



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

December 5, 2012

Mr. Kevin Walsh, Site Vice President
c/o Michael O'Keefe
Seabrook Station
NextEra Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 – REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST 11-04, CHANGES TO TECHNICAL SPECIFICATIONS FOR NEW AND SPENT FUEL STORAGE (TAC NO. ME8688)

Dear Mr. Walsh:

By letter dated January 30, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12038A036), as supplemented by letters dated May 10, 2012 (ADAMS Accession No. ML12136A126), and September 20, 2012 (ADAMS Accession No. ML12271A276), NextEra Energy Seabrook, LLC (NextEra) submitted license amendment request (LAR) 11-04 for Seabrook Station, Unit No. 1. The proposed change revises the Technical Specifications (TSs) for new and spent fuel storage, as a result of the new criticality analyses for the new fuel vault (NFV) and the spent fuel pool (SFP).

The proposed amendment would revise the TSs to: (1) reflect elimination of the need to credit Boraflex neutron absorbing material for reactivity control in the SFP; (2) credit soluble boron, burnup, cooling time, peripheral leakage, and rod cluster control assemblies within the storage racks to maintain SFP reactivity within the effective neutron multiplication factor (k_{eff}) limits of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.68(b)(4); and (3) revise the requirements for fuel storage within the NFV.

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that additional information is required to complete its review. The NRC staff's request for additional information (RAI) is contained in the enclosed proprietary version RAI. A draft of these questions was previously sent to Mr. Gary Kilby of your staff with an opportunity to have a teleconference to ensure that the licensee understood the questions and their regulatory basis, as well as to verify that the information was not previously docketed. A conference call was held on November 7, 2012, and Mr. Kilby agreed that NextEra would respond to the RAI by March 29, 2013. Please note that if you do not respond to the RAI by March 29, 2013, the NRC staff may reject your request for relief under the provisions of Title 10 of the *Code of Federal Regulations*, Section 2.108, "Denial of application for failure to supply information."

NOTICE: Enclosure 1 to this letter contains Proprietary Information. Upon separation from the Enclosure 1, this letter is DECONTROLLED.

K. Walsh

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The NRC has determined that the related RAIs contain proprietary information pursuant to Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public Inspections, Exemptions, Requests for Withholding." The proprietary version of the RAIs is provided in Enclosure 1. Accordingly, the NRC staff has also prepared a non-proprietary version of the RAIs, which is provided in Enclosure 2.

If you have any questions, please contact me at (301) 415-3100.

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. RAIs (Proprietary)
2. RAIs (Non-Proprietary)

cc w/ Enclosure 2: Distribution via Listserv

ENCLOSURE 2

(NON-PROPRIETARY)

REQUEST FOR ADDITIONAL INFORMATION
REGARDING LICENSE AMENDMENT REQUEST 11-04
CHANGES TO TECHNICAL SPECIFICATIONS
FOR NEW AND SPENT FUEL STORAGE
NEXTERA ENERGY SEABROOK, LLC
SEABROOK STATION, UNIT NO. 1
DOCKET NUMBER 50-443

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

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

REQUEST FOR ADDITIONAL INFORMATION

REGARDING LICENSE AMENDMENT REQUEST 11-04

CHANGES TO TECHNICAL SPECIFICATIONS

FOR NEW AND SPENT FUEL STORAGE

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NUMBER 50-443

1.0 SCOPE

By letter dated January 30, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12038A036), as supplemented by letters dated May 10, 2012 (ADAMS Accession No. ML12136A126), and September 20, 2012 (ADAMS Accession No. ML12271A276), NextEra Energy Seabrook, LLC (NextEra) submitted a license amendment request (LAR) 11-04 for Seabrook Station, Unit No. 1. The proposed change revises the Technical Specifications (TSs) for new and spent fuel storage as the result of a new criticality analyses for the new fuel vault (NFV) and the spent fuel pool (SFP).

The proposed amendment would revise TSs to: (1) reflect elimination of the need to credit Boraflex neutron absorbing material for reactivity control in the SFP; (2) credit soluble boron, burnup, cooling time, peripheral leakage, and rod cluster control assemblies within the storage racks to maintain SFP reactivity within the effective neutron multiplication factor (k_{eff}) limits of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.68(b)(4); and (3) revise the requirements for fuel storage within the NFV.

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2.0 RAI

New Fuel Vault

1. The new fuel vault (NFV) fuel storage racks sit in a fairly tight fitting thick-walled concrete vault. Provide a description, including uncertainties, for the concrete composition model, including water content, used in the NFV. Provide a justification for the model used. Calculate and provide the uncertainties in k_{eff} due to uncertainty in the NFV concrete wall composition. It may be necessary to revise the analysis and conclusions to include the uncertainties associated with concrete composition.



