



March 24, 2021  
SBK-L-21033  
10 CFR 50.90

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington DC 20555-0001

RE: Seabrook Station  
Docket No. 50-443  
Renewed Facility Operating License No. NPF-86

Response to Request for Additional Information (RAI) Regarding License Amendment Request (LAR) 20-02, Resolve Non-Conservative Heat Flux Hot Channel Factor ( $F_Q(Z)$ ) Requirements

References:

1. License Amendment Request 20-02, Resolve Non-Conservative Heat Flux Hot Channel Factor ( $F_Q(Z)$ ) Requirements, August 17, 2020 (ADAMS Accession No. ML20230A425)
2. NRR Email Capture, Request for Additional Information Regarding Seabrook Heat Flux Hot Channel Requirement Amendment Request (L-2020-LLA-0187), February 23, 2021

In Reference 1, NextEra Energy Seabrook, LLC (NextEra) requested an amendment to Renewed Facility Operating License (RFOL) NPF-86 for Seabrook Nuclear Plant Unit 1 (Seabrook). The proposed license amendment revises the Seabrook Technical Specifications (TS) to resolve non-conservative requirements associated with the nuclear heat flux hot channel factor,  $F_Q(Z)$  [RAOC-W(Z) Methodology], as reported in Westinghouse Nuclear Safety Advisory Letter (NSAL) 09-5, Revision 1, "Relaxed Axial Offset Control  $F_Q$  Technical Specification Actions", dated September 23, 2009, and NSAL 15-1, "Heat Flux Hot Channel Factor Technical Specification Surveillance", dated February 3, 2015.

In Reference 2, the NRC requested additional information determined necessary to complete its review.

The enclosure to this letter provides NextEra's response to the request for additional information (RAI). In addition, and as discussed in the enclosure, NextEra is proposing an additional change to the Seabrook TS. Attachment 1 to the enclosure provides the additional TS page marked up to show the proposed change. The TS marked up page in Attachment 1 is to be added to the corresponding TS marked up pages provided in Reference 1. No changes are proposed to the TS Bases pages provided in Reference 1.

The supplements included in this RAI response provide additional information that clarifies the application, do not expand the scope of the application as originally noticed, and should not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register*.

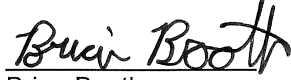
This letter contains no new regulatory commitments.

Should you have any questions regarding this submission, please contact Mr. Ken Browne, Safety Assurance and Learning Site Director, at 603-773-7932.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on the 22<sup>nd</sup> day of March 2021.

Sincerely,



Brian Booth  
Nuclear Site Vice President - Seabrook Nuclear Power Station  
NextEra Energy

Enclosure

cc: USNRC Region I Administrator  
USNRC Project Manager  
USNRC Senior Resident Inspector

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## Seabrook Station

### Response to Request for Additional Information (RAI) Regarding LAR 20-02, Resolve Non-Conservative Heat Flux Hot Channel Factor ( $F_Q(Z)$ ) Requirements

In Reference 1, NextEra requested an amendment to Renewed Facility Operating License (RFOL) NPF-86 for Seabrook Nuclear Plant Unit 1 (Seabrook). The proposed license amendment revises the Seabrook Technical Specifications (TS) to resolve non-conservative requirements associated with the nuclear heat flux hot channel factor,  $F_Q(Z)$  [RAOC-W(Z) Methodology], as reported in Westinghouse NSAL 09-5, Revision 1 (Reference 2), and NSAL 15-1 (Reference 3).

In Reference 4, the NRC requested additional information determined necessary to complete its review, as provided below. NextEra's RAI response follows:

#### **RAI #1**

Justify the validity of the adoption of the  $R_j$  factor in light of the fact that doing so will result in COLR specifications that do not adhere to the methods referenced in 6.8.1.6.b.14, as required by the Seabrook TS. As necessary, consider proposing a revised TS citation that specifies, with adequate accuracy, the Seabrook-specific methods that would be used.

#### **NextEra Response:**

The current  $F_Q$  Technical Specifications (TS) surveillance requirement includes the application of the greater of a 1.02 factor or a factor specified in the COLR to account for potential increases in  $F_Q^{W(Z)}$  between surveillances. As stated in WCAP-17661-P-A, (Reference 5), Section 3.2.5, this penalty factor, which is now referred to as  $R_j$ , will continue to be applied, with no minimum of 2%, whenever the minimum margin to the  $F_Q^{W(Z)}$  limit is predicted to decrease.

