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May 19, 2016

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. NA3-16-014
Docket No. 52-017
COL/RAB

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
SUBMISSION OF RAI RESPONSE AND TECHNICAL REPORTS

In the North Anna Unit 3 (NA3) Seismic Closure Plan (SCP) (ADAMS Accession No. ML14297A199), Dominion committed to provide the NRC responses to certain Requests for Additional Information (RAIs) and technical reports on a defined schedule in order to support the NRC's review. Dominion submitted the last of these reports on December 16, 2015 (Dominion Letter Nos. NA3-15-033 and NA3-15-037). As a result of the fuel audit that the NRC staff conducted on March 23-25, 2016, Dominion is revising one RAI response and two technical reports to address comments from the staff. This letter transmits the revisions to these documents.

The following documents are provided in the attached enclosures:

- Revised response to RAI 04.02-1, including COLA markups
- GEH Report WG3-002N9544, Revision 2, North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report
- GEH Report 002N8005, Revision 2, North Anna 3 Control Rod Seismic Analysis

The enclosures to this letter provide paper copies of the reports being sent to the Document Control Desk to be scanned and entered into ADAMS. A DVD containing electronic copies of the reports is being sent to the NRC project manager, with additional copies available upon request.

Reports WG3-002N9544 and 002N8005 contain proprietary information. The proprietary versions of the reports are included in Enclosures 2 and 3. The affidavits, signed by GEH, the owner of the information, are provided in each report. Each affidavit sets forth the basis on which the information in the proprietary version of the report should be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (a)(4) of 10 CFR 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information, which is proprietary to GEH, be withheld from public disclosure in accordance with 10 CFR 2.390 of the Commission's regulations. Correspondence with respect to the copyright or proprietary aspects of the GEH information noted above or the supporting GEH affidavit should be addressed to: David Hinds, Manager, New Units Engineering,

D089
NRO

ENCLOSURES 2-3 CONTAIN ~~PROPRIETARY INFORMATION~~
Enclosures 2 and 3 contain ~~proprietary information~~ and must be protected accordingly in accordance with 10 CFR 2.390. Upon removal of the enclosures, this letter is decontrolled.

GE Hitachi Nuclear Energy, 3901 Castle Hayne Road, Wilmington, NC 28401. The public versions of the reports are included in Enclosures 4 and 5.

Please contact Regina Borsh at (804) 273-2247 (regina.borsh@dom.com) if you have questions.

Very truly yours,

Mark D. Mitchell

Mark D. Mitchell

Enclosures:

1. Response to RAI 04.02-1
2. GEH Report WG3-002N9544, Revision 2, North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report (PROPRIETARY)
3. GEH Report 002N8005, Revision 2, North Anna 3 Control Rod Seismic Analysis (PROPRIETARY)
4. GEH Report WG3-002N9544, Revision 2, North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report (PUBLIC)
5. GEH Report 002N8005, Revision 2, North Anna 3 Control Rod Seismic Analysis (PUBLIC)

Commitments made by this letter:

This information will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in Enclosure 1.

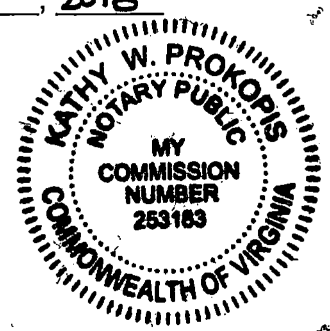
COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Mitchell, who is Vice President–Generation Construction of Virginia Electric and Power Company (Dominion Virginia Power). He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 19 day of May, 2016
My registration number is 253183 and my
Commission expires: September 30, 2016

Kathy W. Prokopis
Notary Public



cc (hard copy and email) with convenience DVD (2 copies each) and w/o Enclosures:
- J.J. Shea, Jr. NRC
- T. Tai, NRC

cc w/o Enclosures or convenience DVD:
- U. S. Nuclear Regulatory Commission, Region II
- M. Eudy, NRC
- T. S. Dozier, NRC
- G. Croon, NRC
- D. Paylor, VDEQ
- W. T. Lough, SCC
- M. K. Brandon, DTE
- R. J. Bell, NEI

ENCLOSURE 1

Revised Response to NRC RAI Letter 130

RAI 7580 Question 04.02-1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

North Anna Unit 3

Dominion

Docket No. 52-017

RAI NO.: 7580 (RAI Letter 130)

SRP SECTION: 04.02 – FUEL SYSTEM DESIGN

QUESTIONS for the Reactor System Branch

DATE OF RAI ISSUE: 06/24/2014

QUESTION NO.: 04.02-1

As noted in NAPS Departure 3.7-1, the site-specific SSE design ground motion for the purpose of seismic design, analysis, and qualification of structures, systems, and components exceeds the ESBWR Certified Seismic Design Response Spectra (CSDRS). The ESBWR standard plant seismic analysis, which utilizes the CSDRS, formed the basis for the GE14E fuel assembly and ESBWR Marathon control rod blade mechanical designs. DCD Tier 2* Reference 4.2-4 describes the structural capability of the GE14E assembly and assembly components to withstand seismic/dynamic loading. DCD Tier 2* Reference 4.2-8 describes the structural capability of the ESBWR Marathon control rod blade.

