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

November 2, 2015

Mr. Dean Curtland
Site Vice President
c/o Mr. Michael Ossing
NextEra Energy Seabrook, LLC
Seabrook Station
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT REGARDING LICENSE AMENDMENT REQUEST 14-04, REVISED REACTOR COOLANT SYSTEM PRESSURE/TEMPERATURE LIMITS APPLICABLE FOR 55 EFFECTIVE FULL POWER YEARS (TAC NO. MF4577)

Dear Mr. Curtland:

The Commission has issued the enclosed Amendment No. 151 to Facility Operating License No. NPF-86 for the Seabrook Station, Unit No. 1. This amendment consists of changes to the technical specifications (TSs) in response to your application dated July 24, 2014, as supplemented by letters dated March 9, April 23, June 24, July 9, July 20, and September 8, 2015.

The amendment revises the pressure-temperature limits in TS 3.4.9.1, "Reactor Coolant System Pressure/Temperature Limits," to be applicable to 55 effective full power years. The amendment also revises TS 3.4.9.3, "Overpressure Protection Systems," by providing new overpressure protection setpoints and lowering the reactor coolant system temperature at which the TS is applicable.

A copy of our related safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

John G. Lamb, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosures:
1. Amendment No. 151 to NPF-86
2. Safety Evaluation

cc w/enclosures: Distribution via Listserv

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

NEXTERA ENERGY SEABROOK, LLC, ET AL.*

DOCKET NO. 50-443

SEABROOK STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 151
License No. NPF-86

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

   A. The application for amendment filed by NextEra Energy Seabrook, LLC, et al., (the licensee) dated July 24, 2014, as supplemented by letters dated March 9, April 23, June 24, July 9, July 20, and September 8, 2015, 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, 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 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.

*NextEra Energy Seabrook, LLC is authorized to act as agent for the: Hudson Light & Power Department, Massachusetts Municipal Wholesale Electric Company, and Taunton Municipal Light Plant and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility.

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-86 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 151, and the Environmental Protection Plan contained in Appendix B are incorporated into the Facility License No. NPF-86. NextEra Energy Seabrook, LLC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented by March 2, 2017.

FOR THE NUCLEAR REGULATORY COMMISSION

Douglas A. Broaddus, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications and Facility Operating License

Date of Issuance: November 2, 2015

ATTACHMENT TO LICENSE AMENDMENT NO. 151

FACILITY OPERATING LICENSE NO. NPF-86

DOCKET NO. 50-443

Replace the following page of the Facility Operating License with the revised page. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Remove	Insert
3	3

Replace the following pages of 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	Insert
3/4 4-23	3/4 4-23
3/4 4-24	3/4 4-24
3/4 4-26	3/4 4-26
3/4 4-30	3/4 4-30

(4) NextEra Energy Seabrook, LLC, pursuant to the Act and 10 CFR 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) NextEra Energy Seabrook, LLC, pursuant to the Act and 10 CFR 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;

(6) NextEra Energy Seabrook, LLC, pursuant to the Act and 10 CFR 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 authorized herein; and

(7) DELETED

C. This 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 to the rules, regulations, and orders of the Commission now or hereafter in effect; is subject to the additional conditions specified or incorporated below:

(1) <u>Maximum Power Level</u>

NextEra Energy Seabrook, LLC, is authorized to operate the facility at reactor core power levels not in excess of 3648 megawatts thermal (100% of rated power).

(2) <u>Technical Specifications</u>

The Technical Specifications contained in Appendix A, as revised through Amendment No. 151*, and the Environmental Protection Plan contained in Appendix B are incorporated into the Facility License No. NPF-86. NextEra Energy Seabrook, LLC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(3) <u>License Transfer to FPL Energy Seabrook, LLC**</u>

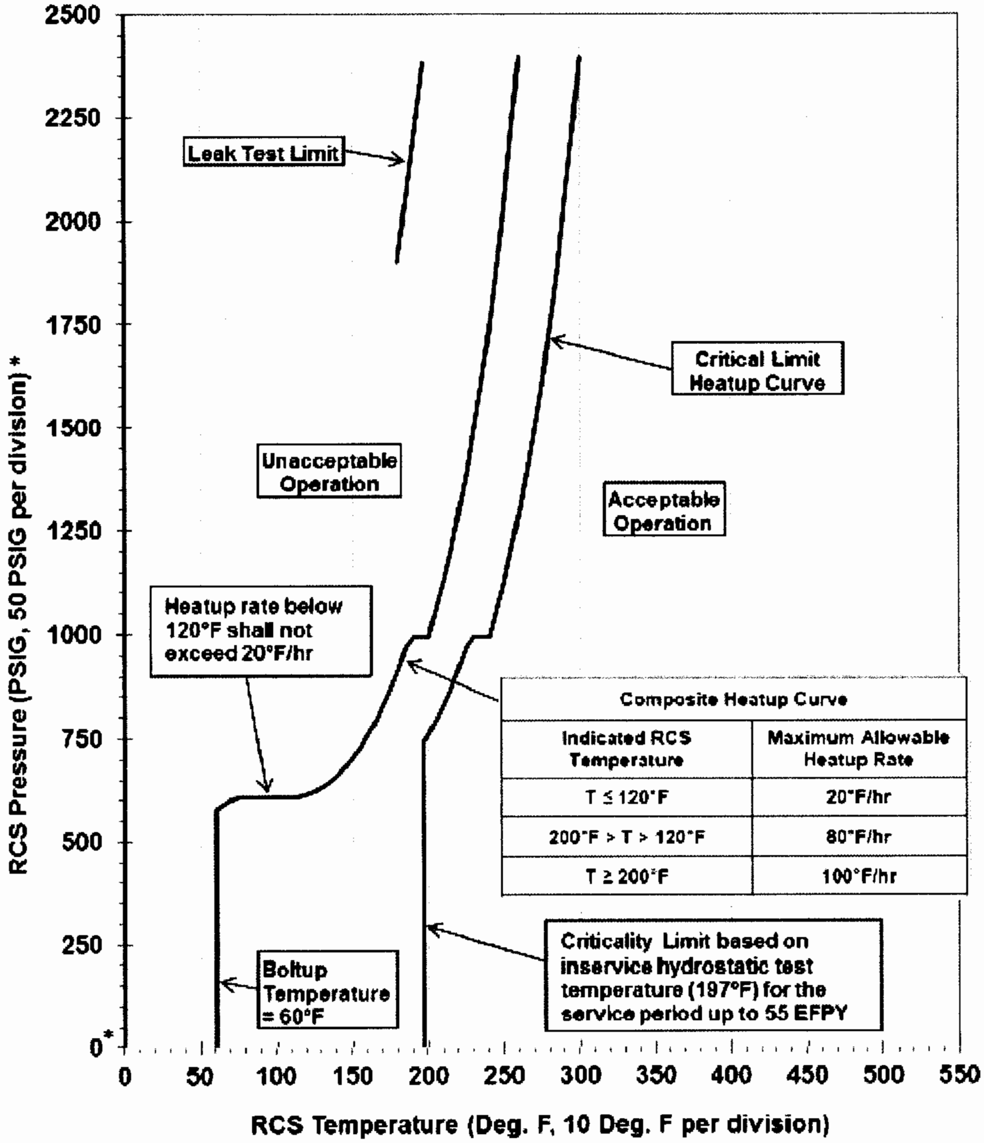
a. On the closing date(s) of the transfer of any ownership interests in Seabrook Station covered by the Order approving the transfer, FPL Energy Seabrook, LLC**, shall obtain from each respective transferring owner all of the accumulated decommissioning trust funds for the facility, and ensure the deposit of such funds and additional funds, if necessary, into a decommissioning trust or trusts for Seabrook Station established by FPL Energy Seabrook, LLC**, such that the amount of such funds deposited meets or exceeds the amount required under 10 CFR 50.75 with respect to the interest in Seabrook Station FPL Energy Seabrook, LLC**, acquires on such dates(s).