The penalty factor,  $R_j$ , is generated in the same manner as for the current  $F_Q$  TS surveillance, except for the elimination of 2% minimum penalty. This penalty factor,  $R_j$ , is determined using the WCAP-10216-P-A, Revision 1A (Reference 6), methodology, as discussed in WCAP-17661-P-A, Section 3.2.5 and Section 5.5 (page 5-6). WCAP-10216-P-A, Revision 1A, is listed as an approved COLR methodology in TS 6.8.1.6.b. To implement the proposed methodology related to the elimination of minimum penalty of 2% and the application of the  $R_j$  penalty based on the predicted margin trends, the license amendment proposed by this amendment request will be added to the listing of COLR approved methodologies referenced in Seabrook TS 6.8.1.6.b, consistent with the NRC staff's recommendation.

Attachment 1 provides the existing TS 6.8.1.6.b page marked up to show the change proposed in this RAI response. The TS marked up page is in addition to the corresponding TS marked up pages provided in Reference 1. No changes are proposed to the TS Bases pages provided in Reference 1.

#### **RAI #2**

Justify the applicability of the  $R_j$  factor, in light of the fact that the Seabrook licensee does not intend to adopt the broader surveillance formulation described in WCAP-17661-P-A.

**NextEra Response:**

The penalty factor  $R_j$  is unrelated to the adoption of new  $F_Q$  surveillance formulation and remains applicable to the current  $F_Q$  formulation, based on  $W(z)$ , as seen in the example of flux map application in Section 6.7 of WCAP-17661-P-A, Equation 6-1.

A note in the current  $F_Q$  TS, which requires application of the greater of a 1.02 factor or a factor specified in the COLR, is to account for potential increases in  $F_Q^W(Z)$  between surveillances. As stated in WCAP-17661-P-A, Section 3.2.5, the note will be eliminated but application of the penalty factor, which is now referred to as  $R_j$ , will continue to be required whenever the minimum margin to the  $F_Q^W(Z)$  limit is predicted to decrease. Additionally, a minimum penalty of 2% in the current TS is eliminated and the magnitude of the penalty factor is based on the predicted margin which is set to 1.0 when the margin is predicted to increase.

**RAI #3**

Justify the implementation of RAOC Operating Spaces as consistent with WCAP-10216-P-A, Revision 1A, or provide additional information to describe how the RAOC Operating Spaces would be formulated. As necessary, consider proposing a revised TS citation that specifies, with adequate accuracy, the Seabrook-specific methods that would be used.

**NextEra Response:**

The implementation of RAOC Operating Spaces remains consistent with WCAP-10216-P-A, Revision 1A. The proposed  $F_Q$  margin improvement by reducing RAOC Axial Flux Difference (AFD) Operating Space, including reduction in power if necessary, is discussed in WCAP-17661-P-A in Section 3.2.3, specifically on top of page 3-14, as applicable to the current TS  $F_Q^W(Z)$  formulation with an example in Figure 3-6.

The required limits on thermal power and required reductions on AFD limits will be determined using the standard RAOC methodology of WCAP-10216-P-A, Revision 1A, which is the current method used to analyze RAOC Operating Spaces. The WCAP-10216-P-A, Revision 1A methodology is referenced in the current Seabrook TS 6.8.1.6.b.14.

**RAI #4**

Describe how the required margin improvements contained in Table 3 of the COLR were formulated, demonstrate that they provide the required, additional margin to justify continued operation in the event  $F_Q^W(Z)$  exceeds its limit, and as necessary, consider proposing a revised TS citation that specifies, with adequate accuracy, the Seabrook-specific methods that would be used.

**NextEra Response:**

The proposed COLR changes include sample data in Table 3, which is not considered to be representative of any Seabrook cycle design. For the Seabrook cycle-specific COLR, Seabrook core design specific data will continue to be generated using the RAOC WCAP-10216-P-A, Revision 1A methodology with the discrete maximum power levels and reduced AFD limits, as required, to quantify the margin improvements. The methodology used (WCAP-10216-P-A, Revision 1A) is the same as that used in the current RAOC analysis and is in the Seabrook list of approved COLR methods for  $F_Q$  referenced in TS 6.8.1.6.b.14. If more than one Operating Space is specified in the COLR, cycle specific data similar to Table 3 of the sample COLR will be generated for each of the Operating Spaces.

**RAI #5**

Discuss the applicability of LIMITATION 2 imposed in the NRC safety evaluation approving WCAP-17661-P-A to Seabrook specific methods. If the licensee determines that LIMITATION 2 is not applicable, please provide rationale for the basis of the determination. If LIMITATION 2 is applicable, please justify a value, other than 50 percent, that would be "specified in cycle specific COLR," as stated in the LAR.