Provide information in NAPS FSAR Section 4.2 that demonstrates that the NAPS fuel assembly and control rod blade mechanical loads remain bounded by the component design analyses and testing performed for the ESBWR certification. If exceeded, provide the results of additional testing and analyses that demonstrate acceptability of the components throughout their design lifetime.

Dominion Response

The questions in this RAI are based on the December 2013 North Anna Unit 3 (NA3) COLA submittal, which included NAPS Departure 3.7-1 for exceedances of the certified standard design response spectra (CSDRS). Subsequently, in the Seismic Closure Plan (SCP), which was submitted to the NRC by letter NA3-14-043, dated October 22, 2014 (ADAMS Accession Number ML14297A199),

Dominion included a commitment to revise the COLA to provide the site-specific seismic analysis results for the fuel assemblies and control rods to address this RAI. The original response to RAI 04.02-1 was submitted by Dominion letter NA3-15-037, December 16, 2015 (ML15364A384). This revised response supersedes and replaces the original response in its entirety.

GEH Technical Reports NEDC-33240P-A, "GE14E Fuel Assembly Mechanical Design Report" (Reference 1) and NEDE-33244P-A, "ESBWR Marathon Control Rod Mechanical Design Report" (Reference 2), which are incorporated by reference in DCD Table 1.6-1, describe the design features and structural evaluations of the fuel assemblies and control rods for the standard design.

The site-specific evaluations are described in Technical Reports WG3-002N9544, "North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report" (Reference 3), and 002N8005, "North Anna 3 Control Rod Seismic Analysis Report" (Reference 4), which have been submitted to the NRC and will be Tier 2* references in the FSAR, as shown on the attached COLA markups. In addition, the site-specific analyses will be described in Section 4.2, which will be listed in Table 1.8-201 and COLA Part 7 as part of NAPS Departure 3.7-1 for the seismic exceedance of the CSDRS.

The site-specific evaluations were performed using seismic loads obtained from the results of the site-specific seismic response analyses following the processes described in Section 3.7.2 of the FSAR.

<u>Fuel Assemblies</u>

For the site-specific evaluations of GE14E fuel assemblies, seismic and dynamic loads were combined using the square root sum of the squares (SRSS) method and analyzed using the methodology described in Reference 3. The maximum horizontal and vertical seismic acceleration loads used in these evaluations were obtained from the results of the site-specific soil-structure interaction (SSI) analyses of the Reactor Building / Fuel Building (RB/FB) presented in Section 3.7.2.4 and Appendix 3A of the FSAR. The acceleration time histories that were used for the calculation of the fuel maximum accelerations were obtained from the fuel lumped-mass stick model that is an integral part of the global RB/FB dynamic model described in Section 3A.7 of the FSAR. The results of the site-specific evaluation indicate that the combined load accelerations meet the acceptance criteria. DCD Tier 1 ITAAC 15 in Table 2.1.1-3 will be completed prior to fuel load to verify the as-built combined load accelerations meet the acceptance criteria.

Control Rods

Site-specific evaluations indicate that the standard design of the control rods is acceptable for NA3, considering site-specific seismic loads. Standard design evaluations were reviewed to identify specific evaluations that are potentially affected by the site-specific seismic loads. Reviews indicated that two control rod components and the seismic scram testing could potentially be affected by the slightly larger seismic fuel channel oscillations due to NA3 seismic loads. The two components and the seismic scram testing have been evaluated with the NA3 seismic loading (1) using the same methodology as the standard design analyses, and (2) using combined loads with conservatively assumed LOCA and SRV loads or deflections. Results of the site-specific control rod evaluations are as follows:

- Wing outer edge: The maximum strain at the outer edge of the control rod wing remains less than the material allowable strain.
- Absorber tube to tie rod weld: The maximum stress at the absorber tube to tie rod weld remains below the material allowable stress.
- Seismic scram testing: Testing of an ABWR Marathon control rod, which is representative of the ESBWR marathon control rod as explained in FSAR Section 4.2.4.2, confirmed that scram time requirements were met through 40 mm of fuel channel oscillation with no control rod damage. The NA3 calculated values of oscillation amplitude are well below the 40 mm acceptance limit.

These evaluations indicate that there is sufficient margin in the control rod design to accommodate expected dynamic loads in combination with the site-specific seismic loads for NA3. Therefore, the control rods are acceptable for use at NA3.

ITAAC for Fuel and Control Rods

ITAAC for the initial fuel and control rods to be loaded into the core are (1) ITAAC 15 of DCD Tier 1, Table 2.1.1-3 (fuel assemblies), and (2) COLA Part 10, ITAAC 1, Table 2.4.19-1 (control rods).

- Completing the ITAAC for Fuel Assemblies

  Section 3.3 of Reference 3 describes the method and acceptance criteria for verifying DCD Tier 1 ITAAC 15 in Table 2.1.1-3.

