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

September 3, 2014

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

SUBJECT: SEABROOK STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT REGARDING LICENSE AMENDMENT REQUEST REGARDING FUEL STORAGE CHANGES (TAC NO. ME8688)

Dear Mr. Curtland:

The Commission has issued the enclosed Amendment No. 142 to Facility Operating License No. NPF-86 for the Seabrook Station, Unit No. 1. This amendment consists of changes to the facility technical specifications (TSs) in response to your application dated January 30, 2012, as supplemented by letters dated May 10, 2012, September 20, 2012; March 27, 2013, December 20, 2013; and January 29, 2014.

The original application proposed revisions to the TSs for new and spent fuel storage as a result of the new criticality analyses for the new fuel vault (NFV) and spent fuel pool (SFP). By letter dated December 20, 2013, NextEra requested that the SFP and NFV be separated into two separate license amendment requests. This amendment revises the TSs related to spent fuel storage as a result of new criticality analyses for the SFP. The license amendment request for the NFV will be processed under TAC No. MF3283.

Enclosure 3 transmitted herewith contains sensitive unclassified information
When separated from Enclosure 3, this document is decontrolled.

A copy of our 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. 142 to NPF-86
2. Non-Proprietary Safety Evaluation
3. Proprietary Safety Evaluation

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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. 142
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 January 30, 2012, as supplemented May 10, 2012, September 20, 2012; March 27, 2013, December 20, 2013; and January 29, 2014, 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. 142, 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 within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert G. Schaaf, Acting Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the License and Technical Specifications

Date of Issuance: September 3, 2014

ATTACHMENT TO LICENSE AMENDMENT NO. 142

FACILITY OPERATING LICENSE NO. NPF-86

DOCKET NO. 50-443

Replace the following page of Facility Operating License No. NPF-86 with the attached 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 as indicated. The revised pages are identified by amendment number and contain marginal lines indicating the area of change.

Remove	Insert
3/4 9-16	3/4 9-16
3/4 9-17	3/4 9-17
3/4 9-18	3/4 9-18
5-10	5-10
5-11	5-11
-	5-12
-	5-13
-	5-14
-	5-15
-	5-16
-	5-17
-	5-18

(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) Maximum Power Level

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) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 142*, 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) License Transfer to FPL Energy Seabrook, LLC**

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".

3/4.9.13 SPENT FUEL ASSEMBLY STORAGE

LIMITING CONDITION FOR OPERATION

3.9.13 Fuel assemblies stored in the Spent Fuel Pool shall be placed in the spent fuel storage racks according to the criteria shown in Specification 5.6.1.3.

APPLICABILITY: Whenever fuel is in the Spent Fuel Pool.

ACTION:

a. With the requirements of the above specification not satisfied, suspend all other fuel movement within the Spent Fuel Pool and immediately move the non-complying fuel assemblies to allowable locations in the Spent Fuel Pool in accordance with Specification 5.6.1.3.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.13.1 Prior to fuel assembly movement into or within the Spent Fuel Pool, verify by administrative means that the requirements of Specification 5.6.1.3 are satisfied.

3/4.9.14 NEW FUEL ASSEMBLY STORAGE

LIMITING CONDITION FOR OPERATION

3.9.14 The New Fuel Storage Vault may be maintained with a full loading of 90 assemblies with fuel enrichment up to 3.675 w/o ^{235}U. The loading must be reduced to 81 assemblies for enrichments from 3.675 to 5.0 w/o ^{235}U by limiting the fuel assembly placement in the central column of the New Fuel Storage Vault to every other location.

APPLICABILITY: Whenever fuel is in the New Fuel Storage Vault.

ACTION:

a. With the requirements of the above specification not satisfied, suspend all other fuel movement within the New Fuel Storage Vault and move the non-complying fuel assemblies to allowable locations in the New Fuel Storage Vault in accordance with the requirements of the above specification.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.14.1 After fuel assembly(ies) movement into or within the New Fuel Storage Vault, the position of the new fuel assembly(ies) that was (were) moved shall be checked and independently verified to be in accordance with the requirements of the above specification.

3/4.9.15 SPENT FUEL POOL BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.15 The boron concentration in the Spent Fuel Pool shall be greater than or equal to 2000 ppm.

APPLICABILITY: Whenever fuel is in the Spent Fuel Pool

ACTION:

a. With boron concentration in the Spent Fuel Pool less than 2000 ppm, immediately suspend movement of fuel in the Spent Fuel Pool and immediately initiate action to restore boron concentration to 2000 ppm or greater.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.15.1 The boron concentration of the Spent Fuel Pool shall be verified to be 2000 ppm or greater at least once per 7 days.

5.6 FUEL STORAGE

CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. A k_{eff} less than 1.0 when flooded with unborated water, which includes an allowance for biases and uncertainties as described in UFSAR Chapter 9.

b. A k_{eff} less than or equal to 0.95 when flooded with water borated to 500 ppm, which includes an allowance for biases and uncertainties as described in UFSAR Chapter 9.

c. A nominal 10.35 inch center-to-center distance between fuel assemblies placed in the storage racks.

5.6.1.2 The new fuel storage racks are designed and shall be maintained with:

a. A k_{eff} equivalent to less than or equal to 0.95 when flooded with unborated water, which includes margin for uncertainty in calculational methods and mechanical tolerances with a 95% probability at a 95% confidence level.

b. A k_{eff} equivalent to less than or equal to 0.98 when aqueous foam moderation is assumed, which includes margin for uncertainty in calculational methods and mechanical tolerances with a 95% probability at a 95% confidence level.

c. A nominal 21 inch center-to-center distance between fuel assemblies placed in the storage racks.

