensee stated that River Bend Procedure STP-050-0700, is used to meet the TS SR requirements associated with the P-T limit curves in TS Figure 3.4.11-1. The licensee clarified that the current version of the procedure only includes criteria for monitoring RCS temperatures in the vicinity of the beltline region of the RPV. However, the licensee stated that, with the implementation of P-T limit curves for both the beltline and bottom head regions of the RPV, the procedure will be updated to require RPV beltline and bottom head temperature monitoring be performed in relation to the corresponding P-T limit curve for the RPV location in the updated TS figure. The licensee stated that the changes to the procedures will be tracked through the site-specific PCRS. The NRC staff finds that since the procedural changes will be tracked by the PCRS and will be subject to applicable criteria in the licensee's 10 CFR Part 50, Appendix B, quality assurance program, these SR monitoring criteria do not need to be accounted for through a proposed change to the provisions in TS SR Section 3.4.11.1. The NRC staff also finds that the current version of TS SR Section 3.4.11.1 is adequate without any need to amend the existing TS SR section by the licensee.

3.5.1 Proposed Changes to P-T Limit Curve for the RPV Beltline during Inservice Hydrostatic Pressure Test or Inservice Leak-Rate Test Conditions (Service A Loading Conditions)

The NRC staff reviewed the proposed changes to the P-T limit curve in TS Figure 3.4.11-1 for RPV beltline components under Service A loading conditions to determine whether the proposed P-T limit curve for 54 EFPY is at least as conservative as that generated using the methods in the ASME Code Section XI, Appendix G. The NRC staff performed an independent P-T limit calculation for RPV beltline component under Service A Conditions using the methodology in ASME Code Section XI, Appendix G, as modified for the assessment of RPV nozzles using the NRC staff approved methodology in GEH Proprietary Report

No. NEDC-33178P-A, Revision 1. The NRC staff independently verified that the P-T limit curve was based on the composite data for the RPV minimum temperature requirements, use of the limiting RT_{NDT}, and use of the limiting stress inputs for the limiting RPV beltline component (i.e., RPV Shell # 2 axial welds made from Heat No. 5P6756). In addition, the NRC staff verified that use of the maximum stress intensities for the limiting RPV beltline welds under Service A loading conditions would always bound the limiting stress intensities for nozzles that are adjoined to the RPV, including the **[[ ]]**.

The NRC staff calculated P-T limit temperatures that were within 0.5 ºF of those calculated by the licensee for the assessed pressure range (0 – 1400 pounds per square inch). This provides sufficient demonstration that the licensee's P-T limit curve for the RPV beltline effective to 54 EFPY under Service A loading conditions is at least as conservative as the P-T limit curve that would be generated if methods of ASME Code Section XI, Appendix G were used for the analysis, and that the proposed curve incorporates the minimum temperature/lowest service temperature requirements specified in the 10 CFR Part 50, Appendix G. Based on this review, the NRC staff finds that the licensee may implement the proposed P-T limit curves for 54 EFPY that applies to the RPV beltline region under Service A loading conditions, with a maximum allowable 20 ºF/hr restriction on RCS temperature rate changes associated with the RCS pressure test operations.

3.5.2 Proposed Changes to the P-T Limit Curves for the RPV Beltline during Non-Nuclear Plant Heatup or Cooldown of the Reactor (Service B Loading Conditions) and During Nuclear Heatup or Cooldown of the Reactor with the Core Critical (Service C Loading Conditions)

The NRC staff reviewed the proposed changes to the P-T limit curves in TS Figure 3.4.11-1 for RPV beltline components under Service B or C loading conditions to determine whether the proposed P-T limit curves for 54 EFPY are at least as conservative as those generated using the methods in the ASME Code Section XI, Appendix G. The NRC staff's review included an assessment of the impacts that discontinuities from the **[[ ]]** would have on the proposed P-T limits for the RPV beltline under Service B and C loading conditions through 54 EFPY. The NRC staff performed an independent P-T limit calculation for RPV beltline components using the methodology in ASME Code Section XI, Appendix G, as modified for the assessment of RPV nozzles using the NRC staff approved methodologies in GEH Proprietary Report No. NEDC-33178P-A, Revision 1, and in WRC Bulletin No. 175.

