VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

March 31, 2014

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

Serial No. 14-133
NL&OS/WDC R0
Docket Nos. 50-338/339
License Nos. NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
RESPONSE TO MARCH 12, 2012 INFORMATION REQUEST
SEISMIC HAZARD AND SCREENING REPORT (CEUS SITES) FOR
RECOMMENDATION 2.1

References:

1. NRC Letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 12, 2012
2. NEI letter to NRC, Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations, dated April 9, 2013
3. NRC Letter, Electric Power Research Institute Final Draft Report 3002000704, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations, dated May 7, 2013
4. EPRI Report 1025287, Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic
5. NRC Letter, Endorsement of EPRI Final Draft Report 1025287, "Seismic Evaluation Guidance," dated February 15, 2013

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Reference 1 to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 1 of Reference 1 requested each addressee in the Central and Eastern United States (CEUS) to submit a Seismic Hazard and Screening Report within 1.5 years from the date of Reference 1.

In Reference 2, the Nuclear Energy Institute (NEI) requested NRC agreement to delay submittal of the final CEUS Seismic Hazard and Screening Reports so that an update to the Electric Power Research Institute (EPRI) ground motion attenuation model could be completed and used to develop that information. NEI proposed that descriptions of subsurface materials and properties and base case velocity profiles be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted by March 31, 2014. NRC agreed with that proposed path forward in Reference 3.

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Reference 4 contains industry guidance and detailed information to be included in the Seismic Hazard and Screening Report submittals. NRC endorsed this industry guidance in Reference 5.

The attached Seismic Hazard and Screening Report for North Anna Power Station provides the information described in Section 4 of Reference 4 in accordance with the schedule identified in Reference 2.

If you have any questions regarding this information, please contact Mr. Thomas Shaub at (804) 273-2763.

Sincerely,

David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140542
My Commission Expires May 31, 2014

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Heacock, who is President and Chief Nuclear Officer of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 31st day of March, 2014.

My Commission Expires: May 31, 2014

Vicki L. Hull
Notary Public

Commitments made in this letter: No new regulatory commitments

Attachment: Seismic Hazard and Screening Report

cc: U.S. Nuclear Regulatory Commission, Region II
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ATTACHMENT

SEISMIC HAZARD AND SCREENING REPORT

March 2014

**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2**

Executive Summary

Following the accident at the Fukushima Daiichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the NRC established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations and to determine if the agency should make additional improvements to its regulatory system. Subsequently, the NRC issued a 10 CFR 50.54(f) letter (Reference 7.1) that requests information to assure that selected recommendations from the NTTF are addressed by U.S. nuclear power plants. Recommendation 2.1: Seismic involves reevaluation of the seismic hazard at plant sites consistent with present-day NRC requirements. The 10 CFR 50.54(f) letter requests licensees to re-evaluate the seismic hazard for applicable reactor units. Depending on the comparison of the re-evaluated seismic hazard and the current design basis, a risk assessment may be required. Based upon the results of risk evaluations, where performed, the 10 CFR 50.54(f) letter indicates that NRC staff will determine whether additional regulatory actions are necessary.

This report provides the information requested in items (1) through (7) of the Enclosure 1 section titled "Requested Information" of the 50.54(f) letter for North Anna Power Station. In providing this information, Dominion followed the guidance provided in Electric Power Research Institute (EPRI) Report 1025287, *Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 7.2).

In response to the 50.54(f) letter, and following the guidance provided in Reference 7.2, a seismic hazard reevaluation was performed. For screening purposes, a Ground Motion Response Spectrum (GMRS) was developed. The comparison of the GMRS with the safe shutdown earthquake (SSE) indicates that North Anna Units 1 and 2 screen-in for a risk evaluation, along with a high-frequency confirmation and Spent Fuel Pool evaluation. A seismic probabilistic risk assessment (SPRA) will be performed for North Anna in accordance with the guidance in EPRI Report 1025287 (SPID).

EPRI Report 3002000704, *Augmented Approach, Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 7.3), has been developed as the process for evaluating selected critical plant equipment prior to completing plant seismic risk evaluations. In accordance with this guidance, North Anna screens in for performance of the Expedited Seismic Evaluation Process (ESEP) as an interim measure.

Seismic core damage frequency (CDF) calculations have been performed by EPRI for plants in the Central and Eastern United States (CEUS) using the plant capacities from the Individual Plant Examination of External Events (IPEEE) program and the recently updated seismic hazard curves. The results of these calculations for North Anna Units 1 and 2 support the conclusion of the NRC GI-199 Safety/Risk Assessment (Reference 7.17) that "Overall seismic core damage risk estimates are consistent with the Commission's Safety Goal Policy Statement..." and "...the current seismic design of operating reactors provides a safety margin to withstand potential earthquakes exceeding the original design basis" as indicated in NEI letter to NRC dated March 12, 2014 (Reference 7.16).

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1.0 INTRODUCTION

Following the accident at the Fukushima Daiichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the NRC established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations and to determine if the agency should make additional improvements to its regulatory system. The NTTF developed a set of recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. Subsequently, the NRC issued a 10 CFR 50.54(f) letter (Reference 7.1) that requests information to assure that these recommendations are addressed by all U.S. nuclear power plants. The 50.54(f) letter requests that licensees and holders of construction permits under 10 CFR Part 50 reevaluate the seismic hazards at their sites against present-day NRC requirements. The comparison between the reevaluated seismic hazard and the current design basis will result in either no further risk evaluation or the performance of a seismic risk assessment. Risk assessment approaches acceptable to the NRC staff include a seismic probabilistic risk assessment (SPRA) or a seismic margin assessment (SMA). Based upon this information, the NRC staff will determine whether additional regulatory actions are necessary.

This report provides the information requested in items (1) through (7) of the Enclosure 1 section titled "Requested Information" of the 50.54(f) letter for North Anna Power Station Units 1 and 2, located in Louisa County, Virginia. In providing this information, Virginia Electric and Power Company (Dominion) followed the guidance provided in Electric Power Research Institute (EPRI) Report 1025287, *Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 7.2). EPRI Report 3002000704, *Augmented Approach, Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 7.3), was developed as the process for evaluating selected critical plant equipment prior to performing the complete plant seismic risk evaluations.

In response to the 50.54(f) letter and following the guidance provided in Reference 7.2, a seismic hazard reevaluation was performed. For screening purposes, a Ground Motion Response Spectrum (GMRS) was developed.

2.0 SEISMIC HAZARD REEVALUATION

The North Anna Power Station is located approximately 45 miles northwest of Richmond, Virginia, on a peninsula on the southern shore of Lake Anna. This places the plant in the central portion of the Piedmont physiographic province. Bedrock within the Piedmont is metamorphic, consisting of granites, gneisses, and schists. The bedrock typically is deeply weathered into a saprolite mantle up to approximately 100 ft thick. Detailed studies carried out during the siting investigation for North Anna Units 1 and 2, and more recently for the proposed North Anna Unit 3, show that there are no capable faults within the site vicinity. The reactor buildings are founded on competent bedrock, about 70 ft below the plant grade of El. 271 ft.

For the purpose of establishing a design basis earthquake (DBE) (also referred to as the Safe Shutdown Earthquake (SSE)) for North Anna, it was assumed that an earthquake equal to the largest shock associated with the Arconia Syncline might occur close to the site area. With the epicenter of a shock similar to the 1875 intensity-VII Arconia earthquake shifted to the vicinity of the site, it was estimated that the maximum horizontal ground acceleration at the rock surface would be less than 0.12g. Accordingly, the SSE for structures founded on rock was taken at 0.12g for horizontal ground motion and two-thirds that value for vertical ground motion. For structures founded on soil, the SSE was taken at 0.18g for horizontal motion and 0.12g for vertical motion.

2.1 REGIONAL AND LOCAL GEOLOGY

The site is located in the central portion of the Piedmont physiographic province with the Blue Ridge province about 40 miles to the west and the Coastal Plain province about 15 miles to the east. The Piedmont terrain is characterized by gently sloping upland areas and broad, relatively shallow valleys. The Piedmont Upland section is underlain by Late Precambrian and Paleozoic age crystalline rocks. The crystalline rocks consist of deformed and metamorphosed sedimentary, igneous and volcanic rocks, intruded by mafic dikes and granitic plutons. The North Anna site is located in the Chopawamsic belt, which is bounded on the west and east by the Chopawamsic and Spotsylvania thrust faults, respectively. The belt comprises the Chopawamsic Formation and the Ta River Metamorphic Suite, which is overlain unconformably by the Quantico Formation and intruded by rocks of the Falmouth Intrusive Suite.

North Anna Units 1 and 2 are located on a peninsula on the southern shore of Lake Anna, approximately 45 miles northwest of Richmond, Virginia. The reactor buildings are founded on competent bedrock; other principal structures are founded on weathered bedrock or on structural fill overlying bedrock. The bedrock has been weathered unevenly into saprolitic soils of varying thickness, ranging from a few feet to as much as 100 ft below original grade. No capable tectonic sources exist in the site vicinity that would cause surface deformation in the site area.

2.2 PROBABILISTIC SEISMIC HAZARD ANALYSIS

The information provided in Section 2.2.1 was developed for EPRI by Lettis Consultants International (LCI) as part of an industry-wide effort (References 7.5 and 7.6). EPRI/LCI also provided the baseline hard rock probabilistic seismic hazard analysis (PSHA) calculation and deaggregation data for North Anna (Reference 7.27). Using the hard rock hazard and de-aggregation data, Bechtel Power Corporation performed the site response analyses and developed the control point hazard curves and response spectra for the North Anna site (Reference 7.10), as described in Sections 2.3 and 2.4.

2.2.1 PROBABILISTIC SEISMIC HAZARD ANALYSIS RESULTS

In accordance with the 50.54(f) letter and following the guidance in the SPID (Reference 7.2), a PSHA was completed and reported in LCI Project 1041 Report (Reference 7.5) using the recently developed U.S. Nuclear Regulatory Commission (NRC) Report NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," (CEUS-SSC) (Reference 7.7) together with the updated EPRI Report 3002000717, "EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project," (Reference 7.8). For the PSHA, a lower-bound moment magnitude of 5.0 was used, as specified in the 50.54(f) letter.

For the PSHA, the CEUS-SSC background seismic source zones out to a distance of 400 miles (640 km) around North Anna were included. This distance exceeds the 200 mile (320 km) recommendation contained in NRC Regulatory Guide (RG) 1.208 "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," (Reference 7.9) and was chosen for completeness. Background sources included in this site analysis are the following:

1. Atlantic Highly Extended Crust (AHEX)
2. Extended Continental Crust—Atlantic Margin (ECC_AM)
3. Mesozoic and younger extended prior – narrow (MESE-N)
4. Mesozoic and younger extended prior – wide (MESE-W)
5. Midcontinent-Craton alternative A (MIDC_A)
6. Midcontinent-Craton alternative B (MIDC_B)
7. Midcontinent-Craton alternative C (MIDC_C)
8. Midcontinent-Craton alternative D (MIDC_D)
9. Non-Mesozoic and younger extended prior – narrow (NMESE-N)
10. Non-Mesozoic and younger extended prior – wide (NMESE-W)
11. Paleozoic Extended Crust narrow (PEZ_N)
12. Paleozoic Extended Crust wide (PEZ_W)
13. St. Lawrence Rift, including the Ottawa and Saguenay grabens (SLR)
14. Study region (STUDY_R)

Large magnitude CEUS-SSC modeled sources Repeated Large Magnitude Earthquake (RLME) within 1,000 km of the site, were included in the analysis. These sources are:

1. Charleston
2. Eastern Rift Margin Fault northern segment (ERM-N)
3. New Madrid Fault System (NMFS)
4. Wabash Valley

For each of the above background and RLME sources, the mid-continent version of the updated CEUS EPRI GMM (Reference 7.8) was used.

2.2.2 BASE ROCK SEISMIC HAZARD CURVES

Consistent with the industry report template, base rock seismic hazard curves are not provided. Seismic hazard curves are provided in Section 2.3.7 at the control point elevation.

2.3 SITE RESPONSE EVALUATION

Following the guidance contained in Seismic Enclosure 1 of the 50.54(f) letter and in the SPID, for nuclear power plant sites that are not sited on hard rock (shear wave velocity ≥ 9200 ft/sec [SPID]), a site response analysis was performed for North Anna Units 1 and 2.

2.3.1 DESCRIPTION OF SUBSURFACE MATERIAL

Bedrock at North Anna consists mainly of metamorphic gneiss and schist. There has been extensive in-place weathering of the rock. The rock has weathered completely into saprolitic soil near the ground surface.

The general subsurface profile at North Anna can be divided into 6 zones:

I	Residual clays and clayey silts – all structure of parent rock is lost.
IIA	Saprolite – medium dense silty sand, with some fine-grained layers.
IIB	Saprolite – very dense silty sand.
III	Weathered rock – core stone more than 50% of volume of overall mass.
III-IV	Moderately weathered to slightly weathered rock.
IV	Parent rock – slightly weathered to fresh rock.

The weathering across the site is uneven, and the thickness of the various zones varies widely and randomly throughout the site. The rock zones are defined by both rock quality designation (RQD) and shear wave velocity. Considering the original site investigations at the Units 1 and 2 site and the more recent site investigations at the proposed site for Unit 3 (which shares the same geologic characteristics) (Reference 7.11), the North Anna site is well-characterized and extensively investigated with abundant high-quality data (>200 borings, including five deep borings with shear wave velocity measurements from Suspension P-S logging), which reduces epistemic uncertainty in the site properties. These data also provide information to characterize the aleatory variation in layer thickness and shear wave velocity across the site.

Table 2.3.1-1 provides a brief description of the subsurface material in terms of the geologic units and layer thicknesses. This table includes best estimate values of shear wave velocity (V_S), compressive wave velocity (V_P), unit weight and Poisson's ratio. Structures at North Anna Units 1 and 2 were designed and analyzed using a uniform groundwater level at El. 256 ft.

Table 2.3.1-1: Geologic profile and estimated layer thicknesses for North Anna

Depth Range[1] (ft)	Soil/Rock Description	Density (pcf)	V_S[3] (ft/sec)	V_P[3] (ft/sec)	Poisson's Ratio
0 – 3	Zone IIA Saprolite	125	795	1655	0.35
3[2] – 47	Zone III Weathered Rock	150	4,251	10,410	0.40
47 – 66	Zone III-IV Moderately to Slightly Weathered Rock	163	5,449	10,820	0.33
66 – 101	Zone III-IV Moderately to Slightly Weathered Rock	163	5,177	10,280	0.33
101 – 136	Zone IV Slightly Weathered to Fresh Rock	164	8,800	15,680	0.27
136+	Zone IV Slightly Weathered to Fresh Rock	164	9,740	17,350	0.27

Notes:

(1) Depth below plant grade of El. 271 ft.

(2) As described in Section 3.2, the Control Point is defined as the foundation bearing elevation of the highest rock-supported, safety-related structure, which, in the case of North Anna, is the base of the Casing Cooling Tank and Pumphouse foundation is at El. 268 ft, or 3 ft below grade.

(3) Best estimate values.

2.3.2 DEVELOPMENT OF BASE CASE PROFILES AND NONLINEAR MATERIAL PROPERTIES

Shear wave velocity measurements in the bedrock for North Anna Units 1 and 2 were made in 3 boreholes with a Birdwell 3D Velocity Recorder down to a maximum depth of 128 ft below original grade of El. 304 ft, i.e., down to El. 176 ft. Confirmatory seismic cross-hole tests were performed during construction of the units. Suspension P-S logging was performed in 5 boreholes for proposed North Anna Unit 3, with the deepest reading at approximately El. 22 ft. From the Unit 3 data, two V_S profiles were developed. Profile 1 is the lower bound profile that represents mainly weathered and/or fractured rock encountered at the site while Profile 2 is the upper bound profile that represents mainly unweathered and/or unfractured rock encountered at the site. Profile 1 and Profile 2 capture the majority of the measured V_S values in the bedrock, as well as V_S values correlated from other parameters (such as RQD). The best estimate V_S profile (V_{BE}) is the log-mean of the Profile 1 and Profile 2 V_S values. The differences between the best estimate and Profiles 1 and 2, i.e., (V_{BE} – Profile 1) and (Profile 2 - V_{BE}) are considered to approximate one standard deviation.

The V_S data from North Anna Units 1 and 2, along with visual descriptions of the rock obtained from North Anna Units 1 and 2 borings, and the corresponding RQD values compare well with the more extensive North Anna 3 measurements. Consequently, it was determined that the Profile 1 and Profile 2 V_S values and the V_{BE} profile derived for North Anna Unit 3 could be used for North Anna Units 1 and 2 with only minor modifications. The V_S values for the Zone IIA saprolite were obtained from measurements from North Anna Unit 3.