5.6.1.3 Fresh or irradiated fuel assemblies shall be stored in the spent fuel pool in compliance with the following:

a. Any 2x2 array of Region 1 storage cells containing fuel shall comply with the storage pattern in Figure 5.6-1 and the requirements of Table 5.6-1. The reactivity ranks of fuel assemblies in the 2x2 array (rank determined using Table 5.6-1) shall be equal to or less than defined for the 2x2 array.

b. Any 2x2 array of Region 2 storage cells containing fuel shall comply with the storage requirements defined in Figure 5.6-2 and the requirements of Table 5.6-1 or with the allowable exception of evaluated assemblies stored on the periphery of Region 2 as defined in 5.6.1.3.c. The evaluated assemblies are listed in Table 5.6-2.

FUEL STORAGE

CRITICALITY

5.6.1.3 (Continued)

c. 2x2 arrays fully within the first two rows closest to the West Wall composed only of fuel assemblies documented in Table 5.6-2 or empty locations are allowed without having to meet the storage requirements defined in Figure 5.6-2 and the requirements of Table 5.6-1.

d. In addition to meeting the requirements defined in 5.6.1.3.a, fuel assemblies placed in Region 1 in the row adjacent to Region 2 shall continue the Region 2 patterns as defined in Figure 5.6-2 and shall meet the associated Region 2 reactivity class requirements.

e. Any fuel assembly (with or without an RCCA) may be replaced by an empty water cell, non-fuel hardware or a fuel rod storage basket.

TABLE 5.6-1

BURNUP REQUIREMENTS FOR EACH REACTIVITY CLASS

Bounding Polynomial Fits for Minimum Burnup Requirements
See Notes 1, 2 and 3 for use of Table 5.6-1

Reactivity Class (1)	Cooling Time	Coefficient A(2)			Coefficient B		
RC 1(3)	N/A	N/A			N/A		
RC 2	N/A	-23.9486			7.4857		

Reactivity Class	Cooling Time	Coefficient C
RC 1(3)	N/A	N/A
RC 2	N/A	0.0000

Reactivity Class	Cooling Time	Enrichment <3.6 w/o Coefficients			Enrichment ≥ 3.6 w/o Coefficients		
		A	B	C	A	B	C
RC 3	0 years	-46.4893	24.2342	-1.4689	-46.9639	23.9883	-1.4535
	2.5 years	-45.3671	23.6083	-1.4430	-44.6422	22.7925	-1.3592
	5 years	-43.3626	22.3467	-1.2912	-42.8691	21.5892	-1.2031
	10 years	-41.2729	21.3176	-1.2238	-40.4786	20.4229	-1.1214
	15 years	-37.5450	19.2208	-0.9792	-36.5543	18.2164	-0.8607
	20 years	-37.1511	19.1067	-0.9965	-35.8945	17.9317	-0.8518
RC 4	0 years	-39.4986	24.8329	-1.4714	-35.5129	22.5425	-1.2508
	2.5 years	-42.0614	26.2021	-1.7536	-31.0986	20.3032	-1.0635
	5 years	-43.5036	26.7220	-1.8423	-28.4171	18.8863	-0.9270
	10 years	-40.2450	24.8908	-1.6792	-32.5900	20.6289	-1.1778
	15 years	-39.4193	24.3389	-1.6482	-35.7271	22.0541	-1.3825
	20 years	-38.0193	23.4289	-1.5482	-33.6429	20.7970	-1.2397
RC 5	0 years	-18.6729	17.1776	-0.3238	15.4943	0.4484	1.5317
	2.5 years	-22.0079	18.6718	-0.6196	27.0014	-5.0979	2.0587
	5 years	-24.5664	19.9913	-0.8744	20.9571	-2.1108	1.6159
	10 years	-25.9493	20.7089	-1.0982	-0.9900	8.4067	0.2667
	15 years	-26.8021	21.1165	-1.2220	-13.6314	14.4202	-0.5032
	20 years	-26.3500	20.8067	-1.2333	-20.7757	17.7162	-0.9238

TABLE 5.6-1 (Continued)

BURNUP REQUIREMENTS FOR EACH REACTIVITY CLASS
Bounding Polynomial Fits for Minimum Burnup Requirements
See Notes 1, 2 and 3 for use of Table 5.6-1

Notes

1. Reactivity Classes are presented from High to Low, i.e., RC 1 is most reactive fuel, RC 5 is least reactive fuel.

2. The specific minimum burnup (Bu) required for each fuel assembly for Reactivity Classes 2-5 is calculated from the following equation:

   $$Bu = A + B \times En + C \times En^2$$

   where the coefficients A, B and C are defined above for each Reactivity Class and cooling time (if applicable) and En is defined as the nominal initial central zone enrichment. Actual cooling time is rounded down to the nearest value, e.g., an assembly with an actual cooling time of 12 years would utilize the 10 year coefficients. No uncertainties should be applied when determining the minimum burnup requirement; all appropriate uncertainties have been included during the coefficient generation.

3. Fresh or irradiated fuel with an initial enrichment of $\leq$ 5.0 w/o U-235.

TABLE 5.6-2

EVALUATED ASSEMBLIES ON PERIPHERY OF REGION 2

C01	C17	C33	C49
C02	C18	C34	C50
C03	C19	C36	C51
C04	C20	C37	C52
C05	C21	C38	C53
C06	C22	C39	C55
C07	C23	C40	C56
C09	C24	C41	C57
C10	C26	C42	C58
C11	C27	C43	C59
C12	C28	C44	C60
C13	C29	C45	C61
C14	C30	C46	C62
C15	C31	C47	C63
C16	C32	C48	C64

ALLOWABLE STORAGE PATTERN REGION 1
(See Notes 1 and 2)

Pattern "A"
See Definition 1

RC 1	RC 2
RC 2	RC 1

DEFINITIONS:

1. Allowable pattern is fuel assemblies that meet Reactivity Class (RC) 1, 2, 3, 4, or 5 checkerboarded with fuel assemblies that meet RC 2, 3, 4, or 5. Requirements for all RC are defined in Table 5.6-1. Diagram is for illustration only.