Combined Loadings: For the portion of the ITAAC related to seismic and dynamic analysis of the as-built fuel assemblies, the site-specific SSE loads and the combined loads using time histories, resultant vectors, and SRSS by approved methods will be evaluated using the final as-built inputs for the fuel that will be loaded into the initial core. The evaluation will use the method of combining SSE and LOCA loads for fuel assemblies as in Reference 3. As described in Reference 1, Section 3.3.1, the fuel structural components are designed such that combined primary and secondary stresses remain less than the material tensile strength. The stress limits are met if the combined seismic and dynamic accelerations of the fuel remain below the horizontal and vertical acceleration limits for the GE14, which are given in Reference 3.

Fuel Lift: To perform the fuel lift portion of the ITAAC, the procedure and the fuel loadings that will be used are as described in Reference 1, which refers to NEDE-21175-3-P-A for the method for fuel lift evaluation for fuel assemblies. These procedures and loadings will be the basis to be used for NA3 with the final as-built information. The acceptance criterion is provided as a limit such that the fuel-bundle lift-out of the fuel support piece does not exceed a specific value, which is given in Reference 3.

These acceptance criteria are consistent with DCD Appendix 4B, "Fuel Licensing Acceptance Criteria." The limits that ensure the acceptance criteria are met are described in Reference 3.

- Completing the ITAAC for Control Rods

COLA Part 10 is being revised as shown on the attached markups for Part 10, Section 2.4.19. The site-specific evaluation will be performed with final as-built information to complete ITAAC 1 in Table 2.4.19-1 of Part 10, Section 2.4.19, and to demonstrate that the acceptance criteria are met.

To complete the control rods seismic and dynamic analysis, quantitative analyses will be performed as described in Reference 4, with final as-built values for the control blades and the combined loads for SSE (based on NA3 seismic loads), LOCA, and SRV. The analysis will compare the site-specific control rod stresses and strains to the ultimate stress or strain limits specified in Reference 4. The analysis will confirm that the site-specific cumulative fatigue usage factor does not exceed 1.0. The analysis will also confirm that the maximum horizontal fuel channel oscillation amplitude calculated for the final as-built combined loads is within the acceptance limit of 40 mm, as described in Reference 4.

References:

1. Global Nuclear Fuel, NEDC-33240P-A, "GE14E Fuel Assembly Mechanical Design Report," Proprietary (NEDO-33240-A, Nonproprietary) (Revision 1, September 2010).
2. GE Hitachi Nuclear Energy, NEDE-33244P-A, "ESBWR Marathon Control Rod Mechanical Design Report," Proprietary (NEDO-33244-A, Nonproprietary). (Revision 2, September 2010)
3. Global Nuclear Fuel, WG3-002N9544, "North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report" (proprietary and public versions) (Revision 2, May 2016).
4. GE Hitachi Nuclear Energy, 002N8005, "North Anna 3 Control Rod Seismic Analysis" (proprietary and public versions) (Revision 2, May 2016).

Proposed COLA Revisions

COLA Part 7, "Departures Report," COLA Part 10, "Tier 1/ITAAC/Proposed License Conditions," and Part 2 FSAR Sections 1.6, 1.8, and 4.2 will be revised as indicated on the COLA markups submitted with this revised RAI response.

NAPS SUP 1.6-1

Table 1.6-201 Referenced Topical Reports

Report No.	Title	Section
~~WG3-002N9544~~	~~[*Global Nuclear Fuel, "North Anna Unit 3 Site-Specific Supplement to NEDC-33240P-A, GE14E Fuel Assembly Mechanical Design Report," WG3-002N9544, Class II (Proprietary); and Class I (Nonproprietary public redacted version), Revision 0, August 2015.*]*~~	~~4.2~~
~~002N8005~~	~~[*GE Hitachi Nuclear Energy, "North Anna 3 Control Rod Seismic Analysis," 002N8005, Class II (Proprietary); and Class I (Nonproprietary public redacted version), Revision 1, July 2015.*]*~~	~~4.2~~
002N8467	GE Hitachi Nuclear Energy, "North Anna 3 Fuel Rack Seismic Analysis," 002N8467, Class I (Nonproprietary), Revision 2, November 2015.	9.1

~~* References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2*. Prior NRC approval is required to change Tier 2* information.~~

Delete as marked.

Delete as marked.

Chapter 4 Reactor

4.1 Summary Description

This section of the referenced DCD is incorporated by reference with no departures or supplements.

4.2 Fuel System Design

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

4.2.3.1.3 Fuel Lift and Seismic and Dynamic Load Analysis

Replace this section with the following.

See Insert 4.2.3 #1 for the replacement text.

