March 18, 2016

MEMORANDUM TO: Ronaldo V. Jenkins, Chief
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

FROM: James Shea, Senior Project Manager **/RA/**
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: REGULATORY AUDIT REPORT FOR DOMINION VIRGINIA POWER, COMBINED LICENSE APPLICATION SITE-SPECIFIC SEISMIC DEMAND AND SUPPORTING ANALYSES (TAC NO. RP7614)

Enclosed is the U.S. Nuclear Regulatory Commission (NRC) staff's seismic audit-1 report for Dominion Virginia Power (Dominion) regarding the North Anna 3 Combined Operating License Application (COLA) (Docket No. 52-017). The staff reviewed site-specific seismic demand analyses and calculations used in support of the North Anna COLA Final Safety Analysis Report Chapter 3, Sections 3.7 and 3.8. This audit is the first of two audits to be completed by the staff as part of the applicants seismic closure plan dated October 22, 2014.

The audit was conducted over five days, starting on September 28, 2015, at the General Electric-Hitachi Offices in Wilmington, North Carolina. The staff reviewed several applicant calculation reports and closed a number of significant action items as outlined in the enclosed report. No new significant issues were identified or requests for information were needed as a result of this staff audit.

Docket No.: 52-017

Enclosure:
As stated

cc w/encl: See next page

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the U.S. Nuclear Regulatory Commission (NRC) staff's seismic audit-1 report for Dominion Virginia Power (Dominion) regarding the North Anna 3 Combined Operating License Application (COLA) (Docket No. 52-017). The staff performed site-specific seismic demand analyses and calculations used in support of the staff's review of the North Anna COLA Final Safety Evaluation Chapter 3, Sections 3.7 and 3.8. This audit is the first of two audits to be completed by the staff as part of the applicants seismic closure plan dated October 22, 2014.

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DATE	03/02/2016	03/07/2016	03/14/2016	03/18/2016	03/18/2016

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Audit of Site-Specific Seismic Input/Demand and the Supporting Analyses (Final Safety Analysis Report (FSAR) Section 3.7)

Dates of Audit: September 28 to October 2, 2015

Audit Location: GE Hitachi Office
3901 Castle Hayne Road 3901,
Wilmington, NC 28401

Review Team: James Shea (NRC Project Manager)
Donald Brittner (NRC Project Manager)
Jim Xu (NRC SEB Branch Chief)
Manas Chakravorty (NRC Lead Technical Reviewer)
Jinsuo Nie (NRC Technical Reviewer)
George Wang (NRC Technical Reviewer)
Sunwoo Park (NRC Technical Reviewer)
Joseph Braverman (BNL, NRC contractor)

Audit Scope

The scope of this audit was to review the site-specific seismic input and seismic soil-structure interaction/structure-soil-structure interaction (SSI/SSSI) analyses performed to establish the site-specific seismic demand for the North Anna 3 Combined License application, as well as the responses to the U. S. Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI) pertaining to the FSAR Section 3.7 (submitted in February 2015 and July 2015).

Specifically, the staff reviewed supporting calculations, markups to the FSAR Tier 2, Section 3.7, and other pertinent documents that were prepared to support the information submitted by Dominion in accordance with its Seismic Closure Plan (SCP) transmitted in Dominion letter NA3-14-043, dated October 22, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14297A199). The major focus of the audit included site-specific input development, seismic demand development and the associated methods and analyses for the reactor and fuel building (RB/FB), control building (CB), and firewater service complex (FWSC), sensitivity and stability analyses, verification and validation (V&V) of system for analysis of soil-structure interaction (SASSI) 2010, [a computer code for performing finite element analyses of soil-structure interaction during seismic ground motions] and advanced computational software for 3D dynamic analysis (ACS SASSI), methodology for exceedance consideration, and seismic demand for the Spent Fuel Pool and Buffer Pool Storage Racks and Passive Containment Cooling System (PCCS) condenser.

A list of 29 Bechtel calculations and 42 GEH supporting reports available for the NRC audit is included in Table 1, "List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit."

Audit Summary

The Applicant for North Anna 3 Dominion Virginia Power (DOM) and its representatives from GE-Hitachi (GEH), Bechtel Corporation, Shimizu Corporation, Fluor Corporation participated in the audit, including key technical personnel involved with the North Anna 3 site specific seismic analysis. A list of attendees including the NRC staff as well as its contractor from Brookhaven National Laboratory (BNL) is provided in Table 2.

The NRC staff made some introductory remarks regarding the audit background, scope, objectives, and agenda. Following these remarks, GEH presented a brief overview of the development of the additional oscillators and the confirmatory Nuclear Energy Institute (NEI) check[1]. To address questions that the staff raised during the audit, the applicant presented information to facilitate the discussion on: comparison of maximum absolute acceleration (ZPA) at the top of the basemat and the peak ground acceleration ("PGA") of the foundation input response spectra (FIRS) for RB/FB and CB, and confirmatory NEI check with modified acceleration time histories. During the audit, the staff conducted a detailed review of selected calculations and reports. The staff focused on the following areas:

- Review of SSI inputs, development of strain iterated backfill/rock profiles, and synthetic time histories
- Review of the V&V report of SASSI 2010, V&V calculation for ACS SASSI, and benchmark studies for comparing the SASSI 2010 Direct Method (DM) and Modified Subtraction Method (MSM)
- Review of calculations addressing the spurious spikes in transfer functions
- Review of the FWSC concrete fill demand calculation
- Review of the large difference between the ZPA at the top of basemat and the "PGA" of the FIRS for CB and RB/FB
- Review of SSI analysis of RB/FB, CB, and FWSC models
- Review of SSSI analysis of CB-RB/FB, CB-FWSC, and FWSC-CB models
- Review of RB/FB, CB, and FWSC seismic stability analyses which include sliding, overturning, soil bearing pressures and lateral soil pressures on embedded walls
- Review of the development of additional oscillators used in seismic analysis models
- Review of seismic demand loads for fuel racks

[1] The NEI New Reactor Seismic Issues Resolution Program undertook several studies producing industry white papers. The guidelines developed in ISG-17, the NEI white paper, and the development of the criteria associated with this ISG result from the coordination of the industry initiative, U.S. Nuclear Regulatory Commission (NRC) studies, and other stakeholder inputs through interactions in public meetings. In particular, the meeting of September 25–26, 2008, was instrumental in establishing a framework of common understanding (see meeting summary, ADAMS Accession No. ML082950476)

- Review of seismic demand loads for PCCS condenser

- Details of the review and discussions are given below following this section of the audit report.