2. The uncertainty associated with the [[
]]. Modeling simplifications are not uncertainties. The analysis may be performed using conservative bounding simplifications, but the impact of doing so is not to be handled as an uncertainty. Revise the analysis and conclusions to properly reflect use of the modeling simplification or provide a better justification for handling the simplification as an uncertainty.
3. The results provided for the NFV wall thickness tolerance in Table 3.6.2 are either non-physical or [[

]].

4. No uncertainties are provided in Table 3.5.2 for storage cell pitch values or for the distances between the array and the NFV walls. Further, the dimension and uncertainty are not listed for the distance from the bottom of the fuel to floor. [[
]] Revise the analysis and conclusions to include consideration of the uncertainties associated with cell pitch and wall-to-array spacing. [[
]]
5. Section 3.2.3.2 addresses the reactivity effect of water temperature and density variation. [[

]] This raises a few questions.

- a. Provide justification for [[
]].
 - b. Address the impact of or provide justification for [[
]]. Note that computational difficulty is not an acceptable justification.
 - c. [[
]]
 - d. Describe and justify the validation of k_{eff} calculations [[
]] or provide the uncertainty in k_{eff} associated with the use of [[
]].
6. Sections 3.2.3.4 and 3.6.4 and Table 3.6.2 of HI-2114996 evaluate eccentric assembly placement [[





]]. The fuel should be evaluated for normal conditions at the most reactive acceptable fuel position, which should be optimized separately for normal and abnormal/accident conditions. [[

]]. Update the analysis and conclusions to reflect storage of fuel in its most reactive approved position as a normal condition. Alternatively, provide justification showing that the eccentric positions evaluated cannot credibly occur and include evaluation of credible fuel assembly positions.

7. Section 3.2.3.5 of HI-2114996, [[

]]. However, it is important to consider potential common mode failures, such as seismically induced NFV rack movement/deformation and seismically induced flooding of the NFV. The applicant may be able to credit measures (e.g., use of a water-proof hatch and raised curbs around the NFV, high-capacity drains or flow paths out of the NFV, lack of water sources present around the NFV, etc.) that could preclude flooding of the NFV during and after a seismic event. Provide justification for limiting accident analysis to the current scope. Address scenarios involving common mode failure initiators such as seismic events, fires and flooding events.

8. [[

]].

[[

]]. Use of these experiments to validate NFV low-water-density optimum moderation peak keff values is probably not appropriate. [[

]]. Provide a better justification for use of these experiments to validate the low-water-density NFV keff calculations. If such justification cannot be provided, address how the low-water density calculations are validated. Validation gaps and weaknesses may need to be covered with additional keff margin.

[[



]]

Spent Fuel Pool

9. Section 4.2.3.2 addresses the reactivity effect of water temperature and density variation. The analysis described in Sections 4.2.3.2, 4.2.3.7.1, and 4.6.11, and in Tables 4.6.4 and 4.6.5 [[

]]. This raises a couple of questions.

- a. Provide justification for [[
]]. Note that computational difficulty is not an acceptable justification. The justification should address the impact of this modeling approximation on the calculated k_{eff} values.
- b. Provide justification [[

]].

10. Section 4 of HI-2114996 evaluates eccentric assembly placement [[
]]. This is not appropriate because criticality is a local effect, not a fuel storage rack average or vault average phenomenon. The maximum k_{eff} of the system is affected by the eccentric placement of a small number of assemblies. The fuel should be evaluated for normal conditions at the worst acceptable fuel positions, which should be optimized separately for normal and abnormal/accident conditions. [[

]].

Update the analysis and conclusions to reflect storage of fuel in its most reactive approved position as a normal condition. Alternatively, provide justification showing that the eccentric positions evaluated cannot occur under normal and credible abnormal and include evaluation of credible fuel assembly positions.

11. Validation issues:

- a. Section 4.2.2.1 notes that [[]] cross-section data were used in the analysis. Section 4.2.2.1.1 notes that benchmarking of [[]] for criticality calculations is documented in HI-2104790, Rev. 0. The validation work presented in HI-2104790 is for calculations using [[]]. From the data presented in the SFP analysis, it is not clear which nuclides were [[]]. Provide a list of nuclides that were used in the analysis and were not adequately validated in HI-2104790.

For poorly validated nuclides, describe and justify how the bias and uncertainty associated with the nuclides other than fission products were addressed. The response to the RAI should [[

]].