As noted in Section 2.3.1, the North Anna site is well-characterized and extensively investigated with abundant high-quality data (>200 borings, including five deep borings with Suspension P-S logging shear wave velocity measurements), which reduces epistemic uncertainty in the site properties. These data also provide information to characterize the aleatory variation in layer thickness and V_S across the site. These variations are included in considerations of aleatory uncertainties for the base-case profile. No alternate profiles are considered because of the significant amount of recent site specific data and the resulting relative insignificance of epistemic uncertainty with respect to the aleatory variability for this site. The single base case profile (V_{BC}) is thus the V_{BE} profile described in the previous paragraph, with minor rounding.

The V_{BC} profile selected for use is presented in Table 2.3.2-1. Profile 1 and Profile 2 are included in the table. As described in Section 2.3.3, Profiles 1 and 2 are used in defining the aleatory uncertainty for the randomization process.

Table 2.3.2-1: Geologic profile and estimated layer thicknesses for North Anna

Depth Range (ft)	Thickness (ft)	Soil/Rock Description	V_S (ft/sec)		
			V_{BC}	Profile 1	Profile 2
0 – 3	3	Zone IIA Saprolite	795	560[(1)]	1030[(1)]
3 – 47	44	Zone III Weathered Rock	4250	3,115	5,800
47 – 66	19	Zone III-IV Moderately to Slightly Weathered Rock	5450	4,475	6,635
66 – 101	35	Zone III-IV Moderately to Slightly Weathered Rock	5180	3,450	7,770
101 – 136	35	Zone IV Slightly Weathered to Fresh Rock	8800	8,800	8,800
136+	-	Zone IV Slightly Weathered to Fresh Rock	9740	9,740	9,740

Note:
(1) Values are +/- 1 standard deviation from V_{BC} for saprolite

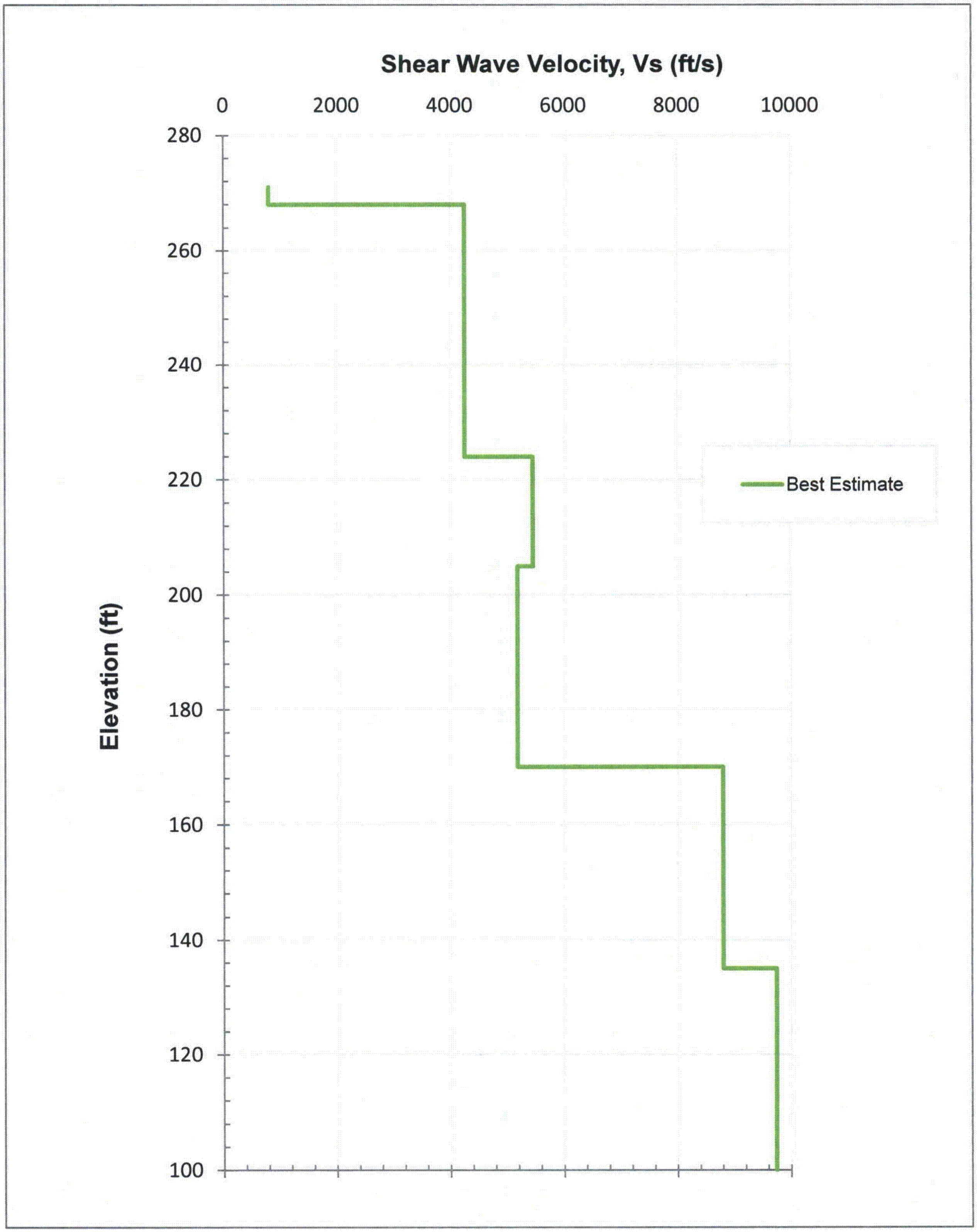

Figure 2.3.2-1: Base case V_S profile (V_{BC}) for North Anna

2.3.2.1 SHEAR MODULUS AND DAMPING CURVES

The shear modulus values of the Zone III-IV and Zone IV bedrock are independent of shear strain. The ratios of shear modulus values (G) to the maximum shear modulus value (G_{MAX}) of the Zone IIA saprolite are the average of the 0 to 20 ft and 20 ft to 50 ft curves provided in EPRI TR-102293, "Guidelines for Determining Design Basis Ground Motions," (Reference 7.12) and are based on the results of three resonant column and torsional shear (RCTS) tests on the saprolite performed for the recent North Anna Unit 3 investigation. These values are shown versus shear strain in Table 2.3.2-2 and are plotted in Figure 2.3.2-2.

The G/G_{MAX} values of the Zone III weathered rock are based on values for relatively soft rock in Sun et al (Reference 7.13). These values are shown versus shear strain in Table 2.3.2-2 and are plotted in Figure 2.3.2-2.

As with the shear modulus, the damping ratio (D) values for the Zone III-IV and Zone IV bedrock are independent of shear strain. A best estimate value of 1% is used for these materials.

The damping values of the Zone IIA saprolite are the average of the 0 to 20 ft and 20 ft to 50 ft curves provided in EPRI TR-102293, and are based on the results of three RCTS tests on the saprolite performed for the recent North Anna Unit 3 investigation. These values are shown versus shear strain in Table 2.3.2-2 and are plotted in Figure 2.3.2-3. The damping values of the Zone III weathered rock are shown in Table 2.3.2-2 and plotted in Figure 2.3.2-3. Note that for analysis, values of damping are truncated at 15%.

The variation in damping is accounted for later in the randomization process.

Table 2.3.2-2: G/G_{MAX} and Damping Ratio for North Anna

Shear Strain (%)	G/G_{MAX}		Damping Ratio D, (%)	
	Zone IIA	Zone III	Zone IIA	Zone III
0.0001	1.00	1.00	1.3	0.6
0.000316	1.00	1.00	1.3	0.6
0.001	0.99	1.00	1.6	0.6
0.00316	0.94	1.00	2.4	0.6
0.01	0.79	1.00	4.4	0.6
0.0316	0.57	0.98	8.2	0.6
0.1	0.32	0.87	14.3	2.7
0.316	0.15	0.63	20.6	8.2
1.0	0.05	0.33	27.9	17.0

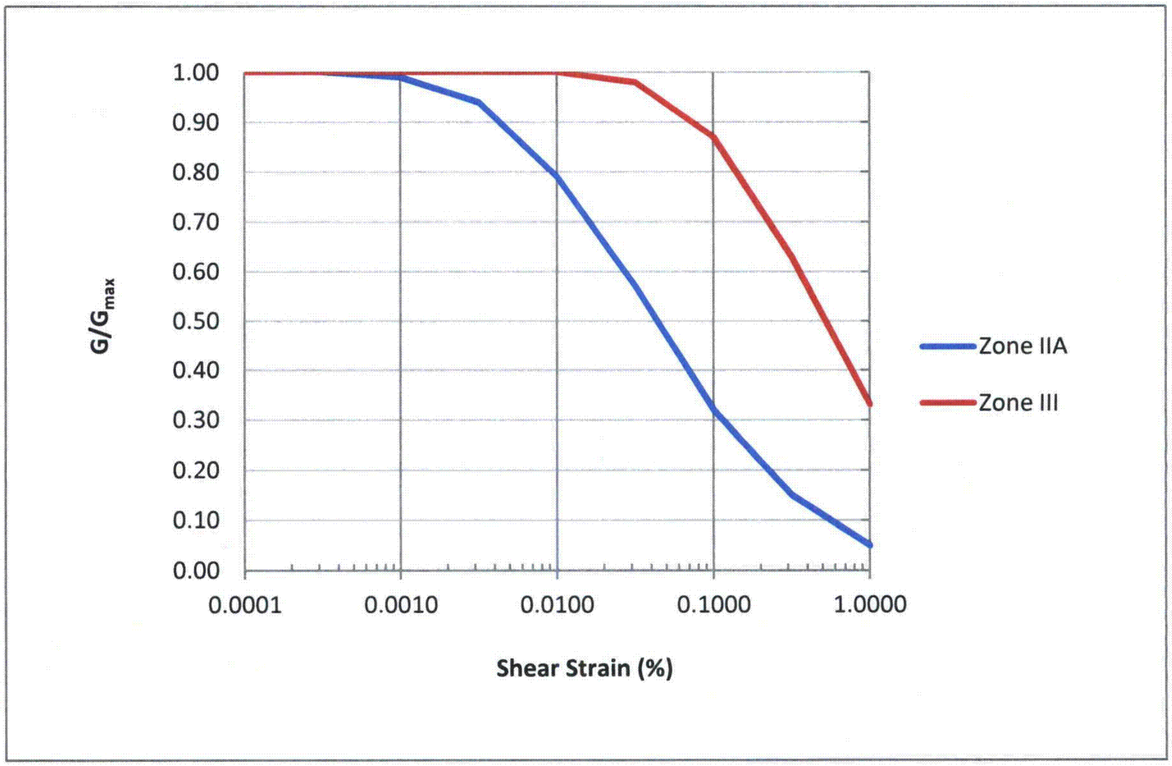

Figure 2.3.2-2: G_{MAX}/G versus shear strain for North Anna

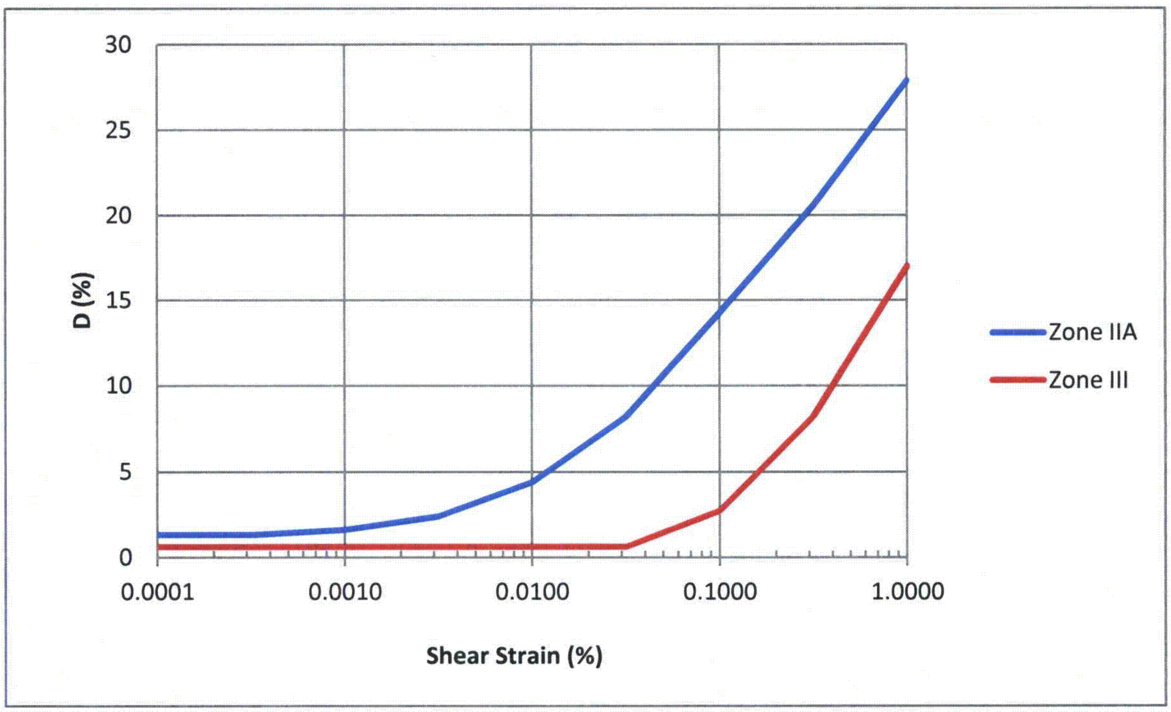

Figure 2.3.2-3: Damping ratio versus shear strain for North Anna

2.3.2.2 KAPPA

Given the shallow nature of the site profile and the high shear wave velocities, only the 0.006 seconds reference rock component of the local site attenuation parameter was explicitly incorporated into the site response analysis.

2.3.3 RANDOMIZATION OF BASE CASE PROFILES

As discussed in Section 2.3.2, considering the original site investigations for North Anna Units 1 and 2 and the more recent site investigations at the proposed site for Unit 3, the epistemic uncertainty is considered insignificant relative to the observed aleatory variability for this site. Thus, a single base-case profile was considered for the site as presented in Table 2.3.2-1 and Figure 2.3.2-1. The variations in shear-wave velocity, layer thicknesses, and shear-modulus reduction and damping curves are included in consideration of aleatory uncertainties for the base-case profile through the randomization process.

The soil profile simulation was performed to generate sets of site-specific simulated (randomized) soil profiles to represent the dynamic properties of the soil columns while considering the uncertainty associated with each of these properties. The simulated profiles were used in site response analysis using random vibration theory (RVT).

A total of 60 simulated profiles were generated using the following inputs based on available field data:

- Estimates of soil and rock stratum thicknesses and their range of variation
- Estimates of mean and standard deviation of shear-wave velocity for each soil or rock stratum
- Strain-dependent G/G_{max} (also referred to as G/G_0) and damping curves assigned to site-specific strata and their uncertainties
- Cross correlations between adjacent layers are also assigned for each soil or rock property to prevent unreasonable variations between them and to guarantee that the total depth is also within a specified range

The thicknesses of the soil and rock strata were also simulated with ±2σ bounds as shown in Table 2.3.3-1. The aleatory uncertainty in the shear-wave velocity was modeled using a log-normal distribution with the reported best-estimate values corresponding to the median (geometric mean) of the distribution. Using Profile 1 and Profile 2 (Table 2.3.2-1), the aleatory uncertainty is defined by $\sigma_{\ln Vs}$. The values of the median shear-wave velocities and $\sigma_{\ln Vs}$ used for profile simulation are presented in Table 2.3.3-1. Note that for the purposes of the randomization and site response analyses, the 3 ft of Zone IIA saprolite above the control point is considered insignificant due to its limited thickness and the large elastic threshold (insignificant strain dependency) of the material below the control point.

A set of 60 simulated profiles was generated which represents the simulated free field subsurface conditions. The simulation includes variation of the shear wave velocity, stratum thicknesses, strain dependent G/G_{max} and damping curves for nonlinear material, and damping ratios for linear material.

A limit of $\pm 2\sigma$ about the median value for shear wave velocity, damping ratio, and shear-modulus reduction and damping curves in each stratum was assumed. These limits were placed to prevent unrealistic variation of the parameters. In the case that a variation exceeds the limit, a new random variable was computed. Furthermore, the maximum value on the damping curves is limited to 15%.

The Reference 7.14 correlation model is used to obtain the between-stratum correlation as a function of the stratum interface depth and the average thickness of the two correlated strata. The model uses coefficients based on the U. S. Geological Survey (USGS) site classification A, which is based on the average Vs of the top 30 meters (100 ft) of soil (V_{s30}).

Table 2.3.3-1: Properties of the site profile at the GMRS location.