* Implemented
** On April 16, 2009, the name "FPL Energy Seabrook, LLC" was changed to "NextEra Energy Seabrook, LLC".

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Lower Shell Plate R1808-1 without using surveillance data, Position 1.1
LIMITING ART VALUES AT 55 EFPY: 1/4T, 117°F (Axial Flaw)
3/4T, 105°F (Axial Flaw)

Curves applicable for the first 55 EFPY and contain margins for possible instrument errors



Composite Heatup Curve	
Indicated RCS Temperature	Maximum Allowable Heatup Rate
T ≤ 120°F	20°F/hr
200°F > T > 120°F	80°F/hr
T ≥ 200°F	100°F/hr

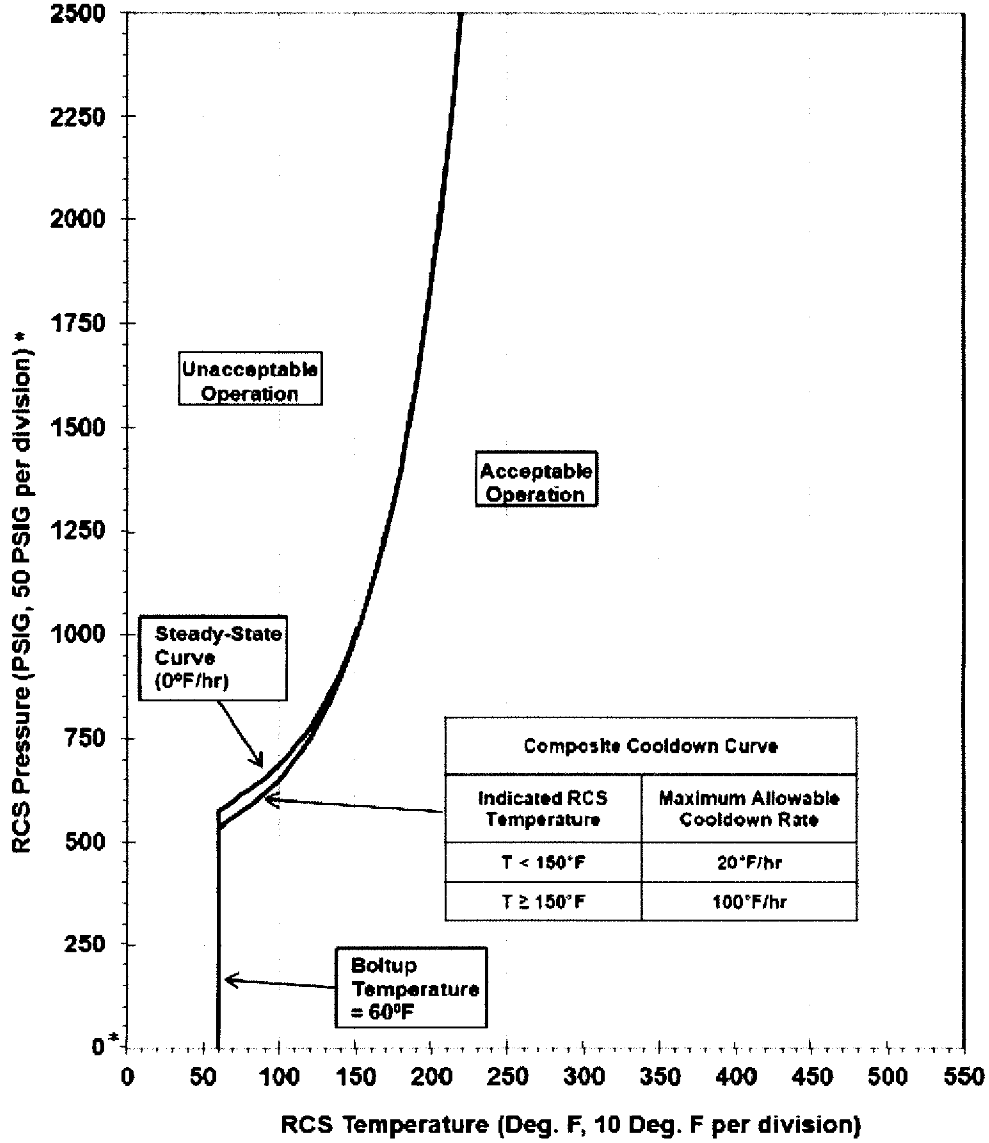
* Curve is Applicable for RCS Vacuum fill.

FIGURE 3.4-2
REACTOR COOLANT SYSTEM HEATUP LIMITATIONS – APPLICABLE UP TO 55 EFPY

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Lower Shell Plate R1808-1 without using surveillance data, Position 1.1
LIMITING ART VALUES AT 55 EFPY: 1/4T, 117°F (Axial Flaw)
3/4T, 105°F (Axial Flaw)

Curves applicable for the first 55 EFPY and contain margins for possible instrument errors



* Curve is Applicable for RCS Vacuum fill.

FIGURE 3.4-3
REACTOR COOLANT SYSTEM COOLDOWN LIMITATIONS – APPLICABLE UP TO 55 EFPY

OVERPRESSURE PROTECTION SYSTEMS

LIMITING CONDITION FOR OPERATION

3.4.9.3 The following Overpressure Protection Systems shall be OPERABLE:

a. In MODE 4 when the temperature of any RCS cold leg is less than or equal to 225°F; and in MODE 5 and MODE 6 with all Safety Injection pumps inoperable at least one of the following groups of two overpressure protection devices shall be OPERABLE when the RCS is not depressurized with an RCS vent area of greater than or equal to 1.58 square inches:

1) Two residual heat removal (RHR) suction relief valves each with a setpoint of 450 psig +0, -3 %; or

2) Two power-operated relief valves (PORVs) with lift setpoints that vary with RCS temperature which do not exceed the limit established in Figure 3.4-4, or

3) One RHR suction relief valve and one PORV with setpoints as required above.

b. In MODE 5 and MODE 6 with all Safety Injection pumps except one inoperable:

1) The Reactor Coolant System (RCS) depressurized with an RCS vent area equal to or greater than 18 square inches, or

2) The RCS in a reduced inventory condition*.

APPLICABILITY: MODE 4 when the temperature of any RCS cold leg is less than or equal to 225°F; MODE 5 and MODE 6 with the reactor vessel head on and the vessel head closure bolts not fully detensioned.

*A reduced inventory condition exists whenever reactor vessel (RV) water level is lower than 36 inches below the RV flange.