The audit concluded in an exit meeting with a list of follow-up actions identified, as shown in Attachment 2, "Audit of Site-Specific Seismic Input/Demand and the Supporting Analyses (FSAR Section 3.7) - Summary and Disposition of Issues of the North Anna 3 Audit." A detailed list on the staff discussions and issues raised before the audit is provided in Attachment 1, "Audit of Site-Specific Seismic Input/Demand and the Supporting Analyses (FSAR Section 3.7) – Notes from Dominion NA3 COLA Seismic Update Meeting with NRC April 15, 2015."

Following the audit, a clarification call with Dominion was made to convey some minor comments on the list of action items in Attachment 2. The actions included revision of a couple of additional calculations to address uplift, justification of American Concrete Institute (ACI) codes for use in FWSC concrete fill shear capacity evaluation, revisions of the technical reports, and improvement of the FSAR markups.

Detailed Review and Discussions

1. Review of SSI inputs, development of strain compatible backfill/soil profiles, and synthetic time histories

2. Selected Bechtel and GEH calculations were reviewed during the audit for the purpose of assessing the development of SSI inputs, strain compatible backfill/soil profiles, and input time histories.

    - **TODI WG3-3-A25-TDI-0006, Revision 0**, "North Anna 3 Best Estimate Elevation of Top of Zone III Rock and Top of Zone III-IV Rock for RB/FB, CB and FWSC Structures." The best estimate elevations for the top of Zone III rock is 274 ft in the area of RB/FB, and 265 ft in the area of CB. The best estimate elevation for the top of Zone III-IV rock is 224 ft in the area of RB/FB and 225 ft in the area of CB. The best estimate elevations for the top of Zone III rock and Zone III/IV rock in the area of FWSC are 244 ft and 220 ft, respectively. **No issues were found.**

    - **TODI WG3-3-A25-TDI-0009, Revision 0**, "1E4 and 1E5 Digitized Site Amplification Factors from Bore Hole B-901, B-907 and B-909 Soil Columns." **No issues were found** for the amplification factors for those bore holes.

    - **TODI WG3-A25-TDI-S-0006, Revision 0**, "North Anna 3 RB/FB, CB & FWSC Outcrop SSI Design Motion Time- Histories." The design motion time histories were examined in the staff confirmatory analysis, and **no issues were found** during the review of this report.

    - **25161-G-011, Revision 10**, "COL Dynamic Properties of Bedrock." The shear wave velocity of the 2500 psi concrete fill was estimated to be 7000 ft/s, based on two approaches. **No issues were found.**

    - **25659-000-K0C-0000-00010, Revision 0**, "Soil Profile Simulation for RB/FB and

CB." There was a concern on the applicant's method to calculate the log standard deviation of the stain-compatible soil properties. The staff performed a confirmatory analysis of the 60 simulated soil profiles for the four cases LF4, HF4, LF5, and HF5; and the staff determined that the concerned method could not lead to a significantly biased estimate because the LF4 and HF4 profiles were very close. The confirmatory analysis identified several consistency issues in the data files the applicant submitted and those inconsistencies were explained later by the applicant in a conference call and during the September 10, 2015, public meeting. The audit review confirmed these aspects. During the audit, the staff found that an equation related to the interpolation between the 1E-4 and 1E-5 appeared to be different from that included in the response to RAI 7520, **Question 03.07.01-8. Bechtel staff and the NRC staff were able to show the equivalence of the two equations at the audit.**

- **25659-000-K0C-0000-00011, Revision 0**, "Site Response Analysis, GMRS and FIRS for RB/FB and CB." The RVT method implemented in P-SHAKE was used to perform the site response analyses. The strain-compatible P-wave velocities were calculated using the strain-compatible Vs and Poisson's ratios. V/H ratios were used to calculate the vertical design response spectra. The site response analyses followed the Regulatory Guide 1.208 guidance. GMRS was calculated at El. 224 ft, which is at the lowest excavation level. The effect of water levels and the potential numerical problem in SSI analysis caused by high Poisson's ratio were considered in the site response analyses. **No issues were identified in the review of this report.**

- **25659-000-K0C-0000-00017, Revision 2**, "Development of Spectrum Compatible Time Histories for the Economic Simplified Boiling-Water Reactor (ESBWR) FWSC FIRS Spectra." Bechtel code "RSPM" was used to generate spectrum-matching time histories. The staff performed a confirmatory analysis of the final design time histories in a separate effort. The applicant performed an assessment of the power sufficiency in the time histories without comparing to properly determined target power spectral density functions. However, the staff's confirmatory analysis on this issue concluded that the design time histories were acceptable. **No other issues were identified in this calculation.**

In summary, the staff did not identify any new issues in the areas of the development of seismic inputs, strain-compatible soil profiles, and design acceleration time histories during the audit, and the applicant answered staff's questions adequately.

3. Review of the V&V report of SASSI2010, and the V&V calculation for ACS SASSI, and the benchmark studies for comparing the SASSI 2010 Direct Method (DM) and Modified Subtraction Method (MSM)

   The staff's review of the responses to RAI 7536, Question 03.07.02-10; RAI 7810, Question 03.07.02-26; and technical reports did not identify any further technical issues beyond those described in the RAIs. All technical issues identified previously were addressed adequately in the RAI responses. However, since only SER-DMN-020, Revision 2, "Validation Summary Report," was submitted for staff review before the audit, the full SASSI 2010 V&V report, S/VTR-SAS, Revision 1, "Validation Test Report for SASSI 2010 Version 1," was reviewed during the audit to confirm the consistency

between the summary report and the V&V report. The V&V of ACS SASSI is documented in Appendix I to WG3-U71-ERD-S-0001, Revision 2, "Reactor/Fuel Building Complex Seismic Analysis Report." At the audit, Dominion discussed ACS SASSI Product Acceptance Test and other relevant documentation. **The applicant agreed to incorporate into the FSAR the conclusions regarding the V&V of ACS SASSI as presented in Appendix I to WG3-U71-ERD-S-0001, Revision 2.**

4. Review of calculations addressing the spurious spikes in transfer functions

During the audit, the staff reviewed SER-DMN-033, Revision 0, "Effect of Additional Frequencies on SSI Analysis Results," as part of assessing the effect of the spurious peaks in some of the SASSI transfer functions on structural responses. To address the issue of spurious peaks in transfer functions, the applicant performed additional SASSI analyses with frequencies added near the numerical anomalies. The additional SASSI analysis cases were:

For RB/FB: UC100 model for LB, BE, UB partial columns; UC100 model LB, BE, UB full columns; CR00 and CR50 models for LB full column

For CB: UC_OBE full columns

For FWSC: UC_OBE full columns with input at El. 220 ft

For CB-FWSC: UB full column

The transfer function plots showed that many spurious peaks disappeared after adding additional frequencies. However, some transfer functions showed increases at the additional frequencies, with some increases being very large but within a very narrow frequency range.