NOTES

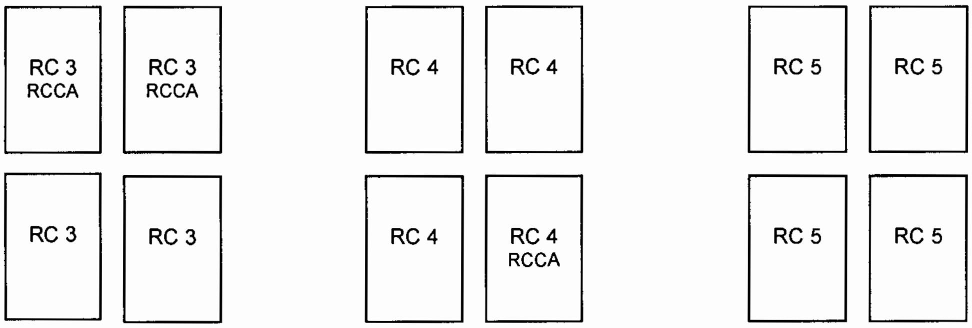
1. There are no interface limitations within Region 1 between rack modules or within racks. Each cell is a part of up to four 2x2 arrays, and each cell must simultaneously meet the requirements of all those arrays of which it is a part.

2. Replacement of any fuel assembly by an empty water hole, non-fuel hardware or fuel rod storage basket is acceptable.

FIGURE 5.6-1

ALLOWABLE STORAGE PATTERNS REGION 2 (See Notes 1, 2)

Pattern "B" Pattern "C" Pattern "D"



See Definition 1 See Definition 2 See Definition 3

DEFINITIONS

1. Allowable pattern is fuel assemblies that meet Reactivity Class (RC) 3, 4, or 5 in each of the 2x2 array locations combined with two RCCAs placed in any two locations within the 2x2 array. Requirements for all RC are defined in Table 5.6-1. 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. Diagram is for illustration only.

2. Allowable pattern is fuel assemblies that meet Reactivity Class (RC) 4 or 5 in each of the 2x2 array locations with one RCCA placed anywhere in the 2x2 array. Requirements for all RC are defined in Table 5.6-1. 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. Diagram is for illustration only.

3. Allowable pattern is Reactivity Class (RC) 5 in each of the 2x2 array locations. Minimum burnup for RC 5 is defined in Table 5.6-1 as a function of nominal initial central zone enrichment and cooling time. Replacement of any fuel assembly by an empty water hole, non-fuel hardware or fuel rod storage basket is acceptable. Diagram is for illustration only.

NOTES

1. The storage arrangements of fuel within a rack module may contain more than one pattern. There are no interface limitations within Region 2 between rack modules or within racks. Each cell is a part of up to four 2x2 arrays, and each cell must simultaneously meet the requirements of all those arrays of which it is a part.

2. All permanent and transient configurations for fuel placed within Region 2 must meet the requirements of Figure 5.6-2 and Table 5.6-1.

FIGURE 5.6-2

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 14 feet 6 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1236 fuel assemblies.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

TABLE 5.7-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	200 heatup cycles at ≤ 100°F/h and 200 cooldown cycles at ≤ 100°F/h	Heatup cycle - T_{avg} from ≤ 200°F to ≥ 550°F. Cooldown cycle - T_{avg} from ≥ 550°F to ≤ 200°F.
	200 pressurizer cooldown cycles at ≤ 200°F/h.	Pressurizer cooldown cycle temperatures from ≥ 650°F to ≤ 200°F.
	80 loss of load cycles, without immediate Reactor trip.	≥ 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss-of-offsite A.C. electrical power.	Loss-of-offsite A.C. electrical ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 Reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	10 auxiliary spray actuation cycles.	Spray water temperature differential > 320°F.
	200 leak tests.	Pressurized to ≥ 2250 psig.
	10 hydrostatic pressure tests.	Pressurized to ≥ 3106 psig.
Secondary Coolant System	1 steam line break.	Break in a > 6-inch steam line.
	10 hydrostatic pressure tests.	Pressurized to ≥ 1481 psig.

UNITED STATES
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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 142

TO FACILITY OPERATING LICENSE NO. NPF-86

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

Proprietary information pursuant to
Title 10 of the *Code of Federal Regulations* (10 CFR), Section 2.390
has been redacted from this document.
Redacted information is identified by blank space enclosed within double brackets
as shown here [[ ]].

Enclosure 2

1.0 INTRODUCTION

By application 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), September 20, 2012 (ADAMS Accession No. ML12271A276), March 27, 2013 (ADAMS Accession No. ML13099A022), December 20, 2013 (ADAMS Accession No. ML13360A045), and January 29, 2014 (ADAMS Accession No. ML14035A218), NextEra Energy Seabrook, LLC (NextEra or the licensee) requested changes to the technical specifications (TSs) for Seabrook Station, Unit 1 (Seabrook).

The original application proposed revisions to the TSs for new and spent fuel storage as a result of the new criticality analyses for the new fuel vault (NFV) and spent fuel pool (SFP). By letter dated December 20, 2013, (ADAMS Accession No. ML13360A045), NextEra requested that the SFP and NFV be separated into two separate license amendment requests. This amendment revises the TSs related to spent fuel storage as a result of new criticality analyses for the SFP. The license amendment request for the NFV will be processed under TAC No. MF3283

The supplements dated May 10, 2012, September 20, 2012, March 27, 2013, December 20, 2013, and January 29, 2014, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on August 14, 2012 (77 FR 485859).

HOLTEC report HI-2114996 presents the nuclear criticality safety (NCS) analysis for the requested Seabrook NFV and SFP changes. Revision 3 of HI-2114996 was provided as an attachment to the letter dated March 27, 2013. The report describes the methodology and analytical models used in the NCS analysis to show that the maximum k-effective (k_{eff}) for fuel stored in the NFV and SFP will meet the appropriate limits specified in Section 50.68 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.68). The following evaluation presents the results of the U.S. Nuclear Regulatory Commission's (NRC) staff review of the NCS analysis, as supplemented by the licensee.