VALID FOR THE FIRST 55 EFPY, MAXIMUM SETPOINT ACCOUNTS FOR INSTRUMENT UNCERTAINTIES

T ≤ 75.0°F, P = 520.0 PSIG,
75.0°F < T ≤ 125.0°F, P = 1.5*(T-75.0) + 520.0 PSIG,
125.0°F < T ≤ 160.0°F, P = 3.71*(T-125.0) + 595.0 PSIG,
160.0°F < T ≤ 350.0°F, P = 725.0 PSIG *

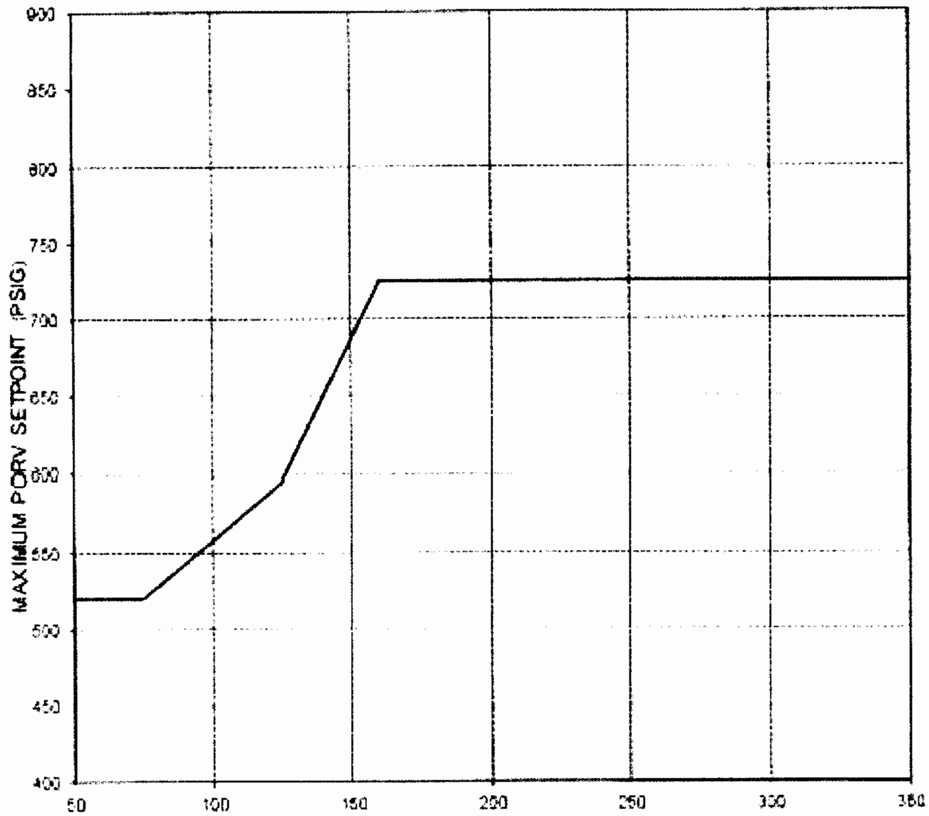


FIGURE 3.4-4 MAXIMUM ALLOWABLE PORV SETPOINTS FOR COLD OVERPRESSURE PROTECTION SYSTEM

*** Note that above the enable temperature the PORV setpoints will not restrict plant heatup and cooldown operations since COMS is not required to be armed at temperatures higher than 225°F. Hence the PORV setpoint values ramp up to the nominal setpoint value of 2385 psig is not shown.**

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 151

TO FACILITY OPERATING LICENSE NO. NPF-86

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By application dated July 24, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14216A404), as supplemented by letters dated March 9, April 23, June 24, July 9, July 20, and September 8, 2015 (ADAMS Accession Nos. ML15072A023, ML15125A140, ML15181A262, ML15194A042, ML15205A314, and ML15257A212, respectively), NextEra Energy Seabrook, LLC (NextEra or the licensee) requested changes to the technical specifications (TSs) for Seabrook Station, Unit No. 1 (Seabrook). The amendment revises TS Sections 3.4.9.1, "Reactor Coolant System Pressure/Temperature Limits," and 3.4.9.3, "Overpressure Protection Systems," to include new reactor coolant system (RCS) pressure-temperature (P-T) limit curves for heatup, cooldown, and pressure test operations, and new low temperature overpressure protection (LTOP) system requirements. The proposed P-T limit curves would be valid for 55 effective full power years (EFPY) of Seabrook operation. The proposed revisions to the LTOP system requirements include new pressure setpoints for the power-operated relief valves (PORVs) based on the proposed 55 EFPY P-T limits and a change to the RCS cold leg temperature at which the LTOP system must be operable (also referred to as the LTOP system applicability temperature).

By letter dated July 28, 2015 (ADAMS Accession No. ML15205A334), the U.S. Nuclear Regulatory Commission (NRC) granted an exemption from specific minimum temperature requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G, Table 1, related to the application of Footnote 2 to Table 1. This exemption allows for the use of an alternate methodology contained in WCAP-17444-P, Revision (Rev.) 0, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Seabrook Unit 1," in lieu of these minimum temperature requirements. The provisions of this exemption are implemented in the licensee's proposed TS P-T limits through the elimination of the specific minimum temperature criteria that are based on Footnote 2 to Table 1 of 10 CFR Part 50, Appendix G for pressures greater than 20 percent of the preservice hydrostatic test pressure. The NRC staff's evaluation of the licensee's implementation of this exemption in the proposed TS P-T limits is addressed in Section 4.3.4 of this safety evaluation.

The supplements dated March 9, April 23, June 24, July 9, July 20, and September 8, 2015, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on September 30, 2014 (79 FR 58822). The supplement dated September 8, 2015, superseded the No Significant Hazards Consideration (NSHC) in the supplement dated July 9, 2015, and re-instated the original NSHC in the letter dated July 24, 2015.

2.0 BACKGROUND

2.1 P-T Limit Curves

The P-T limits are not derived from design basis accident (DBA) analyses. They are prescribed during normal operation to avoid encountering pressure, temperature, and temperature rate of change conditions that might cause undetected flaws to propagate and cause non-ductile failure of the reactor coolant pressure boundary (RCPB), an unanalyzed condition. Although the P-T limits are not derived from any DBA, the P-T limits are acceptance limits since they preclude operation in an unanalyzed condition. All components of the RCS are designed to withstand effects of cyclic loads due to system pressure and temperature changes in accordance with 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 31, "Fracture prevention of reactor coolant pressure boundary."

TS 3.4.9.1, "Pressure/Temperature Limits," contains the heatup and cooldown limit curves (Figures 3.4-2 and 3.4-3 respectively) that establish the limits for the pressure and temperature changes during RCS heatup and cooldown. The consequence of violating the TS 3.4.9.1 limits is that the RCS may have been operated under conditions that can result in brittle failure of the RCPB, possibly leading to a non-isolable leak or loss-of-coolant accident. The development of the P-T limits for the RCPB must consider not only the vessel shell material with the highest reference temperature but also other vessel materials with structural discontinuities, and in particular, the reactor vessel (RV) nozzle materials. Specifically, all ferritic components within the entire RCPB must be considered in the development of P-T limits. Further, the effects of neutron radiation must be considered for any materials that are projected to experience an end-of-license neutron exposure greater than 1×10^{17} neutron per square centimeter (n/cm^2) (energy greater than 1 mega electron volt (E>1 MeV)). The present P-T limits consider all ferritic components within the entire RCPB. As documented by NRC letter dated April 15, 2013 (ADAMS Accession No. ML120820510), "Issuance of Amendment Regarding Revision to the Applicability of the Reactor Coolant System Pressure-Temperature Limits and the Cold Overpressure Protection Setpoint," it was concluded that considering the RV inlet and outlet nozzles and the ferritic RCPB components not part of the RV, the P-T limit curves are bounding for the entire RV and RCPB, and meet the applicable requirements of the American Society of Mechanical Engineers (ASME) Code, Section III and Section IX, as required by 10 CFR Part 50, Appendix G.

The P-T limit curves contained in TS 3.4.9.1 define an acceptable region for normal operation and establish operating limits that provide margin against brittle failure for the RV and RCPB. The RV is the limiting RCPB component for establishing the P-T limit curves. Appendix G, "Fracture Toughness Requirements," of 10 CFR 50 requires the establishment of P-T limits based on specific material fracture toughness requirements. GDC 31 requires an adequate margin to brittle failure during normal operation, anticipated operational occurrences, and system hydrostatic tests.