Stratum	Mean Thickness [ft]	$\sigma_{thickness}$	Elevation Top [ft]	Unit Wt. [kcf]	Damping [%]	Vs [ft/sec]	σ_{lnV_S}
III	44	19	268	0.150	0.60	4250	0.3
III-IVa	19	7	224	0.163	1.00	5450	0.2
III-IVb	35	12	205	0.163	1.00	5180	0.4
IV	35	12	170	0.164	1.00	8800	0.1
HS	--	--	135	0.164	1.00	9200	0.0

2.3.4 INPUT SPECTRA

Consistent with the guidance in Appendix B of the SPID, input Fourier amplitude spectra and associated acceleration response spectra were defined for a single representative earthquake magnitude using two different assumptions regarding the shape of the seismic source spectrum (single-corner and double-corner). A range of 11 different input amplitudes (peak ground accelerations (PGA) ranging from 0.01g to 1.5 g) were used in the site response analyses. These specific loading levels are identified later in the report as 'G001, G005, G010, G020, G030, G040, G050, G075, G100, G125, and G150' based on the suite of 11 specific input PGA levels. The characteristics of the seismic source and upper crustal attenuation properties assumed for the analysis of the North Anna site were the same as those identified in Tables B-4, B-5, B-6 and B-7 of the SPID as appropriate for typical CEUS sites. The input spectra for the single-corner and double-corner seismic source spectra are shown in Figures 2.3.4-1a and 2.3.4-1b. These spectra are defined at a suite of 38 spectral frequencies between 0.1 – 100 Hz.

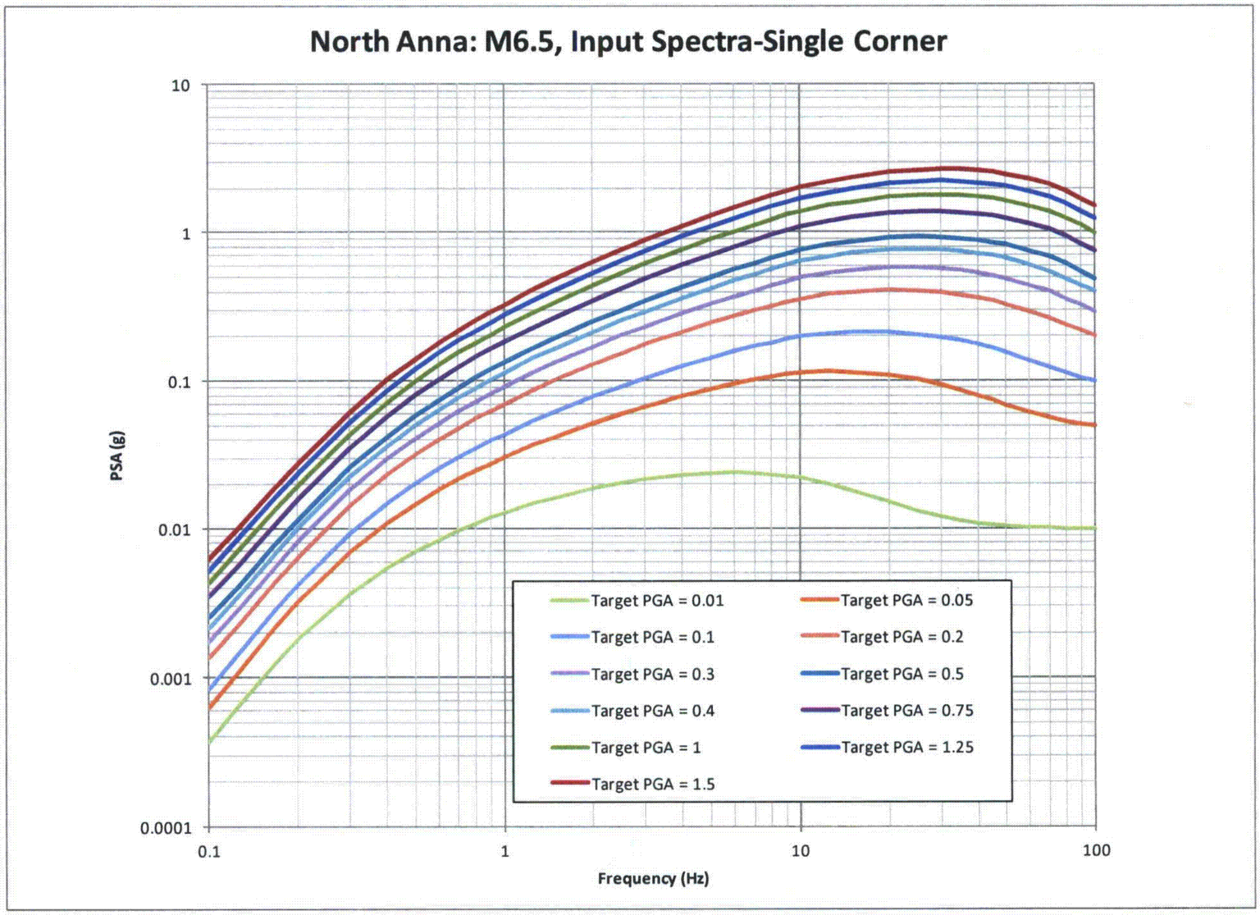

Figure 2.3.4-1a: Input spectra based on the single-corner seismic source model for the suite of 11 PGA levels for a spectral damping of 5%

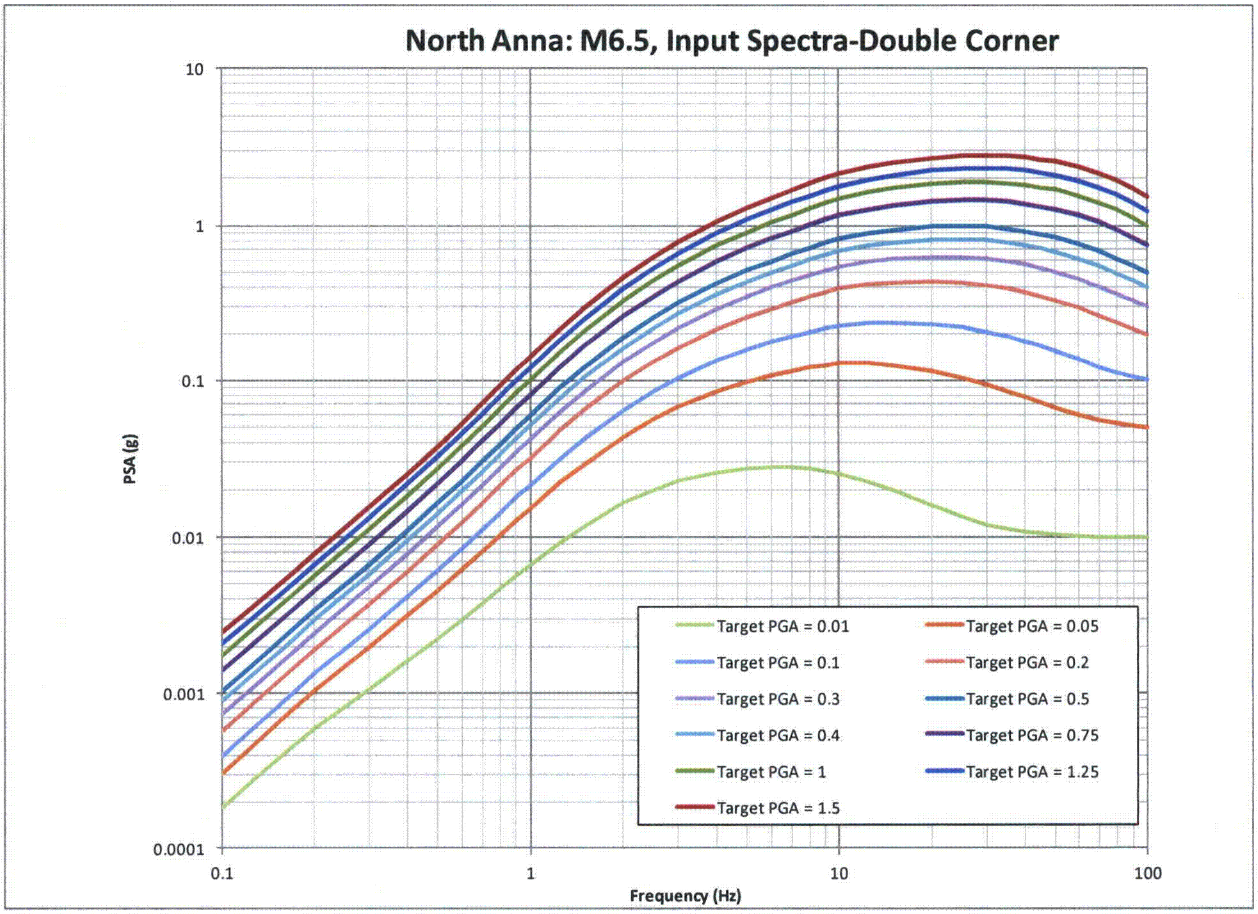

Figure 2.3.4-1b: Input spectra based on the double-corner seismic source model for the suite of 11 PGA levels for a spectral damping of 5%

2.3.5 METHODOLOGY

Site response analyses were carried out to evaluate the amplification factors corresponding to the 60 simulated (randomized) profiles for each of the input hard-rock spectra. RVT is employed consistent with existing NRC requirements and the SPID. Moreover, the guidance contained in Appendix B of the SPID on incorporating the applicable uncertainties in the site response model and source spectra was followed.

For the 60 generated profiles, described in Section 2.3.3, and input motions, described in Section 2.3.4, the site amplification is computed as the ratio between 5% damped geologic outcrop pseudo acceleration response spectrum at the control point and bedrock. The analysis is carried out at 301 frequency points ranging from 0.1 to 100 Hz and equally spaced in logarithmic space. The median (computed as the logarithmic mean) and the logarithmic standard deviation (Log-SD) of the site amplification at each frequency are then computed.

The probabilistic seismic hazard curves are defined at the following 38 frequencies (in units of Hz):

100 90 80 70 60 50 45 40 35 30 25 20 15 12.5 10 9 8 7 6 5 4 3 2.5 2 1.5 1.25 1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.167 0.125 0.1

At each of these frequencies, the site amplification is computed using linear interpolation in log-log space from the 301 site amplification values.

2.3.6 AMPLIFICATION FUNCTIONS

For the base profile and for each seismological model, the median amplification (exponential of the log-mean amplification factors for 5% damped pseudo spectral acceleration (PSA)) and logarithmic standard deviation (log-SD) are calculated at the 38 frequencies of interest for each of the 11 different input amplitudes. The input PSA values for the single-corner seismological model are presented in Table 2.3.6-1. The single-corner median amplification factors and log-SD are provided in Tables 2.3.6-2 and 2.3.6-3, respectively. The same information is shown in Figures 2.3.6-1 and 2.3.6-2.

Similar results for the double-corner seismological model are presented in Table 2.3.6-4 through Table 2.3.6-6 and Figure 2.3.6-3 and Figure 2.3.6-4.

Generally, the computed amplification is insensitive to loading level due to the high-shear wave velocities in the profile and large elastic threshold (shear strain at which nonlinear properties start to change). The exceptions are the high frequency results corresponding to the low amplitude input rock motions (target PGA = 0.01g in Figure 2.3.4-1a and Figure 2.3.4-1b) which are different due to significantly different distances that result in different response spectral shapes of these input response spectra compared to higher input levels.

Table 2.3.6-1: Input 5% damped PSA values in units of g at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the single-corner seismological model

Freq.	Loading Level										
[Hz]	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	0.000368	0.000630	0.000858	0.00134	0.00174	0.00217	0.00253	0.00350	0.00439	0.00532	0.00623
0.125	0.000639	0.00108	0.00144	0.00221	0.00285	0.00352	0.00410	0.00562	0.00704	0.00851	0.00995
0.167	0.00124	0.00214	0.00283	0.00429	0.00549	0.00675	0.00783	0.0107	0.0133	0.0160	0.0187
0.2	0.00181	0.00319	0.00423	0.00640	0.00818	0.0100	0.0116	0.0158	0.0197	0.0237	0.0276
0.3	0.00366	0.00693	0.00935	0.0143	0.0183	0.0225	0.0261	0.0354	0.0441	0.0531	0.0619
0.4	0.00544	0.0109	0.0149	0.0230	0.0296	0.0364	0.0423	0.0577	0.0720	0.0867	0.101
0.5	0.00704	0.0146	0.0203	0.0316	0.0409	0.0505	0.0588	0.0804	0.100	0.121	0.141
0.6	0.00846	0.0182	0.0255	0.0401	0.0519	0.0643	0.0749	0.103	0.128	0.155	0.181
0.7	0.00973	0.0215	0.0305	0.0481	0.0626	0.0777	0.0906	0.124	0.156	0.188	0.220
0.8	0.0109	0.0247	0.0353	0.0559	0.0729	0.0905	0.106	0.145	0.182	0.220	0.258
0.9	0.0119	0.0277	0.0398	0.0634	0.0827	0.103	0.120	0.166	0.208	0.252	0.294
1	0.0128	0.0305	0.0441	0.0705	0.0922	0.115	0.134	0.185	0.233	0.282	0.330
1.25	0.0148	0.0367	0.0539	0.0869	0.114	0.143	0.167	0.231	0.291	0.352	0.413
1.5	0.0163	0.0423	0.0628	0.102	0.134	0.168	0.197	0.274	0.345	0.418	0.490
2	0.0187	0.0521	0.0788	0.129	0.171	0.215	0.253	0.352	0.445	0.540	0.634
2.5	0.0205	0.0604	0.0927	0.154	0.204	0.257	0.303	0.424	0.535	0.651	0.765
3	0.0217	0.0676	0.105	0.176	0.235	0.296	0.350	0.490	0.620	0.754	0.887
4	0.0232	0.0795	0.127	0.215	0.288	0.365	0.432	0.608	0.771	0.940	1.106
5	0.0238	0.0886	0.144	0.247	0.333	0.424	0.503	0.710	0.902	1.101	1.298
6	0.0240	0.0960	0.159	0.276	0.374	0.477	0.567	0.802	1.021	1.248	1.472
7	0.0238	0.102	0.172	0.301	0.410	0.525	0.624	0.886	1.130	1.383	1.632
8	0.0234	0.107	0.183	0.323	0.442	0.567	0.676	0.962	1.229	1.505	1.778
9	0.0228	0.111	0.193	0.344	0.471	0.606	0.724	1.033	1.320	1.619	1.914
10	0.0222	0.114	0.201	0.360	0.496	0.640	0.765	1.094	1.400	1.719	2.032
12.5	0.0200	0.116	0.211	0.385	0.535	0.693	0.831	1.195	1.534	1.887	2.234
15	0.0180	0.115	0.215	0.400	0.558	0.727	0.874	1.263	1.627	2.004	2.377
20	0.0150	0.109	0.215	0.411	0.581	0.764	0.923	1.345	1.741	2.152	2.558
25	0.0132	0.101	0.208	0.408	0.584	0.773	0.939	1.379	1.792	2.222	2.647
30	0.0121	0.0934	0.198	0.398	0.575	0.767	0.935	1.382	1.803	2.241	2.675
35	0.0115	0.0860	0.188	0.384	0.559	0.749	0.917	1.365	1.786	2.225	2.660
40	0.0111	0.0795	0.177	0.367	0.539	0.726	0.891	1.333	1.751	2.186	2.618
45	0.0109	0.0738	0.166	0.349	0.516	0.699	0.860	1.294	1.703	2.131	2.554
50	0.0108	0.0691	0.156	0.332	0.493	0.670	0.827	1.248	1.647	2.065	2.479
60	0.0107	0.0619	0.139	0.298	0.446	0.610	0.755	1.148	1.521	1.912	2.300
70	0.0106	0.0571	0.125	0.268	0.401	0.550	0.683	1.043	1.385	1.745	2.102
80	0.0106	0.0542	0.114	0.241	0.361	0.494	0.613	0.937	1.246	1.570	1.892
90	0.0106	0.0525	0.106	0.219	0.326	0.444	0.550	0.837	1.111	1.399	1.685
100	0.0105	0.0513	0.101	0.203	0.297	0.402	0.495	0.747	0.987	1.240	1.491

Table 2.3.6-2: Median amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the single-corner seismological model