NAPS DEP 3.7-1

~~[The fuel lift and seismic and dynamic load analysis is completed prior to fuel release as described in DCD Reference 4.2-4 and Reference 4.2-201, which addresses the Unit 3 site conditions for seismic input. The site-specific stress analysis using Unit 3 seismic conditions results in stress values for the GE14E fuel assemblies that exceed the standard design stress values. However, the site-specific values remain bounded by the acceptance limits given in the standard design report. As explained in Reference 4.2-201, the standard design fuel assembly design provides sufficient margin to the seismic and dynamic load criteria.]~~

4.2.4.2 Seismic

Replace this section with the following.

NAPS DEP 3.7-1

Fuel channel deflections that result from seismic and LOCA events impose lateral loads on the control rods. The Marathon control rod is analyzed for SSE events, using the CSDRS as inputs for the standard design (DCD Reference 4.2-8) and the Unit 3 response spectra for the site-specific seismic analysis (Reference 4.2-202). The BWR/2 through BWR/6 and the ABWR control rod designs have similar channel lengths and deflections. Because the ESBWR channel has a shorter length compared to previous designs, but the same relative cross-section, the expected deflection is less. [The site-specific evaluation of wing outer edge bending is performed and documented in Reference 4.2-202. There is a slight increase in maximum strain at the outer edge of the control rod wing, but the resulting strain is below the material allowable strain.]

Insert 4.2.3 #1

4.2.3.1.3 **Fuel Lift and Seismic and Dynamic Load Analysis**

Replace this section with the following.

NAPS-DEP 3.7-1

[The fuel lift and seismic and dynamic load analysis is completed prior to fuel release as described in DCD Reference 4.2-4 and Reference 4.2-201.

Reference 4.2-201 provides the results of evaluations that are performed for the GE14E fuel design, considering seismic demands obtained from site-specific analyses using the methods described in Section 3.7.2. Reference 4.2-201 also describes the methods for performing and the acceptance criteria for completing ITAAC 15 of DCD Tier 1 Table 2.1.1-3 for the GE14E fuel assemblies to be loaded into the initial core.]

The standard design SSE analysis using the CSDRS seismic input is performed by evaluating the strain in the Marathon control rod absorber section when deflected approximately 6 mm. During a seismic event, it is assumed the seismic deflections could be added to any preexisting channel bow. The absorber section strain is analyzed for channel deflections due to seismic and channel bow deflections when deflected approximately 10 mm and found to be acceptable, as documented in DCD Reference 4.2-8. [The site-specific evaluation of the absorber tube to tie rod weld is performed and documented in Reference 4.2-202. There is a slight increase in maximum stress at the absorber tube to tie rod weld, but the maximum stress remains well below the material allowable stress.]

Testing was performed on the ABWR Marathon control rod to confirm seismic scram capability of the ESBWR standard design control rod. The ABWR Marathon control rod was tested at amplitudes of 10, 20, 30 and 40 mm. The scram times were found to be acceptable and the control rod was not damaged. The ESBWR channels are shorter than previous designs, making the fuel assembly stiffer and the fuel channel lateral deflections less. The increase in system stiffness and the decrease in lateral deflection make the ABWR Marathon control rod seismic scram capability test bounding for the ESBWR conditions. [Although the Unit 3 fuel channel oscillation exceeds the standard design fuel channel oscillation, the testing bounds both the standard design and the Unit 3 fuel channel oscillation values, as documented in Reference 4.2-202.

The site-specific evaluations demonstrate that the ESBWR control rod design is acceptable under Unit 3 seismic loading.]

with margin to accommodate the combination of seismic and expected dynamic loads, as demonstrated using conservatively assumed values for LOCA and SRV loads. The methodology and acceptance criteria for completing ITAAC 1 in Part 10, Table 2.4.19-1, considering site-specific seismic demands, LOCA and SRV loads, and final as-built information, are described in Reference 4.2-202.

Revision 2, May 2016.]*

4.2.7 References

Add the following at the end of this section.

Delete text as marked.

4.2-201 [*Global Nuclear Fuel, "North Anna Unit 3 Site-Specific ~~Supplement to NEDC-33240P-A,~~ GE14E Fuel Assembly Mechanical Design Report," WG3-002N9544, Class II (Proprietary); and Class I (Nonproprietary public redacted version), ~~Revision 0, August 2015.~~*]~~1~~

4.2-202 [*GE Hitachi Nuclear Energy, "North Anna 3 Control Rod Seismic Analysis," 002N8005, Class II (Proprietary); and Class I (Nonproprietary public redacted version), ~~Revision 1, July 2015.~~*]*

Revision 2, May 2016.

4.3 Nuclear Design

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

4.3.3.1 Nuclear Design Description

Replace the last paragraph with the following.

STD COL 4.3-1-A There are no changes to the fuel, control rod, or core design from that described in the referenced certified design.

4.3.5 COL Information

4.3-1-A Variances from Certified Design

STD COL 4.3-1-A This COL Item is addressed in Section 4.3.3.1.

4.4 Thermal and Hydraulic Design

This section of the referenced DCD is incorporated by reference with no departures or supplements.

4.5 Reactor Materials

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Change "1" to "*"

~~1~~ Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2*. Prior NRC approval is required to change.