- b. Describe and justify the validation of k_{eff} calculations at [[]] or provide the uncertainty in k_{eff} associated with [[]].
- c. Describe and justify the validation of the depletion and Δk_{eff} calculations associated with [[]]. or provide uncertainty in k_{eff} associated with use of the unvalidated calculations.

12. The analysis includes a calculation of [[]]. Justify the method used to model the [[

]]. Review and confirm that both the depletion and k_{eff} calculations were performed correctly.

The reviewer's concern is that some of the results in Tables 4.6.17 through 4.6.20 and Tables 4.6.22 through 4.6.25 have trends that are inconsistent with each other and inconsistent with expected behavior. For example, Tables 4.6.18 and 4.6.23 are for Pattern B with blanketed and non-blanketed fuel. Table 4.6.18 shows too many zero Δk values and appears to be relatively insensitive to [[]] when compared to the data in Table 4.6.23.

The expected behavior is that, since [[

]] and the blanketed and non-blanketed fuel should yield similar behavior.

13. The analysis includes calculations to show the impact of [[]] for non-blanketed fuel. There may be a problem with the results presented for Pattern A in Table 4.6.21. The results indicate that Pattern A is insensitive to the effects of [[]] on burned fuel compositions. Some confirmatory calculations were performed indicating that there should be observable sensitivity, even in this two-out-of-four fresh plus burned fuel arrangement. Review and confirm that both the depletion and k_{eff} calculations were performed correctly.

14. The analysis notes in several places that [[]] the 17x17 Vantage 5 assembly design. Table 4.5.1 includes dimensions that are labeled as being for a Vantage 5. From the dimensions provided in Table 4.5.1, it appears that the assembly design is a Vantage 5H. The distinction is important because the fuel rods in the Vantage 5 assembly have a smaller radius. Confirm that the assembly design is the Vantage 5H.

A review of the 2002 RW-859 Commercial Spent Nuclear Fuel (CSNF) inventory data showed that Seabrook assembly IDs H29, H30, H31 and H32, discharged in May of 2002, contained significantly lower uranium loading than the other assemblies (433 kgU vs ~460 kgU). If these assemblies are still stored in the SFP, describe how these assemblies vary from the design basis assembly and provide the logic showing that the design basis assemblies are bounding for these assemblies. Also, identify any other assemblies that vary from the designs described in Table 4.5.1 and, if such assemblies exist, provide the logic showing that the design basis assemblies are bounding. Note that lower mass does not necessarily equate to lower reactivity.

15. Section 4.2.3.5.6 describes the analysis of fuel creep and growth. Provide a reference for the maximum fuel rod growth value that is provided in the section. If this reference is not publicly available, provide a copy.

Consistent with RAI 10 provided by the NRC on March 30, 2012, **if the analysis is revised** to correct other deficiencies noted in the RAIs, the impact of fuel creep and growth should be handled [[]]. **If the analysis is not revised**, consistent with the applicant's response to RAI 10 in Holtec Letter RRTI-2064-001 dated April 24, 2012, which was provided by the applicant in an attachment to a letter dated May 20, 2012, NRC Staff will assume the loss of [[]] margin associated with fuel rod creep and growth.

16. Item 6 of Section 4.2.3.5.11 notes that fuel and rack structures [[]]. Insufficient information is provided concerning the development of the simplified model of the rack, pool, and pool floor below the fuel. Provide descriptions of the rack, pool and pool floor below the assemblies. Include distances from the bottom of the active fuel to the pool floor. Provide a description of the axial features of the model below the active fuel, including water thickness and boundary condition below the water. Provide either a supporting reference or a better justification for the model used. In some cases, layers of water, steel and concrete have been shown to provide better reflection than water alone.

17. Section 4.6.11.3.2 discusses the criticality safety of fuel stored on the periphery of the Region 2 rack. [[
]]. Insufficient details of the modeling of the pool and pool wall were provided. Provide a supplementary description of the model used to model the fuel stored in the Region 2 peripheral locations. The description should include the details of the side of the rack, soluble boron concentration, the water thickness to the wall, and the wall materials and thicknesses. The description should include dimensional and material composition uncertainties. Provide estimates for the impact of uncertainties on the calculated k_{eff} values. Note that the uncertainties that apply to only the finite model may affect the analysis and conclusions presented in Section 4.6.11.3.2 and Table 4.6.52.

If the entire model is depicted in Figure 4.6.7, it is not clear that this model, [[
]] is sufficient.