Frequency	Loading Level										
[Hz]	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	1.005	1.007	1.011	1.014	1.016	1.016	1.017	1.019	1.019	1.020	1.020
0.125	1.003	1.012	1.016	1.018	1.019	1.019	1.020	1.020	1.020	1.020	1.020
0.167	1.004	1.012	1.017	1.020	1.022	1.023	1.024	1.026	1.026	1.027	1.027
0.2	1.004	1.013	1.017	1.021	1.022	1.024	1.024	1.026	1.027	1.027	1.028
0.3	1.005	1.015	1.019	1.023	1.024	1.026	1.026	1.028	1.029	1.029	1.030
0.4	1.007	1.016	1.021	1.025	1.026	1.028	1.028	1.030	1.031	1.031	1.032
0.5	1.007	1.018	1.023	1.026	1.028	1.029	1.030	1.031	1.032	1.033	1.033
0.6	1.008	1.019	1.024	1.027	1.029	1.030	1.031	1.033	1.033	1.034	1.034
0.7	1.010	1.020	1.025	1.029	1.030	1.032	1.032	1.034	1.035	1.035	1.036
0.8	1.011	1.022	1.027	1.030	1.032	1.033	1.034	1.035	1.036	1.037	1.037
0.9	1.012	1.023	1.028	1.032	1.033	1.034	1.035	1.037	1.037	1.038	1.038
1	1.013	1.025	1.030	1.033	1.035	1.036	1.037	1.038	1.039	1.039	1.040
1.25	1.018	1.029	1.034	1.037	1.039	1.040	1.041	1.042	1.043	1.044	1.044
1.5	1.023	1.035	1.039	1.043	1.044	1.046	1.046	1.048	1.048	1.049	1.049
2	1.035	1.048	1.053	1.056	1.058	1.059	1.060	1.061	1.062	1.062	1.063
2.5	1.052	1.066	1.071	1.074	1.076	1.077	1.078	1.079	1.080	1.080	1.081
3	1.072	1.087	1.093	1.096	1.098	1.099	1.100	1.101	1.102	1.103	1.103
4	1.126	1.145	1.151	1.155	1.156	1.158	1.159	1.160	1.161	1.162	1.162
5	1.197	1.220	1.227	1.232	1.234	1.235	1.236	1.238	1.239	1.240	1.240
6	1.281	1.310	1.317	1.322	1.325	1.326	1.327	1.329	1.330	1.331	1.332
7	1.366	1.401	1.409	1.414	1.416	1.418	1.419	1.421	1.423	1.424	1.425
8	1.439	1.479	1.487	1.492	1.495	1.497	1.498	1.500	1.502	1.503	1.504
9	1.491	1.537	1.544	1.549	1.552	1.554	1.555	1.557	1.558	1.559	1.560
10	1.522	1.571	1.578	1.582	1.585	1.586	1.587	1.590	1.591	1.592	1.592
12.5	1.515	1.568	1.573	1.575	1.577	1.578	1.579	1.581	1.582	1.582	1.583
15	1.451	1.500	1.502	1.502	1.503	1.504	1.504	1.505	1.506	1.506	1.507
20	1.356	1.408	1.407	1.406	1.406	1.406	1.406	1.406	1.407	1.407	1.407
25	1.320	1.397	1.395	1.393	1.392	1.391	1.391	1.391	1.391	1.392	1.392
30	1.304	1.411	1.411	1.410	1.409	1.408	1.408	1.409	1.409	1.410	1.410
35	1.296	1.447	1.454	1.454	1.454	1.453	1.453	1.454	1.454	1.455	1.455
40	1.284	1.428	1.430	1.428	1.426	1.424	1.424	1.423	1.422	1.422	1.422
45	1.277	1.414	1.413	1.408	1.406	1.404	1.403	1.402	1.401	1.401	1.401
50	1.273	1.417	1.417	1.412	1.409	1.407	1.406	1.404	1.403	1.403	1.403
60	1.268	1.410	1.409	1.399	1.395	1.391	1.389	1.385	1.384	1.383	1.382
70	1.266	1.416	1.420	1.412	1.407	1.403	1.400	1.396	1.394	1.393	1.392
80	1.264	1.418	1.428	1.423	1.418	1.414	1.412	1.407	1.405	1.404	1.403
90	1.262	1.416	1.429	1.423	1.418	1.413	1.410	1.404	1.401	1.399	1.397
100	1.260	1.415	1.432	1.429	1.425	1.421	1.418	1.413	1.410	1.407	1.406

Table 2.3.6-3: Log-SD of the amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the single-corner seismological model

Freq.	Loading Level										
[Hz]	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	0.00326	0.00537	0.00731	0.00869	0.00943	0.00993	0.0103	0.0108	0.0111	0.0114	0.0116
0.125	0.00318	0.00796	0.00949	0.00945	0.00941	0.00949	0.00959	0.00989	0.0101	0.0103	0.0104
0.167	0.00345	0.00820	0.0103	0.0118	0.0126	0.0131	0.0134	0.0140	0.0143	0.0146	0.0148
0.2	0.00367	0.00851	0.0105	0.0120	0.0127	0.0132	0.0135	0.0141	0.0144	0.0147	0.0148
0.3	0.00454	0.00957	0.0115	0.0129	0.0135	0.0140	0.0143	0.0148	0.0151	0.0153	0.0155
0.4	0.00530	0.0105	0.0124	0.0137	0.0143	0.0148	0.0150	0.0155	0.0158	0.0160	0.0161
0.5	0.00604	0.0113	0.0131	0.0144	0.0150	0.0154	0.0157	0.0161	0.0164	0.0166	0.0167
0.6	0.00682	0.0120	0.0138	0.0150	0.0156	0.0160	0.0162	0.0167	0.0169	0.0171	0.0172
0.7	0.00764	0.0128	0.0146	0.0157	0.0162	0.0166	0.0168	0.0172	0.0175	0.0177	0.0178
0.8	0.00855	0.0137	0.0154	0.0164	0.0169	0.0173	0.0175	0.0179	0.0181	0.0183	0.0184
0.9	0.00954	0.0146	0.0162	0.0173	0.0177	0.0181	0.0183	0.0186	0.0189	0.0190	0.0191
1	0.0106	0.016	0.0172	0.0182	0.0186	0.0189	0.0191	0.0195	0.0197	0.0199	0.0200
1.25	0.0138	0.019	0.0201	0.0209	0.0213	0.0216	0.0218	0.0221	0.0223	0.0224	0.0225
1.5	0.0176	0.022	0.0237	0.0244	0.0248	0.0251	0.0252	0.0255	0.0256	0.0258	0.0259
2	0.0272	0.032	0.0331	0.0338	0.0341	0.0343	0.0344	0.0347	0.0348	0.0349	0.0350
2.5	0.0397	0.045	0.0457	0.0462	0.0465	0.0467	0.0468	0.0470	0.0472	0.0473	0.0474
3	0.0552	0.060	0.0613	0.0618	0.0621	0.0623	0.0624	0.0626	0.0628	0.0629	0.0630
4	0.0951	0.101	0.102	0.102	0.102	0.102	0.103	0.103	0.103	0.103	0.103
5	0.143	0.149	0.150	0.150	0.150	0.151	0.151	0.151	0.151	0.151	0.152
6	0.187	0.193	0.193	0.193	0.194	0.194	0.194	0.194	0.194	0.195	0.195
7	0.214	0.220	0.220	0.220	0.220	0.220	0.220	0.221	0.221	0.221	0.222
8	0.224	0.229	0.229	0.229	0.230	0.230	0.230	0.230	0.230	0.231	0.231
9	0.220	0.227	0.228	0.228	0.228	0.228	0.228	0.229	0.229	0.229	0.229
10	0.212	0.223	0.224	0.225	0.225	0.225	0.226	0.226	0.226	0.227	0.227
12.5	0.193	0.221	0.225	0.227	0.228	0.229	0.229	0.230	0.231	0.231	0.231
15	0.167	0.216	0.223	0.226	0.228	0.228	0.229	0.230	0.230	0.231	0.231
20	0.124	0.189	0.199	0.203	0.204	0.205	0.205	0.206	0.207	0.207	0.208
25	0.111	0.178	0.189	0.194	0.196	0.198	0.199	0.200	0.201	0.201	0.202
30	0.105	0.161	0.173	0.179	0.181	0.182	0.183	0.185	0.186	0.186	0.187
35	0.108	0.150	0.163	0.170	0.172	0.174	0.175	0.176	0.177	0.178	0.178
40	0.105	0.132	0.148	0.156	0.158	0.160	0.161	0.162	0.163	0.164	0.164
45	0.104	0.124	0.143	0.154	0.158	0.161	0.162	0.165	0.166	0.167	0.168
50	0.105	0.115	0.133	0.145	0.149	0.152	0.154	0.157	0.158	0.160	0.161
60	0.106	0.108	0.121	0.133	0.138	0.142	0.143	0.146	0.148	0.149	0.150
70	0.106	0.103	0.104	0.112	0.117	0.120	0.122	0.126	0.128	0.130	0.131
80	0.106	0.106	0.102	0.108	0.112	0.116	0.118	0.122	0.124	0.125	0.126
90	0.106	0.109	0.104	0.105	0.108	0.111	0.113	0.116	0.118	0.120	0.121
100	0.106	0.111	0.104	0.102	0.101	0.101	0.101	0.102	0.103	0.104	0.104

Table 2.3.6-4: Input 5% damped PSA values in units of g at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the double-corner seismological model

Freq.	Loading Level										
[Hz]	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	0.000184	0.000303	0.000395	0.000573	0.000744	0.000908	0.00105	0.00143	0.00178	0.00213	0.00249
0.125	0.000278	0.000461	0.000594	0.000848	0.00109	0.00133	0.00154	0.00206	0.00257	0.00306	0.00357
0.167	0.000451	0.000771	0.000990	0.00141	0.00180	0.00218	0.00252	0.00336	0.00417	0.00495	0.00577
0.2	0.000596	0.00104	0.00135	0.00191	0.00245	0.00296	0.00342	0.00455	0.00565	0.00670	0.00781
0.3	0.00107	0.00199	0.00262	0.00375	0.00482	0.00584	0.00675	0.00901	0.0112	0.0133	0.0155
0.4	0.00162	0.0031	0.0042	0.0061	0.0079	0.0095	0.0110	0.0148	0.0184	0.0218	0.0255
0.5	0.00226	0.00456	0.00616	0.00900	0.0117	0.0142	0.0164	0.0220	0.0274	0.0326	0.0381
0.6	0.00300	0.00624	0.00851	0.0125	0.0162	0.0198	0.0230	0.0309	0.0385	0.0459	0.0536
0.7	0.00384	0.00818	0.0113	0.0167	0.0217	0.0265	0.0307	0.0414	0.0516	0.0615	0.0719
0.8	0.00474	0.0104	0.0144	0.0214	0.0279	0.0341	0.0396	0.0534	0.0667	0.0795	0.0930
0.9	0.00571	0.0127	0.0178	0.0266	0.0347	0.0425	0.0495	0.0669	0.0836	0.100	0.117
1	0.00672	0.0153	0.0215	0.0322	0.0422	0.0517	0.0603	0.0815	0.102	0.122	0.142
1.25	0.00930	0.0221	0.0316	0.0478	0.0628	0.0772	0.0900	0.122	0.153	0.183	0.214
1.5	0.0118	0.0293	0.0423	0.0645	0.0851	0.105	0.122	0.166	0.209	0.250	0.293
2	0.0164	0.0435	0.0641	0.0990	0.131	0.162	0.190	0.259	0.326	0.391	0.459
2.5	0.0200	0.0564	0.0845	0.132	0.176	0.218	0.256	0.350	0.441	0.529	0.621
3	0.0227	0.0676	0.103	0.162	0.217	0.270	0.317	0.435	0.549	0.660	0.775
4	0.0260	0.0853	0.134	0.214	0.288	0.360	0.424	0.586	0.741	0.892	1.049
5	0.0274	0.098	0.157	0.256	0.347	0.435	0.514	0.712	0.904	1.089	1.283
6	0.0279	0.108	0.177	0.291	0.397	0.499	0.592	0.823	1.046	1.262	1.490
7	0.0277	0.115	0.193	0.322	0.441	0.556	0.660	0.920	1.172	1.417	1.674
8	0.0271	0.121	0.206	0.348	0.479	0.605	0.720	1.008	1.286	1.556	1.840
9	0.0264	0.125	0.217	0.370	0.512	0.650	0.774	1.087	1.389	1.683	1.992
10	0.0254	0.128	0.226	0.389	0.540	0.687	0.820	1.155	1.479	1.792	2.124
12.5	0.0224	0.128	0.235	0.415	0.582	0.744	0.892	1.264	1.625	1.975	2.343
15	0.0197	0.125	0.238	0.428	0.606	0.779	0.937	1.335	1.724	2.100	2.495
20	0.0158	0.115	0.233	0.435	0.625	0.812	0.983	1.416	1.839	2.248	2.682
25	0.0135	0.104	0.221	0.427	0.622	0.815	0.992	1.443	1.884	2.313	2.765
30	0.0122	0.0942	0.207	0.411	0.606	0.801	0.980	1.437	1.885	2.322	2.783
35	0.0116	0.0853	0.193	0.392	0.584	0.777	0.955	1.410	1.858	2.295	2.758
40	0.0112	0.0778	0.179	0.371	0.558	0.747	0.921	1.370	1.812	2.246	2.703
45	0.0110	0.0717	0.167	0.350	0.530	0.714	0.884	1.322	1.755	2.180	2.629
50	0.0109	0.0669	0.155	0.330	0.503	0.679	0.844	1.269	1.691	2.104	2.542
60	0.0108	0.0602	0.137	0.293	0.450	0.612	0.763	1.157	1.550	1.935	2.344
70	0.0107	0.0564	0.123	0.261	0.402	0.548	0.686	1.044	1.403	1.756	2.131
80	0.0107	0.0543	0.113	0.235	0.361	0.491	0.613	0.934	1.256	1.573	1.911
90	0.0107	0.0532	0.107	0.216	0.326	0.441	0.549	0.833	1.117	1.398	1.697
100	0.0107	0.0524	0.103	0.202	0.300	0.402	0.497	0.746	0.995	1.240	1.501

Table 2.3.6-5: Median amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the double-corner seismological model

Frequency [Hz]	Loading Level										
	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	1.006	1.025	1.032	1.037	1.039	1.041	1.042	1.044	1.045	1.046	1.047
0.125	1.012	1.022	1.029	1.034	1.037	1.039	1.040	1.042	1.043	1.044	1.044
0.167	1.012	1.019	1.026	1.032	1.034	1.036	1.037	1.039	1.040	1.040	1.041
0.2	1.011	1.018	1.024	1.030	1.032	1.033	1.035	1.036	1.037	1.038	1.039
0.3	1.011	1.023	1.023	1.026	1.028	1.029	1.030	1.032	1.033	1.034	1.034
0.4	1.012	1.024	1.028	1.030	1.031	1.031	1.031	1.031	1.031	1.031	1.031
0.5	1.013	1.024	1.029	1.033	1.035	1.036	1.036	1.037	1.037	1.038	1.038
0.6	1.014	1.025	1.030	1.034	1.036	1.037	1.038	1.039	1.040	1.040	1.041
0.7	1.015	1.026	1.031	1.035	1.037	1.038	1.039	1.040	1.041	1.041	1.042
0.8	1.017	1.028	1.033	1.036	1.038	1.039	1.040	1.041	1.042	1.042	1.043
0.9	1.018	1.029	1.034	1.038	1.039	1.040	1.041	1.042	1.043	1.044	1.044
1	1.020	1.031	1.036	1.039	1.041	1.042	1.043	1.044	1.045	1.045	1.045
1.25	1.025	1.037	1.041	1.044	1.046	1.047	1.048	1.049	1.049	1.050	1.050
1.5	1.031	1.043	1.048	1.051	1.052	1.053	1.054	1.055	1.055	1.056	1.056
2	1.045	1.058	1.063	1.066	1.067	1.068	1.069	1.070	1.071	1.071	1.071
2.5	1.063	1.077	1.082	1.085	1.086	1.087	1.088	1.089	1.090	1.090	1.091
3	1.084	1.099	1.104	1.108	1.109	1.110	1.111	1.112	1.113	1.113	1.114
4	1.139	1.157	1.163	1.167	1.168	1.170	1.170	1.172	1.172	1.173	1.174
5	1.211	1.233	1.240	1.244	1.246	1.247	1.248	1.250	1.251	1.252	1.252
6	1.297	1.322	1.330	1.335	1.337	1.339	1.340	1.341	1.343	1.344	1.344
7	1.384	1.413	1.421	1.426	1.428	1.430	1.431	1.433	1.435	1.436	1.437
8	1.459	1.491	1.499	1.504	1.507	1.509	1.510	1.512	1.513	1.514	1.515
9	1.514	1.548	1.556	1.561	1.563	1.565	1.566	1.568	1.570	1.570	1.571
10	1.546	1.582	1.589	1.593	1.595	1.597	1.598	1.600	1.601	1.602	1.603
12.5	1.545	1.580	1.583	1.585	1.586	1.587	1.588	1.589	1.590	1.591	1.591
15	1.485	1.512	1.511	1.511	1.511	1.511	1.511	1.512	1.513	1.513	1.513
20	1.399	1.422	1.417	1.413	1.412	1.412	1.412	1.412	1.412	1.412	1.412
25	1.371	1.412	1.405	1.400	1.398	1.397	1.397	1.396	1.396	1.396	1.396
30	1.356	1.428	1.422	1.417	1.415	1.415	1.414	1.414	1.414	1.415	1.415
35	1.349	1.464	1.465	1.462	1.461	1.460	1.459	1.459	1.459	1.460	1.460
40	1.340	1.450	1.445	1.438	1.434	1.432	1.430	1.428	1.428	1.427	1.427
45	1.334	1.441	1.430	1.419	1.415	1.412	1.410	1.408	1.407	1.406	1.406
50	1.331	1.444	1.436	1.424	1.419	1.416	1.414	1.411	1.409	1.408	1.408
60	1.327	1.444	1.434	1.416	1.408	1.402	1.399	1.394	1.391	1.389	1.388
70	1.325	1.449	1.448	1.432	1.423	1.417	1.413	1.406	1.403	1.400	1.399
80	1.324	1.452	1.457	1.446	1.437	1.431	1.427	1.420	1.416	1.413	1.412
90	1.322	1.450	1.460	1.449	1.441	1.434	1.429	1.420	1.415	1.411	1.409
100	1.320	1.448	1.462	1.456	1.449	1.444	1.439	1.431	1.426	1.423	1.420