2.0 BACKGROUND

The Seabrook SFP contains 12 spent fuel storage rack (SFSR) modules of two similar designs that vary primarily in type of neutron absorbing poison panel used. According to the current Seabrook TS 5.6.3, "Capacity," the spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1236 fuel assemblies. All SFSR modules are flux-trap style racks in which fuel is stored on a nominal 10.35" center-to-center spacing. There is a nominal 1.05" gap between each storage cell location within a rack module. The six Region 1 modules utilize BORAL™ panels having a minimum boron (^{10}B) areal density of 0.015 grams per centimeter squared (g/cm^2). Some BORAL™ blistering has been observed at Seabrook and is accounted for in the Region 1 criticality analysis. Region 2 includes six rack modules that utilized Boraflex as a neutron absorber. Boraflex degradation is described generically in the

letter dated January 30, 2012. As a result of the Boraflex degradation issue, the new criticality analysis takes no credit for ^{10}B in the Region 2 SFSRs. The criticality analysis and proposed TS also introduce credit for soluble boron under normal and abnormal conditions.

3.0 REGULATORY EVALUATION

The regulations in 10 CFR Part 50, Appendix A, Criterion 62 require, in part, that, "Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

Paragraph 50.68(b)(1) of 10 CFR requires, "Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water."

Paragraph 50.68(b)(2) of 10 CFR requires, "The estimated ratio of neutron production to neutron absorption and leakage (k-effective) of the fresh fuel in the fresh fuel storage racks shall be calculated assuming the racks are loaded with fuel of the maximum fuel assembly reactivity and flooded with unborated water and must not exceed 0.95, at a 95-percent probability, 95-percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such flooding or if fresh fuel storage racks are not used."

Paragraph 50.68(b)(3) of 10 CFR requires, "If optimum moderation of fresh fuel in the fresh fuel storage racks occurs when the racks are assumed to be loaded with fuel of the maximum fuel assembly reactivity and filled with low-density hydrogenous fluid, the k-effective corresponding to this optimum moderation must not exceed 0.98, at a 95-percent probability, 95-percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such moderation or if fresh fuel storage racks are not used."

Paragraph 50.68(b)(4) of 10 CFR requires, "If no credit for soluble boron is taken, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95-percent probability, 95-percent confidence level, if flooded with unborated water. If credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95-percent probability, 95-percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95-percent probability, 95-percent confidence level, if flooded with unborated water."

Paragraph 50.36(c) (4) of 10 CFR requires, "Design features. Design features to be included are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (c) (1), (2), and (3) of this section."

The Seabrook SFP NCS analysis does take credit for soluble boron for normal operating conditions and abnormal conditions. Therefore, the regulatory requirements are: (1) that the k_{eff} of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity and flooded with borated water must not exceed 0.95, at a 95-percent probability, 95-percent confidence level; and (2) that the k_{eff} of the spent fuel storage racks loaded with fuel of the

maximum fuel assembly reactivity and flooded with unborated water must be less than 1.0, at a 95-percent probability, 95-percent confidence level.

4.0 TECHNICAL EVALUATION

4.1 Proposed Change

There are several proposed TS changes, originally provided by Attachment 1 to the letter dated January 20, 2012, and modified by Attachment 1 to the letter dated December 20, 2013, that either impact the NCS analysis or implement changes in fuel storage requirements. These changes are related to revised criticality control requirements in the SFP SFSRs, incorporating the effects of BORAL™ blistering in the Region 1 analysis, eliminating of credit for Boraflex in the Region 2 analysis, and taking credit for the presence of soluble boron in the SFP.

The TS changes associated with the storage of fresh and spent fuel in the SFP are related to crediting soluble boron and revised storage arrangement requirements, including modified burnup credit acceptance criteria, required use of rod control cluster assemblies (RCCAs) for some configurations, and division of the SFSRs in the SFP into Regions 1 and 2.

The revised TS Section 3/4.9.13 removes the references to Figure 3.9-1 and instead directs the reader to Section 5.6.1.3 for storage requirements. Surveillance Requirements (SRs) 4.9.13.1 and 4.9.13.2, which addressed determination of fuel assembly burnup, fuel assembly burnup records maintenance, and post-movement checks and verifications, are replaced with a single SR criteria requiring that compliance with TS 5.6.1.3 be checked prior to fuel movement into or within the SFP.

Section 3/4.9.15, "SPENT FUEL POOL BORON CONCENTRATION," is added, requiring that the SFP soluble boron concentration be no less than 2000 ppm of boron.

The TSs 5.6.1.1 in the existing CRITICALITY subsection in TS 5.6, "FUEL STORAGE," are replaced with new TSs 5.6.1.1, 5.6.1.2, and 5.6.1.3.

New TS 5.6.1.1 provides the center-to-center cell spacing within the SFSR modules, describes the analysis requirements applicable to fuel stored in the SFP, and implements soluble boron credit, including a requirement that k_{eff} be no greater than 0.95 if the soluble boron concentration drops to 500 ppm.

New TS 5.6.1.3, Tables 5.6-1 and 5.6-2, and Figures 5.6-1 and 5.6-2 provide the detailed requirements for storage of fuel in the Seabrook SFP.

4.2 Method of Review

The review was performed consistent with Section 9.1.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [light-water reactor] Edition."

The NRC staff issued an internal memorandum on August 19, 1998 (ADAMS Accession No. ML003728001), containing guidance for performing the review of SFP/CP NCS analysis. This

memorandum is known colloquially as the "Kopp memo," after the author. While the Kopp memo does not specify a methodology, it does provide some guidance on the more salient aspects of an NCS analysis, including computer code validation. The guidance is germane to boiling-water reactors (BWRs) and pressurized-water reactors (PWRs), borated and unborated. The Kopp memo has been used for virtually every light-water reactor SFP NCS analysis since, including this Seabrook analysis.

This safety evaluation also considered guidance provided in Division of Safety System Interim Staff Guidance DSS-ISG-2010-01, "Staff Guidance Regarding the Nuclear Criticality Safety Analysis for Spent Fuel Pools," dated October 13, 2011 (ADAMS Accession No. ML110620086).