Additionally, it is possible that the presence of Pattern B or C next to rows 1 and 2 might yield a higher k_{eff} value than did Pattern D. For example, Pattern B with two rod cluster control assemblies (RCCAs) in row 4 and relatively lower burnup assemblies in both rows 3 and 4 may yield a higher k_{eff} value. Either revise the model and analysis or provide discussion supporting the use of what appears to be a rather limited modeling and analysis effort.

18. Section 4.2.3.5.2 describes the isotopes modeled in the burned fuel compositions. What is the maximum worth (i.e. spent fuel storage rack Δk_{eff}) of [[
]]?

19. Section 4.2.3.5.3.2 states that Seabrook "typically" operates at all rods out (ARO) at full power. "Typically" operating at ARO is not an acceptable basis for evaluating only ARO. If atypical rodded operation at power has occurred and some of the fuel has experienced even partially rodded operation for extended periods, this needs to be addressed in the safety analysis. Either confirm that there has not been rodded operation at power for extended periods, or provide justification for not evaluating the impact of rodded operation on fuel compositions.

20. From review of Section 4.2.3.5.11, Table 4.5.6, and Figure 4.5.1, it appears that [[

]].

21. The axial burnup profiles used in the analysis are described in Sections 4.2.3.5.5 and 4.6.10 and in Tables 4.6.37 and 4.6.38. The following concerns the development and use of the axial burnup profiles in the analysis.

- a. The final paragraph in Section 4.2.3.5.5 states [[

]]. This would likely be non-conservative at lower assembly average burnup values. Confirm that both axially-dependent and uniform axial burnup profiles were used for both

c. The placement [[]] is described as a normal condition in Section 4.2.4 and in Section 4.6.11.3.5. This activity is not described in enough detail to support review. Provide supplementary description of this operation, including [[

Provide analysis of normal and credible abnormal operations for [[]].
consideration of abnormal/accident conditions might include [[]].

d. Insufficient information is provided concerning design and use of the Fuel Rod Storage Basket (FRSB). Provide information describing the FRSB and its use and provide the logic supporting the FRSB model used. Include information about limits on the amount of fuel that is permitted in the FRSB, and design and structural features that limit the amount and spacing of fuel that can be stored in an FRSB.

23. In Section 4.6.2 [[

]]. The proper goal of the Δk calculations is to provide an accurate or conservative estimate for the uncertainty associated with some parameter variation. The estimate should be the Δk value + 2 standard deviations of the uncertainty. [[

]] the applicant should calculate the biases and uncertainties in a more conventional method such as the following:

$$\Delta k = (k_{high} - k_{low}) + 2 * \sqrt{\sigma_{k_{high}}^2 + \sigma_{k_{low}}^2}$$

[[

]]. Revise the analysis and conclusions to reflect accurate or conservative determination and incorporation of biases and uncertainties.

24. Footnote 21 under Table 4.5.9, which describes the RCCAs credited in Patterns B and C, states that [[

]].



Table 4.5.9 cites Reference 22 for the [[]].
From Section 4.2.3.5.11 item 10), [[

]].

]]. To avoid follow-on RAIs, provide the original reference rather than a reference to a chain of other references. The information will be used by NRC staff to confirm that the [[]] are acceptable.

25. From HI-2114996, it looks like a [[

]]. Provide a list of the initial enrichments and minimum burnups for which the maximum k_{eff} calculation and minimum burnup value (i.e., analysis similar to that shown in Table 4.6.39 for 5 wt%) were calculated. This data will be used to confirm that the bounding polynomial fits presented in Tables 4.6.43 through 4.6.45 and used in the proposed technical specifications are indeed conservative.

26. Concerning replacement of an assembly with or without an RCCA with an empty cell or FRSB, text in definitions 1 & 2 under Figure 5.6-2 in the proposed technical specifications reads "Replacement of any fuel assembly (with or without an RCCA) by an empty water hole, non-fuel hardware or fuel rod storage basket is acceptable." This could be interpreted to mean that any or all assemblies in Patterns B & C may be replaced with an empty cell or an FRSB. [[

]]. Either provide the additional analysis or revise the proposed technical specifications to limit assembly substitution consistent with the analysis provided in HI-2114996.

A second issue with the analysis presented in Table 4.6.49 is that, consistent with the language in Section 4.6.2, the Pattern B [[

]]. Perform and document the additional analysis or provide justification for not doing so.