Table 2.3.6-6: Log-SD of the amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the double-corner seismological model

	Loading Level										
Freq. [Hz]	G001	G005	G010	G020	G030	G040	G050	G075	G100	G125	G150
0.1	0.00682	0.0148	0.0174	0.0191	0.0199	0.0205	0.0208	0.0214	0.0217	0.0220	0.0222
0.125	0.00768	0.0138	0.0165	0.0183	0.0190	0.0196	0.0198	0.0204	0.0207	0.0209	0.0211
0.167	0.00871	0.0124	0.0151	0.0169	0.0177	0.0182	0.0185	0.0191	0.0194	0.0196	0.0198
0.2	0.00855	0.0115	0.0143	0.0161	0.0169	0.0174	0.0177	0.0183	0.0186	0.0188	0.0190
0.3	0.00863	0.0126	0.0127	0.0144	0.0152	0.0157	0.0160	0.0166	0.0169	0.0172	0.0174
0.4	0.00905	0.0143	0.0148	0.0145	0.0146	0.0149	0.0151	0.0156	0.0159	0.0161	0.0163
0.5	0.00967	0.0147	0.0163	0.0170	0.0170	0.0170	0.0169	0.0168	0.0167	0.0167	0.0168
0.6	0.0105	0.0152	0.0168	0.0179	0.0183	0.0186	0.0188	0.0189	0.0190	0.0191	0.0191
0.7	0.0115	0.0159	0.0174	0.0184	0.0189	0.0192	0.0194	0.0197	0.0199	0.0201	0.0202
0.8	0.0125	0.0168	0.0182	0.0191	0.0195	0.0198	0.0200	0.0203	0.0205	0.0206	0.0207
0.9	0.0137	0.0179	0.0191	0.0199	0.0203	0.0205	0.0207	0.0210	0.0212	0.0213	0.0214
1	0.0150	0.019	0.0201	0.0209	0.0212	0.0215	0.0216	0.0219	0.0220	0.0222	0.0223
1.25	0.0187	0.022	0.0234	0.0239	0.0242	0.0244	0.0245	0.0247	0.0249	0.0250	0.0250
1.5	0.0230	0.027	0.0273	0.0278	0.0280	0.0281	0.0282	0.0284	0.0285	0.0286	0.0287
2	0.0333	0.037	0.0373	0.0376	0.0378	0.0379	0.0379	0.0380	0.0381	0.0382	0.0383
2.5	0.0462	0.050	0.0501	0.0503	0.0505	0.0505	0.0506	0.0507	0.0508	0.0508	0.0509
3	0.0618	0.065	0.0658	0.0660	0.0661	0.0662	0.0662	0.0663	0.0664	0.0665	0.0666
4	0.102	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.107	0.107	0.107
5	0.150	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.155
6	0.194	0.197	0.196	0.196	0.197	0.197	0.197	0.197	0.197	0.197	0.198
7	0.221	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.224	0.224
8	0.230	0.233	0.232	0.232	0.232	0.232	0.232	0.233	0.233	0.233	0.233
9	0.226	0.231	0.230	0.230	0.230	0.231	0.231	0.231	0.231	0.231	0.231
10	0.219	0.226	0.227	0.227	0.228	0.228	0.228	0.228	0.229	0.229	0.229
12.5	0.198	0.223	0.227	0.230	0.231	0.232	0.232	0.233	0.233	0.234	0.234
15	0.170	0.216	0.224	0.228	0.230	0.231	0.231	0.232	0.233	0.233	0.234
20	0.128	0.187	0.198	0.203	0.205	0.206	0.207	0.208	0.209	0.209	0.209
25	0.121	0.174	0.188	0.194	0.197	0.198	0.199	0.201	0.202	0.203	0.203
30	0.122	0.156	0.171	0.178	0.181	0.183	0.184	0.185	0.186	0.187	0.188
35	0.127	0.145	0.160	0.168	0.171	0.173	0.174	0.176	0.177	0.178	0.179
40	0.126	0.128	0.144	0.154	0.157	0.159	0.160	0.162	0.163	0.164	0.164
45	0.127	0.120	0.138	0.151	0.156	0.159	0.161	0.164	0.166	0.167	0.168
50	0.127	0.115	0.128	0.142	0.147	0.151	0.153	0.156	0.158	0.160	0.161
60	0.128	0.114	0.118	0.130	0.136	0.140	0.142	0.145	0.147	0.149	0.150
70	0.128	0.115	0.106	0.110	0.115	0.118	0.121	0.125	0.127	0.129	0.130
80	0.128	0.118	0.107	0.107	0.111	0.114	0.116	0.120	0.123	0.125	0.126
90	0.128	0.121	0.111	0.107	0.109	0.110	0.112	0.116	0.118	0.120	0.121
100	0.129	0.122	0.113	0.107	0.105	0.104	0.104	0.104	0.105	0.105	0.106

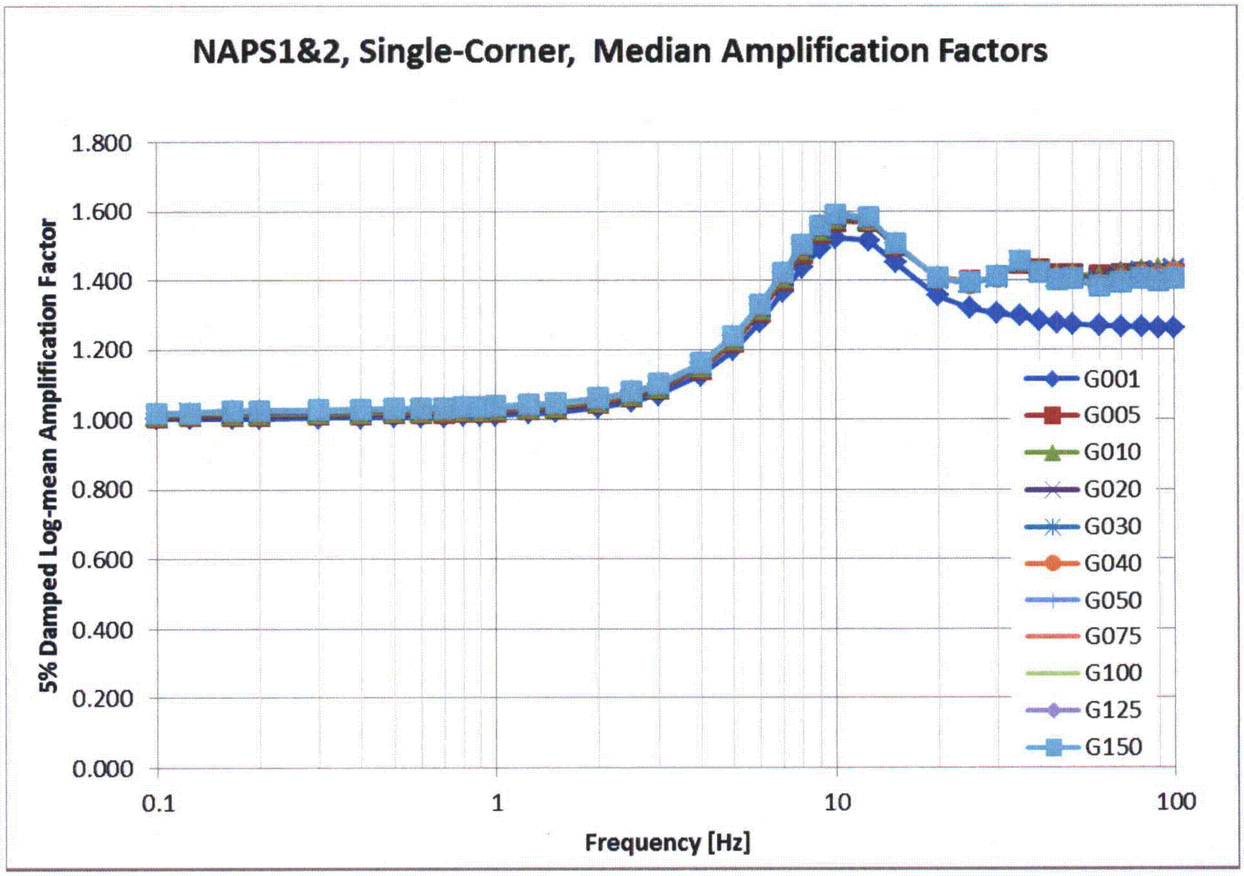

Figure 2.3.6-1: Median amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the single-corner seismological model

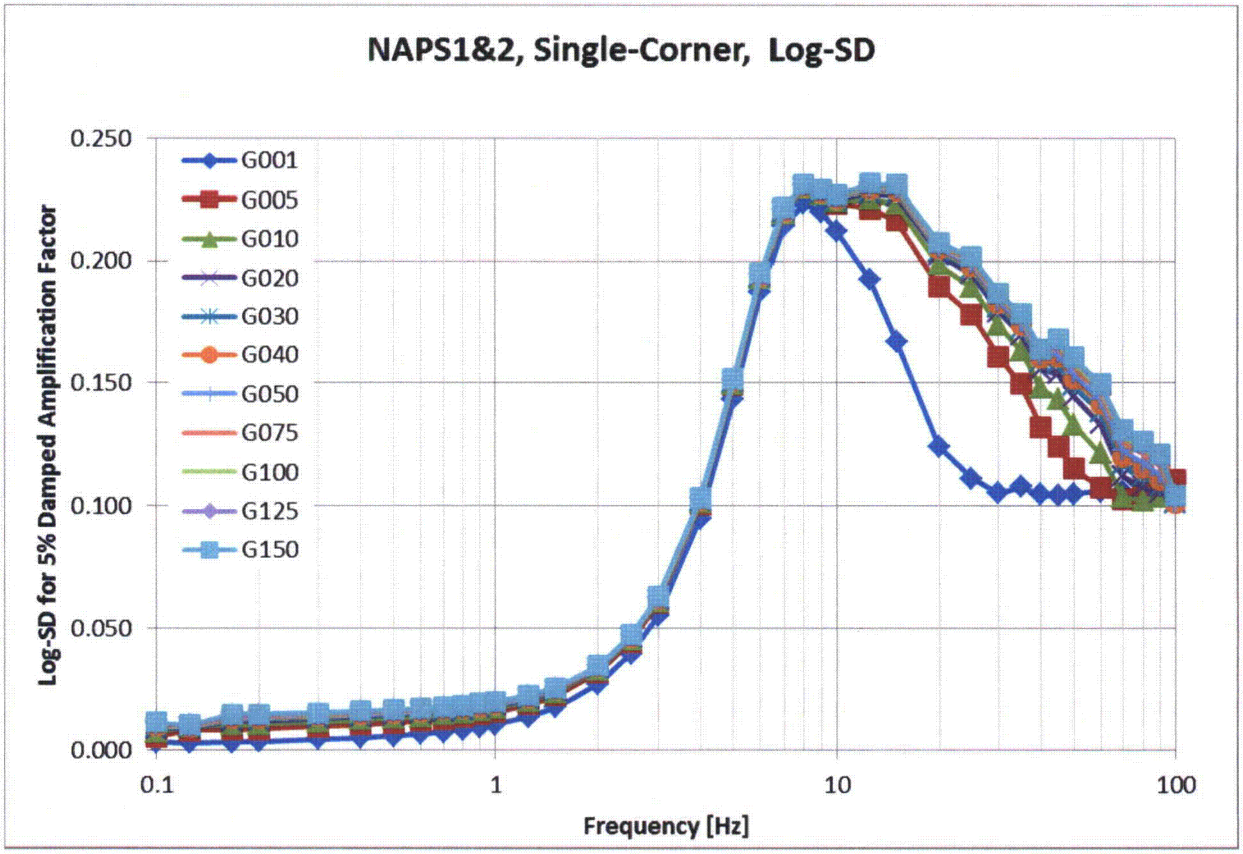

Figure 2.3.6-2: Log-SD of the amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the single-corner seismological model

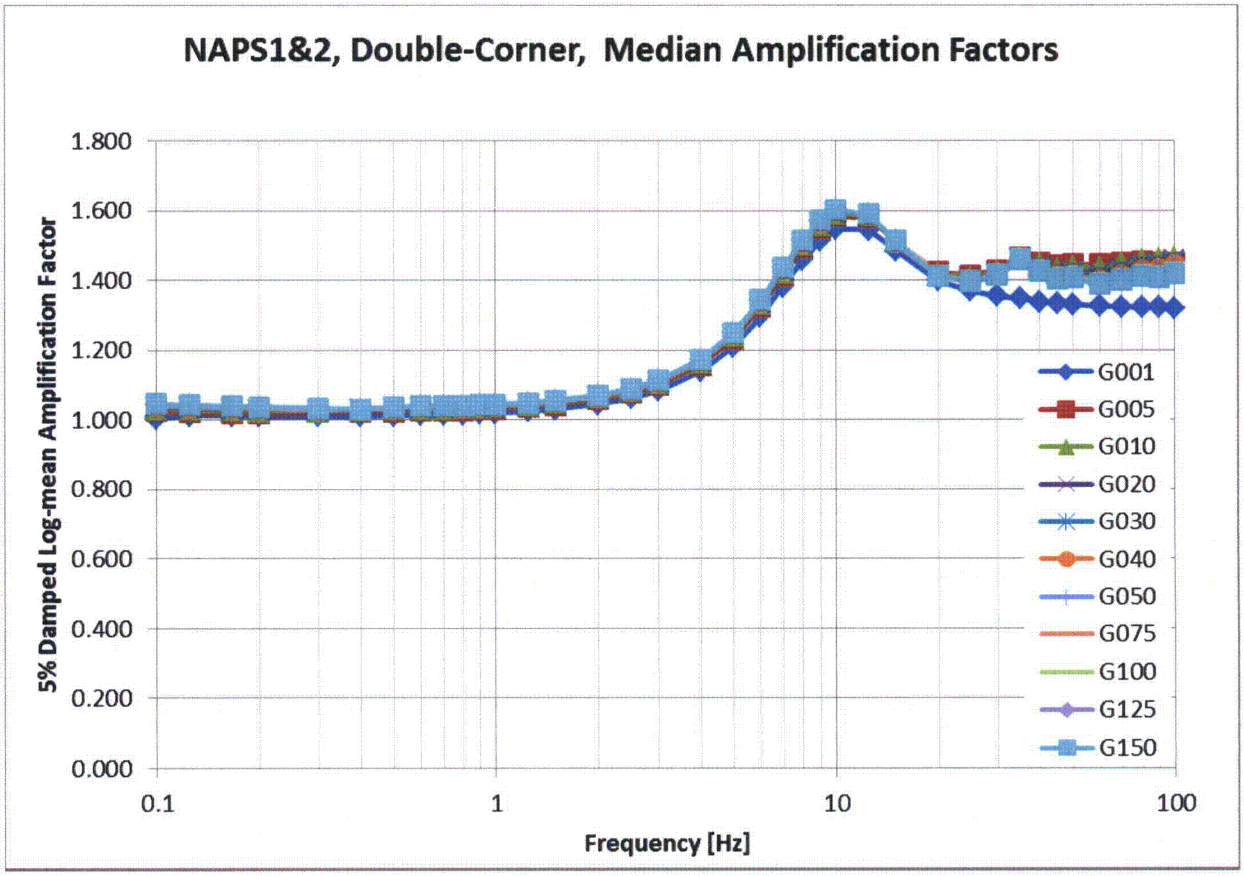

Figure 2.3.6-3: Median amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the double-corner seismological model