4.3 SFP NCS Analysis Review

4.3.1 SFP NCS Analysis Method

There is no generic or standard methodology for performing NCS analyses for fuel storage and handling. The methods used for the NCS analysis for fuel in the Seabrook SFP are described in HI-2114996, Revision 3 of the letter dated March 27, 2013. Additional information describing the methods and data used is provided in the request for additional information (RAI) responses via letters dated May 10, 2012, September 20, 2012, March 27, 2013, and January 29, 2014. Some SFP analysis deficiencies were identified during the review, but as will be discussed below, sufficient margin is built into the analysis methodology to offset the deficiencies. Consequently, the methodology is specific to this analysis and, without further revision, is not appropriate for other applications.

The criticality analysis considers the decrease in fuel reactivity typically seen in PWRs as the fuel is depleted during reactor operations. This method is frequently used in PWR criticality analyses and is sometimes referred to as burnup credit (BUC). In this method, the changes in fuel composition with burnup are conservatively calculated using a two-dimensional (2D) lattice depletion code. The fresh or burned fuel compositions are then used in a three-dimensional (3D) Monte Carlo (MC) method computer code to calculate the model k_{eff} values. Since the burned fuel composition calculations are performed in 2D, it is necessary to impose a conservative axial burnup profile on the 3D models used to calculate k_{eff}. Use of conservative axial burnup profiles ensures that the models cover the variation in actual axial burnup distributions seen in the past and expected in the future.

The burned fuel composition calculations were performed using CASMO-4 (M. Edenius, K. Ekberg, B.H. Forrsen, and D. Knott, "CASMO-4 A Fuel Assembly Burnup Program User's Manual," Studsvik/SIA-95/1, Studsvik of America, Inc. and Studsvik Core Analysis AB - proprietary) using its 70-group-cross-section library. The MCNP5, Version 1.51 computer code (MCNP – A General Monte Carlo N-Particle Transport Code, Version 5, Los Alamos National Laboratory, LA-UR-03-1987, April 24, 2003 – Revised February 1, 2008) is used with its ENDF/B-V and VI nuclear data, [[

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These computer codes and their associated nuclear data sets have been used in many NCS analyses, are industry standards, and are considered acceptable.

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Since the NCS analysis credits fuel burnup, it is necessary to consider validation of the computer codes and data used to calculate burned fuel compositions and the computer code and data that utilize the burned fuel compositions to calculate k_{eff} for systems with burned fuel.

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Recent work published in NUREG/CR-7109, "An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses—Criticality (k_{eff}) Predictions," indicates that an uncertainty of about 3 percent of the minor actinide and fission product worth should be sufficient to conservatively bound biases that may be associated with minor actinides and fission products. Uncertainties associated with lumped fission products and RCCAs appear to be conservative. Therefore, the NRC staff believes the uncertainties adopted adequately cover the MCNP5 validation deficiencies with regard to items above.

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With the additional uncertainties and bias applied to the validation as described above, the NRC staff finds the NCS Analysis Method acceptable.

4.3.2 SFP Storage Racks

4.3.2.1 SFP Water Temperature

NRC guidance provided in the Kopp memorandum states the NCS analysis should be performed at the temperature corresponding to the highest reactivity. [[

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The NRC staff identified two issues with the SFP water temperature modeling. [[

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4.3.2.2 SFP/CP Storage Rack Models

The Seabrook SFP contains 12 rack modules of varying sizes for a total fuel assembly storage capacity of 1236 fuel assemblies. The 12 rack modules are of similar neutron flux-trap design in which fuel is stored on a nominal 10.35" center-to-center spacing. The six rack modules in Region 2 were built using Boraflex neutron absorber panels. As a result of potential Boraflex degradation, the ^{10}B in the Boraflex is not credited in this analysis. The six Region 1 rack modules were built using BORAL™ neutron absorber panels. [[

]] Considering the generally local nature of BORAL™ panel blistering to date, this approach is adequately conservative.

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]] This is true across rack module boundaries and across region boundaries. This means that the first row of assemblies in Region 1 at the Region 1/Region 2 interface must meet the more restrictive Region 2 requirements even though the Region 1 row has BORAL™ poison panels and no poison panels are credited in Region 2.

Region 1 uses a checkerboard arrangement of fresh (or burned) fuel and burned fuel that meets the Pattern A BUC loading curve. There is no credit for cooling time in Region 1.

Region 2 uses Patterns B, C and/or D. Pattern B requires two RCCAs and that fuel meet the Pattern B BUC loading curve. Pattern C requires 1 RCCA and that fuel meet the Pattern C BUC loading curve. Pattern D requires only that fuel meet the Pattern D BUC loading curve.

TS 5.6.1.3.a includes the following sentence:

> The reactivity ranks of fuel assemblies in the 2x2 array (rank determined using Table 5.6.1) shall be equal or less that defined for the 2x2 array.

The "reactivity rank" is determined using the "reactivity class" as defined in Table 5.6-1.

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The last row of assemblies next to the west wall of the SFP (see Figure 4.5.5 of HI-2114996) is the exception. The first two rows must be loaded with any of the assemblies listed in TS Table 5-6.2. The first row does not have to meet the Pattern B, C, or D requirements. The second row does have to meet the Pattern B, C and/or D requirements since it would interface with the third row. Some of the assemblies in TS Table 5-6.2 have assembly burnups lower than the Pattern D requirements and thus, if they are not in the first row, cannot be in or next to a Pattern D 2x2 array. In the response for RAIs 17 and 29 provided in the letter dated March 27, 2013, additional analysis was performed and documented to demonstrate that it was still conservative if Patterns B and/or C were adjacent to the first row.

4.3.2.3 SFP Storage Rack Models Manufacturing Tolerances and Uncertainties

The incorporation of storage rack model uncertainties and tolerances into the criticality analysis was performed using the dominant uncertainties. This approach was justified by performing additional detailed uncertainty analysis of some cases.

Region 1 and 2 racks are the same design, with no credit taken for Boraflex in the Region 2 racks. Nominal values were used for rack wall thicknesses and center-to-center spacing. Sensitivity studies were performed to quantify the impact of manufacturing tolerances and uncertainties on the SFP k_{eff}.