The structural responses were used to determine the effect of the spurious peaks. For RB/FB, 2 percent or less difference was observed in the maximum acceleration, maximum forces/moments for governing cases, while larger differences (but still <10%) were observed for non-governing cases. For other structures, the report concluded that the agreement is very good. In its review of the tables and figures included in this report, the staff recognized that the relative difference for the second mode of an oscillator is about 10 percent. However, since the first modal response is much larger than the second modal response and the relative difference in the first modal response is very small, the effect on the combined structural response would be very small.

No other issues were identified.

5. Review of the FWSC concrete fill demand calculation

SER-DMN-034, Revision 0, "Effects of Soil Separation of FWSC," documents the seismic shear demand calculation for the concrete fill below the FWSC. SASSI2010 was used to analyze the soil separation effect, using the MSM method and the same interaction nodes as the benchmark study. The stress results from the three components of input motion were combined using the algebraic sum method in the time domain. The sensitivity analysis of soil separation was performed for the LB, BE, and UB FWSC SSI models and for the LB, BE, and UB FWSC-CB SSSI models. Soil

separation depths vary from case to case in a range of 4.75 m to 8.83 m, which were determined based on the static soil pressure and dynamic (tensile) pressure on the walls. The calculated soil separation depths generally agree with the ASCE 4-98 provision for soil separation consideration, which is 6 m. Soil separation was achieved in the SSI/SSSI model by deleting the contact springs.

To calculate the shear demand at a horizontal cross section in the concrete fill, the shear stresses in all elements across that section were summed. However, the number of elements in the report was not clearly defined regarding whether it consists of only the half SSI model or the whole structural section (which doubles the number of elements). The Shimizu staff confirmed that the number of elements appropriately considers the whole section (not the half model).

The applicability of ACI 207 or ACI 318/349 to the design consideration of the shear capacity of the concrete fill was discussed at the audit. The conclusion from this discussion was that the FWSC concrete fill has its own unique engineering characteristics and since this is a design issue, it will be explored further in the seismic design phase and will be audited in the second audit.

The exceedance in the site-specific structural response due to soil separation for FWSC was discussed. The soil separation analyses showed that the maximum increase in structural demands was about 7 percent and the maximum increase in ISRS was about 30 percent. These exceedances were not initially considered for the site-specific design evaluation. However, the staff requested at the audit and **the applicant agreed to consider these exceedance in their structural design and in the design of equipment and components.**

6. Review of the large difference between the ZPA at the top of basemat and the “PGA” of the FIRS for CB and RB/FB

The staff noticed at the April 15, 2015, public meeting that the ZPA at the top of the CB basemat was significantly smaller than the “PGA” (spectral acceleration at 100 Hz) of the FIRS. The applicant provided reasons why that happened during the September 10, 2015, pubic meeting. The major reason the applicant provided is that the in-column peak acceleration is significantly smaller than the “PGA” of the FIRS. The staff accepted the applicant’s explanation during the September 10, 2015, public meeting and requested the applicant perform the same comparison for the RB/FB building and the FWSC.

During the audit, the applicant presented the same comparison for the RB/FB building. A similar but smaller difference was observed as compared to the CB building. The staff noticed that the in-column response spectra is higher than the FIRS for the RB/FB building in the lower frequency region with a higher margin and larger frequency range than the case of CB. The higher in-column spectra than the FIRS in the low frequency range was a result of the NEI check, which led to increases in SSI input response spectra in the same frequency range. Higher low frequency components in an acceleration time history led to larger spectral accelerations in high frequency range, which resulted in the smaller difference for RB/FB than for CB between the ZPA at the top of the basemat and the “PGA” of the FIRS.

The applicant did not perform this comparison for the FWSC because it is surface

founded. The staff accepted this explanation.

7. Review of SSI analysis of RB/FB, CB, and FWSC

Confirmatory NEI Check

The applicant performed the NEI check using the random vibration theory (RVT) method during the development of the ground motion response spectrum (GMRS) and FIRS. The staff noticed that the design time histories used in the SSI analysis were not confirmed whether the envelope of the corresponding response spectra at the ground surface also envelops the performance based surface response spectra (PBSRS). At the staff's request, the applicant compared this envelope with the PBSRS; however a ±20 percent smoothing was applied on the envelope of the three acceleration response spectra (corresponding to the lower bound (LB), best-estimate (BE) and upper bound (UB) soil profiles) at the ground surface. The staff did not consider the approach of smoothing the response spectrum was acceptable because the ±20 percent smoothing method is normally applied to power spectral density function but not to response spectra. The staff requested, during the September 10, 2015, public meeting (ADAMS Accession No. ML15267A050), that the applicant compare the raw envelope of the three response spectra to the PBSRS.

The applicant presented the comparison of the raw envelope to the PBSRS, and found there were a few cases that the raw envelopes of response spectra at the ground surface for the LB, BE, and UB soil cases were below the PBSRS for some frequencies.

For the cases in the horizontal direction, the dips were generally small and occurred in very narrow frequency ranges. These dips correlate to the dips shown on the spectrally matched response spectra. However, since the structural demands were calculated using the design time histories (not directly using the FIRS) in the SSI analysis, the staff requested, during the audit, that the applicant assess the effect of these dips on structural responses. The applicant took the time history for the CB partial column in the H1 direction, and changed several points in this time history so that its response spectrum was above the design response spectrum around the affected frequency. The in-structure response spectra (ISRS) calculated using this modified time history did not show significant changes and those changes did not affect the enveloping and broadened ISRS. Therefore, it was concluded that the small dips which occurred in very narrow frequency ranges in the raw envelope were acceptable.

For the case in the vertical direction, the applicant explained that the PBSRS was calculated using the response spectral ratios (V/H) from NUREG/CR-6728 (ADAMS Accession No. ML013100012), and is not necessarily consistent with response spectra of the synthetic time histories in the vertical direction. The staff agreed during the audit that this explanation was reasonable and acceptable. The applicant agreed to incorporate this explanation to the FSAR. After the audit, the staff also reviewed the pertinent information in interim staff guidance (ISG) - DC/COL-ISG-17, FSAR, and NUREG/CR-6728, and found that since both the vertical FIRS and PBSRS used the same V/H ratio, they were not consistent with the vertical soil profiles (but rather consistent with the horizontal soil profiles). The observed difference between the vertical PBSRS and the envelope of the vertical FIRS propagated up to the ground surface is expected.