The neutron embrittlement effect on the material toughness is reflected by increasing the nil ductility reference temperature (RT_{NDT}) as exposure to neutron fluence increases. The actual shift in the RT_{NDT} of the vessel material is established periodically by removing and evaluating the irradiated RV material specimens, in accordance with American Society of Testing Materials (ASTM) E 185 as required by Appendix H of 10 CFR 50, "Reactor Vessel Material Surveillance Program Requirements." To find the most limiting RT_{NDT} at any time period in the reactor's life, Delta RT_{NDT} due to the radiation exposure associated with that time period must be added, along with a margin term, to the initial RT_{NDT} (IRT_{NDT}). The extent of the shift in RT_{NDT} is enhanced by certain chemical elements, specifically, copper and nickel, which are present in RV steels. The operating P-T limit curves are adjusted, as necessary, based on the evaluation findings and the recommendations of Regulatory Guide (RG) 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials" (hereinafter "RG 1.99"). RG 1.99 provides the approved method for predicting radiation embrittlement. RG 1.99 is used for the calculation of adjusted RT_{NDT} (ART) values (IRT_{NDT} + Delta RT_{NDT} + margins for uncertainties) at the 1/4T and 3/4T locations, where T is the thickness of the vessel at the beltline region measured from the clad/base metal interface. The most limiting ART values are used in the generation of heatup and cooldown P-T limit curves for normal operation.

2.2 RCS Cold Overpressure Protection Setpoints

TS 3.4.9.3, "Overpressure Protection Systems," contains the system requirements for overpressure protection during low temperature operation. The Overpressure Protection System (OPS) provides the capability to mitigate the overpressure transients that may occur during cold shutdown, heatup, and cooldown operations to minimize the potential for challenging RV integrity when operating at or near RV ductility limits (i.e., 10 CFR 50, Appendix G limits). Two potential overpressure transients form the design basis and are considered in the analysis for low temperature overpressure protection — mass injection (MI) and heat injection (HI) transients. The design basis MI transient for Seabrook is specified as a result of starting a single centrifugal charging pump into a water solid RCS with letdown assumed to be isolated. The design basis HI transient for Seabrook is specified as the start of an idle RCP, with all loops initially inactive and the steam generator secondary side a maximum of 50 degrees Fahrenheit (°F) hotter than the RCS primary side.

In accordance with TS 3.4.9.3, the pressurizer power operated relief valves (PORV) can be used to mitigate low temperature overpressure transients. The PORV setpoints are selected such that the peak pressure during the design basis MI and HI transients will not exceed the 10 CFR 50, Appendix G limits. The PORV setpoints are contained in TS Figure 3.4-4, "RCS Cold Overpressure Protection Setpoints." The current PORV setpoints for Seabrook are based on 10 CFR 50, Appendix G, P-T limits valid through 23.7 EFPYs.

The proposed change would update the 10 CFR 50, Appendix G, P-T limits to be applicable to 55 EFPYs. The revised P-T limit curves were developed by NextEra without the application of the 10 CFR Part 50, Appendix G, Table 1 minimum temperature requirements that are based on Footnote 2 to Table 1, for pressures greater than 20 percent of the preservice hydrostatic test pressure. The implementation of P-T limits without these minimum temperature requirements results in higher operating margins for the PORV setpoints. Therefore, based on the proposed P-T limit curve changes, new PORV setpoints were developed by the licensee. As such, the proposed changes include a new TS Figure 3.4-4 applicable up to 55 EFPYs to replace the current TS Figure 3.4-4 (applicable up to 23.7 EFPYs).

2.3 OPS Effective Temperature

TS 3.4.9.3, "Overpressure Protection Systems," contains the TS requirements for the OPS. The OPS limits RCS pressure at low temperatures so the integrity of the RCPB is not compromised by violating the P-T limits of 10 CFR 50, Appendix G. The RV is the limiting RCPB component for demonstrating such protection. The ferritic RV materials are less tough at low temperatures than at normal operating temperature. Therefore, RCS pressure is maintained low at low temperatures and is increased only as temperature is increased. The OPS effective temperature is the limiting RCS cold leg temperature below which the RV may suffer damage from a cold overpressure event. Fracture mechanics analyses establish the OPS effective temperature. The OPS effective temperature is the temperature below which the system addressed in TS 3.4.9.3 is required to be operable. As such, the OPS effective temperature is part of the applicability of TS 3.4.9.3.

The OPS effective temperature is part of the TS requirements, which ensure that the integrity of the RCPB is protected in accordance with the P-T limits of 10 CFR 50, Appendix G. The proposed changes by NextEra include updating the 10 CFR 50, Appendix G, P-T limits to be applicable to 55 EFPYs. As such, the OPS effective temperature will also be revised consistent with the proposed change to the 10 CFR 50, Appendix G, P-T limits.

3.0 REGULATORY EVALUATION

The following regulatory provisions and guidance are applicable to this license amendment request.

- 10 CFR 50.60, "Acceptance criteria for fracture prevention measures for light-water nuclear power reactors for normal operation," which states:

  (a) Except as provided in paragraph (b) of this section, all light-water nuclear power reactors, other than reactor facilities for which the certifications required under § 50.82(a)(1) have been submitted, must meet the fracture toughness and material surveillance program requirements for the reactor coolant pressure boundary set forth in appendices G and H to this part.

  (b) Proposed alternatives to the described requirements in Appendices G and H of this part or portions thereof may be used when an exemption is granted by the Commission under § 50.12.

- 10 CFR 50, Appendix G, “Fracture Toughness Requirements,” which states, in part:

> This appendix specifies fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary of light water nuclear power reactors to provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests, to which the pressure boundary may be subjected over its service lifetime.

The provisions of 10 CFR 50, Appendix G require that the P-T limits for an operating light-water nuclear power reactor be at least as conservative as those that would be generated if the methods of Appendix G to Section XI of the ASME Code were used to generate the P-T limits. Appendix G also requires that applicable surveillance data from reactor pressure vessel (RPV) material surveillance programs be incorporated into the calculations of plant-specific P-T limits, and that the P-T limits for operating reactors be generated using a method that accounts for the effects of neutron irradiation on the material properties of the RPV beltline materials.

Table 1 of 10 CFR 50, Appendix G provides the NRC staff’s criteria for meeting the P-T limit requirements of the ASME Code, Section XI, Appendix G, as well as the minimum temperature requirements for the RPV during normal heatup, cooldown, and pressure test operations. In addition, NRC staff regulatory guidance related to P-T limit curves is contained in RG 1.99 and Standard Review Plan Chapter 5.3.2, “Pressure-Temperature Limits and Pressurized Thermal Shock.”

P-T limit curve calculations are based, in part, on the reference nil-ductility temperature (RT_{NDT}) for the material, as specified in the ASME Code, Section XI, Appendix G. Appendix G of the ASME code requires that RT_{NDT} values for materials in the RPV beltline region be adjusted to account for the effects of neutron irradiation.

- Appendix H of 10 CFR 50, “Reactor Vessel Material Surveillance Program Requirements,” which states, in part:

> The purpose of the material surveillance program required by this appendix is to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors which result from exposure of these materials to neutron irradiation and the thermal environment. Under the program, fracture toughness test data are obtained from material specimens exposed in surveillance capsules, which are withdrawn periodically from the reactor vessel. These data will be used as described in Section IV of Appendix G to Part 50.
>
> ASTM E 185-73, “Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels”; ASTM E 185-79, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power

Reactor Vessels"; and ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels", which are referenced in the following paragraphs, have been approved for incorporation by reference by the Director of the Federal Register.

- 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 31, "Fracture prevention of reactor coolant pressure boundary," which states:

  > The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.

- RG 1.99 describes general procedures acceptable to the NRC staff for calculating the effects of neutron radiation embrittlement of the low-alloy steels currently used for light-water-cooled reactor vessels.

  RG 1.99 contains methodologies for calculating the ART due to neutron irradiation. The 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 term. The ΔRT_{NDT} is a product of a chemistry factor (CF) and a fluence factor. The CF is dependent upon the amount of copper and nickel in the material and may be determined from tables in RG 1.99 or from surveillance data. The fluence factor is dependent upon the neutron fluence at the maximum postulated flaw depth assumed for the P-T limit calculations. The margin term is dependent upon whether the initial RT_{NDT} is a plant-specific or a generic value and whether the CF was determined using the tables in RG 1.99 or from 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 neutron fluence, and the calculational procedures. RG 1.99 describes the methodology to be used in calculating the margin term.

