ENCLOSURE 2

SAFETY EVALUATION RELATED TO

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT 1

DOCKET NO. 50-443

REQUEST FOR EXEMPTION FROM TABLE 1 OF

10 CFR PART 50, APPENDIX G

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO REQUEST FOR EXEMPTION FROM TABLE 1 OF

10 CFR PART 50, APPENDIX G

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT 1

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1.0 INTRODUCTION

By letter dated July 24, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML14216A403), as supplemented by letters dated March 9, April 24, and June 24, 2015 (ADAMS Accession Nos. ML15072A023, ML15125A140, and ML15181A262), NextEra Energy Seabrook, LLC (NextEra or the licensee) submitted a request for an exemption from Title 10 of the *Code of Federal Regulations* (10 CFR), Section 60 for Seabrook Station, Unit 1 (Seabrook).

The exemption would permit the use of the of the provisions of WCAP-17444-P, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Seabrook Unit 1," October 2011, in lieu of the minimum temperature requirements of 10 CFR Part 50, Appendix G that are based on the material properties of the reactor pressure vessel (RPV) closure flange region, for pressures greater than 20 percent of the pre-service hydrostatic test pressure.

The licensee requested the exemption to implement the provisions of a license amendment request (LAR), also submitted in its letter dated July 24, 2014, to revise the pressure-temperature (P-T) limit curves established in the Seabrook Technical Specifications (TSs).

To support the U.S. Nuclear Regulatory Commission (NRC) staff's technical basis for the exemption, NextEra submitted a letter dated July 9, 2015 (ADAMS Accession No. ML15194A042), that revised the proposed TS P-T limit curves to restrict the reactor coolant heat-up rate at temperatures less than 120 °F.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.12(a)(2)(ii) provide that the NRC may, upon application by a licensee or on its own initiative, grant exemptions from the requirements of the regulations in circumstances in which application of the regulation would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule[1].

10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," 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.

General Design Criterion 31, “Fracture prevention of reactor coolant pressure boundary,” requires that the reactor coolant pressure boundary be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a non-brittle 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.

10 CFR 50.60 "Acceptance criteria for fracture prevention measures for lightwater 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.

3.0 TECHNICAL EVALUATION

10 CFR Part 50, Appendix G, “Fracture Toughness Requirements,” requires that P-T limits and minimum temperature criteria be established for RPVs during normal operating and hydrostatic or leak rate testing conditions. Regarding minimum temperature requirements, 10 CFR Part 50, Appendix G states the following:

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[1] Notwithstanding the special circumstances of the exemption request, 10 CFR 50.12(a)(1) requires that the exemption must be authorized by law, not present an undue risk to the public health and safety, and be consistent with the common defense and security.

> The minimum temperature requirements...pertain to the controlling material, which is either the material in the closure flange or the material in the beltline region with the highest reference temperature....the minimum temperature requirements and the controlling material depend on the operating condition (i.e., hydrostatic pressure and leak tests, or normal operation including anticipated normal operational occurrences), the vessel pressure, whether fuel is in the vessel, and whether the core is critical. The metal temperature of the controlling material, in the region of the controlling material which has the least favorable combination of stress and temperature, must exceed the appropriate minimum temperature requirement for the condition and pressure of the vessel specified in Table 1 [of 10 CFR Part 50, Appendix G].

Additionally, Footnote 2 to Table 1 in 10 CFR Part 50, Appendix G specifies that RPV minimum temperature requirements related to RPV closure flange considerations shall be based on "[t]he highest reference temperature of the material in the closure flange region that is highly stressed by bolt preload."