4.6 Functional Design of Reactivity Control System

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 4A Typical Control Rod Patterns and Associated Power Distribution for ESBWR

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

4A.1 Introduction

Replace the third paragraph with the following.

STD COL 4A-1-A

There are no changes to the fuel, control rod, or core design from that described in the referenced certified design.

4A.3 COL Information

4A-1-A **Variances from Certified Design**

STD COL 4A-1-A

This COL item is addressed in Section 4A.1.

Appendix 4B Fuel Licensing Acceptance Criteria

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 4C Control Rod Licensing Acceptance Criteria

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 4D Stability Evaluation

This section of the referenced DCD is incorporated by reference with no departures or supplements.

DEPARTURES

Introduction

A *departure* is a plant-specific deviation from design information in a standard design certification rule. Departures from the reference ESBWR Design Control Document (DCD) are identified and evaluated consistent with regulatory requirements and guidance. Each departure is examined in accordance with 10 CFR 52 requirements. Although the ESBWR Design Certification Application is currently under review with the NRC, departures are evaluated utilizing the guidance provided in Regulatory Guide 1.206, Section C.IV.3.3.

It is anticipated that the final certification rulemaking for the ESBWR would have the same change process as that in current appendices to 10 CFR 52 and in the proposed 10 CFR 52 Appendix E, "Design Certification Rule for the ESBWR Design." References in this part to the Design Certification Rule (DCR) or 10 CFR 52 Appendix E are understood to mean the proposed 10 CFR 52 Appendix E and the anticipated final ESBWR DCR.

The following departures are evaluated in this report:

NAPS DEP 3.7-1, Ground Response Spectra for Seismic Structural Loads and Floor Response Spectra

NAPS DEP 8.1-1: Figure 8.1-1, Sheet 1, *Electrical Power Distribution System*

NAPS DEP 8.1-2: Table 8.1-1, On-site Power System SRP Criteria Applicability Matrix

NAPS DEP 11.4-1: Long-term, Temporary Storage of Class B and C Low-Level Radioactive Waste

NAPS DEP 12.3-1: Liquid Radwaste Effluent Discharge Piping Flow Path

NAPS DEP 19A-1: Design of Structures Housing RTNSS Equipment for Hurricane Wind Generated Missiles

Departure: NAPS DEP 3.7-1, Ground Response Spectra for Seismic Structural Loads and Floor Response Spectra

1. Summary of Departure

DCD Table 2.0-1, *Envelope of ESBWR Standard Plant Site Parameters*, defines the safe shutdown earthquake (SSE) horizontal and vertical design ground response spectra of 5 percent damping, also termed the Certified Seismic Design Response Spectra (CSDRS), as the free-field outcrop spectra at the foundation level (bottom of the base slab) of the Reactor Building/Fuel Building and Control Building structures, as shown in DCD Figures 2.0-1 and 2.0-2. As specified in DCD Table 2.0-1, Note (9) for the Firewater Service Complex, which is essentially a surface founded structure, the CSDRS is 1.35 times the values shown in DCD Figures 2.0-1 and 2.0-2 and is

defined as free-field outcrop spectra at the foundation level (bottom of the base slab) of the Firewater Service Complex structure. The Unit 3 site-specific horizontal and vertical seismic response spectra exhibit exceedances at certain frequencies, when compared to the CSDRS. As a result of these exceedances, Dominion performed site-specific soil-structure interaction (SSI) analyses for the RB/FB, CB and FWSC structures and revised the SSE definition to include the ESBWR CSDRS and the site-specific foundation input response spectra (FIRS) for each seismically qualified structure for use in performing seismic design, analysis, and qualification of structures, systems and components (SSCs).

Because the SSE is also defined in DCD Tier 1, Table 5.1-1, the changes to the site-specific definition requires a departure from DCD Tier 1 information. Therefore, a request for exemption from DCD Tier 1 information is provided in Exemption 3.

Finally, DCD Section 3.7 defines, as Tier 2* information, the ESBWR Operating Basis Earthquake (OBE) as one-third of the SSE ground motion. The Unit 3 plant-shutdown OBE response spectrum limit is based on (a) one-third of the CSDRS and (b) one-third of the site-dependent SSE manifestation at grade. Because all safety-related SSCs are designed, analyzed, and qualified to meet both the CSDRS and site-specific FIRS, plant shutdown is required, as discussed in FSAR Section 3.7.4.4, only if both response spectra in FSAR Section 3.7.4.4 (a) and (b) are exceeded.

2. Scope/Extent of Departure

This departure is for the site-specific FIRS exceeding the CSDRS at certain frequencies and a revision of the SSE definition to include the site-specific FIRS for each seismically qualified structure. The changes are identified in FSAR Sections 1.3, 1.11, 2.0, 3.7, 3.8, 4.2, 9.1, 19.1, 19.2, and 19.5, and Appendices 3A, 3C, 3G, and 19A. The departure also involves redefinition of the OBE. The changes to the OBE definition are identified in FSAR Section 3.7.