During its review, the NRC staff could not verify that the proposed P-T limit curves for the RPV beltline region under Service B and C loading conditions would meet the requirement in 10 CFR Part 50, Appendix G, for incorporating appropriate conservatisms in P-T limit calculations. Specifically, the NRC staff noted the plant-specific basis for assessing the **[[ ]]** impacts these P-T limit curves (as evaluated in GEH Report No. NEDC-33882P, Revision 1) and includes some additional methods for assessing **[[ ]]** that were not explicitly defined in the approved generic methodology for assessing these components in NEDC-33178P-A, Revision 1.

By letter dated October 4, 2018 (Reference 2), the licensee stated that use of an **[[ ]]** is warranted for the P-T limits assessment of the **[[ ]]** because it is based on the methods in WRC Bulletin No. 175. The methods contained

in this Bulletin are acceptable to the NRC staff for meeting those ASME Code Section XI, Appendix G, safety margin requirements that apply to P-T limit assessments of RPV nozzle appurtenances.[1] The licensee also provided a sample **[[ ]]** and the specific **[[ ]]** that apply to the **[[ ]]** over the range of pressures evaluated in Service B and C loading condition assessments of the component.

The NRC staff determined that the licensee's response provided sufficient justification for applying **[[ ]]** to the P-T limit thermal stress evaluation of the **[[ ]]** because they are based on the NRC staff-endorsed methodology in WRC Bulletin No. 175. The NRC staff also determined that the P-T limit curves proposed for the RPV beltline region under Service B and C loading conditions are acceptable because they meet the requirements in 10 CFR Part 50, Appendix G, and the safety margin requirements in ASME Code Section XI, Appendix G, including those specified in the ASME appendix for RPV nozzle appurtenance assessments. Based on this review, the NRC staff finds that the licensee may implement the proposed P-T limit curves for 54 EFPY that apply to the RPV beltline region under Service B and C loading conditions, with a maximum allowable 100 ºF/hr restriction on RCS temperature rate changes associated with these types of operations.

3.5.3 Proposed Changes to P-T Limit Curve for the RPV Bottom Head during Heatup of Cooldown Associated with Pressure Test Conditions (Service A Loading Conditions) and During Non-Nuclear Plant Heatup or Cooldown of the Reactor (Service B Loading Conditions)

The NRC staff verified that the application dated April 2, 2018 (Reference 1) proposed new P-T limit curves for the RPV bottom head under Service A and B loading conditions that were not previously part of the licensing basis.[2] The NRC staff finds that it is permissible for the licensee to propose new P-T limit curves for the RPV bottom head under these loading conditions because the requirements in 10 CFR Part 50, Appendix G do not preclude licensees from developing separate P-T limit curves for RPV bottom head regions.

The NRC staff reviewed the proposed P-T limit curves for the RPV bottom head region under Service A or B loading conditions to determine whether the proposed P-T limit curves for 54 EFPY are at least as conservative as those generated using the methods in the ASME Code Section XI, Appendix G. The NRC staff's review included an assessment of the impacts that discontinuities from the **[[ ]]**, would have on the proposed P-T limits for the RPV bottom head under Service A and B loading conditions through 54 EFPY. The NRC staff performed independent P-T limit calculations for RPV bottom head components using the methodology in ASME Code Section XI, Appendix G, as modified for the assessment of the RPV nozzles using the NRC staff-approved methodologies in GEH Proprietary Report No. NEDC-33178P-A, Revision 1.

[1] The methods in WRC Bulletin 175 are endorsed through reference in 10 CFR 50.55a, "Codes and Standards." The provisions in ASME Section XI, Appendix G, "Fracture Toughness Criteria for Protection Against Failure," permit the methods of WRC Bulletin No. 175 to be used as an acceptable methodology for assessing RPV nozzle stresses.

[2] That is, prior to April 2, 2018, , the licensing basis for the P-T limits in TS Figure 3.4.11-1 included only NRC-staff-approved P-T limit curves for the RPV beltline region under Service A, B, and C loading conditions. The P-T limit curves that were approved for 32 EFPY in License Amendment No. 120 did not include NRC staff approval of P-T limit curves for RPV bottom head region under Service A and B loading conditions.