Uplift Calculation for RB/FB and CB

During the review of the methods for calculation of basemat uplift, the staff noticed that the stress contours of the basemat showed only uplift along the exterior walls for RB/FB and CB, which did not appear to be realistic. A further review of this issue revealed that the SSI models for these two structures do not have interior walls connected to the basemat. These models were judged to be adequate for other SSI responses because there were rigid beams connecting the super structure (lumped mass stick model) to the exterior walls (shell elements) at the top of the basemat. However, because the basemat was modeled as shell elements without the interior walls to represent the stiffness of the super structure against the basemat, the shell model representation of the basemat is much more flexible than the real basemat construction. Therefore, the staff requested the applicant perform uplift calculation using an appropriate method to consider the effect of the interior walls (and consequently also the stiffness of the super structure).

In addition to performing the calculations discussed above, the applicant agreed that the reports for the RB/FB SSI analysis and CB SSI analysis, as well as the FSAR, would be updated to reflect the additional uplift calculations that properly consider the stiffness of interior walls and super structures.

The SSI model for the FWSC was considered to be adequate because its basemat is modeled in a manner that represents the actual structure.

8. Review of SSSI analysis of CB-RB/FB, CB-FWSC, and FWSC-CB models

Selected North Anna 3 report WG3-U73-ERD-S-0002, Revision 4, “Control Building and Firewater Service Complex SSSI Analysis Report,” dated September 25, 2015, and North Anna 3 report WG3-U73-ERD-S-0005, Revision 1, “Control Building and Reactor/Fuel Building Complex SSSI Analysis Report,” dated September 18, 2015, were reviewed. The applicant explained the scaling method [$CR_{SSSI}=(UC_{SSSI}/UC_{SSI})xCR_{SSI}$] during the audit to consider the concrete cracking for the SSSI analyses of CB-RB/FB, CB-FWSC and FWSC-CB models. The results indicated that both ISRS and load demands for the FWSC and ISRS for the CB were affected by the scaling factor. **The staff found the scaling method to be acceptable.**

The staff did not identify any new issues during the audit.

9. Review of RB/FB, CB, and FWSC seismic stability analyses which include sliding, overturning, soil bearing pressures and lateral soil pressures on embedded walls

Selected North Anna 3 calculations and reports related to the stability analyses were reviewed during the audit. These reviews included evaluations of the consideration of stiffness variations and SSSI effects, seismic lateral soil pressures on embedded walls, and parameters used in the stability analyses.

For the RB/FB, the North Anna 3 report WG3-U71-ERD-S-0001, Revision 2, “Reactor/Fuel Building Complex Seismic Analysis Report,” dated September 25, 2015, were reviewed. In particular, Appendix B, Section B.4.1, “Effect of Stiffness Variation on Site-Specific Structural Loads Demands,” was reviewed to determine whether the effects of concrete cracking affect the loads used in the sliding, overturning, soil bear pressures

and lateral soil pressures on embedded walls. This section of the report refers to Figures B.4-1 through B.4-4, and B.4-6 through B.4-9 which show that the cracked cases for shear force demands, overturning moments, and vertical accelerations are bounded by the uncracked case (UC100 model with OBE damping). Therefore, the licensing basis analyses of the UC100 model provide seismic demands for the evaluation of the RB/FB foundation stability, dynamic soil bearing pressures, and lateral dynamic pressures on the embedded walls that bound the effects of structural stiffness variations. Because the RB/FB is so much heavier than the CB, the SSSI effects of the CB on the RB/FB were determined not to have a significant effect.

For the CB, the North Anna 3 report WG3-U73-ERD-S-0001, Revision 1, "Control Building Seismic Analysis Report," dated September 25, 2015, were reviewed. Based on the information and results presented in Appendix B, Section B.4.1, "Effect of Stiffness Variation on Site-Specific Structural Loads Demands," it was determined that the licensing basis analyses of the UC_{SSE} (full stiffness properties and SSE damping) model provide seismic demands for the evaluation of the CB foundation stability, dynamic bearing soil pressures, and lateral dynamic pressures on embedded walls that bound the effects of structural stiffness variation.

For the consideration of SSSI effects on the CB by the RB/FB, North Anna 3 report WG3-U73-ERD-S-0005, Revision 1, "Control Building and Reactor/Fuel Building Complex SSSI Analysis Report," dated September 18, 2015, was reviewed. The results presented in Section 5.5, "SSSI Effects of RB/FB on Site-Specific Load Demands on CB Structure," and associated figures, show that the North Anna 3 site-specific SSI loads bound the SSSI loads, and in the case of vertical accelerations are practically the same as the SSSI loads.

For the consideration of SSSI effects on the CB by the FWSC, North Anna 3 report WG3-U73-ERD-S-0002, Revision 4, "Control Building and Firewater Service Complex SSSI Analysis Report," dated September 25, 2015, was reviewed. Based on Section 5.5, "SSSI Effects of FWSC on Site-Specific Load Demands on CB Structure," and associated figures, the North Anna 3 site-specific SSI loads bound the SSSI loads.

For the FWSC, the North Anna 3 report WG3-U63-ERD-S-0001, Revision 1, "Firewater Service Complex Seismic Analysis Report," dated September 25, 2015, were reviewed. The information and results presented in Appendix B, Section B.4.1, "Effect of Stiffness Variation on Site-Specific Structural Loads Demands," and associated figures, show that the cracked cases for shear force demands, overturning moments, and vertical accelerations are bounded by the design basis uncracked case (UC_{SSE} SSI) for both the fire water storage tank (FWS) and fire pump enclosure (FPE) lumped mass stick models (LMSMs), with the exception of the FWS stick obtained from the analysis of the FWSC CR_{SSE}. This mass node represents only a portion of the total weight of the FWSC, and therefore, the effect of this exceedance on the total vertical seismic demand on the supporting subgrade was determined to be negligible.

For SSSI effects on the FWSC by the CB, North Anna 3 report WG3-U73-ERD-S-0002, Revision 4, "Control Building and Firewater Service Complex SSSI Analysis Report," dated September 25, 2015, was reviewed. Section 5 of this report indicates that some increases in loads occur. Section 7 of this report indicates that the results obtained from

the FWSC-CB SSSI analyses presented in this report will be used to develop the FWSC site-specific design basis that will envelop amplifications of the FWSC response that are due to the SSSI with the CB.