Pursuant to 10 CFR 50.12, by letter dated July 24, 2014, as supplemented by letters dated March 9, April 24, and June 24, 2015, NextEra requested an exemption from 10 CFR 50.60, "Acceptance criteria for fracture prevention measures for light water nuclear power reactors for normal operation." The exemption would permit the use of the provisions of the Westinghouse report, WCAP-17444-P, Rev. 0, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Seabrook Unit 1," October 2011, in lieu of the specific requirements of 10 CFR Part 50, Appendix G, related to the establishment of minimum temperature criteria for all modes of reactor operation addressed by Table 1 of 10 CFR Part 50, Appendix G. These minimum temperature criteria are based on the properties of the material of the RPV closure flange region that is highly stressed by the bolt preload, for pressures greater than 20 percent of the pre-service hydrostatic test pressure. The non-proprietary version of WCAP-17444-P (WCAP-17444-NP) is available for public examination under ADAMS Accession No. ML14216A406. The licensee requested the exemption in order to implement the provisions of a LAR to revise the P-T limit curves established in the Seabrook TSs.

The requirements from which the licensee requested that Seabrook be exempted shall be referred to, for the purpose of this exemption, as those requirements related to the application of Footnote 2 to Table 1 of 10 CFR Part 50, Appendix G for pressures greater than 20 percent of the pre-service hydrostatic test pressure. NextEra did not request exemption from those requirements related to the application of Footnote 2 to Table 1 of 10 CFR Part 50, Appendix G for pressures less than or equal to 20 percent of the pre-service hydrostatic test pressure. These minimum temperature requirements (hereafter referred to as the minimum bolt-up temperature requirements) shall remain in effect for the proposed TS P-T limit curves for all modes of reactor operation.

WCAP-17444-P documents a linear elastic fracture mechanics (LEFM) analysis of postulated flaws in the Seabrook RPV closure flange region under normal operating conditions associated with RPV bolt-up, the 100 °F per hour reactor coolant system (RCS) heat-up transient, and the 100 °F per hour cool-down transient. The LEFM analysis was performed by first calculating through-wall stress distributions for the flange region based on a finite element analysis (FEA) for bolt-up and the 100 °F per hour heat-up and cool-down transients. The RCS heat-up and cool-down transients were evaluated by calculating the flange stresses as RCS pressure and temperature vary with time. The P-T changes were modeled based on realistic 100 °F per hour heat-up and cool-down transients that would be considered permissible for normal operating conditions based on the proposed TS P-T limit curves. Therefore, the stress at any given temperature is based on a lower pressure than the limiting pressure from the proposed TS P-T limit curve, which is based on the limiting RPV beltline material properties and minimum bolt-up temperature requirement. The pressures used are those that are actually achievable based on physical properties of the reactor coolant during the heat-up process and the plant operating configuration, rather than what is permitted by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Appendix G P-T limits that are calculated based on the beltline material properties. However, as discussed below in its evaluation of the licensee's RAI responses, the NRC staff was able to verify that there is adequate assurance that flange integrity would be maintained with the required safety margin even for P-T in accordance with the proposed TS P-T limit curves. Therefore, the NRC staff finds the use of the realistic transient P-T to be acceptable.

WCAP-17444-P indicates that the highest stresses were found to occur at two limiting locations: (1) the top head torus-to-flange weld at the bolt-up condition, and (2) the top head dome-to-torus weld at the end of the 100 °F per hour heat-up transient. With these stresses, Westinghouse calculated the applied stress intensity factor (K_I) for postulated semi-elliptical outside diameter (OD) surface breaking flaws with an aspect ratio (length vs. depth) of 6:1, and with depths ranging from 0 to 80 percent of the thickness of the component low alloy steel pressure boundary. The K_I values were calculated by using stress intensity factor influence coefficients that were derived from a polynomial fit to the through-wall stress distributions from the FEA. This methodology for calculating K_I is consistent with the ASME Code Section XI, Appendix G, Paragraph G-2220 requirements for the analysis of structural discontinuity locations. WCAP-17444-P compared the K_I values for the OD flaw with depth equal to one-tenth of the flange pressure boundary thickness (0.1t) to the lower bound plane strain fracture toughness values for static crack initiation (K_{IC}). The K_{IC} values were calculated in accordance with the ASME Code, Section XI, Appendix G, Paragraph G-2110 based on the most limiting nil-ductility transition reference temperature (RT_{NDT}) value for the Seabrook RPV closure flange materials.