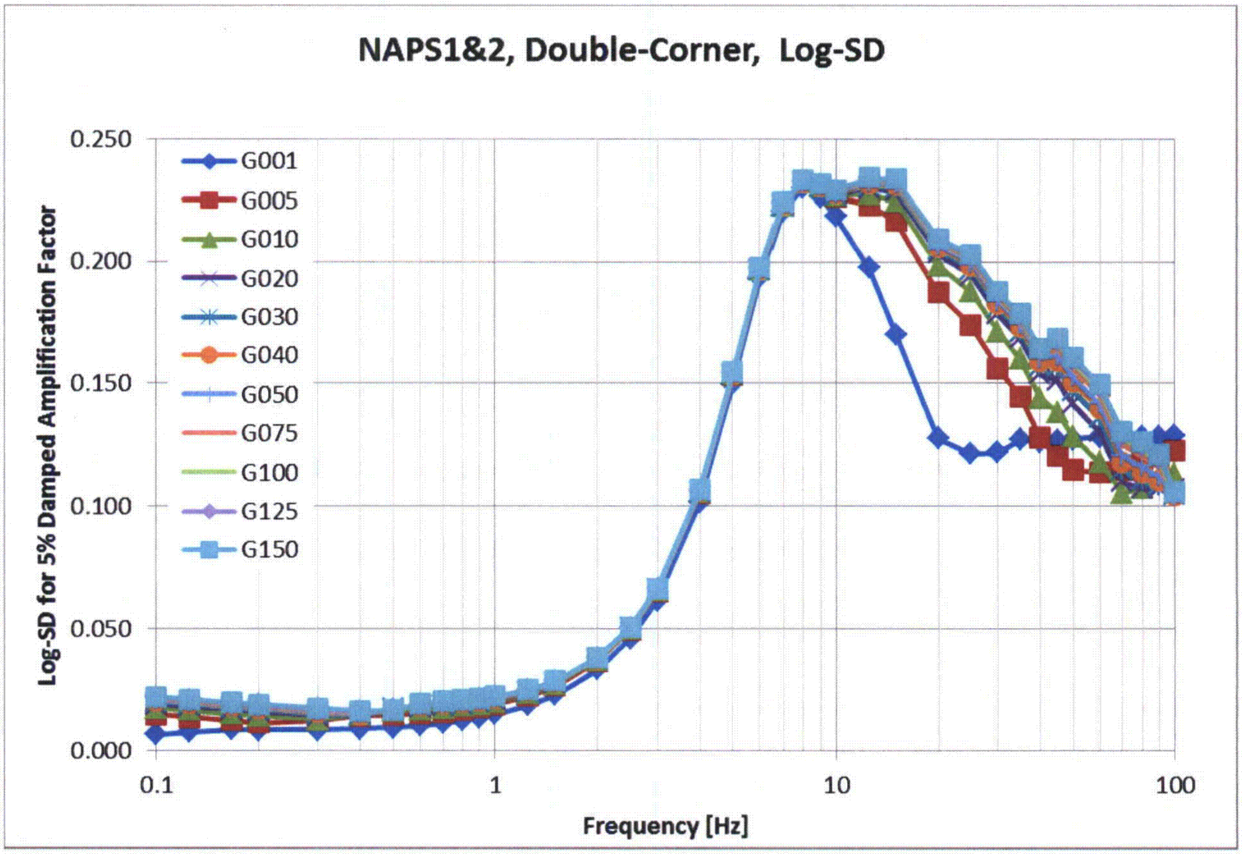

Figure 2.3.6-4: Log-SD of the amplification factors (for 5% damped PSA) developed for the North Anna Units 1 and 2 profile at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g using the double-corner seismological model

2.3.7 CONTROL POINT SEISMIC HAZARD CURVES

The procedure to develop probabilistic site-specific control point hazard curves used in the present analysis follows the methodology described in McGuire et al. (Reference 7.15) and Section B-6.0 of the SPID. This procedure (referred to as Method 3) computes a site-specific control point hazard curve for a broad range of spectral accelerations given the site-specific bedrock hazard curve and site-specific estimates of soil or soft-rock response (i.e., median amplification factors) and associated uncertainties (i.e., sigma in natural log units) presented in the previous section.

As part of the implementation of Method 3, base rock hazard curves for 31 spectral frequencies in addition to the original seven frequencies of 100 Hz (PGA), 25 Hz, 10 Hz, 5 Hz, 2.5 Hz, 1 Hz, and 0.5 Hz are initially developed and used in the application of Method 3 to capture the resulting expected site resonance characteristics from the site response analysis. Given the base rock hazard curves from the seven reference spectral frequencies, uniform hazard response spectra (UHRS) are developed for this suite of 38 spectral frequencies over the range of 0.1 – 100 Hz. UHRS are computed for annual frequencies of exceedances (AFE) of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, and 10^{-8}. For the interpolation of ground motions at the additional 31 spectral frequencies, the average of the CEUS base rock single-corner and double-corner spectral shape models (Reference 7.15) is used with a magnitude 6.5 at a distance of 50 km. This average spectral shape for each UHRS is constrained to be equal to the ground motion value for each of the seven reference spectral frequencies. For frequencies less than 0.5 Hz, a constant slope of 1/T is adopted, where T is the spectral period. This methodology for the interpolation of additional spectral frequencies for the base rock hazard curves was applied to both the mean and fractile sets of base rock hazard curves.

The resulting 38 base rock hazard curve sets (i.e., mean and five fractile levels of 5th, 16th, 50th, 84th, and 95th) was used in the Method 3 approach (Reference 7.15) to estimate the control point seismic hazard curves for 38 spectral frequencies along with the median site amplification factors and associated sigma values from the single-corner and double-corner seismic source input spectra. The resulting Method 3 control point hazard curves from the single-corner and double-corner site amplification factors and sigma were combined based on equal weights as recommended in the SPID. The mean control point hazard curves for the seven reference spectral frequencies for the North Anna site are shown in Figure 2.3.7-1. Tabulated values of the site response amplification functions and control point hazard curves are provided in the attached Appendix A.

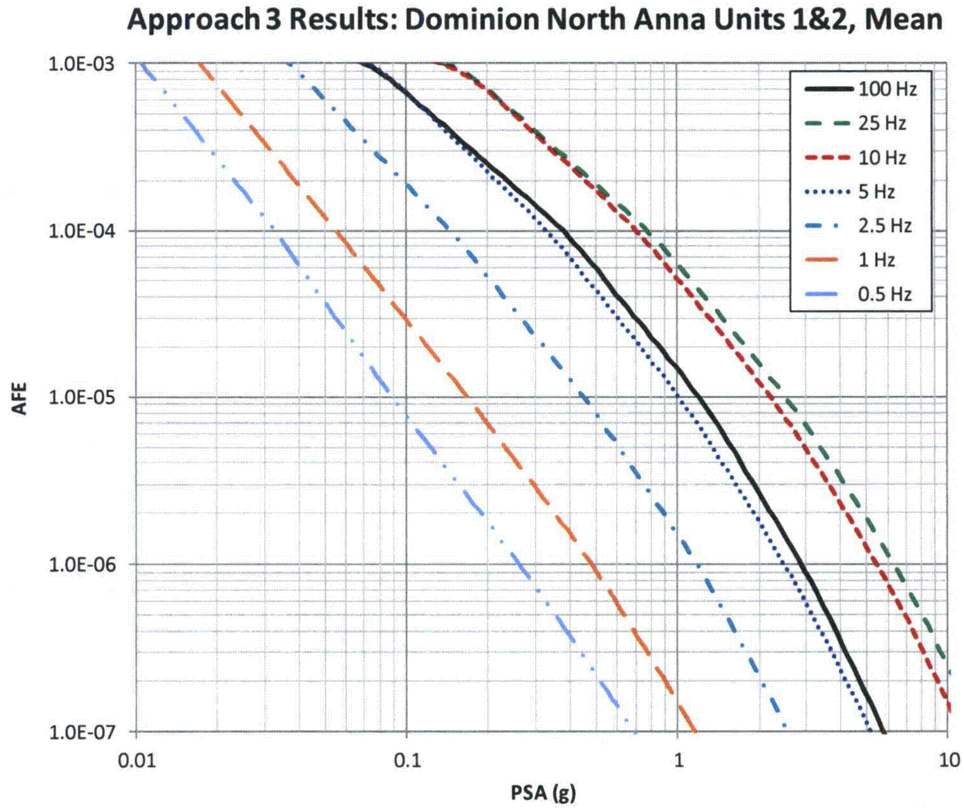

Figure 2.3.7-1: Control point mean hazard curves for spectral frequencies of 0.5, 1, 2.5, 5, 10, 25 and 100 Hz at the North Anna site

2.4 CONTROL POINT RESPONSE SPECTRA

The control point hazard curves described above have been used to develop uniform hazard response spectra (UHRS) and the ground motion response spectrum (GMRS). The UHRS were obtained through linear interpolation in log-log space to estimate the spectral acceleration at each of the 38 oscillator frequencies for the 1E-4 and 1E-5 per year hazard levels.

The 1E-4 and 1E-5 UHRS, along with a design factor (DF) are used to compute the GMRS at the control point using the criteria in Regulatory Guide 1.208. Table 2.4-1 shows the UHRS and GMRS spectral accelerations and these spectra are also plotted in Figure 2.4-1.

Table 2.4-1: Horizontal Direction, 5% Damped UHRS for 10^{-4} and 10^{-5} and GMRS at control point for North Anna

Frequency (Hz)	Mean UHRS (g) (AEP=10^{-4})	Mean UHRS (g) (AEP=10^{-5})	GMRS (g)
100.000	0.3787	1.2012	0.5721
90.000	0.4070	1.2910	0.6149
80.000	0.4596	1.4635	0.6965
70.000	0.5361	1.7090	0.8132
60.000	0.6306	2.0198	0.9601
50.000	0.7286	2.3472	1.1145
45.000	0.7607	2.4549	1.1652
40.000	0.7935	2.5609	1.2155
35.000	0.8203	2.6608	1.2617
30.000	0.7941	2.5790	1.2226
25.000	0.7710	2.5088	1.1889
20.000	0.7625	2.4579	1.1670
15.000	0.7707	2.4613	1.1707
12.500	0.7632	2.4193	1.1525
10.000	0.7017	2.2012	1.0508
9.000	0.6430	2.0154	0.9622
8.000	0.5727	1.7928	0.8562
7.000	0.4927	1.5373	0.7346
6.000	0.4089	1.2684	0.6068
5.000	0.3285	1.0116	0.4847
4.000	0.2509	0.7727	0.3702
3.000	0.1802	0.5570	0.2667
2.500	0.1454	0.4513	0.2159
2.000	0.1196	0.3697	0.1770
1.500	0.0893	0.2749	0.1317
1.250	0.0723	0.2223	0.1065
1.000	0.0549	0.1681	0.0806
0.900	0.0517	0.1545	0.0745
0.800	0.0479	0.1397	0.0677
0.700	0.0435	0.1237	0.0602
0.600	0.0384	0.1067	0.0522
0.500	0.0326	0.0884	0.0435
0.400	0.0260	0.0705	0.0347
0.300	0.0195	0.0529	0.0260
0.200	0.0131	0.0354	0.0174
0.167	0.0109	0.0296	0.0145
0.125	0.0082	0.0221	0.0109
0.100	0.0066	0.0177	0.0087

AEP – annual exceedance probability

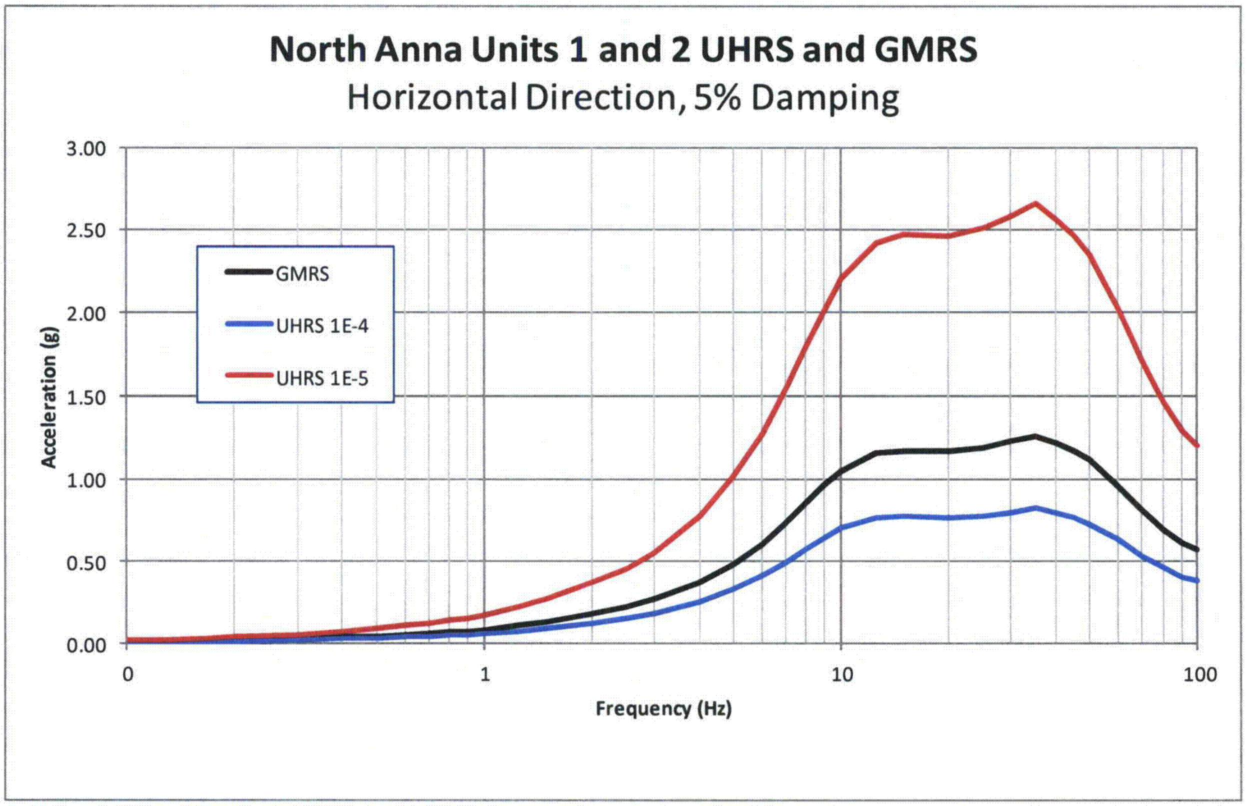

Figure 2.4-1: North Anna Units 1 and 2 UHRS for 1E-4 and 1E-5 and GMRS at Control Point

3.0 DESIGN BASIS EARTHQUAKE

The design basis for North Anna Units 1 and 2 is identified in the Updated Final Safely Analysis Report (UFSAR) (Reference 7.4).

3.1 DESCRIPTION OF SSE SPECTRAL SHAPE

The North Anna UFSAR describes the development of the SSE in Section 2.5.2.6. For the purpose of establishing a design basis earthquake, it was assumed that an earthquake equal to the largest shock associated with the Arconia Syncline might occur close to the site area. With the epicenter of a shock similar to the 1875 intensity-VII Arconia earthquake shifted to the vicinity of the site, it was estimated that the maximum horizontal ground acceleration at the rock surface would be less than 0.12g. Accordingly, the design-basis earthquake for structures founded on rock was taken at 0.12g for horizontal ground motion and two-thirds that value for vertical ground motion.

UFSAR Figure 2.5-12 shows the rock SSE response spectrum. The SSE response spectrum data provided in Table 3.1-1 are based on UFSAR Figure 2.5-12. The SSE response spectrum is plotted in Figure 3.1-1.

Table 3.1-1: SSE (Rock) Horizontal Direction Response Spectrum at 5% Damping for North Anna

Frequency [Hz]	Acceleration [g]	Frequency [Hz]	Acceleration [g]
0.125	0.003	2.000	0.333
0.173	0.005	10.000	0.333
0.201	0.007	10.640	0.318
0.252	0.011	11.184	0.307
0.307	0.017	11.467	0.301
0.357	0.023	12.054	0.291
0.415	0.030	13.000	0.275
0.470	0.036	15.090	0.246
0.532	0.044	18.425	0.212
0.603	0.053	20.359	0.197
0.700	0.067	22.496	0.183
0.800	0.082	25.486	0.167
0.900	0.098	28.162	0.155
1.000	0.116	30.352	0.147
1.183	0.149	35.255	0.132
1.308	0.174	38.000	0.125
1.500	0.214	40.000	0.120
1.720	0.265	50.000	0.120
1.901	0.309		

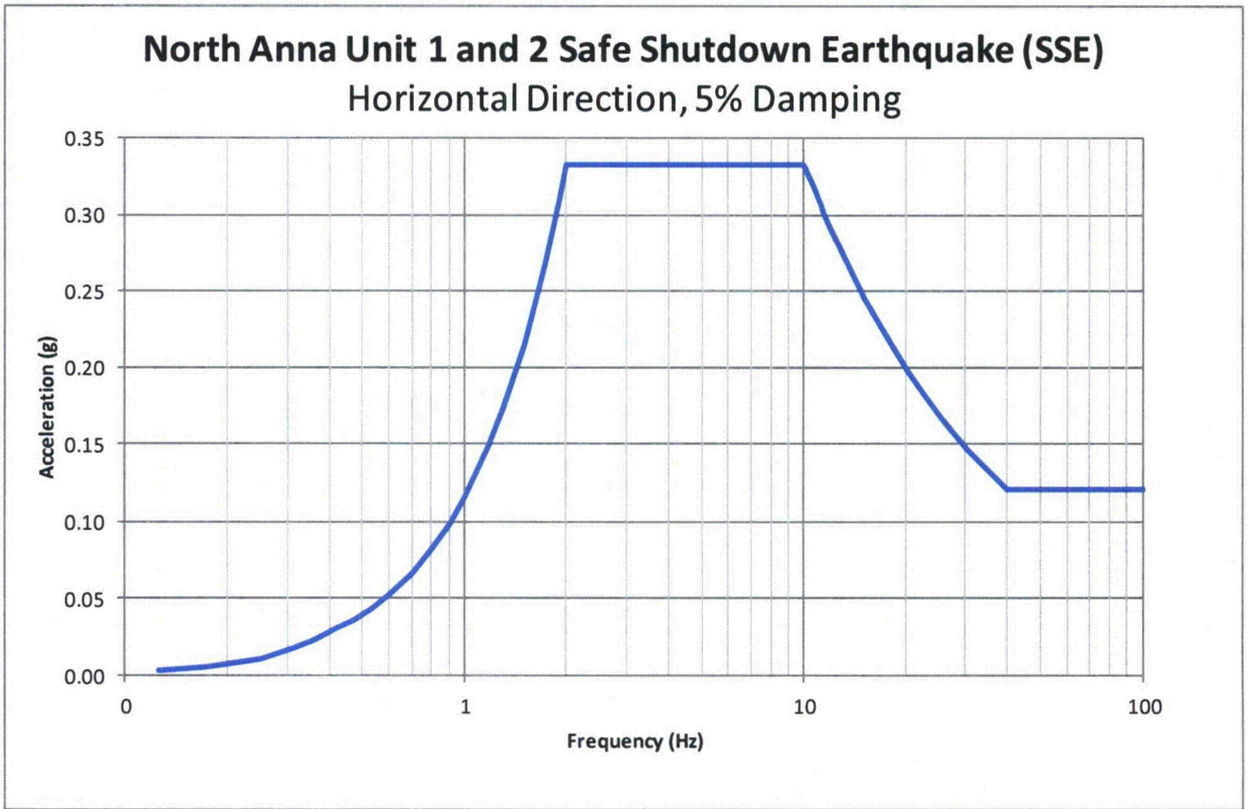

Figure 3.1-1: North Anna Units 1 and 2 Safe Shutdown Earthquake (Rock) Response Spectrum – Horizontal Direction, 5% Damping

3.2 CONTROL POINT ELEVATION

EPRI Report 1025287 (SPID) provides very specific guidelines on how a nuclear power facility is to identify the SSE Control Point elevation for a plant if this control point was not identified in the UFSAR. In the case of a plant designated as a rock site, or where the key safety-related structures are rock-founded (as is the case for North Anna), the SSE control point is defined as the foundation bearing elevation of the highest rock-supported, safety-related structure. At North Anna, the highest rock-founded, safety-related structure is the Casing Cooling Tank and Pumphouse structure. This is a single slab-supported structure founded above weathered bedrock and on concrete backfill. The concrete backfill was placed to create a level bearing surface above the varying elevation of the exposed bedrock surface. Due to its limited horizontal extent, the concrete backfill is not included in the GMRS calculation.