As noted above, an associated request for exemption from DCD Tier 1 information is provided in Exemption 3.

3. Departure Justification

For the RB/FB and CB structures, DCD Table 2.0-1 defines the CSDRS associated with the SSE for horizontal and vertical directions as those presented in DCD Figures 2.0-1 and 2.0-2, respectively. For the FWSC, DCD Table 2.0-1, Note (9) defines the CSDRS. Comparisons of site-specific spectra with the CSDRS are presented in FSAR Figures 2.0-201, 2.0-202, 2.0-203, and 2.0-204 for both full column outcrop motions and geologic outcrop motions. In addition, FSAR Figure 3.7.1-285 presents the SSI input response spectra for the FWSC at the average elevation of the bottom of the concrete fill (Elevation 220 ft NAVD88, 220.86 ft NGVD 29) as further discussed in FSAR Section 3.7.1.1.4.2.3. As discussed in FSAR Section 3.7.1.1, these figures show that the site-dependent FIRS exceed the CSDRS for Seismic Category I structures. The site-specific SSI analyses results are presented in FSAR Section 3.7.2.4 for the RB/FB, CB and FWSC structures.

FSAR Figures 2.0-201, 2.0-202, 2.0-203, and 2.0-204 present the CSDRS and Unit 3 site-specific FIRS for the horizontal and vertical directions, for all of the Unit 3 Seismic Category I structures. These figures reflect the Unit 3 site-specific horizontal and vertical seismic spectra, therefore DCD Figures 2.0-1 and 2.0-2 for the RB/FB and CB structures and DCD Table 2.0-1, Note (9) for the FWSC structure, which defined the CSDRS, are not replaced by this departure. Unit 3 seismic design, analyses, and qualification of site-specific structures, systems, and components use both the CSDRS and the Unit 3 site-specific FIRS for purposes of establishing the SSE ground motion response spectra, as defined in FSAR Section 3.7.1. This approach satisfies the minimum requirements for design ground motion as described in 10 CFR 50, Appendix S (as discussed in FSAR Section 3.7.1.1).

FSAR Section 3.7.2.4 and Appendix 3A discuss the site-specific SSI analyses that are performed to validate the design of the standard plant Seismic Category I structures, based on the site-specific SSI input motions. The results of the site-specific SSI and SSSI analyses, documented in FSAR Section 3.7.2.4 and Appendix 3A, demonstrate that the standard plant seismic design of structural members does not envelope the site-specific seismic responses for the RB/FB, CB and FWSC, in some instances. To address those instances where the standard design is not enveloping, structural evaluations are performed. For certain seismic equipment and supports, structural evaluations indicate that the standard design is not enveloping in all cases.

FSAR Section 3.7.2.8 states that the same process is used for the design and analyses of the Seismic Category II and Radwaste Building structures, including both the SSI analyses and the SSSI analyses, using the same methodology, load combinations, and acceptance criteria as used for the Seismic Category I structures.

FSAR Sections 19.1, 19.2, and 19.5, and Appendix 19A discuss the Unit 3 seismic risk evaluation. A site-specific Seismic Margin Analysis update is performed to evaluate the impact of the Unit 3 peak ground acceleration on the DCD PRA risk insights in support of a plant-specific PRA assessment, as described in these FSAR sections.

FSAR Section 3.7.2.4 refers to FSAR Appendix 3A where the site-specific floor response spectra for the best estimate, lower bound, and upper bound subsurface profiles are compared with the DCD enveloping floor response spectra at 5 percent damping. The analyses described in FSAR Appendix 3A indicate that the site-specific in-structure response spectra (ISRS), in some locations, exceed the DCD corresponding floor response spectra at 5 percent damping. The floor response spectra used for seismic design of systems and components consider the DCD floor response spectra and the site-specific ISRS.

The Unit 3 site-specific SSSI effects evaluations are performed using the same methodologies as used in the standard design using Unit 3 site conditions, as described in FSAR Section 3A.17.11. In addition, SSSI analyses are performed of the CB-RB/FB combined models that include the Access Tunnel to evaluate the site-specific SSSI effects of RB/FB on the CB seismic response. This is not

a change in the methodology but is a difference from the standard design to provide explicit representation of the site conditions that exist between the RB/FB and the CB at Unit 3.

The Unit 3 seismic load demands are used in site-specific structural evaluations that are performed for those structures and components that are evaluated as part of the standard design. The site-specific structural evaluations are performed using the standard design methodologies, with the following changes related to the models and inputs:

- ~~FSAR Section~~ FSAR Section 3G.7.5.3, Stability Requirements (Reactor Building/Fuel Building (RB/FB)): The stability of the RB/FB at Unit 3 is performed without considering the resistance from the shear keys, as in the standard design. No changes are made to the design and the shear keys remain a part of the Unit 3 RB/FB structure.
- FSAR Section 3G.7.5.2, Site Design Loads, Load Combinations, and Material Properties: The TRACG thermal loads, updated temperatures, and upper pool design changes described in DCD Section 3G.5 are evaluated for the standard design as separate calculations and with separate results provided in DCD Section 3G.5. The site-specific structural evaluations involving the TRACG thermal loads, updated temperatures, and upper pool design changes are performed in total using the updated global finite element model, which is used for the DCD Section 3G.5 calculations. The thermal loads for the RCCV are ~~reduced~~ addressed using the SSDP-2D process (which is described in DCD Section 3G.1.5.4) for evaluating stresses in concrete and rebar for the structural evaluations as described in FSAR Section 3G.7.5.2. Rather than having two separate calculations, the site-specific structural evaluations combine these inputs for the Unit 3 results, and the methodology described in DCD Section 3G.1.5.4. This is ~~not a departure from a methodology, but is~~ a change in (1) using the updated model (used for the DCD Section 3G.5 calculations), (2) thermal loads, and (3) the upper pool design for the structural evaluations. FSAR Section 3G.7.5.4.3.6 is a site-specific section that addresses the IC/PCCS Pools (Element 32 of the Reactor Building). This approach is acceptable because it is a global evaluation that considers the loads together, and uses the conservative SSDP-2D method for reducing thermal loads for the RCCV.

The results of the structural evaluations of the structures, which are described in FSAR Appendix 3G, and equipment and components, which are described in FSAR Sections 3.8.2, 3G.7, 4.2, and 9.1, are compared to acceptance limits. Changes that are necessary to ensure that the Unit 3 structures and equipment are seismically adequate are listed below by the FSAR section that describes the change.

- FSAR Section 3G.7.5.4.1, PCCS Condenser: The support saddle bolts and their embedment are changed to withstand the Unit 3 seismic loads.
- FSAR Section 3G.7.5.4.3, Structural Design Evaluation (Reactor Building): The arrangement of shear ties for Element 24211 in Section 23 at the exterior wall of the RB, Elevation 22.50 m to 24.60 m, is changed to withstand the Unit 3 seismic loads.

- FSAR Section 3G.8.5.4, Structural Design Evaluation (Control Building): For the Unit 3 CB, the size of steel girder SG-23 (CBAR ID 21016) is changed from that used in the standard design to withstand the Unit 3 seismic loads.
- FSAR Section 3G.9.5.4, Structural Design Evaluation (Fuel Building): The arrangements of shear ties and reinforcement at the exterior wall at Elevations 4.65 m to 6.60 m are updated from standard design to withstand the Unit 3 seismic loads.
- FSAR Section 3G.10.5.4, Structural Design Evaluation (FWSC): ~~Shear ties are added to shear key Element 72008 in FSAR Table 3G.10-204, but were not shown on DCD Table 3G.4-16. The added shear ties are included in both the standard design structural evaluation and the site-specific structural evaluation and are shown on DCD Figure 3G.4-1~~ Rebar is added to basemat Element 227 and rebar and shear ties are added to shear key Elements 72008 and 73017.
- FSAR Section 9.1.1, New Fuel Storage: For the new fuel storage racks in the buffer pool, the size of the anchor bolts is increased and the loads in the final embedment are increased to withstand the Unit 3 seismic loads.
- FSAR Section 9.1.2, Spent Fuel Storage: For the spent fuel storage racks in the buffer pool deep pit, the size of the anchor bolts is increased, the welds from the enveloping plate to the base plates are increased, and the loads in the final embedment are increased to withstand the Unit 3 seismic loads.

~~In addition to the above changes, departures from the standard design structural acceptance criteria specified in DCD Sections 3.8.3.5 and 3.8.4.5 are identified.~~

- Diaphragm Floor, described in FSAR Section 3G.7.5.4.2.1: ~~The use of a conservative value for the out-of-plane load, representing only the flexible mode of vibration of the floor, yields stress demands on the upper and lower radial web plates of the diaphragm floor that exceed the code allowable stress by approximately 6 percent. Applying the same methodology as the one used for development of the out-of-plane loads on other slabs (equivalent average acceleration) demonstrates that the standard design of the diaphragm floor is adequate for Unit 3 site~~ A refined calculation has been performed applying the methodology consistent with the one used for development of the out-of-plane loads on slabs using equivalent average acceleration to demonstrate that the site-specific stress demands for the upper and lower radial plates remain within allowable limits.
- ~~FSAR Section 3.8.3.5.1 is modified to address the acceptance criteria for the diaphragm floor.~~
- ~~FB Element 72004, described in FSAR Section 3G.9.5.4: This wall segment is overstressed in concrete compression for flexure and membrane action. A confirmatory evaluation of the significance of this overstress using an alternative method (ACI 349-01 axial-flexural capacity) indicates that structural integrity of the FB at this element is not compromised by this calculated overstress.~~

- ~~FSAR Section 3.8.4.5 is modified to address the acceptance criteria for FB Element 72004.~~
- Acceptance Criteria, FSAR Section 3.8.4.5: ~~The acceptance criteria for the Unit 3 RB and FB structures, as described in FSAR Section 3.8.4.5, are modified to provide that either the ASME BPVC, Section III, Division 2, Subsection CC, or ACI 349-01 acceptance criteria may be used, rather than the more limiting as for the standard design~~ The stress evaluation approach is modified for the Unit 3 Seismic Category I structures, as described in FSAR Section 3.8.4.5 using axial load-moment interaction curves to demonstrate that the ASME BPVC, Section III, Division 2, Subsection CC and ACI 349-01 acceptance criteria are met. The ASME acceptance criteria are based on a parabolic concrete stress-strain relationship and applicable ASME allowable stresses for a cross section subjected to membrane loads and moments due to factored loads. This refined approach is also described in FSAR Sections 3G.7.5.4, 3G.8.5.4, 3G.9.5.4, and 3G.10.5.4.