**NextEra Response:**

LIMITATION 2 is applicable to Seabrook and the final power decrease to 50% will be specified in the Seabrook COLR based on the NRC's prior approval of this power level in WCAP-17661-P-A. The intent of the "as specified in cycle specific COLR" was to allow change in the event of any future NRC approved changes. For the COLR, implementing the changes proposed in this amendment request, Seabrook will comply with LIMITATION 2 imposed in the SE for WCAP-17661-P-A to use 50 percent as the final power level reduction.

**RAI #6**

Discuss how the effect of terms, such as  $[T(z)]COLR$  and  $AXY(z)$ , on the proposed FQW formulation in the COLR were determined to involve low safety significance, and justify the adequacy of the proposed surveillance formulations in COLR with use of  $FQ(Z)$  instead of  $FX(Y)$  in the NRC-approved formulations (Equations 5-1 and 5-2) in WCAP-17661-P-A.

**NextEra Response:**

The proposed  $F_Q^W$  formulation in the COLR is the same as the current formulation in the TS, which is based on  $W(z)$ . The acceptability/adequacy of this  $W(z)$  formulation is discussed below.

WCAP-17661-P-A states the following in RAI 15.a response:

"However, the option of using Method 1 to set  $A_{xy}(z)$  factor to unity (as discussed in Section 4.3.1 of the TR) will still be retained as an alternative to using Method 2 to explicitly calculate the  $A_{xy}(z)$  factor at the time of the surveillance. Setting the  $A_{xy}(z)$  factor to 1.0 is effectively the same as not using it at all. In this respect, using Method 1 is consistent with the current  $F_Q$  Surveillance methodology, which makes no correction for surveillances that are performed at conditions different than were assumed in generating the  $F_Q$  surveillance factors."

"Section 4.3.1 of the TR states that setting  $A_{xy}(z)$  to 1.0, "is a reasonable option that will in all likelihood result in conservative surveillances at off-normal conditions."

NRC SE (Section 4.1.1) on page 18, states:

"Several considerations justify an allowance to keep the RAOC surveillance uncorrected. First among these is the fact that the vast majority of surveillances are performed in a Hot Full Power (HFP), All Rods Out configuration, such that there would be little deviation from the reference condition. Stated differently, in most cases, the  $A_{xy}$  factor would seldom deviate from unity, and deviations are usually expected to be minor. Second, the existing methodology does not include this correction. Third, in response to RAI 15.e, several tables were provided for a demonstration plant with several successive surveillances completed slightly above 80-percent RTP, with a 14-percent D-bank control rod insertion. These tables show that the  $A_{xy}$  factor removes a small amount of conservatism from the uncorrected surveillance, meaning that, in these conditions, a unity-value  $A_{xy}$  is conservative."

Based on the above conclusions documented in WCAP-17661-P-A, where the Method 1 of the new formulation is considered to be consistent with the current  $F_Q$  Surveillance methodology, the use of the current  $F_Q$  surveillance formulation is considered to be an acceptable method with no identified safety concerns. Also, Seabrook operates essentially with all rods out (ARO) conditions, which further justifies the use of the current  $F_Q$  surveillance methodology.

**References:**

1. License Amendment Request 20-02, Resolve Non-Conservative Heat Flux Hot Channel Factor (FQ(Z)) Requirements, August 17, 2020 (ADAMS Accession No. ML20230A425)
2. Westinghouse Nuclear Safety Advisory Letter 09-5, Revision 1, Relaxed Axial Offset Control  $F_Q$  Technical Specification Actions, September 23, 2009.
3. Westinghouse Nuclear Safety Advisory Letter 15-1, Heat Flux Hot Channel Factor Technical Specification Surveillance, February 3, 2015.
4. NRR Email Capture, Request for Additional Information Regarding Seabrook Heat Flux Hot Channel Requirement Amendment Request (L-2020-LLA-0187), February 23, 2021
5. Westinghouse WCAP-17661-P-A, Revision 1, Improved RAOC and CAOC  $F_Q$  Surveillance Technical Specifications, February 2019 (ADAMS Accession No. ML18298A314)
6. Westinghouse WCAP-10216-P-A, Revision 1A, Relaxation of Constant Axial Offset Control  $F_Q$  Surveillance Technical Specification, February 1994 (ADAMS Accession No. ML20063L185)

**ATTACHMENT 1**

**PROPOSED TECHNICAL SPECIFICATION PAGES (MARKUP)**

(3 pages follow)

## ADMINISTRATIVE CONTROLS

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6.8.1.6.b The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in:

1. WCAP-12945P-A, "Code Qualification Document for Best Estimate LOCA Analysis," Volume 1, Revision 2, and Volumes 2 through 5, Revision 1; Bajorek, S. M., et al, 1998.