- In March 2001, the NRC staff issued RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Neutron fluence calculations for use in ART and P-T limit curve analyses are acceptable if they are performed using NRC-approved methodologies that are shown to conform to the guidance in RG 1.190.

- On October 14, 2014, the NRC issued Regulatory Issue Summary 2014-11, "Information on Licensing Applications for Fracture Toughness Requirements for Ferritic Reactor Coolant Pressure Boundary Components," which clarified that the beltline definition in 10 CFR Part 50, Appendix G is applicable to all RPV ferritic materials with projected neutron fluence values greater than 1×10^{17} neutrons/centimeter-squared (n/cm^2) with energy greater than one million electron volts (E > 1 MeV), and this neutron fluence threshold remains applicable for the design life as well as throughout the licensed operating period.

4.0 TECHNICAL EVALUATION

4.1 Proposed TS Changes

Specifically, the proposed change revises the Seabrook TSs as follows:

4.1.1 TS 3.4.9.1, "Pressure/Temperature Limits"

- Replace current Figure 3.4-2, "Reactor Coolant System Heatup Limitations - Applicable Up to 23.7 EFPY," with a new figure applicable to 55 EFPY.

- Replace Figure 3.4-3, "Reactor Coolant System Cooldown Limitations - Applicable Up to 23.7 EFPY," with a new figure applicable to 55 EFPY.

4.1.2 TS 3.4.9.3, "Overpressure Protection Systems"

- The current TS 3.4.9.3.a reads:

  In MODE 4 when the temperature of any RCS cold leg is less than or equal to 290°F; and in MODE 5 and MODE 6 with all Safety Injection pumps inoperable at least one of the following groups of two overpressure protection devices shall be OPERABLE when the RCS is not depressurized with an RCS vent area of greater than or equal to 1.58 square inches:

- The proposed revised TS 3.4.9.3.a will read as follows:

  In MODE 4 when the temperature of any RCS cold leg is less than or equal to 225°F; and in MODE 5 and MODE 6 with all Safety Injection pumps inoperable at least one of the following groups of two overpressure protection devices shall be OPERABLE when the RCS is not depressurized with an RCS vent area of greater than or equal to 1.58 square inches:

- The current TS 3.4.9.3 APPLICABILITY reads:

  MODE 4 when the temperature of any RCS cold leg is less than or equal to 290°F; MODE 5 and MODE 6 with the reactor vessel head on and the vessel head closure bolts not fully detensioned.

- The proposed revised TS 3.4.9.3 APPLICABILITY will read as follows:

  MODE 4 when the temperature of any RCS cold leg is less than or equal to 225°F; MODE 5 and MODE 6 with the reactor vessel head on and the vessel head closure bolts not fully detensioned.

- Replace the current Figure 3.4-4, "RCS Cold Overpressure Protection Setpoints," with a new Figure 3.4-4, "Maximum Allowable PORV Setpoints for Cold Overpressure Protection System," which is valid for up to 55 EFPYs.

4.2 Licensee's Evaluation

The technical basis for NextEra's revised P-T limits is provided in Attachment 3 to a letter dated July 24, 2014: Non-Proprietary Westinghouse Report No. WCAP-17441-NP, Rev. 0, "Seabrook Unit 1 Heatup and Cooldown Limit Curves for Normal Operation," October 2011 (ADAMS Accession No. ML14216A405). WCAP-17441-NP indicates that the proposed 55 EFPY heatup and cooldown P-T limit curves were generated using ART values for the most limiting RPV beltline shell material, based on the NRC-approved generic P-T limits methodology documented in Westinghouse Topical Report WCAP-14040-A, Rev. 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves" (hereafter "WCAP-14040-A") May 2004 (ADAMS Accession No. ML050120209). WCAP-17441-NP also states that the neutron transport evaluation methodologies for determining RPV beltline neutron fluence followed the guidance of RG 1.190 and are consistent with the NRC-approved methodology described in WCAP-14040-A. The licensee's evaluation in the license amendment request (LAR) and WCAP-17441-NP also addresses the implementation of an exemption from the minimum temperature requirements of Table 1 of 10 CFR Part 50, Appendix G that are based on the material properties of the RPV closure flange region for pressures greater than 20 percent of the preservice hydrostatic test pressure. This exemption was approved by the NRC staff in a letter dated July 28, 2015 (ADAMS Accession No. ML15205A334). The NRC staff's evaluation of NextEra's implementation of this exemption in the proposed TS P-T limits for 55 EFPY is addressed below in Section 4.4 of this safety evaluation (SE).

WCAP-17441-NP includes a detailed description of the methods employed for generating the P-T limit curves, which are based on the linear elastic fracture mechanics (LEFM) procedures of the ASME Code, Section XI, Appendix G. The key LEFM parameters necessary for generating P-T limit curves are the RPV material fracture toughness, K_{IC}, and the applied stress intensity factors due to pressure and thermal stresses, K_{IP} and K_{IT}, respectively. For all RPV beltline materials, K_{IC} was established based on the ART for the material, consistent with the 1998 Edition through 2000 Addenda of the ASME Code, Section XI, Appendix G, paragraph G-2110. WCAP-17441-NP describes how the ART values for the RPV beltline materials were determined by calculating the effects of projected neutron embrittlement through 55 EFPY using the procedures in RG 1.99. For the RPV shell region, the K_{IP} and K_{IT} values were calculated using the formulations specified in WCAP-14040-A, which are the same as those specified in paragraph G-2214 of the ASME Code, Section XI, Appendix G.

The P-T limits for cooldown and pressure test conditions were generated using K_{IC}, K_{IP}, and K_{IT} values that were calculated by considering a postulated inside diameter surface breaking flaw with a depth of one-quarter of the RPV wall thickness (1/4T crack tip location through the RPV wall thickness). The P-T limits for the heatup condition were generated by considering a postulated outside diameter surface breaking flaw of the same depth (3/4T crack tip location through the RPV wall thickness). These postulated flaw parameters are in accordance with the requirements of the ASME Code, Section XI, Appendix G.

WCAP-17441-NP did not specifically address the impact of complex geometry RPV components (i.e., structural discontinuities such as RPV nozzles, penetrations, etc.) outside the of the RPV beltline shell region that experience higher local stresses than the RPV shell. However, NextEra stated in the LAR that the bounding RPV components outside of the RPV beltline shell – the inlet and outlet nozzles – were previously evaluated for 55 EFPY to support the staff's evaluation for the current TS P-T limits authorized in License Amendment No. 135, issued on April 15, 2013 (ADAMS Accession No. ML120820510). Therefore, the licensee determined that the nozzle analysis remains applicable for the proposed TS P-T limit for 55 EFPY and need not be repeated for the subject LAR.

The LAR also addressed the proposed TS changes to the LTOP system pressure setpoints for the PORVs and the LTOP system applicability temperature. The LAR indicates that the revised PORV pressure setpoints are based on the revised P-T limit curves and were developed in accordance with the NRC-approved generic methodology for determining LTOP system pressure setpoints described in WCAP-14040-A. The LAR states that the new LTOP system applicability temperature was calculated in accordance with the alternative LTOP system criteria established in ASME Code Case N-641, "Alternative Pressure-Temperature Relationship and Low Temperature Overpressure Protection System Requirements, Section XI, Division 1."