To evaluate the basis for using a coefficient of friction equal to 0.6 in the sliding stability analyses of the seismic Category I structures, North Anna 3 report TODI WG3-3-A25-TDI-0007, "North Anna 3 Engineering Properties of Subsurface Material for Sliding Stability Analyses," Revision 0, was reviewed. This report indicates that the 0.6 coefficient of friction was based on the value of 0.6 for Zone III and 0.65 for Zone III-IV subsurface material against concrete. These values are also identified in North Anna 3 FSAR Table 2.5.4-208. For CB and FWSC, these structures have an additional potential sliding plane i.e., basemat to concrete fill. The use of 0.6 is consistent with the provisions of ACI 318 for concrete placed against hardened concrete not intentionally roughened. Thus, 0.6 is used as the minimum coefficient of friction for the sliding stability analyses.

A question regarding the calculation of seismic lateral soil pressures on embedded walls was raised during the audit. Based on the methodology used in the ESBWR standard design and the guidance in Standard Review Plan Section 3.8.4, the dynamic lateral soil pressure distributions on embedded walls consider all three cases consisting of the lateral soil pressures from the seismic SSI/SSSI analyses, ASCE 4-98 methodology, and the passive pressures relied upon in the sliding stability analysis. In the case of North Anna 3, the American Society of Civil Engineers. Standards (ASCE 4-98) methodology was not considered. In response, Dominion explained why the ASCE 4-98 methodology was not utilized. The technical justifications provided for not using the ASCE 4-98 method are primarily based on the observations that the assumptions embedded in the ASCE method are not consistent with the North Anna 3 site conditions. The ASCE method is based on the assumption of a homogenous distribution of soil media, while the embedment of the RB/FB and CB at the North Anna 3 site consists of layers of saprolite/engineered backfill and Zone III rock/concrete fill, whose stiffness properties are significantly different. Also, the ASCE method assumes that the building/walls below grade are rigid and the support media beneath the structure is rigid, which are not consistent with the North Anna 3 conditions. The use of SASSI SSI and SSSI analyses were judged to be more suitable to capture the dynamic response in terms of capturing the seismic wave propagations, wave scattering, varying soil/rock layering effects, interaction effects between structures, and flexibility effects of below grade walls.

10. Review of the development of additional oscillators used in seismic analysis models

Based on the staff review of North Anna 3 report SER-DMN-014, Revision 1, dated March 13, 2015, a number of questions identified by the NRC team were discussed with Dominion. Some of the questions were addressed by showing that the approach used to develop these oscillators was the same approach utilized in the ESBWR standard design. Others were addressed by providing explanations of the figures showing the modeling of the floor slabs and grouping of the different floor regions into oscillator springs. The basis for some of the equations and criteria for determining the additional oscillators were also explained. Lastly, the data presented in the various tables were reviewed with Dominion to ensure proper interpretation by the NRC staff.

11. Review of seismic demand loads for fuel racks

The North Anna 3 GEH report 002N8467, Revision 1, dated August 2015, “North Anna 3 Fuel Rack Seismic Analysis,” was reviewed. This report summarizes the analysis of all three fuel rack designs: spent fuel storage racks in the spent fuel pool, spent fuel storage racks in the deep pit of the buffer pool, and the new fuel storage racks in the buffer pool. The fuel racks were reanalyzed using the North Anna 3 site-specific SSE response spectra. A comparison of the North Anna 3 site-specific response spectra to the standard design response spectra used previously was presented in the report. There were some increases in the North Anna 3 SSE spectra at certain frequency ranges, with the more significant increases occurring primarily in the vertical direction.

The results of the reanalysis of the fuel racks show that the forces, displacements, component stresses, and maximum reactions on the bearing pads in the pool liner are either bounded by the results presented in NEDO-33373, Revision 5, “Dynamic Load-Drop and Thermal-Hydraulic Analyses for ESBWR Fuel Racks,” September 2010, or are below their code allowable values, with a few exceptions. The few exceptions are being addressed by making design changes to the racks. Four items that were requested by the staff to be provided in the future are: (1) enhance the fuel rack report to demonstrate the adequacy of the acceleration time histories that are also to be used to evaluate the racks, (2) present plots of the seismic response spectra of the acceleration time histories for comparison with the response spectra determined for the North Anna 3 fuel rack seismic analysis, (3) document the structural adequacy of the fuel assembly stored in the racks, and (4) revise the FSAR for the fuel racks summarizing the evaluations performed.

12. Review of seismic demand loads for PCCS condenser

The North Anna 3 GEH report 002N8530, Revision 1, dated August 2015, “North Anna 3 PCCS Condenser Seismic Analysis,” was reviewed. This report summarizes the analysis of the PCCS condenser using the site-specific North Anna 3, SSE response spectra. A comparison of the North Anna 3 site-specific response spectra to the standard design response spectra used previously was presented in the report. There were some increases in the North Anna 3 SSE spectra at certain frequency ranges, primarily in the vertical direction. Based on the seismic reanalysis, the component stresses are all below their allowable values. For the maximum reactions on the top slab penetration and support base plate anchor bolts, all loads remain below the results presented in NEDE-33572P, Revision 3, “ESBWR ICS and PCCS Condenser Combustible Gas Mitigation and Structural Evaluation,” September 2010, with one exception. The tension on the support saddle bolts increased, and thus, the support saddle bolts and embedment will be designed to withstand this increase in the anchor tension load. The staff requested that the FSAR be revised to summarize the evaluations performed for the PCCS condenser.

13. Miscellaneous

ITAAC for Seismic Category II Structures

Because of the potential SSSI effect of a seismic Category II structure on an adjacent seismic Category I structure, the staff pointed out the need for updating affected ITAAC and the applicant agreed to revise the ITAAC for Category II Structures (Turbine Building, Service Building, Ancillary Diesel Building, and Radwaste Building) to be specific regarding adjacent Category I structures. Also the applicant agreed to add an ITAAC for the design of seismic Category II Access Tunnel.

SSE Definition at Elevation 220 ft for FWSC

The applicant agreed to revise COLA Part 10 as necessary to include the FWSC SSI Input Response Spectra at Elevation 220 ft in the definition of the SSE. The applicant will also review other parts of the COLA (e.g., Part 7) to determine if other changes need to be made.