The NRC staff observed that the proposed P-T limit curves for the RPV bottom head under Service Level A and B loading conditions were developed using the calculational and stress analysis methodology for a **[[ ]]** evaluated in NEDC-33178P-A, Revision 1 (Reference 18). The NRC staff also observed that the generic methodology in 33178P-A permits the licensee to develop P-T limit curves for the BWR RPV bottom head using the **[[ ]]** provided the plant specific **[[ ]]**

Based on the generic methodology and the NRC staff's independent calculations using this methodology, the NRC staff verified that the P-T limit curves proposed by the licensee for the RPV bottom head under Service Level A and B loading conditions will meet the safety margin requirements in 10 CFR Part 50, Appendix G, through 54 EFPY. However, the NRC staff observed that the plant-specific basis in GEH Report No. NEDC-33882P, Revision 1 (Reference 4), did not provide the **[[ ]]** for the design of the RPV bottom head at River Bend. Therefore, the NRC staff did not have sufficient information to verify that use of the generic methodology basis was bounding and valid for the P-T limit analyses of the RPV bottom head region.

In the letter dated October 4, 2018 (Reference 2), the licensee stated that the plant-specific RPV bottom head dimensions are an **[[ ]]** and a **[[ ]]**. The licensee also stated that, based on these dimensions, the plant-specific **[[ ]]**. The NRC staff noted that these site-specific dimensions provide sufficient demonstration that the plant-specific **[[ ]]** for the RPV bottom head is bounded by the **[[ ]]** in GEH Report No. NEDC-33178P-A, and that the generic methodology may be used to establish the P-T limit curves for the RPV bottom head.

Based on the generic methodology and the applicable site-specific information, the NRC staff has verified that the proposed P-T limit curves for the RPV bottom head under Service Level A and B loading conditions are conservative and acceptable because the licensee has sufficiently demonstrated that the P-T limit curves for the RPV bottom head will meet the requirements of 10 CFR Part 50, Appendix G, and the safety margins specified in ASME Code Section XI, Appendix G, through 54 EFPY. Further, the NRC staff determined that the changes will allow the TS to continue to meet the regulatory requirements of 10 CFR 50.36(c)(2) for LCOs and 10 CFR 50.36(c)(3) for SRs. Based on its review, the NRC staff finds that the licensee may implement the proposed P-T limit curves for 54 EFPY that apply to the RPV bottom head region under Service A and B loading conditions, with a maximum allowable 20 ºF/hr restriction on RCS temperature rate changes associated with the Service Level A pressure test operations and a maximum allowable 100 ºF/hr restriction on RCS temperature rate changes associated with the Service Level B non-critical power operations.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Louisiana State official was notified of the proposed issuance of the amendment on December 20, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of facility components 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 published in the *Federal Register* on June 5, 2018 (83 FR 26115). 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) there is reasonable assurance that 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.

7.0 REFERENCES

1. Maguire, W. F., Entergy Operations, Inc. letter to U.S. Nuclear Regulatory Commission, "License Amendment Request to Correct Non-Conservative Technical Specification Figure 3.4.11-1 'Minimum Temperature Required vs. RCS Pressure,' by Replacing with 54 Effective Full Power Year (EFPY) Curves, River Bend Station – Unit 1, Docket No. 50-458, License No. NPF-47," dated April 2, 2018. (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18092B187).

2. Maguire, W. F., Entergy Operations, Inc. letter to U.S. Nuclear Regulatory Commission "Response to License Amendment Request to Correct a Non-Conservative Technical Specification Figure 3.4.11-1, 'Minimum Temperature Required vs. RCS Pressure,' by Replacing with 54 Effective Full Power Years (EFPY) Curves, NRC Request for Additional Information (RAI), River Bend Station, Unit 1, Docket No. 50-458, License No. NPF-47," dated October 4, 2018 (ADAMS Accession No. ML18277A311).

3. Moody, R. E., U.S. Nuclear Regulatory Commission, letter to Mr. Randall K. Edington, Entergy Operations, Inc., "River Bend Station, Unit 1 – Issuance of Amendment Re: Revision to Reactor Vessel Pressure/Temperature (P-T) Limits (TAC NO. MB1153)," dated September 14, 2001 (ADAMS Accession No. ML012280403).