The use of K_{IC} as the fracture toughness property represents the most significant difference between the LEFM analysis provided in WCAP-17444-P and the analysis that was performed as the basis for establishing the minimum temperature requirements in Table 1 of 10 CFR Part 50, Appendix G. The minimum temperature requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G were incorporated into 10 CFR based on the evaluation documented in the 1983 Commission Rulemaking Issue Paper ("SECY Paper"), SECY-83-80, "10 CFR Part 50 – General Revision of Appendices G and H, Fracture Toughness and Reactor Vessel Material Surveillance Requirements," February 25, 1983. These minimum temperature requirements are based on analyses that used the ASME Code lower bound crack arrest fracture toughness (K_{IA}) as the parameter for characterizing a material's ability to resist crack initiation. The use of K_{IA} is more conservative than K_{IC} for LEFM evaluations, and its use in the SECY-83-80 evaluation that established the minimum temperature requirements in 10 CFR Part 50, Appendix G was based on the limited knowledge of RPV material behavior that was available at that time. It has since been established that the use of K_{IC}, not K_{IA}, is consistent with the actual physical processes that would govern crack initiation under conditions of normal RPV operation, including RPV heat-up, cool-down, and hydrostatic and leak testing. Based on this understanding of the behavior of RPV materials, K_{IC} was incorporated into the ASME Code, Section XI, Appendix G in the 1990s. Accordingly, the RPV beltline P-T limit curves are now routinely calculated using K_{IC} as the fracture toughness property, which is in accordance with the 10 CFR Part 50, Appendix G requirement that the P-T limits must be at least as conservative as those obtained based on the methods of analysis in the ASME Code, Section XI, Appendix G.

Table 6-2 of WCAP-17444-P demonstrates that the ASME Code-required margin against fracture, as quantified by the ratio of K_{IC} to K_I (K_{IC}/K_I), is maintained for the limiting flange locations for the bolt-up condition and for the end of heat-up. Specifically K_{IC}/K_I is equal to 2.31 for the top head torus-to-flange weld for the bolt-up condition, and 3.73 for the top head dome-to-torus weld at the end of heat-up, based on the 0.1t postulated flaw. Therefore, in both cases, the margin against fracture exceeds the requirements of the ASME Code, Section XI, Appendix G, which specifies a margin of two on K_I components due to primary stresses (i.e. stresses caused by pressure loading and bolt preload) and a margin of one on K_I components due to secondary stresses, which include thermal transient stresses (i.e., through-wall thermal stresses caused by the normal heat-up and cool-down transients). The bolt-up condition corresponds to the condition of low metal temperature (and correspondingly low fracture toughness) in the flange region and relatively low stress, whereas the end of heat-up represents a condition of high metal temperature (and correspondingly high fracture toughness) and the highest stress. The more limiting of the two cases is the bolt-up condition due to the much lower fracture toughness compared to the end of heat-up.

With respect to the use of the 0.1t OD postulated flaw for determining the above margins against fracture, the NRC staff found that this flaw depth is justified, in part, because the evaluation documented in SECY-83-80 (the technical basis for the current minimum temperature requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G) was based on the same flaw parameters, including the 0.1t flaw depth, for the flange region. In addition, WCAP-17444-P indicates that the use of the 0.1t reference flaw depth for the K_I calculations is based on established industry flaw detection capability for flaws in RPVs. Appendix A to WCAP-17444-P provides an industry proprietary evaluation of RPV inservice inspection reliability, which demonstrates that 0.1t is still the appropriate reference flaw depth for an OD surface breaking flaw in the flange region. Additionally, the ASME Code, Section XI, Appendix G states that, "[s]maller [postulated] defect sizes [relative to the 1/4t flaw normally postulated for the beltline region] may be used on an individual case basis if a smaller size of maximum postulated defect can be ensured." Therefore, for reasons discussed above, the NRC staff determined that the 0.1t flaw depth is acceptable for the flange region.