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Bechtel Calculations Developed for FSAR Section 3.7 (Including Supporting Calculations)

Doc Type	Document No. (Bechtel SDN)	Revision	Title	Audit Primary or supporting calc.	Supporting (Input) Calcs/Docs	Notes
Calc	25161-G-011	10	COL Dynamic Properties of Bedrock	supporting		Input to multiple FSAR 3.7 calcs
Calc	25161-G-017	6	COL Dynamic Properties of Soil and Weathered Rock	supporting		Input to multiple FSAR 3.7 calcs
Calc	25161-G-018	6	Engineering Properties of Subsurface Materials [Static]	supporting		Input to multiple FSAR 3.7 calcs Input to GEH analyses (Ref. TODIs WG3-3-A25-TDI-0003 and WG3-3-A25-TDI-0007)
Calc	25161-G-019	7	Bearing Capacity and Settlement Analysis	supporting		Input to calc 25659-000-K0C- 0000-00034 Input to GEH analysis (Ref. TODI WG3-3-A25-TDI-0007)
Calc	25161-G-036	3	Groundwater Flow Model	supporting		Input to GEH analysis (Ref. TODI WG3-3-A25-TDI-0004)
Calc	25161-G-603	1	Shear Wave Velocity Profile for Unit 1 and 2 Containment Buildings	supporting		Input to calc 25659-000-K0C- 0000-00035
Calc	25161-G-606	0	SSI Analysis of Units 1 and 2 Containment Building Subject to 2011 Mineral, VA Earthquake	supporting		Input to calc 25659-000-K0C- 0000-00035
Calc	25659-000-K0C-0000-00010	0	Soil Profile Simulation for RB/FB and CB	primary	25161-G-011 25161-G-017 25161-G-018 25659-000-V14-CY05-00024 Dominion letter 25659-000-LC- GAM-00044 (Revised response to RFI 25659-000-GRI-GEX-00034)	Input to GEH analysis (Ref. TODI WG3-3-A25-TDI-0006)

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No. (Bechtel SDN)	Revision	Title	Audit Primary or supporting calc.	Supporting (Input) Calcs/Docs	Notes
Calc	25659-000-K0C-0000-00011	0	Site Response Analysis, GMRS and FIRS for RB/FB and CB	supporting		Input to calc 25659-000-K0C- 0000-00026 Input to GEH analysis (Ref. TODI WG3-3-A25-TDI-0007)
Calc	25659-000-K0C-0000-00014	1	SSI Input Profiles for ESBWR RB/FB and CB	supporting		Input to calc 25659-000-K0C- 0000-00029
Calc	25659-000-K0C-0000-00015	0	Soil Profile Simulation for FWSC	primary	25161-G-011 25161-G-017 25161-G-018 25659-000-K0C-0000-00010 Dominion letter 25659-000-LC- GAM-00044 (Revised response to RFI 25659-000-GRI-GEX-00034)	Input to GEH analysis (Ref. TODI WG3-3-A25-TDI-0006)
Calc	25659-000-K0C-0000-00016	1	Site Response Analysis and FIRS Calculation for ESBWR FWSC	supporting		Input to calc 25659-000-K0C- 0000-00030
Calc	25659-000-K0C-0000-00017	2	Development of Spectrum Compatible Time Histories for the ESBWR FWSC FIRS Spectra	supporting		Input to calc 25659-000-K0C- 0000-00031
Calc	25659-000-K0C-0000-00021	1	Soil Profile Simulation and Site Response Analysis for Free Field Slope Stability Evaluation	primary	25161-G-011 25161-G-017 25161-G-018 25659-000-K0C-0000-00010 25659-000-K0C-0000-00015 25659-000-K0C-0000-00026 25659-000-K0C-0000-00030 25659-000-V14-CY05-00024 25659-000-V14-CY05-00033	

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No. (Bechtel SDN)	Revision	Title	Audit Primary or supporting calc.	Supporting (Input) Calcs/Docs	Notes
Calc	25659-000-K0C-0000-00026	1	Site Response Analysis, GMRS and FIRS for ESBWR RB/FB and CB - 2013 GMPE	primary	25161-G-011 25161-G-017 25161-G-018 25659-000-K0C-0000-00010 25659-000-K0C-0000-00011 25659-000-V14-CY05-00033 Dominion letter 25659-000-LC- GAM-00057 (Revised response to RFI 25659-000-GRI-GEX-00033 & -00044)	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0002)
Calc	25659-000-K0C-0000-00027	0	Acceleration Time History Matching for RB/FB and CB FIRS Spectra, EPRI 2013 GMM	primary	25659-000-K0C-0000-00026 25659-000-V14-CY05-00033	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0006)
Calc	25659-000-K0C-0000-00028	1	Power Spectral Density for CB and RB/FB FIRS Spectrum-Compatible Time Histories, EPRI 2013 GMM	primary	25659-000-K0C-0000-00027	
Calc	25659-000-K0C-0000-00029	1	SSI Inputs for ESBWR RB/FB and CB - 2013 GMPE	primary	25161-G-018 25659-000-K0C-0000-00010 25659-000-K0C-0000-00014 25659-000-K0C-0000-00026 25659-000-K0C-0000-00027 25659-000-V14-CY05-00033	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0004)
Calc	25659-000-K0C-0000-00030	0	Site Response Analysis and FIRS Calculation for ESBWR FWSC - 2013 GMPE	primary	25161-G-011 25161-G-017 25161-G-018 25659-000-K0C-0000-00010 25659-000-K0C-0000-00015 25659-000-K0C-0000-00016 25659-000-K0C-0000-00026 25659-000-V14-CY05-00033 Dominion letter 25659-000-LC- GAM-00057 (Revised response to RFI 25659-000-GRI-GEX-00033 & -00044)	