During the review, it was noted that some uncertainties were being deemed statistically insignificant and discarded. The basis for this determination was whether or not the calculated sensitivity was greater than the combined Monte Carlo uncertainty associated with the two calculations used to estimate the sensitivity. This approach was based on an unstated assumption that there is no uncertainty unless it is large enough to be statistically significant. Use of this assumption is inappropriate in criticality analysis. If the Monte Carlo uncertainties are large enough, many uncertainties could simply be discarded. The goal of the uncertainty analysis should be to yield accurate or conservative estimates for the uncertainties. When Monte Carlo calculations are used, the uncertainty should be calculated as the Δk plus two times the combined standard deviations from the Monte Carlo calculations. The RAI 23 response provided in the letter dated March 27, 2013, indicates that all uncertainties were reevaluated using the approach that yields conservative estimates for the uncertainties.

Some modeling variations were inappropriately handled as uncertainties. For the fuel storage racks, this included eccentric fuel placement (RAI 10). In response to RAI 10 in the letter dated March 27, 2013, the analysis was modified to use the sensitivity of k_{eff} to worst case eccentric placement as bias and bias uncertainty terms. This treatment is appropriate.

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]] However, if more severe BORAL™ panel blistering or other degradation (i.e., gap formation, BORAL™ relocation, or neutron absorber dissolution) is observed, it will be necessary to review the criticality analysis for potential impacts to ensure compliance with TS 5.61.3.

The NRC staff reviewed the licensee's treatment of the SFP storage racks and identified several areas requiring additional information. The licensee was able to either provide sufficient information to support their approach or modify the analysis, where appropriate, to address the NRC staff's concern. Therefore, the NRC staff finds the licensee's treatment of the SFP storage racks to be acceptable.

4.3.3 Fuel Assembly

4.3.3.1 Bounding Fuel Assembly Design

New fuel assemblies currently used at Seabrook are the Westinghouse 17x17 removable fuel assembly design. Other designs used at Seabrook in the past have included Westinghouse Standard and Vantage 5H designs. These PWR assemblies are 17x17 lattices with 24 guide tubes and one central instrumentation tube. Sensitivity studies were performed that identified the Westinghouse Vantage 5H design as the bounding fuel assembly design.

The review tentatively identified two classes of outlier fuel assemblies were potentially in the Seabrook SFP, but outside the determination of the bounding fuel assembly design. The first issue is that a review of the RW-859 (2002) data for Seabrook revealed four assemblies with total uranium loadings that were significantly below (433 kg U versus ~460 kg U) the rest of the inventory. The RAI 14 response provided in the letter dated March 27, 2013, indicates that the applicant reviewed the records for the specifically identified fuel assemblies and indicates that the values listed in the RW-859 (2002) data are incorrect and that these four assemblies have uranium loadings similar to the rest of the inventory. Since the licensee has affirmed that the data in RW-859 (2002) is in error, the NRC staff considers the disposition of this issue closed.

The second class of non-standard fuel is fuel that has been reconstituted. The RAI 22 response provided in the letter dated March 27, 2013, identified assembly IDs G64, G63, G69, and G70 as having undergone fuel assembly reconstitution. Analysis of these four reconstituted bundles is provided in the RAI response. The analysis adequately indicated that these four reconstituted fuel assemblies are bounded by the analysis. The NRC staff considers the disposition of this issue to be closed.

4.3.3.2 Fuel Assembly Manufacturing Tolerances and Uncertainties

The incorporation of fuel assembly model uncertainties and tolerances into the criticality analysis was performed using the dominant uncertainties. The conservative nature of this approach was checked by performing additional detailed uncertainty analysis of some cases.

Uncertainties evaluated included enrichment, pellet density, pellet outside diameter (OD), clad inside diameter (ID) and OD, and fuel rod pitch.

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]] The response adequately addressed NRC staff concerns.

4.3.3.3 Spent Fuel Characterization

Burned fuel compositions were calculated using the CASMO-4 computer code. The reactor input parameters used for the depletion included soluble boron concentration, moderator density, fuel temperature and power density. Sensitivity studies were performed to establish that values used are conservative. [[

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]] This potential non-conservatism will be addressed below in the subsection on analysis of margins.

4.3.3.4 Burnup Uncertainty

In the Kopp memo, the NRC staff provided its method for evaluating burnup uncertainty:

> A reactivity uncertainty due to uncertainty in the fuel depletion calculations should be developed and combined with other calculational uncertainties. In the absence of any other determination of the depletion uncertainty, an uncertainty equal to 5 percent of the reactivity decrement to the burnup of interest is an acceptable assumption.

The licensee used this approach in HI-2114996 to address the uncertainty in the burned fuel compositions.

4.3.3.5 Axial Apportionment of the Burnup or Axial Burnup Profile

A key aspect of modern PWR burnup credit analysis is that the analysis must conservatively model the axial burnup distribution. As the fuel is depleted in the reactor, it accumulates burnup more slowly on the ends of the fuel. At some burnup and in spite of axial neutron leakage, the lower burnup fuel at the top of the assembly becomes the most reactive part of the fuel assembly in fuel storage and handling configurations. This is sometimes referred to as the "end effect" and is discussed more fully in NUREG/CR-6801, "Recommendations for Addressing Axial Burnup in PWR Burnup Credit Analyses."

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The RAI 21.c response in the letter dated March 27, 2013, states that the reactor reload analysis includes a requirement to confirm that the key fuel criticality analysis parameters are met. Thus, reload process will ensure that future axial burnup profiles are bounded by the profiles used in the criticality analysis.

4.3.3.6 Burnup History/Core Operating Parameters

The reactivity of LWR fuel varies with the conditions the fuel experiences in the reactor. Since residual integral neutron absorbers are not being credited in the analysis, factors that lead to a less thermal neutron energy distribution increase plutonium generation. This increases fuel reactivity with burnup compared to nominal or average conditions and results in higher in-rack k_{eff} values.