4.3 NRC Staff Evaluation

The NRC staff reviewed NextEra's LAR submittal, including WCAP-17441-NP, to determine whether NextEra's proposed 55 EFPY P-T limit curves are in compliance with the requirements of 10 CFR Part 50, Appendix G, taking into consideration the licensee's exemption from 10 CFR 50.60 to use an alternative methodology in lieu of specific minimum temperature requirements in Table 1 of 10 CFR Part 50, Appendix G. The NRC staff verified that the proposed 55 EFPY P-T limits were developed by taking into account all portions of the RPV, including the inlet and outlet nozzles. The NRC staff noted that based on the evaluation of all regions of the RPV, the bounding P-T limits for 55 EFPY are controlled by the RPV beltline shell region and the minimum boltup temperature. The NRC staff also reviewed the licensee's proposed TS revisions for the LTOP PORV pressure setpoints and LTOP system applicability temperature to verify that these parameters are consistent with the NRC-approved methodologies of WCAP-14040-A, and ASME Code Case N-641. The details of the NRC staff's evaluation are discussed below.

4.3.1 Evaluation of the Neutron Fluence Values Used for Determining the RPV Beltline Region ARTs

One of the critical parameters necessary for calculating the RPV beltline material ARTs is the projected neutron fluence. The methodology used for determining projected neutron fluence values for the RPV beltline region is described in Section 2 of WCAP-17441-NP. The projected neutron fluence values for 55 EFPY are provided in Table 2-2 of WCAP-17441-NP. The NRC staff reviewed these sections of WCAP-17441-NP and confirmed that the 55 EFPY neutron fluence values were calculated using the methods described in WCAP-14040-A. As documented in the NRC SE approving WCAP-14040-A, these neutron fluence calculational methods adhere to the guidance contained in RG 1.190. Based on this consideration, the NRC staff determined that the fluence calculations described in WCAP-17441-NP are acceptable.

4.3.2 Evaluation of the ART Values and P-T Limit Curves for RPV Beltline Shell Region

The NRC staff verified that the licensee's proposed 55 EFPY P-T limits were calculated based on an evaluation of the RPV beltline shell region, accounting for projected neutron embrittlement through 55 EFPY, as documented in WCAP-17441-NP. NextEra projected neutron embrittlement through 55 EFPY by calculating the ARTs for the RPV beltline materials using the procedures of RG 1.99. The licensee's ART calculations for the RPV beltline shell region at the 1/4T and 3/4T locations are provided in Tables 5-5 and 5-6 of WCAP-17441-NP, respectively, including all of the input parameters necessary for calculating the ART values. A summary of the limiting ART values is provided in Table 5-7 of WCAP-17441-NP. These tables indicate that the limiting beltline shell material is the Lower Shell Plate R1808-1 (Heat No. D1081-3) based on Regulatory Position 1.1 of RG 1.99. The limiting ART values are 117 °F at the 1/4T location and 105 °F at the 3/4T location at 55 EFPY. The NRC staff independently verified that the 55 EFPY ART values for the limiting beltline shell material were calculated correctly using the procedures in Regulatory Position 1.1 of RG 1.99 and that Lower Shell Plate R1808-1 is limiting at the 1/4T and 3/4T locations.

The NRC staff verified that the licensee correctly applied RPV material surveillance data in accordance with Regulatory Position 2.1 of RG 1.99 to determine that the RPV surveillance materials, Lower Shell Plate R1808-3 (Heat No. D1136-2) and all of the intermediate/lower shell welds of Heat No. 4P6052, are not limiting. The NRC staff verified that NextEra's analysis incorporated data from the latest surveillance capsule pulled from the Seabrook RPV (Capsule "V"), as documented in WCAP-16526-NP, Rev. 0, "Analysis of Capsule V from FPL Energy - Seabrook Station Unit 1 Reactor Vessel Radiation Surveillance Program" (ADAMS Accession No. ML061030088). Therefore, the NRC staff determined that the licensee's consideration of the RPV surveillance data is acceptable.

The NRC staff verified that the initial RT_{NDT}, Copper (Cu) content, Nickel (Ni) content, CF, and margin values used for calculating the beltline material ARTs are consistent with those identified in Table 4.2.3-1 of the Seabrook License Renewal Application (LRA) (ADAMS Accession No. ML101590091), and approved by the NRC staff in the Seabrook LRA safety evaluation report (SER) with open items, "Safety Evaluation Report With Open Items Related to the License Renewal of Seabrook Station," June 2012 (ADAMS Accession No. ML12160A374). It should be noted that the Seabrook LRA open items do not apply to the ART calculations for the RPV beltline region, and the ARTs were found to be acceptable by the NRC staff as documented in Section 4.2 of the LRA SER. The NRC staff also verified that the initial RT_{NDT}, Cu content, and Ni content values for all RPV beltline materials are consistent with those listed in Table 5.3-3 of the Seabrook Updated Final Safety Analysis Report. Therefore, since the NRC staff verified that NextEra correctly determined the ART values for the RPV beltline materials in accordance with RG 1.99, based on valid input parameters, the NRC staff determined that the licensee's ART analysis of the RPV beltline region is acceptable.

The NRC staff verified that the licensee's proposed 55 EFPY P-T limits were calculated in accordance with WCAP-14040-A, and are based on an evaluation of the limiting RPV beltline shell material, including the 55 EFPY ART inputs documented above. For the limiting beltline shell material, the NRC staff performed a set of confirmatory calculations, which verified that NextEra's 55 EFPY P-T limits are consistent with WCAP-14040-A and the ASME Code, Section XI, Appendix G. Therefore, the NRC staff determined that NextEra's proposed 55 EFPY P-T limits for the limiting beltline shell material are acceptable.

4.3.3 Evaluation of the Licensee's Analysis of the RPV Inlet and Outlet Nozzles

For RPV structural discontinuity components outside of the beltline shell region, the licensee determined that the RPV inlet and outlet nozzles are the only components that could potentially define more bounding P-T limits than those defined by the limiting beltline shell material. This determination was made based on the fact that these nozzles are the most highly stressed ferritic component and are the only structural discontinuity projected to experience significant neutron embrittlement for 55 EFPY. The NRC staff determined that the licensee appropriately identified the inlet and outlet nozzles as the most highly stressed ferritic RPV components, because there are no other large diameter RPV nozzles that are subject to such elevated stresses in RPVs for Westinghouse plants. It should be noted that the RPV closure flange region materials are also highly stressed components. However, the integrity of these components is governed by 10 CFR Part 50, Appendix G minimum temperature criteria and the provisions of the exemption (discussed below). Furthermore, based on the neutron fluence values provided in WCAP-17441-NP, the NRC staff verified that the RPV inlet and outlet nozzles are the only highly stressed ferritic components projected to experience neutron embrittlement for 55 EFPY. Therefore, the NRC staff determined NextEra's consideration of these nozzles for determining the bounding RPV P-T limits to be acceptable.

The NRC staff noted that the licensee had demonstrated in a previous analysis that the RPV inlet and outlet nozzles do not define the bounding P-T limits for the RPV. Specifically, in order to support a previous LAR, dated November 17, 2011 (ADAMS Accession No. ML11329A017) to extend the applicability of the current TS P-T limits through 23.7 EFPY, NextEra submitted a response dated January 9, 2013 (ADAMS Accession No. ML13014A624), to an NRC staff request for additional information (RAI), which demonstrated that the P-T limits for the RPV inlet and outlet nozzles are bounded by those for the limiting beltline shell material, Lower Shell Plate R1808-1. NextEra's calculated ART values for the nozzles were also based on projected neutron fluence for 55 EFPY. The 55 EFPY neutron fluence values for these nozzles were based on the WCAP-17441-NP neutron fluence analysis and were found to be acceptable.

As documented in its SE for License Amendment No. 135, issued by letter dated April 15, 2013, the NRC staff determined that NextEra demonstrated that the inlet and outlet nozzle P-T limits are bounded by those for the limiting beltline shell material, Lower Shell Plate R1808-1.