Methodology for Specification:

- 3.2.2 - Heat Flux Hot Channel Factor

2. WCAP-10079-P-A, (Proprietary) and WCAP-10080-A (Nonproprietary), "NOTRUMP: A Nodal Transient Small Break and General Network Code", August 1985.

Methodology for Specification:

- 3.2.2 - Heat Flux Hot Channel Factor

3. YAEC-1363-A, "CASMO-3G Validation," April, 1988.

YAEC-1659-A, "SIMULATE-3 Validation and Verification," September, 1988.

WCAP-11596-P-A, (Proprietary), "Qualification of the PHOENIX-P/ANC Nuclear Design System for Pressurized Water Reactor Cores", June, 1988.

WCAP-10965-P-A, (Proprietary), "ANC: A Westinghouse Advanced Nodal Computer Code", September, 1986.

Methodology for Specifications:

- 3.1.1.1 - SHUTDOWN MARGIN for MODES 1,2, 3, and 4
- 3.1.1.2 - SHUTDOWN MARGIN for MODE 5
- 3.1.1.3 - Moderator Temperature Coefficient
- 3.1.3.5 - Shutdown Bank Insertion Limit
- 3.1.3.6 - Control Rod Insertion Limits
- 3.2.1 - AXIAL FLUX DIFFERENCE
- 3.2.2 - Heat Flux Hot Channel Factor
- 3.2.3 - Nuclear Enthalpy Rise Hot Channel Factor

4. Seabrook Station Updated Final Safety Analysis Report, Section 15.4.6, "Chemical and Volume Control System Malfunction That Results in a Decrease in the Boron Concentration in the Reactor Coolant System".

Methodology for Specifications:

- 3.1.1.1 - SHUTDOWN MARGIN for MODES 1, 2, 3, and 4
- 3.1.1.2 - SHUTDOWN MARGIN for MODE 5



## ADMINISTRATIVE CONTROLS

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### 6.8.1.6.b (Continued)

12. NYN-95048, Letter from T. C. Feigenbaum (NAESCo) to NRC, "License Amendment Request 95-05: Positive Moderator Temperature Coefficient", May 30, 1995.

Methodology for Specification:

3.1.1.3 - Moderator Temperature Coefficient

13. WCAP-12610-P-A, "VANTAGE + Fuel Assembly Reference Core Report". April, 1995, (Westinghouse Proprietary).

WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™", July 2006.

Methodology for Specification:

3.2.2 - Heat Flux Hot Channel Factor

14. WCAP-10216-P-A, Revision 1A (Proprietary), "Relaxation of Constant Axial Offset Control  $F_Q$  Surveillance Technical Specification", February, 1994.

Methodology for Specification:

3.2.1 - AXIAL FLUX DIFFERENCE

3.2.2 - Heat Flux Hot Channel Factor

15. WCAP-9272-P-A, (Proprietary), "Westinghouse Reload Safety Evaluation Methodology", July, 1985.

Methodology for Specifications:

2.1 - Safety Limits

3.1.1.1 - SHUTDOWN MARGIN for MODES 1,2,3, and 4

3.1.1.2 - SHUTDOWN MARGIN for MODE 5

3.1.1.3 - Moderator Temperature Coefficient

3.1.2.7 - Isolation of Unbored Water Sources - Shutdown

3.1.3.5 - Shutdown Bank Insertion Limit

3.1.3.6 - Control Rod Insertion Limits

3.2.1 - AXIAL FLUX DIFFERENCE

3.2.2 - Heat Flux Hot Channel Factor

3.2.3 - Nuclear Enthalpy Rise Hot Channel Factor

3.2.5 - DNB Parameters

3.5.1.1 - Accumulators for MODES 1, 2, and 3

3.5.4 - Refueling Water Storage Tank for MODES 1, 2, 3, and 4

3.9.1 - Boron Concentration

16. WCAP-13749-P-A, (Proprietary) "Safety Evaluation Supporting the Conditional Exemption of the Most Negative Moderator Temperature Coefficient Measurement," March, 1997.

Methodology for Specifications:

3.1.1.3 - Moderator Temperature Coefficient

INSERT new "17"  
from next page.

INSERT for TS 6.9.1.6.b

17. License Amendment [XXX] issued [XX/XX/21] (ADAMS Accession No.[MLXXXXXXX])

Methodology for Specification:

3.2.2 - Heat Flux Hot Channel Factor