The Seabrook SFP analysis used conservative bounding parameters for soluble boron concentration, moderator density, and fuel temperature. Sensitivity studies were performed to establish which direction is conservative. The sensitivity studies showed that fuel reactivity was insensitive to power density. As was noted in Section 4.3.3.5, the licensee verifies that fuel used in future cycles will be bounded by the key parameters used in the criticality analysis.

4.3.3.7 Integral and Removable Burnable Absorbers

Integral fuel burnable absorbers (IFBA) are used at Seabrook along with removable burnable absorbers. The analysis derived bias and bias uncertainty terms to include the neutron spectrum hardening effects of these neutron absorbers on the fuel compositions, but discarded any residual IFBA prior to use in SFSR k_{eff} calculations.

During the review, it was noted that some of the trends in bias and bias uncertainty results appeared to be inconsistent. Some of the results indicated significantly lower sensitivity of fuel reactivity to the presence of IFBAs or removable absorbers than other results. Responses to RAI 12 and 13 provided in the letter dated March 27, 2013, indicate that the calculations were reviewed and are correct. The NRC agreed that the calculations were correct.

4.3.3.8 RCCAs

Two of the three Region 2 patterns require that one or two RCCAs be installed in each 2x2 array. Table 4.5.9 of HI-2114996 states that the RCCA tolerances are assumed values. Considering the importance of the RCCAs to reactivity control in the SFP, an RAI requested actual, rather than assumed data. The RAI 24 response provided in the letter dated March 27, 2013, states that the tolerances that were listed as assumed were actually larger than the real tolerances for all dimensions and materials and thus conservative.

Additionally, Attachment 7 to the letter dated March 27, 2013, included information describing the relative axial positions of the active fuel length and the RCCA active absorber section. This information was used to confirm that the axial model used for an RCCA inserted into an assembly in the SFSRs was conservative.

Since it appears that there will be extensive use of RCCAs in Region 2, an RAI was generated requesting confirmation that the presence of RCCAs in Patterns B and C was consistent with the SFP seismic analysis. [[

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All issues related to use of intact RCCAs in the SFP have been resolved.

The NRC staff reviewed the licensee's determination of the bounding fuel assembly, characterization of the spent nuclear fuel, and treatment of the manufacturing tolerances of the fuel and RCCAs credited in the analysis. The methods the licensee use were consistent with current guidance and where the NRC staff identified a need for additional information, the licensee was able to either provide sufficient information to support their approach or modify the analysis where appropriate to address the NRC staff's concern. Therefore, the NRC staff finds the licensee's determination and treatment of the fuel assemblies to be acceptable.

4.3.4 Analysis of "Other" Normal Conditions

In addition to normal static storage conditions that are clearly covered by the criticality analysis, Section 4.6.11.3.5 of the criticality analysis claimed to provide coverage for several operations that should be treated as "normal conditions," meeting the requirements of 10 CFR 50.68. These operations include the following:

- Movement of fuel into and out of fuel storage racks
- Movement of a single fuel assembly in the pool
- Fuel assembly in the fresh fuel elevator during inspection

- Fuel assemblies raised on pedestals
- Minor damage to cells
- Ultrasonic testing (UT) of fuel assembly to determine leaking rods
- Reconstitution of fuel assembly
- Fuel rod inspection (eddy current testing (ECT), visuals, etc.)
- Storage of damaged fuel rods, fuel rod inserted in FRSB
- Fuel assembly inspection
- UT fuel assembly cleaning
- Bottom nozzle inspections
- Fuel assembly debris removal
- Top Nozzle Separation visual inspection

Initially, the criticality analysis provided little or no description of these operations, did not provide the logic supporting the subcriticality of these operations with zero ppm of soluble boron in the pool, and did not address potential abnormal conditions that may be associated with the operations. Consequently, an RAI was generated requesting information about and analysis of these conditions.

The RAI 22 responses provided in the letter dated March 27, 2013, provided adequate descriptions of and analyses for many of the operations listed. The response stated conditions employed when reconstituting fuel.

- The analysis for fuel assemblies raised on pedestals notes that administrative controls would be applied to ensure that two fuel assemblies cannot come into close approach during normal operations. The RAI response includes the following text:

  > To cover the future potential use of pedestals, the following conditions will be employed for raised pedestal use: maximum of 2 pedestals during any fuel reconstitution evolution with at least two cells between each pedestal, which creates an infinite separation of the sections of fuel outside of the poisoned area of the rack. In addition, procedures will be revised to make sure fuel assemblies do not pass within two cells during coincident fuel movement operations and the second pedestal should be utilized for the FRSB.

  The NRC staff finds this acceptable.

- The RAI responses provide analysis that justifies the reconstitution work that has been done. It does not present a broader criticality analysis that could be used to cover the general topic of fuel reconstitution. The RAI response includes the following text:

  > If this activity were to be performed in the SFP storage rack area, any fuel stored between the donor assembly and FRSB would be relocated to provide similar [foreign material exclusion] FME protection. Where possible, additional assemblies around the donor assembly and FRSB would be moved to improve visibility and FME controls.

The NRC staff finds this acceptable.

The criticality analysis coverage of other operations is not related to the current or proposed TSs. Criticality analysis for operations other than static storage is required by 10 CFR 50.68(b)(1). Controls and limits for other operations should be derived from a clear and thorough criticality analysis demonstrating compliance with 10 CFR 50.68. Identification and effective implementation of controls and limits is part of the foundation of criticality safety. With the controls proposed by the licensee in the RAI responses described above, the NRC staff finds the "other" operations acceptable.

4.3.5 Analysis of Abnormal Conditions

The analysis of abnormal conditions is documented in Sections 4.2.5 and 4.6.12 of HI-2114996 and in the RAI 27 response provided in the letter dated March 27, 2013.

During the review, it was noted that [[

]] RAI 27a requested a justification for the assumption. [[

]] This response adequately addressed the concerns.