WCAP-17444-P also provided justification for the location of the 0.1t postulated flaw at the OD of the RPV flange region. This justification indicates that the primary bending stress for the bolt-up condition results in tensile stress at the OD and compressive stress at the inside diameter (ID). In addition, the heat-up transient also results in tensile thermal stress at the OD and compressive thermal stress at the ID, whereas the cool-down transient results in compressive stress at the OD and tensile stress at the ID (i.e., the through-wall thermal stress resulting from cool-down counteracts the bolt-up stress). Membrane stress due to internal pressure during heat-up and cool-down is tensile at all locations. Therefore, the maximum tensile stress is produced at the OD during the heat-up transient. The NRC staff determined that these stress profiles are consistent with the loads associated with bolt-up and through-wall temperature gradients for the RPV closure head flange geometry and noted that the stress distribution outputs from the FEA of the flange confirm this description of the stress profile. Therefore, the NRC staff found that the use of the 0.1t postulated flaw at the OD of the RPV flange region is acceptable for demonstrating adequate margins against fracture for the flange region.

Discussion of Staff RAI and Licensee RAI Responses

Based on its review of WCAP-17444-P, the NRC staff determined that additional information was required in order resolve several concerns associated with the limiting flange RT_{NDT} value, the 100 °F per hour heat-up rate, the flange through-wall stress distributions, and the LEFM results for low temperature operations. The NRC staff's RAI and the licensee's RAI response, dated April 23, 2015 (ADAMS Accession No. ML15125A140) are discussed below.

The NRC staff noted that WCAP-17444-P lists RT_{NDT} values for the Seabrook closure head and flange components. The most limiting of these values was selected for determining K_{IC}. In RAI-1, the NRC staff requested that the licensee confirm whether the RT_{NDT} values for the base metal components of the closure flange region are measured heat-specific values from certified material test reports that were determined in accordance with the ASME Code, Section III, NB-2331 requirements.

In its response to RAI-1, NextEra stated that the RT_{NDT} values for the base metal components of the closure flange region are measured heat-specific values from certified material test reports. The licensee indicated that the Seabrook RPV was designed in accordance with the 1971 Edition through Winter 1972 Addenda of the ASME Code, Section III, NB-2300, which required testing of RPV base metal specimens in the transverse (i.e., weak direction). The NRC staff noted that this Code Addenda includes the provisions of NB-2331 for establishing RT_{NDT}. Therefore, the NRC staff found that these RT_{NDT} values are an acceptable material property basis for the flange LEFM analysis. Accordingly, RAI-1 is resolved.

In reviewing WCAP-17444-P stress analysis results, the NRC staff noted a discrepancy between the axial stress distribution for the end of the 100 °F per hour heat-up transient provided in WCAP-17444-P Table 6-1 and the axial stress distribution for the corresponding condition in Appendix C of WCAP-17444-P. Therefore, in RAI-2, the NRC staff requested that the licensee address this discrepancy.

In its response to RAI-2, NextEra stated that the difference between the stress values reported in WCAP-17444-P, Table 6-1 and Appendix C is due to the inclusion of weld residual stresses in the stress values reported in WCAP-17444-P Table 6-1. The licensee stated that the Appendix C stress distributions are from the FEA and do not include the residual stress. The NRC staff noted that Section 6 of WCAP-17444-P also states the through-wall welding residual profile was added to the bolt-up and to the heat-up and cool-down transient pressure and thermal stresses. Since WCAP-17444-P Table 6-1 stress values were used to calculate the K_I values for demonstrating adequate margins against fracture, and the addition of weld residual stress represents an additional conservatism in the analysis, the NRC staff found the incorporation of these stresses in Table 6-1 acceptable. Therefore, RAI-2 is resolved.