4. GE Hitachi Nuclear Energy, Proprietary Report No. NEDC-33882P, Revision 1, "Pressure and Temperature Limits Report (PTLR) Up to 54 Effective Full Power Years," dated November 2017 (publicly available version can be found in Attachment 4 of ADAMS Accession No. ML18092B187).

5. American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Division 1, Appendix G, "Fracture Toughness Criteria for Protection against Failure."

6. U.S. Nuclear Regulatory Commission, "Radiation Embrittlement of Reactor Vessel Materials," Regulatory Guide 1.99, Revision 2, dated May 1988 (ADAMS Accession No. ML003740284).

7. U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," NUREG-0800, Section 5.3.2, Revision 1, "Pressure-Temperature Limits," dated July 1981 and Branch Technical Position 5-3, Revision 2, "Fracture Toughness Requirements," March 2007 (ADAMS Accession Nos. ML052340637 and ML070850035, respectively).

8. Welding Research Council Bulletin No. 175, "PVRC Recommendations on Toughness Requirements for Ferritic Materials," August 1972.

9. U.S. Nuclear Regulatory Commission, Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," dated December 29, 1998 (ADAMS Accession No. ML031110108).

10. GE Energy Nuclear (GEH), Proprietary Report No. NEDC-32983P-A, Revision 2, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 2006 (publicly available version can be found at ADAMS Accession No. ML072480121).

11. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of River Bend Station, Unit 1, Docket No. 50-458, Entergy Operations, Inc. and Entergy Louisiana, LLC, dated August 2018 (ADAMS Accession No. ML18212A151).

12. Maguire, W. F., Entergy Operations, Inc. letter to U.S. Nuclear Regulatory Commission, "Supplemental Information Related to License Renewal Application NRC Request for Additional Information Set 10 (4.2.1-1, 4.7.3-1, and 4.7.3-2), River Bend Station, Unit 1, Docket No. 50-458, License No. NPF-47," dated August 13, 2018 (ADAMS Accession No. ML18225A315).

13. Maguire, W. F., Entergy Operations, Inc. letter to U.S. Nuclear Regulatory Commission, "Response to License Renewal Application NRC Request for Additional Information (RAI) Set 10, River Bend Station, Unit 1, Docket No. 50-458, License No. NPF-47," dated March 26, 2018 (ADAMS Accession No. ML18087A188).

14. Electric Power Research Institute (EPRI), letter to U.S. Nuclear Regulatory Commission transmitting EPRI Non-Proprietary Report No. BWRVIP-87NP, Revision 1, "BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules D, G, and H," dated August 26, 2010 (ADAMS Accession No. ML102420110).

15. Electric Power Research Institute, letter to U.S. Nuclear Regulatory Commission enclosing EPRI Non-Proprietary Report No. BWRVIP-111NP, Revision 1, "BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules E, F, and I," dated September 24, 2010. (ADAMS Accession No. ML102720220).

16. Electric Power Research Institute, letter to U.S. Nuclear Regulatory Commission enclosing EPRI Non-Proprietary Report No. BWRVIP-113NP, "BWR Vessel and Internals Project, River Bend 183 Degree Surveillance Capsule Report," dated September 13, 2010 (ADAMS Accession No. ML102580248).

17. Electric Power Research Institute, letter to U.S. Nuclear Regulatory Commission enclosing EPRI Non-Proprietary Report No. BWRVIP 169NP, "BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program (SSP) Capsules A, B, and C," dated September 14, 2010 (ADAMS Accession No. ML102590092).

18. GE Hitachi Nuclear Energy, Proprietary Report No. NEDC-33178P-A, Revision 1, "GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves," June 2009 (publicly available version can be found at ADAMS Accession No. ML092370487).

Principal Contributor: James Medoff

Date: January 17, 2019

SUBJECT: RIVER BEND STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: CORRECTION OF A NON-CONSERVATIVE TECHNICAL SPECIFICATION FOR PRESSURE-TEMPERATURE LIMITS (EPID L-2018-LLA-0083) DATED JANUARY 17, 2019

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