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No. (Bechtel SDN)	Revision	Title	Audit Primary or supporting calc.	Supporting (Input) Calcs/Docs	Notes
Calc	25659-000-K0C-0000-00031	0	Development of Spectrum Compatible Time Histories for the FWSC Spectra at Elevations 220 ft. and 282 ft. EPRI 2013 GMM	primary	25659-000-K0C-0000-00017 25659-000-K0C-0000-00030 25659-000-V14-CY05-00033	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0006)
Calc	25659-000-K0C-0000-00032	0	Power Spectral Density for FWSC FIRS Spectrum-Compatible Time Histories, EPRI 2013 GMM	primary	25659-000-K0C-0000-00031	
Calc	25659-000-K0C-0000-00033	0	SSI Inputs for FWSC - 2013 GMPE	primary	25659-000-K0C-0000-00015 25659-000-K0C-0000-00030 25659-000-K0C-0000-00031	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0004)
Calc	25659-000-K0C-0000-00034	0	Dynamic Lateral Bearing Pressure of Zone III Rock	primary	25161-G-018 25161-G-019	Input to GEH analysis (Ref. TODI WG3-A25-TDI-S-0003)
Calc	25659-000-K0C-0000-00035	0	Comparison Plot of Response Spectra of the 2011 Mineral, Virginia Earthquake Basemat Records and North Anna Unit 3 SSE	primary	25161-G-603 25161-G-606 25659-000-K0C-0000-00026 25659-000-K0C-0000-00029	Supports response to RAI 02.05.02-8
Calc-LCI	25659-000-V14-CY05-00024	V5	Deaggregation of 10-4, 10-5, and 10-6 Rock Hazard for North Anna using Updated Seismicity Files, 1000km Inclusion Distance (LCI Calculaton NAP001-PC-05, Rev. 4)	supporting		Input to calcs 25659-000-K0C- 0000-00010 and -00021
Calc-LCI	25659-000-V14-CY05-00033	V2	Deaggregation of 10-4, 10-5, and 10-6 Rock Hazard for North Anna using Updated Seismicity Files, 1000km Inclusion Distance, and the 2013 Ground Motion Model (LCI Calculaton NAP001-PC-09, Rev. 1)	supporting		Input to calcs 25659-000-K0C- 0000-00026, -00027, -00029, -00030 and -00031
RFI	25659-000-GRI-GEX-00033	n/a	Response issued by Dominion letter DOBE- WG3-2013-0019, June 2013 (SDN 25659-000- LC-GAM-00057)	supporting		Input to calcs 25659-000-K0C- 0000-00026 and -00030
RFI	25659-000-GRI-GEX-00034	n/a	Response issued by Dominion letter DOBE- WG3-2013-0006, May 2013 (SDN 25659-000- LC-GAM-00044)	supporting		Input to calcs 25659-000-K0C- 0000-00010 and -00015
RFI	25659-000-GRI-GEX-00044	n/a	Response issued by Dominion letter DOBE- WG3-2013-0019, June 2013 (SDN 25659-000- LC-GAM-00057)	supporting		Input to calcs 25659-000-K0C- 0000-00026 and -00030

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Dominion North Anna Unit 3 COLA
GEH Supporting Documents Developed for FSAR Secton3.7

Doc Type	Document No.	Rev	Title	Primary or supporting	Input	Notes
Report	S/VTR-SAS	I	Validation Test Report for SASSI 2010, Version 1	Supporting		
Report	SER-DMN-020	2	Validation Summary Report for SASSI 2010	Supporting		Revision 1 to NRC July 28, 2015
Report	SER-DMN-011	1	Benchmarking of SASSI2010 MSM Results from NA3 Site-Specific SSI Analysis	Supporting		Revision 1 to NRC July 28, 2015
Report	SER-DMN-014	1	Additional Oscillators for fully cracked model for RAI 3.7.2-14(f) Response	Supporting		Revision 1 to NRC June 3, 2015
Report	SER-DMN-019	0	RB/FB Seismic Analyses Bounding Results and In-Structure Response Spectra	Supporting		
Doc Type	**Document No.**	**Rev**	**Title**	**Primary or supporting**	**Input**	**Notes**
Report	SER-DMN-033	0	Effect of Additional Frequencies on SSI Analysis Results	Supporting		
Report	SER-DMN-034	0	Effects of Soil Separation of FWSC	Supporting		
Report	WG3-U71-ERD-S-0001	2	Reactor/Fuel Building Complex Seismic Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006, WG3-3-A25-TDI-5002, TODI WG3-A25-TDI-S-0004, WG3-A25-TDI-S-0005, TODI WG3-A25-TDI-S-0006, DBR-0006613, DBR-0009791	Revision 1 to NRC May 29, 2015
Report	WG3-U71-ERD-S-0003	0	Reactor/Fuel Building Complex Stability Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0007, TODI WG3-A25-TDI-S-0003	Revision 0 to NRC June 30, 2015

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No.	Rev	Title	Primary or supporting	Input	Notes
Report	WG3-U73-ERD-S-0001	1	Control Building Seismic Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006, TODI WG3-A25-TDI-S-0004, WG3-A25-TDI-S-0005, TODI WG3-A25-TDI-S-0006, DBR-0009791	Revision 0 to NRC June 30,2015
Report	WG3-U73-ERD-S-0002	4	Control Building and Firewater Service Complex Seismic Structure-Soil- Structure Interaction Analysis Report	Primary	TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006, TODI WG3-A25-TDI-S-0004, WG3-A25-TDI-S-0005, TODI WG3-A25-TDI-S-0006, DBR-0009791	Revision 1 to NRC August 17, 2015
Report	WG3-U73-ERD-S-0003	1	Control Building Stability Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006, TODI WG3-3-A25-TDI-0007, TODI WG3-A25-TDI-S-0003	Revision 0 to NRC July 28, 2015
Report	WG3-U73-ERD-S-0005	1	Control Building and Reactor/Fuel Building Complex Seismic Structure-Soil-Structure Interaction Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0006, SER-DMN-011, DBR-0009791	Revision 0 to NRC July 28, 2015
Report	WG3-U63-ERD-S-0001	1	Firewater Service Complex Seismic Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006, , TODI WG3-A25-TDI-S-0004, WG3-A25-TDI-S-0005, TODI WG3-A25-TDI-S-0006, DBR-0009791	Revision 0 to NRC June 30, 2015
Report	WG3-U63-ERD-S-0002	0	Firewater Service Complex Stability Analysis Report	Primary	TODI WG3-3-A25-TDI-0004, TODI WG3-3-A25-TDI-0007, TODI WG3-A25-TDI-S-0003, TODI WG3-3-A25-TDI-0005, TODI WG3-3-A25-TDI-0006,	Revision 0 to NRC June 30, 2015
Report	002N8467	1	North Anna 3 Fuel Rack Seismic Analysis	Primary	092-322-F-M-00001, 092-322-F-M-00002, 092-322-F-M-00003	Revision 1 to NRC August 31, 2015
Design Information	TODI WG3-3-A25- TDI-0004	0	North Anna 3 Maximum Ground Water Level	Supporting		