The NRC staff performed a calculation to verify the bounding RCS heat-up rate described in WCAP-17444-P and noted that the heat-up and pressurization of the RCS from the minimum bolt-up temperature to the temperature specified in WCAP-17444-P Table 6-1 for the end of heat-up, within the time specified for the end of heat-up, resulted in a heat-up rate of approximately 87 °F per hour. Therefore, the NRC staff requested in RAI-3 that the licensee address how WCAP-17444-P flange integrity analysis is applicable to a 100 °F per hour heat-up rate.

In its response to RAI-3, NextEra stated that, for the LEFM evaluation, the 100 °F per hour heat-up transient starts at an RCS temperature of 120 °F and a time of 82 minutes, and ends at a temperature of 557 °F and a time 344.2 minutes, corresponding to a 100 °F per hour heat-up rate. The licensee indicated that this represents standard design plant heat-up conditions. The licensee cited the Seabrook Updated Final Safety Analysis Report (UFSAR), Section 3.9(N) as the basis for this heat-up transient.

The NRC staff verified that the heat-up of the RCS from 120 °F to 557 °F, over the time interval from 82 minutes to 344.2 minutes, corresponds to a 100 °F per hour heat-up rate. The NRC staff also verified that the Seabrook UFSAR Section 3.9(N) states the following:

> The design heat-up and cool-down cases are conservatively represented by continuous operations performed at a uniform temperature rate of 100 °F per hour…For these cases, the heat-up occurs from ambient (assumed to be 120 °F) to the no-load temperature and pressure condition and the cool-down represents the reverse situation.

Therefore, the NRC staff found that the licensee adequately demonstrated that WCAP-17444-P LEFM analysis considered a 100 °F per hour heat-up rate. Thus RAI-3 is resolved.

The NRC staff performed an independent calculation, which showed that at a metal temperature of 94 °F, the K_{IC} for the flange exceeds twice the maximum value for the applied K_I at the end of heat-up. The end of heat-up corresponds to the condition of the highest stress in the flange. Therefore, the ASME Code-required margins against fracture would be ensured for RCS operation in accordance with the proposed TS P-T limit curves if the flange metal temperature is greater than or equal to 94 °F. For flange metal temperatures less than 94 °F, the ASME Code-required margins against fracture would be maintained provided that the K_I for the flange does not increase drastically early in the heat-up transient before the flange metal has reached a temperature and fracture toughness necessary for ensuring sufficient margins against fracture. Therefore, the NRC staff was concerned that the increase in the applied K_I values early in the heat-up transient due to a combination of bolt-up stress plus pressure and thermal stresses, while the K_{IC} fracture toughness is still relatively low, would result in a more limiting ratio of K_{IC} to K_I that could possibly not meet the ASME Code-required margin against fracture. Therefore, for the 100 °F per hour heat-up transient, the NRC staff requested in RAI-4 that the licensee address whether the most limiting ratio of K_{IC} to K_I occurs at bolt-up. If the most limiting ratio of K_{IC} to K_I does not occur at bolt-up, the NRC staff requested that the licensee provide the most limiting ratio, the corresponding time during the heat-up transient, and the values of K_I and K_{IC} at that time.

In its response to RAI-4, NextEra provided the most limiting ratio of K_{IC} to K_I at the time corresponding to the beginning of the 100 °F per hour heat-up transient with the flange metal temperature set equal to 60 °F. This calculation was provided in order to demonstrate that adequate margins against fracture would be maintained if the higher stress in the flange corresponding to the beginning of the heat-up transient occurred while the flange was at the minimum bolt-up temperature of 60 °F. The NRC staff reviewed the calculation and determined that it demonstrates that the ASME Code, Section XI, Appendix G-required margins against fracture would still be maintained at the start of the 100 °F per hour heat-up even if the flange metal temperature were still at the minimum bolt-up temperature. The NRC staff confirmed that this calculation is based on the most bounding assumptions with respect to flange metal temperature and applied stress for the beginning of RCS heat-up – specifically, K_{IC} is based on the lowest temperature for the flange material (60 °F), and the applied K_I value is based on the elevated stress in the flange at the start of heat-up. Accordingly, the calculation serves to demonstrate that the ASME Code-required margins against fracture for the flange region would not be violated for Seabrook for bounding conditions associated with the unfavorable combination of low metal temperature and elevated stress in the flange. Therefore, the NRC staff found that the flange integrity would be maintained with the required safety margin for the start of the heat-up transient and at the lowest allowable flange temperature permitted on the proposed TS P-T limit curves, thereby providing assurance that the minimum temperature requirements related to Footnote (2), for pressures greater than 20 percent of the pre-service hydrostatic test pressure, are not necessary to meet the underlying intent of 10 CFR Part 50, Appendix G.