Therefore, the NRC staff authorized the extension of the applicability term for the TS P-T limits to 23.7 EFPY. In the current LAR submittal, the licensee addressed the nozzle evaluation performed to support License Amendment No. 135, and noted that the nozzle analysis accounted for neutron embrittlement through 55 EFPY. The NRC staff determined that since the nozzle analysis supporting License Amendment No. 135 was based on nozzle forging ARTs that incorporate the 55 EFPY fluence values from WCAP-17441-NP, the nozzle P-T limits remain bounded by those for the limiting beltline shell material through 55 EFPY. Therefore, the previous P-T limit calculations for the nozzles provided in support of License Amendment No. 135 remain acceptable for demonstrating that the proposed TS P-T limits for 55 EFPY are bounding for the RPV.

Regarding ferritic RCPB components that are not part of the RPV and their potential impact on the bounding P-T limit curves for 55 EFPY, the NRC staff determined in its April 15, 2013, SE for License Amendment No. 135 that ferritic RCPB components outside of the RPV will have no impact. This determination was based on the following findings:

(1) There are no ferritic RCPB piping, pumps, or valves greater than 2.5 inches in nominal wall thickness that require consideration for the establishment of a lowest service temperature in accordance with the ASME Code, Section III, NB-2332(b).

(2) The ferritic components of the pressurizer and steam generators satisfy the applicable design-basis requirements specified in the 1971 Edition through Winter 1972 Addenda of the ASME Code Section III, NB-2330, and do not undergo any aging effects (i.e., neutron embrittlement) that require subsequent evaluation for protection against brittle fracture.

Based on its above evaluation, the NRC staff determined that the proposed TS P-T limits for the limiting beltline shell material, Lower Shell Plate R1808-1 (Heat No. D1081-3) are controlling for the RPV and meet the criteria of the ASME Code, Section XI, Appendix G, for heatup, cooldown, and pressure test conditions as required by 10 CFR Part 50, Appendix G. Therefore, the NRC staff finds the licensee's proposed TS P-T limits to be acceptable for 55 EFPY.

4.3.4 Exemption from 10 CFR Part 50, Appendix G Minimum Temperature Requirements for the RPV Closure Flange

Table 1 of 10 CFR Part 50, Appendix G includes minimum temperature requirements for the RPV, which must be incorporated into plants' P-T limit curves. For normal operating conditions, these minimum temperature requirements are established based on Footnote 2 to Table 1, which refers to the highest RT_{NDT} value "of the material in the [RPV] closure flange region that is highly stressed by the [closure head] bolt preload." For normal operating conditions, Table 1 specifies minimum temperature criteria that shall be established in P-T limit curves for RCS pressures less than or equal to 20 percent of the preservice hydrostatic test pressure ($\leq$ 20% of P_H), and for RCS pressures greater than 20 percent of the preservice hydrostatic test pressure (> 20% of P_H).

In the letter dated July 24, 2014, NextEra included a request for an exemption from the requirements of 10 CFR 50.60 to use the alternative methodology of WCAP-17444-P in lieu of the minimum temperature requirements of Table 1 of 10 CFR Part 50, Appendix G that are specifically based on the application of Footnote 2 to Table 1 for RCS pressures > 20% of P_H. The licensee's proposed TS P-T limit curves incorporate the provisions of this exemption through the elimination of these specific minimum temperature requirements in the curves. By letter dated July 28, 2015 (ADAMS Accession No. ML15205A334), the NRC staff approved the licensee's request for exemption from the subject minimum temperature requirements. The NRC staff's *Federal Register* notice for this exemption is available at ADAMS Accession ML15092A519 and is included as Enclosure 1 to its letter dated July 28, 2015. The NRC staff's detailed review and technical basis for granting this exemption are documented in a supporting SE (ADAMS Accession No. ML15205A333), which is referenced by the exemption *Federal Register* notice, and included as Enclosure 2 to its letter dated July 28, 2015.

As documented in its SE for the exemption, the NRC staff determined that the underlying purpose of 10 CFR Part 50, Appendix G (i.e., the protection of the RCPB from brittle fracture) is satisfied without the application of the Table 1 minimum temperature requirements based on Footnote 2 for RCS pressures > 20% of P_H. This determination is based on its review of the RPV flange LEFM analysis documented in WCAP-17444-P, as supplemented by the licensee's exemption RAI response dated April 24, 2015 (ADAMS Accession No. ML15125A140), and its finding that RCS operation in accordance with the proposed TS P-T limit curves that eliminate the subject minimum temperature requirements will not challenge the ASME Code-required margins against brittle fracture for the RPV closure flange materials. The NRC staff verified that the licensee correctly incorporated the provisions of this exemption in the proposed TS P-T limit curves for conditions with the core critical and the core not critical for RCS pressures > 20% of P_H. Therefore, the NRC staff determined that the elimination of these specific minimum temperature criteria in the proposed TS P-T limit curves is acceptable.

4.3.5 Evaluation of the RPV Minimum Boltup Temperature

The minimum temperature requirements of Table 1 of 10 CFR Part 50, Appendix G for RCS pressures ≤ 20% of P_H (i.e., the minimum RPV boltup temperature requirements) remain applicable for the proposed TS P-T limit curves. The NRC staff verified that the licensee's minimum boltup temperature of 60 °F, as established in the proposed TS P-T limit curves, is in compliance with the minimum temperature requirements of Table 1 of 10 CFR Part 50, Appendix G for RCS pressures ≤ 20% of P_H.

In addition to satisfying the requirements of Table 1 of 10 CFR Part 50, Appendix G, the minimum boltup temperature must also be consistent with the NRC staff's technical basis for approval of the licensee's exemption, which states, in part, that the ASME Code-required margins against fracture for the closure flange materials will be ensured for RCS operation in accordance with the proposed TS P-T limit curves that implement the exemption. The NRC staff's finding regarding adequate margins against fracture for RPV boltup is based on an assumed minimum boltup temperature of 60 °F, as documented in the WCAP-17444-P exemption methodology and the NRC staff's exemption SE. Therefore, the NRC staff also verified that the licensee's minimum boltup temperature of 60 °F, as established in the proposed TS P-T limit curves, is the same as that assumed in WCAP-17444-P. Thus, the minimum boltup temperature also satisfies the NRC staff's technical basis for approval of the exemption, as established in the WCAP-17444-P, and evaluated in the exemption SE. Therefore, it is acceptable.

4.3.6 Revision to the Proposed TS P-T Limits – Incorporation of RCS Pressure and Temperature Instrument Uncertainty

The NRC staff noted that current TS P-T limit curves for 23.7 EFPY have margins to account for pressure and temperature instrument uncertainty. Specifically, the P-T limits based on the ASME Code, Section XI, Appendix G, were adjusted to account for these instrument uncertainties by subtracting 100 pounds per square inch gauge (psig) on the pressure axis and adding 20 °F on the temperature axis. However, the NRC staff noted that the proposed 55 EFPY TS P-T limits do not have these margins. Therefore, the NRC staff requested in an RAI dated January 9, 2015 (ADAMS Accession No. ML14363A367), that the licensee address how these instrument uncertainties will be accounted for in the proposed TS P-T limits for 55 EFPY.

By response dated July 9, 2015 (ADAMS Accession No. ML15194A042), to the NRC staff's RAI, NextEra revised the proposed TS P-T limit curves for 55 EFPY to account for pressure and temperature instrument uncertainty. The NRC staff verified that the revised P-T limit curves appropriately account for the pressure and temperature instrument uncertainties by subtracting 100 psig and adding 20 °F to the ASME Code, Section XI, Appendix G, P-T limits. Therefore, the NRC staff determined that the licensee's incorporation of these instrument uncertainties in the proposed TS P-T limits is acceptable.