RAI 27b requested justification for not including any accident or abnormal conditions associated with Region 1 BORAL™ panel degradation. The RAI provided examples of potential abnormal and accident conditions that included underestimation of blistering, relocation of BORAL™ neutron absorbing material, underestimation of reduction of flux trap size due to underestimation of bulging of the steel wrapper. The RAI 27b response was that if blistering exceeding the assumed value occurs, it will be detected through surveillance programs and be addressed before it becomes a problem. With regard to relocation of neutron absorbing material, the RAI response is that there is no expectation or indication that the neutron absorbing material will relocate in the event of a seismic event or due to dissolution or erosion of the neutron absorbing material. The RAI response goes on to say that the "coupon program" will detect changes before it becomes a problem. [[

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The NRC staff review of the BORAL™ panel degradation surveillance program(s) should address the effectiveness of the program to identify underestimation of BORAL™ degradation in the spent fuel storage rack. With the assumption that, if underestimation of BORAL™ degradation occurs or if the material properties change so that neutron absorber relocation is possible, it will be identified by surveillance programs; therefore, evaluation of additional abnormal or accident conditions, related to degraded BORAL™ panels, is not needed.

RAI 27c requested confirmation that the use of RCCAs in Patterns B and C had been considered in the seismic analysis. The RAI response noted that the seismic analysis adequately bounded the use of RCCAs.

RAI 27d requested a more complete evaluation of the impact of an assembly mislocated next to a fuel storage rack. The existing analysis evaluated only an assembly placed tightly against the

fuel storage rack. Prior work has shown that, in some cases, adding water between the mislocated assembly and the fuel storage rack can significantly increase reactivity. The RAI 27d response reported additional results for assembly spacing, confirming the analysis reported in HI-2114996 to be conservative.

RAI 27e requested a more complete analysis of the criticality analysis of fuel in the fuel elevator or of assemblies undergoing fuel cleaning. The RAI 27e response included expanded analysis of accidentally moving an assembly next to assemblies in the fuel elevator and in the up-ender. This analysis demonstrated that the configuration was adequately subcritical if the SFP soluble boron concentration was 1400 ppm.

RAI 27f requested justification for the limit scope of the abnormal condition associated with the use of an incorrect loading curve. The RAI response provided expanded analysis of the accidental use of an incorrect loading curve. The results adequately address the NRC staff concerns.

The highest soluble boron concentration credited in abnormal conditions is 1600 ppm. This is below the proposed TS value of 2000 ppm of boron. A maximum soluble boron concentration of 500 ppm was credited during normal conditions. A boron dilution analysis was provided in the attachments to the letter dated January 30, 2012, that concludes that inadvertent dilution of the SFP to 500 ppm of boron is not credible.

The NRC staff reviewed the licensee's analysis of abnormal conditions. The methods the licensee use were consistent with current guidance and where the NRC staff identified a need for additional information, the licensee was able to either provide sufficient information to support its approach or modify the analysis, where appropriate, to address the NRC staff's concern. Therefore, the NRC staff finds the licensees treatment of abnormal conditions to be acceptable.

4.3.6 Margin Analysis and Comparison with Remaining Uncertainties

This section provides evaluation of additional conservatism in the analysis and evaluation of items that may have been treated nonconservatively.

4.3.6.1 Potential Nonconservatisms

- Credited noble gas and volatile nuclides

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- Elevated Temperature Validation

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4.3.6.2 Potential Analysis Conservatisms

The analysis includes several aspects that add margin to the analysis.

These include the following:

- Burnup credit curves include 0.0100 Δk margin

  [[

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- Conservative axial burnup distributions used

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  ]]

4.3.6.3 Conclusion on Analysis Margins

Considering the potential nonconservatisms identified in Section 4.3.6.1 and the conservatisms identified in Section 4.3.6.2, the NRC staff concluded that the available margins offset the potential nonconservatisms and the licensee's approach is acceptable.

4.4 Technical Conclusion

The NRC staff review of the Seabrook SFP storage racks NCS analysis, documented in HI-2114996, Revision 3, identified some non-conservative items.

For the storage of fuel in the SFP, those items were evaluated against the margin to the regulatory limit and what the NRC considers an appropriate amount of margin attributable to conservatisms documented in the analyses.

Following review of the supporting analysis reports and based on the margins to regulatory limits, crediting some analysis conservatism, and including consideration of the identified potential nonconservatisms, the NRC staff concludes that there is a reasonable assurance that the Seabrook SFP fuel storage racks meet the applicable NCS regulatory requirements.

The NRC staff evaluated offsetting effects in the licensee's analysis in coming to the conclusion that the analysis is acceptable. Any future changes would need to preserve the margin inherent in the approach to avoid being a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.

The NRC staff finds the proposed TS changes acceptable.

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. The Commonwealth of Massachusetts had the following questions:

1. How does the blistering effect the efficiency of the pool?
2. Is this an issue with Seabrook or has the NRC seen this in other plants?

Response to Question 1

Blisters and bulges of BORAL™ cladding are material deformations that change the dimensions of the material. These blisters and bulges can be either water filled or gas filled (from the reaction of the SFP water and aluminum from the BORAL™), which may not be accounted for in the criticality analysis. Therefore, this Seabrook LAR is taking into account the BORAL™ degradation. If blistering exceeding the assumed value occurs, it will be detected through surveillance programs and be addressed before it becomes a problem.

Response to Question 2

Some BORAL™ blistering has been observed at Seabrook and is accounted for in the Region 1 criticality analysis. Some BORAL™ blistering has been observed at other nuclear plants. The NRC issued an Information Notice (IN) 2009-26, "Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool," dated October 28, 2009 (ADAMS Accession No. ML092440545).

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 (77 FR 48559, 8/14/12). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need 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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Kent Wood

Date: September 3, 2014

A copy of our 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. 142 to NPF-86
2. Non-Proprietary Safety Evaluation
3. Proprietary Safety Evaluation

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ADAMS Accession No: Package: ML14217A249 Non-Proprietary SE: ML14184A795
Proprietary SE: ML14217A233
***via memo**

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NAME	JLamb	ABaxter	CJackson	BMizuno	RSchaaf	JLamb
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