The base of the Casing Cooling Tank and Pumphouse foundation is at El. 268 ft. The GMRS was calculated at El. 268 ft, or 3 ft below plant grade.

4.0 SCREENING EVALUATION

In accordance with SPID Section 3, a screening evaluation was performed as described below.

4.1 RISK EVALUATION SCREENING (1 TO 10 HZ)

The GMRS exceeds the SSE in the 1 to 10 Hz range. Therefore, North Anna screens in for a risk evaluation.

4.2 HIGH FREQUENCY SCREENING (> 10 HZ)

For the range above 10 Hz, the GMRS exceeds the SSE. Therefore, North Anna screens in for a high frequency confirmation. The high frequency confirmation will be addressed together with the risk evaluation discussed in Section 4.1 above.

4.3 SPENT FUEL POOL EVALUATION SCREENING (1 TO 10 HZ)

In the 1 to 10 Hz part of the response spectrum, the GMRS exceeds the SSE. Therefore, North Anna screens in for a Spent Fuel Pool evaluation.

5.0 INTERIM ACTIONS AND ASSESSMENTS

Consistent with NRC letter dated February 20, 2014 (Reference 7.24), the seismic hazard reevaluations presented herein are distinct from the current design and licensing bases for North Anna Units 1 and 2. Therefore, the results do not call into question the operability or functionality of plant structures, systems and components (SSCs) and are not reportable pursuant to 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and 10 CFR 50.73, "Licensee event report system."

The NRC 50.54(f) letter (Reference 7.1) requests that licensees provide "interim evaluation and actions taken or planned to address the higher seismic hazard relative to the design basis, as appropriate, prior to completion of the risk evaluation." These evaluations and actions are discussed below.

5.1 EXPEDITED SEISMIC EVALUATION PROCESS

The Expedited Seismic Evaluation Process (ESEP) is being performed for North Anna Units 1 and 2 in accordance with the methodology in EPRI 3002000704 (Reference 7.3) as proposed in Nuclear Energy Institute (NEI) letter to NRC dated April 9, 2013 (Reference 7.22) and confirmed in NRC letter dated May 7, 2013 (Reference 7.23).

To support an interim evaluation of the North Anna Units 1 and 2 GMRS, an initial expedited seismic equipment list (ESEL) has been developed for North Anna in accordance with EPRI 3002000704. Estimates of in-structure response spectra (ISRS) corresponding to the GMRS have been made in the 1 to 10 Hz range. Using the GMRS-based ISRS in the 1 to 10 Hz range and 2-times-SSE-based ISRS above 10 Hz, seismic capacity calculations have been performed for ESEL components, and for block walls in the vicinity of the ESEL components. Plant walkdowns have been performed for selected components where previous Unresolved Safety Issue (USI) A-46 or Individual Plant Examination of External Events (IPEEE) walkdown information was not available. The evaluated SSCs have been determined to have sufficient capacities to withstand the above stated seismic spectra.

Dominion plans to submit the ESEP results, consistent with EPRI 3002000704 guidance, to NRC by December 31, 2014 in accordance with the schedule in the Reference 7.22 letter to NRC.

5.2 NORTH ANNA UNITS 1 AND 2 RISK ESTIMATES

NEI letter dated March 12, 2014 (Reference 7.16) provides seismic core damage risk estimates using the same approach as used in Reference 7.17 with the updated seismic hazards for the operating nuclear plants in the Central and Eastern United States, including North Anna. Dominion's estimates of the seismic core damage frequency (CDF) are consistent with the conclusions in Reference 7.16, i.e., the weighted (average of four frequencies) seismic CDF using the methods in Reference 7.17 for North Anna is less than 1E-4 per year. These risk estimates continue to support the following conclusions of the NRC GI-199 Safety/Risk Assessment:

> *Overall seismic core damage risk estimates are consistent with the Commission's Safety Goal Policy Statement because they are within the subsidiary objective of 10^{-4}/year for core damage frequency. The GI-199 Safety/Risk Assessment, based in part on information from the U.S. Nuclear Regulatory Commission's (NRC's) Individual Plant Examination of External Events (IPEEE) program, indicates that no concern exists regarding adequate protection and that the current seismic design of operating reactors provides a safety margin to withstand potential earthquakes exceeding the original design basis.*

5.3 PREVIOUS EVALUATIONS – INCLUDING BEYOND DESIGN BASIS SEISMIC INPUTS

5.3.1 IPEEE AND USI A-46 EFFORTS

North Anna Units 1 and 2 conducted an IPEEE Evaluation using the EPRI Seismic Margin Assessment method to a NUREG-CR/0098 median spectral shape anchored to 0.3g PGA. This PGA level is 2.5 times the PGA of the North Anna SSE for rock founded structures. The vast majority of components were shown to have margin above a high confidence of low probability of failure (HCLPF) capacity of 0.3g. The IPEEE HCLPF Spectrum (IHS), with the NUREG/CR-0098 shape, was anchored at the capacity of the weakest component (the Emergency Condensate Storage Tank (ECST)) in the IPEEE seismic margin analysis. However, the ECST has since been shown to have greater seismic capacity based upon a recent detailed review. The lowest capacity component now becomes the Refueling Water Storage Tank (RWST) with a HCLPF capacity of 0.18g. Therefore, the IHS can be anchored at 0.18g. The IHS, and its comparison with the SSE, is shown in Figure 5.3-1.

The IPEEE program was run concurrently with the USI A-46 program for North Anna and resulted in comprehensive walkdowns of safe-shutdown equipment, detailed relay evaluations, and analyses of tanks, cable trays and conduit systems. As a result of these evaluations, several plant enhancements were made at North Anna, as identified in the IPEEE Summary Report (Reference 7.18).

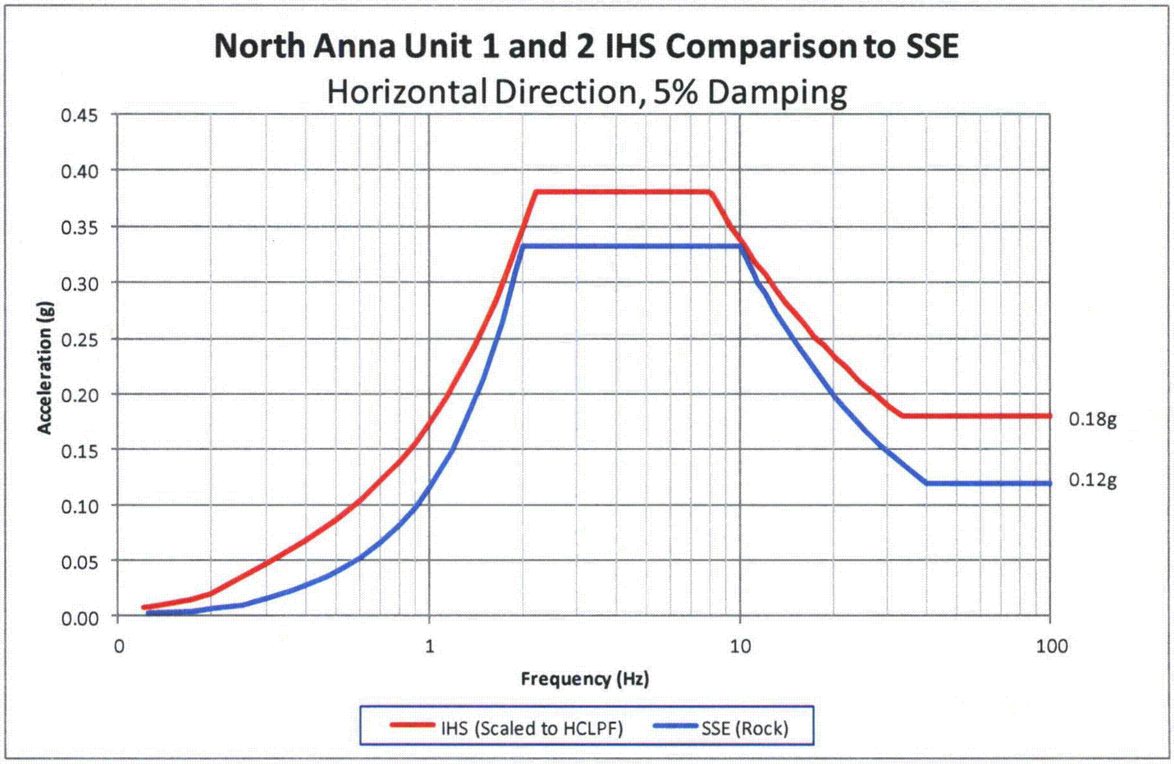

Figure 5.3-1: North Anna Units 1 and 2 IHS Comparison to SSE

5.3.2 WALKDOWNS TO ADDRESS NTTF RECOMMENDATION 2.3: SEISMIC

North Anna recently performed walkdowns for NTTF 2.3 and submitted a summary report to NRC (Reference 7.19). There were no significant findings as they relate to the confirmation that North Anna meets the seismic design basis. The IPEEE commitments were met, as stated in the NTTF 2.3 walkdown report.

5.3.3 ACTIONS FOLLOWING **M**5.8 MINERAL EARTHQUAKE OF AUGUST 23, 2011

The Mineral, Virginia **M**5.8 earthquake of August 23, 2011 exceeded the plant SSE spectra. In the weeks following the Mineral event and as part of long-term commitments, North Anna performed a comprehensive assessment of the entire plant and performed functional and surveillance testing. No damage was observed for safety-related SSCs.

North Anna completed several long-term evaluations and implemented actions requested in an NRC Confirmatory Action Letter (Reference 7.20) related to the evaluation of the effects of the Mineral earthquake. A summary of these completed actions was provided to the NRC in a Dominion letter dated May 13, 2013 (Reference 7.21). Some of the significant evaluations and actions completed are:

- Comprehensive Walkdowns: SSCs were walked down immediately following the Mineral earthquake event by Dominion engineers and several industry experts. No damage to safety-related SSCs was observed.
- Evaluation of Equipment, ASME Class 1 Piping, and Structures: A detailed sampling evaluation of these SSCs per the guidelines of EPRI NP-6695 (Reference 7.25) and NRC RG 1.167 (Reference 7.26) was performed. In-structure response spectra developed from dynamic analyses with the Mineral earthquake recorded time-histories were used. These evaluations corroborated the results of extensive plant inspections and functional tests that were performed in support of the plant restart effort where no physical or functional damage was observed in safety-related structures, systems and components.
- Evaluation of components with HCLPF capacities less than 0.3g: Thirteen groups of components, identified during IPEEE to have HCLPF capacities below 0.3g, were re-evaluated. This review indicated that, in some cases, there was significant conservatism in the previous calculations; therefore, more realistic analyses were performed. Four groups of SSCs were shown to have a HCLPF capacity greater than 0.3g for the review level earthquake (RLE). The components with HCLPF capacity below 0.3g were also thoroughly inspected using the USI A-46 seismic walkdown guidance and no damage was observed.
- Implementation of a Seismic Margin Management Program: North Anna implemented a seismic margin management program (SMMP) to address the impact of the **M**5.8 August 23, 2011 earthquake. To ensure that adequate seismic margins are maintained for plant SSCs, Dominion revised the design control process for North Anna Units 1 and 2 to require explicit evaluation of plant modifications including seismic qualification of new and replacement equipment for the effects of the August 23, 2011 earthquake using ISRS based on the Mineral earthquake event for the Containment, Auxiliary Building, and other buildings containing safety related SSCs. These ISRS were developed via dynamic analyses using the actual time-histories recorded during the Mineral earthquake.

6.0 CONCLUSIONS

In accordance with the NRC 10 CFR 50.54(f) request for information letter (Reference 7.1), a seismic hazard and screening evaluation was performed for North Anna Units 1 and 2. A GMRS was developed solely for purpose of screening for additional evaluations in accordance with the SPID.

Based on the results of the screening evaluation, North Anna Units 1 and 2 screen-in for a risk evaluation, a Spent Fuel Pool evaluation, and a high frequency confirmation. A seismic probabilistic risk assessment (SPRA) will be performed for North Anna in accordance with the guidance in EPRI Report 1025287 (SPID).

7.0 REFERENCES

7.1 U. S. Nuclear Regulatory Commission (NRC) letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3 and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident," dated March 12, 2012.

7.2 Electric Power Research Institute (EPRI) Report No. 1025287, "Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," February 28, 2013.

7.3 EPRI Report No. 3002000704, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1 – Seismic," May 31, 2013.

7.4 North Anna Power Station Units 1 and 2 Updated Final Safety Analysis Report, Revision 49.

7.5 Lettis Consultants International Report, "North Anna Seismic Hazard and Screening Report," Rev. 1, LCI Project 1041, October 29, 2013.

7.6 EPRI Letter RSM-101113-018, "North Anna Rock Seismic Hazard and Screening Report (Revision 1)," to Dominion transmitting the results of EPRI Supplemental Project "Seismic Attenuation and GMRS Project," CF 18139-30157 (Project ID No. 073272).

7.7 Technical Report, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," U.S. Nuclear Regulatory Commission Report, NUREG-2115; EPRI Report 1021097, DOE Report# DOE/NE-0140, 2012.

7.8 EPRI Report No. 3002000717, "EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project," June 13, 2013.

7.9 NRC Regulatory Guide 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," March 2007.

7.10 Bechtel Power Corporation Study No. 25784-000-30R-K01G-00001, Revision 1, "Subsurface Material Properties, Base Case Velocity Profiles, Amplification Functions and Resulting Surface Hazard Curves, GMRS and Comparison to SSE," February 24, 2014.

7.11 North Anna Early Site Permit Application, Revision 9, 2006; North Anna Combined License Application, Revision 7, December 2013 Updated by Submission 14/15.

7.12 EPRI TR-102293, "Guidelines for Determining Design Basis Ground Motions," Vol. 1-5, 1993.

7.13 Sun, J.I., Golesorkhi, R., and Seed, H.B. "Dynamic Moduli and Damping Ratios for Cohesive Soils," Earthquake Engineering Research Center, University of California – Berkeley, California, Report No. EERC-88/15, 1988.

7.14 Toro, G.R. "Probabilistic Models of Site Velocity Profiles for Generic and Site-Specific Ground Motion Amplification Studies," 1996. Published as an appendix in Silva, W.J., N. Abrahamson, G. Toro and C. Costantino. "Description and validation of the stochastic ground motion model," Report Submitted to Brookhaven National Laboratory, Associated Universities, Inc. Upton, New York 11973, Contract No. 770573, 1996.

7.15 McGuire, R.K., W. J. Silva, and C.J. Costantino. "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions, Hazard and Risk Consistent Ground Motion Spectra Guidelines," U.S. Nuclear Regulatory Commission, NUREG/CR-6728, November 2001.

7.16 Anthony R. Pietrangelo, NEI letter to Eric J. Leeds, NRC, "Seismic Risk Evaluations for Plants in the Central and Eastern United States," dated March 12, 2014.