4.3.7 Revision to the Proposed TS P-T Limits – Incorporation of Additional RCS Heatup and Cooldown Rate Restrictions

In addition to the incorporation of instrument uncertainties, the revised P-T limit curves submitted in the RAI response dated July 9, 2015, also incorporate an additional restriction to the RCS heatup and cooldown rates specified on the curves for lower reactor coolant temperatures. Specifically, for the TS heatup P-T limit curve in proposed TS Figure 3.4-2, the licensee added a restriction to the RCS heatup rate of less than or equal to 20 °F per hour (≤ 20 °F per hour) for reactor coolant temperatures less than 120 °F (< 120 °F). For the TS cooldown P-T limit curve in proposed TS Figure 3.4-3, the licensee added a restriction to the RCS cooldown rate of ≤ 20 °F per hour for reactor coolant temperatures < 150 °F. The licensee stated that these changes eliminate the heatup and cooldown rates (greater than 20 °F per hour) that are unachievable for normal RCS operation in these lower temperature ranges.

In addition, NextEra stated that restricting the RCS heatup rate to ≤ 20 °F per hour at temperatures < 120 °F ensures consistency between the maximum allowable RCS heatup rate on the TS heatup P-T limit curve and the heatup transient defined for the exemption methodology described in WCAP-17444-P, as supplemented by the exemption RAI response dated April 24, 2015. The NRC staff verified that the licensee's revision to the proposed TS heatup P-T limit curve to restrict the heatup rate to ≤ 20 °F per hour for RCS temperatures < 120 °F ensures that the actual allowable heatup rate on the TS P-T limit curve is consistent with the design basis heatup transient used for the exemption methodology, as described in its exemption RAI response dated April 24, 2015. Furthermore, this additional heatup rate restriction ensures that RCS operation in accordance with the proposed TS P-T limit curves that implement the provisions of the exemption (the elimination of the minimum temperature requirements based on the application of Footnote 2 to Table 1 of 10 CFR Part 50, Appendix G, for pressures > 20% of P_H) will not challenge the ASME Code-required margins against brittle fracture for the RPV closure flange materials. Therefore, the revised heatup P-T limit curve, through the incorporation of the additional heatup rate restriction, is consistent with NRC staff's technical basis for granting the exemption, as documented in its exemption SE dated July 28, 2015. Accordingly, the NRC staff determined that the revised P-T limit curves submitted in the RAI response dated July 9, 2015, are acceptable for incorporation into the Seabrook TSs.

4.3.8 Evaluation of Proposed Revision to LTOP Pressure Setpoints and LTOP Applicability Temperature

NextEra's LAR dated July 24, 2014, also includes proposed TS revisions to the LTOP system pressure setpoints for the PORVs (the PORV setpoints) and the Hot Shutdown condition. TS requirements for the PORV setpoints and the LTOP system applicability temperature are established in TS Figure 3.4-4 and TS Section 3.4.9.3, respectively.

NextEra discussed the changes to the PORV setpoints in Section 3.2 of the enclosure to the LAR. The NRC staff verified that the revised PORV setpoints were formulated in accordance with the NRC-approved methodology described in Chapter 3 of WCAP-14040-A for LTOP systems (also referred to as "cold overpressure mitigating systems" in WCAP-14040-A). The licensee was able to establish higher operating margins for the PORV setpoints by developing P-T limit curves without the 10 CFR Part 50, Appendix G, Table 1 RPV minimum temperature requirements for the closure flange for RCS pressures > 20% of P_H, as discussed above. Since the licensee developed the setpoints in accordance with an NRC-approved methodology, the NRC staff determined that the proposed changes to these setpoints are acceptable for 55 EFPY.

TS Section 3.4.9.3 currently specifies that the LTOP system shall be operable in MODE 4 when the temperature of one or more RCS cold legs is less than or equal to 290 °F. The licensee's proposed revision to TS Section 3.4.9.3 changes this applicability temperature to 225 °F, based on the licensee's use of the LTOP applicability temperature methodology identified in Section 3.4 of WCAP-14040-A and ASME Code Case N-641. The NRC staff confirmed that the revised LTOP system applicability temperature meets the criteria for these temperatures in Section 3.4 of WCAP-14040-A and ASME Code Case N-641, paragraph 2215.2(a). ASME Code Case N-641 is listed as acceptable for implementation without conditions in RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Rev. 16. Therefore, the NRC staff determined that licensee's proposed revision to the LTOP system applicability temperature is acceptable.

4.4 NRC Staff Technical Conclusion

Based on its evaluation in Section 4.3 of this SE, the NRC staff determined the following:

(1) The licensee's proposed 55 EFPY TS P-T limit curves in TS Figures 3.4-2 and 3.4-3 meet the criteria of the ASME Code, Section XI, Appendix G, and are in compliance with the fracture toughness requirements of 10 CFR 50.60 and 10 CFR Part 50, Appendix G through 55 EFPY.

(2) The licensee's proposed TS P-T limit curves correctly incorporate the provisions of the exemption from the minimum temperature requirements of Table 1 of 10 CFR Part 50, Appendix G that are specifically based on the application of Footnote 2 for RCS pressures > 20% of P_H. Additionally, the proposed TS P-T limit curves and minimum boltup temperature are consistent with the NRC staff's technical basis for granting the exemption.

(3) The licensee's proposed revisions to the LTOP PORV pressure setpoints in TS Figure 3.4-4 were formulated in accordance with the NRC-approved methodology of WCAP-14040-A. The licensee's revised LTOP system applicability temperature in TS Section 3.4.9.3 meets the criteria of WCAP-14040-A and ASME Code Case N-641.

Therefore, the NRC staff concludes that NextEra's proposed TS revisions for the P-T limit curves, LTOP PORV pressure setpoints, and LTOP system applicability temperature are acceptable for incorporation into the Seabrook TSs for 55 EFPY.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New Hampshire and Massachusetts State officials were notified of the proposed issuance of the amendment. The State officials provided no comments.

6.0 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 (79 FR 58822, September 30, 2015). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need to be prepared in connection with the issuance of the amendment.

7.0 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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: C. Sydnor

Date: November 2, 2015

November 2, 2015

Mr. Dean Curtland
Site Vice President
c/o Mr. Michael Ossing
NextEra Energy Seabrook, LLC
Seabrook Station
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT REGARDING LICENSE AMENDMENT REQUEST 14-04, REVISED REACTOR COOLANT SYSTEM PRESSURE/TEMPERATURE LIMITS APPLICABLE FOR 55 EFFECTIVE FULL POWER YEARS (TAC NO. MF4577)

Dear Mr. Curtland:

The Commission has issued the enclosed Amendment No. 151 to Facility Operating License No. NPF-86 for the Seabrook Station, Unit No. 1. This amendment consists of changes to the technical specifications (TSs) in response to your application dated July 24, 2014, as supplemented by letters dated March 9, April 23, June 24, July 9, July 20, and September 8, 2015.

The amendment revises the pressure-temperature limits in TS 3.4.9.1, "Reactor Coolant System Pressure/Temperature Limits," to be applicable to 55 effective full power years. The amendment also revises TS 3.4.9.3, "Overpressure Protection Systems," by providing new overpressure protection setpoints and lowering the reactor coolant system temperature at which the TS is applicable.

A copy of our related safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

John G. Lamb, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosures:
1. Amendment No. 151 to NPF-86
2. Safety Evaluation

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ADAMS Accession No.: ML15096A255 *by memo

OFFICE	LPL1-2/PM	LPL1-2/LA	EVIB/BC*	STSB/BC	OGC	LPL1-2/BC	LPL1-2/PM
NAME	JLamb	LRonewicz	JMcHale	RElliott	JLindell	DBroaddus	JLamb
DATE	8/24/2015	8/24/2015	8/20/2015	8/28/2015	9/11/2015	10/30/2015	11/2/2015

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