In its response to RAI-4, NextEra also provided a description of the design transient for heat-up. The licensee stated that the design heat-up transient, as specified in the Seabrook UFSAR Section 3.9(N), starts at 120 °F and ramps up to 557 °F at a rate of 100 °F per hour. The licensee indicated that this design transient is used in WCAP-17444-P evaluation. The licensee explained that below 120 °F, the RCS is depressurized and at a uniform temperature. The licensee noted that RCS temperature changes between 70 °F and 120 °F are very slow and do not cause significant thermal transient effects in the closure flange region. The licensee stated that this is consistent with TS requirements, where TS Table 1.2 defines Mode 5, "Cold Shutdown," as 200 °F or below with the RPV head tensioned. The licensee also stated that evolutions in Mode 5 such as RCS evacuation and fill or pressurizer bubble formation do not produce rapid temperature changes below 120 °F.

To illustrate the essentially isothermal conditions at low temperatures, the licensee described the most recent plant startup after the March 2014 refueling outage, where the initial heat-up from ambient conditions occurred from 88.5 °F to 155.7 °F over 11 hours, corresponding to a heat-up rate of approximately 6.1 °F per hour. Based on these limitations, the licensee emphasized that for temperatures less than 120 °F there are no significant thermal transient stresses that should be considered for WCAP-17444-P LEFM evaluation.

Based on its review of UFSAR Section 3.9(N) and the licensee's response to RAI-4, the NRC staff found that the licensee adequately demonstrated that the 100 °F per hour heat-up rate does not start at RCS temperatures less than 120 °F. The NRC staff also determined that maintaining the RCS heat-up rate less than or equal to 20 °F per hour for RCS temperatures less than 120 °F would ensure that conditions in the RPV flange region are adequately close to isothermal, such that the ASME Code-required margins against fracture are maintained for the RPV flange region for RCS operation in accordance with the proposed TS P-T limits. In order to ensure consistency between the design-basis conditions for the start of the 100 °F per hour heat-up transient and the proposed TS P-T limit curves, the NRC staff requested that the licensee notate the proposed TS P-T limit curve for heat-up with the requirement that the RCS heat-up rate be maintained less than or equal to 20 °F per hour for RCS temperatures less than 120 °F. In its response to RAI-5, provided by letter dated July 9, 2015 (ADAMS Accession No. ML15194A042), the licensee included this notation in the proposed TS P-T limit curve for heat-up. Therefore, since the NRC staff determined that the necessary margins against fracture are ensured for RCS operation in accordance with the proposed TS P-T limit curves for flange metal temperatures greater than 94 °F, the lowest allowable temperature of 120 °F for the start of the 100 °F per hour heat-up transient would also ensure that the flange metal temperature and fracture toughness are high enough for maintaining the ASME Code-required margins against fracture for RCS operation in accordance with the proposed TS P-T limit curves. Accordingly, the NRC staff determined that RAI-4 is resolved.