A Unit 3 plant-shutdown OBE response spectrum limit is established, as described in FSAR Section 3.7.1, for purposes of requiring a plant shutdown, as described in FSAR Section 3.7.4.4. The Unit 3 plant-shutdown OBE response spectrum limit is established based on one-third of the Unit 3 ground motion response spectra used in the design of seismic SSCs. This approach is consistent with 10 CFR 50, Appendix S, and Regulatory Guide 1.166, Section 4.1.2, for purposes of ensuring margin to the ground motion response spectra used in the design of seismic SSCs in the event of an earthquake.

4. Departure Evaluation

As discussed above, appropriate site-specific analyses for the RB/FB, CB, and FWSC structures have been conducted to assess site-specific FIRS exceeding the CSDRS at certain frequencies and a revision of the SSE definition to include the FIRS for each seismically qualified structure. Specific changes from the standard design that result from the site-specific seismic analyses and structural evaluations are described in Section 3. This departure has been evaluated and determined to comply with the requirements of the ESBWR Design Certification Rule, Section VIII.

This departure involves a change to DCD Tier 1 and DCD Tier 2* information. Pursuant to Section VIII.B.2.b.5a of the ESBWR design certification rule, NRC approval is necessary; Exemption 3 requests the approval for the exemption from the DCD Tier 1 information.

Departure: NAPS DEP 8.1-1 - Figure 8.1-1, Sheet 1, *Electrical Power Distribution System*

1. Summary of Departure

DCD Tier 2, Figure 8.1-1, Sheet 1, *Electrical Power Distribution System*, has a horizontal dashed line with components in the "Turbine Island/Transformer Yard" shown below the line and components in the "Switchyard" shown above the line. This figure shows the location of the main generator circuit breaker and its motor-operated disconnects (MODs) below the dashed line in the

2.4.19 ITAAC for the Control Rods

Design Description

The control rods to be loaded into the initial core will be able to withstand seismic and dynamic loads under normal operation and design basis conditions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.19-1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the control rods.

as-built

Table 2.4.19-1 ITAAC for the Control Rods

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The control rods to be loaded into the initial core will be able to withstand seismic and dynamic loads under normal operation and design basis conditions.	An analysis of the control rods seismic and dynamic loads will be performed on the control rods ~~design~~ that will be loaded into the ESBWR initial core. The analysis will be performed using the same methodology as described in ~~DCD Reference 4.2-8.~~	~~The control rods to be loaded into the core will be capable of withstanding design seismic and dynamic loadings.~~

FSAR Reference 4.2-202.

Replace with: The analyses of the seismic and dynamic loads on the as-built control rods conclude that:
i. stress and strain do not exceed the ultimate stress or strain limits of the material, structure, or welded connection, as specified in FSAR Reference 4.2-202.
ii. fatigue usage factor does not exceed 1.0.
iii. the calculated maximum horizontal fuel channel oscillation amplitude limit in FSAR Reference 4.2-202 is met.

Global Nuclear Fuel - Americas LLC

AFFIDAVIT

I, Patricia L. Campbell, state as follows:

(1) I am the Vice President, Washington Regulatory Affairs, of GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in GNF-A proprietary report, WG3-002N9544, "North Anna Unit 3 Site-Specific GE14E Fuel Assembly Mechanical Design Report," Revision 2, Class II (GNF-A Proprietary Information), May 2016. The GNF-A proprietary information in WG3-002N9544 is identified by a dark red dotted underline inside double square brackets. [[This sentence is an example.{3}]] Figures and large equation objects containing GNF-A proprietary information are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit that provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act (FOIA), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).

(4) Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over GNF-A and/or other companies.

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

c. Information that reveals aspects of past, present, or future GNF-A customer-funded development plans and programs, that may include potential products of GNF-A.

d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GNF-A.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.

(8) The information identified in paragraph (2) above is classified as proprietary because it contains details of GNF-A's fuel design and licensing methodology for the ESBWR design certification, which is referenced in the North Anna 3 Combined License Application. Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GNF-A. The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GNF-A asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit-making opportunities. The fuel design and licensing methodology is part of GNF-A's comprehensive BWR, including the ESBWR, safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GNF-A. The precise value of the expertise to

devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GNF-A would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GNF-A of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

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

Executed on this 9th day of May 2016.

Patricia L. Campbell

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