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No.	Rev	Title	Primary or supporting	Input	Notes
Design Information	TODI WG3-3-A25- TDI-0005	5	North Anna 3 Power Block Excavation/Backfill Drawings, Concrete Backfill Properties & Plot Plan	Supporting		
Design Information	TODI WG3-3-A25- TDI-0006,	0	North Anna 3 Best Estimate Elevation of Top of Zone III Rock and Top of Zone III-IV Rock for RB/FB, CB and FWSC Structures	Supporting		
Design Information	TODI WG3-3-A25- TDI-5002	0	North Anna 3 OBE Damping Values for RPV Components	Supporting	2005 RPV Model Document [PLM Legacy DRF Section 0000-0095-6924 R0, neFile 0000-0095-7691 R0 (file "ESBWRSeismicModel 02-10-05.pdf")]	
Design Information	TODI WG3-A25- TDI-S-0004	0	North Anna 3 RB/FB, CB & FWSC SSI Analyses EPRI 2013 GMPE Based Inputs	Supporting		
Design Information	TODI WG3-A25- TDI-S-0005	0	North Anna 3 RB/FB, CB & FWSC Distances from Adjacent Structures & Sheet Piling	Supporting		
Design Information	TODI WG3-A25- TDI-S-0006	0	North Anna 3 RB/FB, CB & FWSC Outcrop SSI Design Motion Time-Histories	Supporting		
Design Information	TODI WG3-3-A25- TDI-0007	0	North Anna 3 Engineering Properties of Subsurface Material for Sliding Stability Analysis	Supporting		
Design Information	TODI WG3-A25- TDI-S-0003	0	North Anna 3 Rock Allowable Bearing Pressure for Lateral Loading Conditions for the RB/FB, CB & FWSC	Supporting		
Design Information	TODI WG3-3-A25- TDI-0009	0	1E4 and 1E5 Digitized Site Amplification Factors from Bore Hole B-901, B-907 and B-909 Soil Columns	Supporting		
Design Information	TODI WG3-A25- TDI-S-0002	1	Digital Data for Design Response Spectra Curves	Supporting		

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No.	Rev	Title	Primary or supporting	Input	Notes
Calculation	DBR-0006613	1	Site-Specific Seismic Soil-Structure Interaction Analysis of Reduced Stiffness RB/FB Models for Best Estimate and Upper Bound Full Columns and Full Stiffness (uncracked) Model for Upper Bound Full Column	Supporting		
Calculation	DBR-0009791	0	Soil-Structure Interaction Absolute Acceleration Transfer Functions With Respect to Outcrop Motion and Design Motion Power Spectral Densities For RB/FB SSI, CB SSI, FWSC SSI, and CB-FWSC SSSI Analyses	Supporting		
Calculation	092-322-F-M-00001 DBR-0011230)	1	Design Report of the Spent Fuel Storage Racks in the Fuel Building for North Anna 3	Supporting	26A7032AA	
Calculation	092-322-F-M-00002 (DBR-0011230)	2	Design Report of the New Fuel Storage Racks in the Reactor Building for North Anna 3	Supporting	26A7032AA	
Calculation	092-322-F-M-00003 (DBR-0011230)	1	Design Report of the Spent Fuel Storage Racks in the Reactor Building for North Anna 3	Supporting	26A7032AA	
Specification	26A7032AA	0	Fuel Storage Rack Design Specification.	Supporting		
Design Information	TODI WG3-3-A25- TDI-0003	0	NA3 Static Lateral Earth Pressure Coefficients	Supporting		Added during audit
Report	SER-DMN-032	0	NA3 Seismic SSI Analyses Results for CB and FWSC Structural Evaluation	Supporting		Added during audit
Report	DBR-0004744	0	SSI-030Z ECP Software Project Plan (SPP)	Supporting		Added during audit
Report	002N4722	0	SSI-030Z ECP Software User's Manual (SUM)	Supporting		Added during audit
Report	002N4723	1	SSI-030Z Procured Software Name: ACS SASSI V3.0 ECP Procured Acceptance Test (PAT)	Supporting		Added during audit
Report	DBR-0010229		ESBWR Design Basis for PCCS Condenser RAI Response	Supporting		Added during audit
Record	DBR-0007154	0	ESBWR Design Basis for Fuel Rack Design Specification Data Sheet 26A7032AA R0	Supporting		Added during audit

TABLE 1:
List of Bechtel Calculations and GEH Supporting Documents for the North Anna 3 Audit
Dominion North Anna Unit 3 COLA Review

Doc Type	Document No.	Rev	Title	Primary or supporting	Input	Notes
Report	26A6647 Appendix A	7	ESBWR Seismic Analysis of Reactor/Fuel Building Complex Appendix A, Seismic Analysis Model Properties	Supporting		Added during audit
Technical Note	5926ATN02	2	ENSA, ESBWR Fuel Building Pool Bottom Synthesized SSE Accelerations Time Histories	Supporting		Added during audit

TABLE 2:

Dominion North Anna 3 NRC Seismic Audit September 28 through October 2, 2015
GEH Offices, Wilmington NC
Participants

Last name	First Name	Organization	Title
Brittner	Donald	NRC	Project Manager
Braverman	Joseph	NRC Contractor (BNL)	Technical Reviewer
Chakravorty	Manas K	NRC	Lead Technical Reviewer
Nie	Jinsuo	NRC	Technical Reviewer
Park	Sunwoo	NRC	Technical Reviewer
Shea	James	NRC	Lead Project Manager, NA3
Wang	George	NRC	Technical Reviewer
Xu	Jim	NRC	Branch Chief
Borsh	Regina (Gina)	Dominion	Reg Affairs, Overall Dominion Team Lead
Giles	Mark	Dominion	Director, Nuclear Project Technical Support
Hegner	Joseph (Joe)	Dominion	Licensing Manager
Waddill	John	Dominion	Technical Audit Support
Kemp	Douglas	Bechtel	Bechtel Lead
Gregor	Nicholas (Nick)	Bechtel	Technical Audit Support
Hashemi	Alidad	Bechtel	Technical Audit Support
Hicks	Tom	Bechtel/Excel	Reg Affairs Audit Support
Schumitsch	Walter (Skip)	GEH	Project Management Overall GEH Lead
Kirby	Tanya	GEH	Engineering Management Technical Management Lead
Campbell	Patricia	GEH	Reg Affairs Audit Support
Dougherty	Lee	GEH	Reg Affairs Audit Support
Blake	Taylor	GEH	Technical Audit Support
Heiser	Matthew	GEH	Technical Audit Support
Li	Ai Shen	GEH	Technical Audit Support
Todorovski	Luben	GEH	Technical Audit Support
Yue	Dongyi	GEH	Technical Audit Support
Ikeda	Ryosuke	Shimizu	Technical Audit Support
Tsukada	Takaaki	Shimizu	Technical Audit Support
Gaillard	Pete	Fluor	Reg Affairs Audit Support

COL - North Anna Mailing List (Revised 02/18/2015)

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