Based on its evaluation of WCAP-17444-P and the licensee's RAI response, the NRC staff determined that the licensee has demonstrated that the combination high stresses along with low metal temperature in the RPV flange region cannot exist simultaneously. The NRC staff determined that the licensee also demonstrated that the structural integrity of the Seabrook RPV closure flange materials will not be challenged by facility operation in accordance with the proposed TS P-T limit curves that are based on the Seabrook RPV beltline region and the flange minimum bolt-up temperature, without the minimum temperature requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G for pressures greater than 20 percent of the pre-service hydrostatic test pressure.

Therefore, for pressures greater than 20 percent of the pre-service hydrostatic test pressure, the minimum temperature requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G are not necessary to meet the underlying intent of 10 CFR Part 50, Appendix G, to protect the Seabrook RPV closure flange from brittle fracture during normal operation under both core critical and core non-critical conditions and RPV hydrostatic and leak test conditions.

4.0 EXEMPTION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Evaluation of the exemption criteria (1) above for each of the following exemption is addressed in the NRC exemption, Sections III.A, III.B, and III.C of Enclosure 1 to this letter. The evaluation of the special circumstances provision in (2) above is evaluated in Sections 4.1 of this SE.

Special circumstances exist when application of the regulation in the particular circumstance would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule (10 CFR 50.12(a)(2)(ii)).

4.1 Specific Exemption for Table 1 of 10 CFR 50, Appendix G

The underlying purpose of Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G is to protect the integrity of the RPV flange portion of the reactor coolant pressure boundary during normal operations, including heat-up, cool-down, and during hydrostatic pressure and leak tests. The NRC staff accepts the licensee's determination that an exemption would be required to permit NextEra to not meet those requirements specifically related to the application of Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure.

The NRC staff examined the licensee's rationale to support the exemption request. Based on its consideration of the information provided in WCAP-17444-P and the RAI response provided in the licensee's letters dated March 9, April 24, and July 9, 2015, an acceptable technical basis has been established to exempt Seabrook from the requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure. The technical basis provided by the licensee has established that an adequate margin of safety against brittle failure would continue to be maintained for the Seabrook RPV without the application of those requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G, for normal operation under both core critical and core non-critical conditions and RPV hydrostatic and leak test conditions, for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure. Therefore, the NRC staff concludes that, pursuant to 10 CFR 50.12(a)(2)(ii), special circumstances are present because the underlying purpose of 10 CFR Part 50, Appendix G will be achieved without the application of those minimum temperature requirements that specifically relate to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure, and therefore, the proposed exemption should be granted to the licensee such that those requirements related to the application of Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G, for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure, need not be applied to Seabrook.

5.0 ENVIRONMENTAL CONSIDERATION

The environmental considerations for the exemption request are addressed in Section III.E of the associated exemption (ADAMS Accession No. ML15092A519).

6.0 CONCLUSION

The NRC staff has completed its review of the licensee's request for an exemption from Table 1 of Appendix G to 10 CFR Part 50, as specified in this safety evaluation. The requirements of Appendix G to 10 CFR Part 50 that remain in effect are provided in the licensee's letter dated July 24, 2014, as supplemented by letters dated March 9, April 24, and June 24, 2015. On the basis of its review, the NRC staff concludes that an adequate margin of safety against brittle failure would continue to be maintained for the Seabrook RPV without the application of those requirements related to Footnote (2) to Table 1 of 10 CFR Part 50, Appendix G, for normal operation under both core critical and core non-critical conditions and RPV hydrostatic and leak test conditions, for RCS pressures greater than 20 percent of the pre-service hydrostatic test pressure.

Accordingly, the NRC staff has determined that, pursuant to 10 CFR 50.12(a), the exemption evaluated above is authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, special circumstances are present. Specifically, the NRC staff finds the licensee's requested exemption meets the underlying purpose of the requirements in Appendix G to 10 CFR Part 50, and acceptably satisfies the special circumstances in 10 CFR 50.12(a)(2)(ii).

The Seabrook license amendment request that incorporates this exemption will be reviewed separately under the 10 CFR 50.90 license amendment process.

Principal Contributor: C. Sydnor, NRR

Date: July 28, 2015