27. The following questions are related to evaluation of abnormal and accident conditions.

a. The 3rd bullet in Section 4.2.3.2 describes evaluation [[

]].? If this is considered bounding, describe the bases for this position.

b. The 8th item listed in Section 4.2.3.5.11 describes the [[

]]. It would seem to be appropriate to evaluate potential abnormal/accident conditions associated with the degrading BORAL™. Such conditions might include (1) underestimation of blistering, (2) relocation of neutron absorbing material, and (3) bulging of the steel



wrapper or cell can. Relocation might occur due to structural failure caused by thermal cycling or in the event of dropped loads or seismic events. From a review of the responses to prior RAI 11, it is not clear that the gap between cells has been checked for reduction due to wrapper bulging. Provide justification for not including consideration of any **accident and abnormal conditions** related to the degraded BORAL™ panels.

- c. Confirm that the presence of RCCAs in Patterns B and C has been considered in the seismic analysis. This is important from a criticality perspective to ensure that a seismic event will not lead to rack, RCCA or assembly changes that could increase reactivity.
- d. Sections 4.2.5.5 and 4.6.12.2 describe the analysis performed for a mislocated fresh fuel assembly. The text in Section 4.6.12.2 states that the assembly was placed as close as possible to the rack faces to maximize the possible reactivity effects. This analysis needs to include a sensitivity study to demonstrate that zero spacing yields the maximum k_{eff} . Some small spacing between the mislocated assembly and the assemblies in the storage racks may yield a higher k_{eff} value. Note, too, that unless some control prohibits moving an assembly next to the fuel storage rack, this would be considered a normal condition rather than an abnormal condition. Confirm that controls are implemented to prevent moving an assembly next to the fuel storage racks and that a sensitivity study has been performed demonstrating that the maximum k_{eff} value for the mislocated assembly has been calculated.
- e. The second paragraph in Section 4.2.5.5 discusses a condition where an assembly is accidentally placed next to an assembly in the new fuel elevator or two assemblies could be at close approach for fuel cleaning. It is not clear whether these configurations are accident or abnormal conditions. Confirm that controls are implemented to prevent these configurations and that a sensitivity study of assembly spacing has been performed demonstrating that the maximum k_{eff} value for these configurations has been calculated.
- f. Section 4.2.5.7 discusses [[

]]. The text says that these errors would be the "most likely." The appropriate criterion is not the most likely accident. Instead, it is the worst case credible accident. Provide better justification for restricting the scope of evaluation of this accident.

28. In Table 4.5.11, under BORAFLEX™, the MCNP ZAID values are switched for oxygen and hydrogen. Confirm that the correct ZAID values were used in the calculations.

29. The following questions are related to the proposed technical specifications.



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- a. In Section 5.6.1.3.c, there may be a potential conflict between the first and last sentence. The first sentence clearly says any of the identified assemblies may be stored in the first and second row away from the West Wall. The last sentence requires that all assemblies in the 2nd and 3rd rows must meet the requirements of Figure 5.6-2 and Table 5.6-1. Some of the assemblies listed in Table 5.6-2 do not currently meet the requirements for Pattern D. Consistent with the first sentence, operations staff may conclude that it is ok to store any of the assemblies in the second row, without regard for the pattern in rows 2 and 3.

If consistent with the intended changes, consider revising to:

Fuel assemblies listed in Table 5.6-2 may be stored in any position in the first row of the Region 1 and Region 2 storage cells closest to the West Wall. No RCCAs are required in the first row. All 2x2 assembly arrays, other than those in the first row closest to the West Wall in Region 2, shall comply with the requirements of Figures 5.6-1 and 5.6-2 and Table 5.6-1.

If this was not what was intended, revise the proposed technical specifications to remove the ambiguity.

- b. Due to the reliance on RCCAs in the Patterns B and C, guidance should be provided concerning requirements for installation and removal of RCCAs and movement of assemblies to and from the storage rack. Revise Figure 5.6-2 of the proposed technical specifications to include a note that both permanent and transient configurations must meet the requirements of Figure 5.6-2 and Table 5.6-1.
- c. Definitions provided in Figures 5.6-1 and 5.6-2 include the phrase "or fuel of lower reactivity." Insufficient definition or guidance is provided concerning determination of "fuel of lower reactivity." Since the burnup limits are already defined as minimum burnup limits, it is not clear why the definitions include the phrase "or fuel of lower reactivity." Describe how the determination of "fuel of lower reactivity" is to be made and revise the definitions provided in Figure 5.6-1 and 5.6-2 to clarify how the determination is to be made. Alternatively, remove the phrase "or fuel of lower reactivity" from the definitions.
- d. Revise Note 3 under Table 5.6-1 to say "Fresh or irradiated fuel with an initial enrichment of ≤ 5.0 w/o U-235."



K. Walsh

- 2 -

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If you have any questions, please contact me at (301) 415-3100.

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. RAIs (Proprietary)
- 2. RAIs (Non-Proprietary)

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