7.17 NRC Information Notice 2010-18, 'Generic Issue (GI) 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants,"' and NRC Memorandum from Patrick Hiland to Brian Sheron, "Safety/Risk Assessment Results for GI-199," September 2, 2010.

7.18 Virginia Electric and Power Company Letter to U. S. NRC Document Control Desk, "North Anna Power Station, Units 1 and 2, Summary Report for Individual Plant Examination of External Events (IPEEE) - Seismic", Serial No. 97-303 dated May 27, 1997.

7.19 Virginia Electric and Power Company Letter to U. S. NRC Document Control Desk, "North Anna Power Station Units 1 and 2, Report in Response to March 12, 2012 Information Request Regarding Seismic Aspects of Recommendation 2.3," Serial No. 14-017 dated January 30, 2014.

7.20 Eric J. Leeds, NRC letter to David A. Heacock, Virginia Electric and Power Company, "Confirmatory Action Letter Regarding North Anna Power Station Unit Nos. 1 and 2, Long-Term Commitments to Address Exceeding Design Bases Seismic Event (TAC Nos. ME7254 and ME7255)," CAL No. NRR-2011-002 dated November 11, 2011.

7.21 Virginia Electric and Power Company Letter to U. S. NRC Document Control Desk, "North Anna Power Station Units 1 and 2, Confirmatory Action Letter, Notification of Commitment Action Completion," Serial No. 13-143 dated May 13, 2013.

7.22 Anthony R. Pietrangelo, NEI letter to David L. Skeen, NRC, "Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations," dated April 9, 2013.

7.23 Eric J. Leeds, NRC letter to Joseph E. Pollock, NEI, "Electric Power Research Institute Final Draft Report XXXXXX, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations," dated May 7, 2013.

7.24 Eric J. Leeds, NRC letter, "Supplemental Information Related to Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(F) Regarding Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated February 20, 2014.

7.25 EPRI Report NP-6041-SL, "A Methodology for Assessment of Nuclear Plant Seismic Margin(Revision 1)," August 1991.

7.26 NRC Regulatory Guide 1.167, "Restart of a Nuclear Plant Shutdown by a Seismic Event," March 1997.

7.27 Lettis Consultants International Report, "Baseline Hard Rock PSHA Calculation and Deaggregation using the CEUS SSC for North Anna" , LCI Project 1041, November 14, 2013.

Appendix A

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Appendix A

Table A-1a: PGA Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP
0.0504	1.068E-03	0.0217	1.074E-03	0.0264	1.071E-03	0.0408	1.068E-03	0.0756	1.070E-03	0.1162	1.073E-03
0.0530	1.068E-03	0.0228	1.072E-03	0.0277	1.070E-03	0.0428	1.068E-03	0.0793	1.070E-03	0.1216	1.073E-03
0.0558	1.067E-03	0.0239	1.069E-03	0.0292	1.068E-03	0.0450	1.067E-03	0.0831	1.069E-03	0.1273	1.073E-03
0.0586	1.065E-03	0.0252	1.063E-03	0.0307	1.062E-03	0.0473	1.063E-03	0.0871	1.068E-03	0.1333	1.072E-03
0.0617	1.059E-03	0.0265	1.049E-03	0.0322	1.051E-03	0.0497	1.057E-03	0.0913	1.064E-03	0.1395	1.069E-03
0.0648	1.047E-03	0.0278	1.026E-03	0.0339	1.032E-03	0.0523	1.043E-03	0.0957	1.056E-03	0.1460	1.062E-03
0.0682	1.026E-03	0.0292	9.929E-04	0.0357	1.002E-03	0.0549	1.021E-03	0.1003	1.040E-03	0.1528	1.048E-03
0.0717	9.955E-04	0.0307	9.494E-04	0.0375	9.620E-04	0.0577	9.885E-04	0.1051	1.015E-03	0.1600	1.025E-03
0.0754	9.545E-04	0.0323	8.989E-04	0.0394	9.145E-04	0.0607	9.473E-04	0.1102	9.798E-04	0.1675	9.909E-04
0.0793	9.061E-04	0.0340	8.447E-04	0.0415	8.625E-04	0.0638	8.995E-04	0.1155	9.353E-04	0.1753	9.463E-04
0.0834	8.534E-04	0.0357	7.898E-04	0.0436	8.093E-04	0.0670	8.484E-04	0.1210	8.845E-04	0.1835	8.939E-04
0.0877	7.998E-04	0.0375	7.365E-04	0.0458	7.571E-04	0.0705	7.966E-04	0.1269	8.305E-04	0.1921	8.373E-04
0.0922	7.474E-04	0.0395	6.859E-04	0.0482	7.072E-04	0.0741	7.459E-04	0.1330	7.762E-04	0.2011	7.798E-04
0.0969	6.975E-04	0.0415	6.384E-04	0.0507	6.602E-04	0.0778	6.974E-04	0.1394	7.237E-04	0.2105	7.240E-04
0.1019	6.505E-04	0.0436	5.940E-04	0.0533	6.161E-04	0.0818	6.514E-04	0.1461	6.739E-04	0.2203	6.713E-04
0.1072	6.066E-04	0.0459	5.527E-04	0.0560	5.750E-04	0.0860	6.081E-04	0.1531	6.270E-04	0.2306	6.219E-04
0.1127	5.656E-04	0.0482	5.143E-04	0.0589	5.366E-04	0.0904	5.674E-04	0.1605	5.832E-04	0.2414	5.760E-04
0.1186	5.274E-04	0.0507	4.785E-04	0.0620	5.007E-04	0.0950	5.293E-04	0.1682	5.423E-04	0.2527	5.335E-04
0.1247	4.917E-04	0.0533	4.452E-04	0.0652	4.672E-04	0.0998	4.937E-04	0.1763	5.042E-04	0.2645	4.941E-04
0.1311	4.584E-04	0.0560	4.143E-04	0.0685	4.358E-04	0.1049	4.604E-04	0.1848	4.688E-04	0.2768	4.575E-04
0.1379	4.273E-04	0.0589	3.854E-04	0.0720	4.064E-04	0.1103	4.294E-04	0.1937	4.358E-04	0.2898	4.237E-04
0.1450	3.982E-04	0.0619	3.586E-04	0.0758	3.788E-04	0.1159	4.005E-04	0.2031	4.052E-04	0.3033	3.923E-04
0.1524	3.710E-04	0.0651	3.336E-04	0.0797	3.528E-04	0.1218	3.735E-04	0.2128	3.767E-04	0.3175	3.633E-04
0.1603	3.456E-04	0.0684	3.103E-04	0.0838	3.285E-04	0.1280	3.483E-04	0.2231	3.502E-04	0.3324	3.364E-04
0.1686	3.219E-04	0.0719	2.885E-04	0.0881	3.056E-04	0.1345	3.248E-04	0.2338	3.256E-04	0.3479	3.114E-04
0.1773	2.997E-04	0.0756	2.681E-04	0.0926	2.843E-04	0.1414	3.028E-04	0.2451	3.027E-04	0.3642	2.884E-04
0.1864	2.791E-04	0.0795	2.489E-04	0.0974	2.645E-04	0.1486	2.822E-04	0.2569	2.814E-04	0.3812	2.670E-04
0.1960	2.599E-04	0.0836	2.311E-04	0.1024	2.459E-04	0.1562	2.630E-04	0.2693	2.616E-04	0.3990	2.472E-04
0.2061	2.420E-04	0.0879	2.143E-04	0.1077	2.287E-04	0.1642	2.450E-04	0.2822	2.432E-04	0.4177	2.289E-04
0.2168	2.253E-04	0.0924	1.988E-04	0.1132	2.127E-04	0.1725	2.282E-04	0.2958	2.260E-04	0.4372	2.119E-04
0.2280	2.098E-04	0.0971	1.843E-04	0.1191	1.977E-04	0.1813	2.126E-04	0.3101	2.101E-04	0.4576	1.962E-04
0.2397	1.953E-04	0.1021	1.709E-04	0.1252	1.839E-04	0.1906	1.980E-04	0.3250	1.952E-04	0.4790	1.816E-04
0.2521	1.819E-04	0.1073	1.584E-04	0.1317	1.709E-04	0.2003	1.844E-04	0.3407	1.815E-04	0.5014	1.681E-04
0.2651	1.693E-04	0.1128	1.468E-04	0.1384	1.589E-04	0.2105	1.717E-04	0.3571	1.686E-04	0.5249	1.556E-04
0.2788	1.577E-04	0.1186	1.361E-04	0.1456	1.477E-04	0.2213	1.600E-04	0.3743	1.567E-04	0.5494	1.441E-04
0.2931	1.467E-04	0.1247	1.261E-04	0.1531	1.372E-04	0.2326	1.490E-04	0.3923	1.456E-04	0.5751	1.333E-04
0.3082	1.366E-04	0.1311	1.167E-04	0.1610	1.274E-04	0.2444	1.387E-04	0.4112	1.353E-04	0.6020	1.232E-04
0.3241	1.270E-04	0.1378	1.079E-04	0.1692	1.181E-04	0.2569	1.291E-04	0.4310	1.256E-04	0.6302	1.137E-04

Appendix A

Table A-1a: PGA Seismic Hazard Curves at North Anna

Mean		5^{th} Fractile		16^{th} Fractile		50^{th} Fractile		84^{th} Fractile		95^{th} Fractile	
PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP
0.3409	1.180E-04	0.1449	9.954E-05	0.1780	1.094E-04	0.2700	1.200E-04	0.4518	1.164E-04	0.6596	1.046E-04
0.3584	1.093E-04	0.1523	9.161E-05	0.1871	1.011E-04	0.2838	1.114E-04	0.4735	1.076E-04	0.6905	9.587E-05
0.3769	1.008E-04	0.1601	8.413E-05	0.1968	9.310E-05	0.2983	1.030E-04	0.4963	9.905E-05	0.7227	8.753E-05
0.3964	9.252E-05	0.1684	7.713E-05	0.2069	8.553E-05	0.3135	9.483E-05	0.5202	9.076E-05	0.7565	7.962E-05
0.4168	8.446E-05	0.1770	7.063E-05	0.2176	7.840E-05	0.3295	8.693E-05	0.5453	8.280E-05	0.7919	7.223E-05
0.4383	7.678E-05	0.1861	6.464E-05	0.2288	7.176E-05	0.3463	7.938E-05	0.5715	7.526E-05	0.8289	6.541E-05
0.4609	6.959E-05	0.1956	5.914E-05	0.2406	6.563E-05	0.3639	7.228E-05	0.5991	6.825E-05	0.8677	5.918E-05
0.4847	6.298E-05	0.2056	5.410E-05	0.2530	5.999E-05	0.3825	6.572E-05	0.6279	6.180E-05	0.9083	5.353E-05
0.5097	5.696E-05	0.2162	4.949E-05	0.2660	5.483E-05	0.4020	5.971E-05	0.6581	5.594E-05	0.9507	4.840E-05
0.5360	5.150E-05	0.2273	4.527E-05	0.2797	5.011E-05	0.4225	5.423E-05	0.6898	5.061E-05	0.9952	4.376E-05
0.5636	4.656E-05	0.2389	4.142E-05	0.2941	4.579E-05	0.4441	4.924E-05	0.7231	4.579E-05	1.0417	3.958E-05
0.5927	4.210E-05	0.2512	3.789E-05	0.3093	4.183E-05	0.4667	4.471E-05	0.7579	4.143E-05	1.0904	3.579E-05
0.6233	3.806E-05	0.2641	3.466E-05	0.3252	3.822E-05	0.4905	4.060E-05	0.7944	3.748E-05	1.1414	3.236E-05
0.6554	3.440E-05	0.2776	3.170E-05	0.3420	3.492E-05	0.5156	3.687E-05	0.8327	3.391E-05	1.1948	2.926E-05
0.6892	3.110E-05	0.2919	2.899E-05	0.3596	3.191E-05	0.5419	3.347E-05	0.8728	3.068E-05	1.2506	2.646E-05
0.7248	2.812E-05	0.3068	2.652E-05	0.3781	2.915E-05	0.5695	3.039E-05	0.9148	2.776E-05	1.3091	2.393E-05
0.7622	2.542E-05	0.3226	2.425E-05	0.3976	2.664E-05	0.5986	2.760E-05	0.9588	2.512E-05	1.3703	2.164E-05
0.8015	2.298E-05	0.3391	2.217E-05	0.4181	2.434E-05	0.6291	2.506E-05	1.0050	2.273E-05	1.4344	1.957E-05
0.8428	2.078E-05	0.3565	2.027E-05	0.4396	2.223E-05	0.6612	2.275E-05	1.0534	2.056E-05	1.5014	1.770E-05
0.8863	1.879E-05	0.3748	1.854E-05	0.4623	2.031E-05	0.6949	2.066E-05	1.1042	1.861E-05	1.5716	1.600E-05
0.9320	1.698E-05	0.3940	1.696E-05	0.4861	1.856E-05	0.7304	1.876E-05	1.1573	1.683E-05	1.6451	1.446E-05
0.9801	1.535E-05	0.4142	1.550E-05	0.5112	1.695E-05	0.7676	1.703E-05	1.2131	1.523E-05	1.7220	1.306E-05
1.0306	1.387E-05	0.4355	1.417E-05	0.5375	1.548E-05	0.8068	1.546E-05	1.2715	1.376E-05	1.8026	1.177E-05
1.0838	1.250E-05	0.4578	1.294E-05	0.5652	1.414E-05	0.8480	1.403E-05	1.3327	1.242E-05	1.8868	1.058E-05
1.1397	1.124E-05	0.4813	1.179E-05	0.5943	1.289E-05	0.8912	1.271E-05	1.3969	1.117E-05	1.9751	9.473E-06
1.1985	1.005E-05	0.5059	1.070E-05	0.6249	1.173E-05	0.9367	1.148E-05	1.4642	1.001E-05	2.0674	8.450E-06
1.2603	8.941E-06	0.5319	9.659E-06	0.6571	1.062E-05	0.9845	1.032E-05	1.5347	8.916E-06	2.1641	7.511E-06
1.3253	7.904E-06	0.5592	8.664E-06	0.6910	9.555E-06	1.0347	9.219E-06	1.6086	7.902E-06	2.2652	6.658E-06
1.3937	6.953E-06	0.5879	7.726E-06	0.7266	8.533E-06	1.0875	8.183E-06	1.6861	6.972E-06	2.3712	5.891E-06
1.4655	6.097E-06	0.6180	6.858E-06	0.7640	7.570E-06	1.1430	7.222E-06	1.7673	6.134E-06	2.4820	5.208E-06
1.5411	5.337E-06	0.6497	6.072E-06	0.8034	6.682E-06	1.2013	6.349E-06	1.8524	5.386E-06	2.5981	4.602E-06
1.6206	4.668E-06	0.6830	5.369E-06	0.8448	5.881E-06	1.2625	5.568E-06	1.9416	4.726E-06	2.7195	4.065E-06
1.7042	4.082E-06	0.7181	4.745E-06	0.8883	5.168E-06	1.3269	4.878E-06	2.0352	4.147E-06	2.8467	3.591E-06
1.7921	3.569E-06	0.7549	4.193E-06	0.9341	4.540E-06	1.3946	4.272E-06	2.1332	3.639E-06	2.9798	3.172E-06
1.8845	3.121E-06	0.7936	3.705E-06	0.9822	3.987E-06	1.4658	3.741E-06	2.2359	3.193E-06	3.1191	2.802E-06
1.9817	2.729E-06	0.8343	3.274E-06	1.0329	3.502E-06	1.5406	3.275E-06	2.3436	2.802E-06	3.2650	2.475E-06
2.0840	2.387E-06	0.8771	2.893E-06	1.0861	3.075E-06	1.6192	2.868E-06	2.4565	2.459E-06	3.4176	2.185E-06
2.1914	2.088E-06	0.9221	2.556E-06	1.1420	2.700E-06	1.7018	2.511E-06	2.5748	2.158E-06	3.5774	1.930E-06
2.3045	1.826E-06	0.9694	2.258E-06	1.2009	2.371E-06	1.7886	2.199E-06	2.6988	1.893E-06	3.7447	1.703E-06
2.4233	1.597E-06	1.0191	1.995E-06	1.2628	2.082E-06	1.8798	1.925E-06	2.8287	1.661E-06	3.9198	1.502E-06
2.5483	1.395E-06	1.0713	1.762E-06	1.3278	1.828E-06	1.9757	1.685E-06	2.9650	1.455E-06	4.1030	1.323E-06

Appendix A

Table A-1a: PGA Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP	PGA (g)	AEP
2.6798	1.216E-06	1.1263	1.555E-06	1.3962	1.603E-06	2.0765	1.474E-06	3.1078	1.272E-06	4.2949	1.161E-06
2.8180	1.055E-06	1.1840	1.369E-06	1.4682	1.405E-06	2.1824	1.286E-06	3.2575	1.109E-06	4.4957	1.014E-06
2.9633	9.115E-07	1.2448	1.202E-06	1.5438	1.226E-06	2.2938	1.119E-06	3.4143	9.628E-07	4.7059	8.818E-07
3.1162	7.830E-07	1.3086	1.048E-06	1.6234	1.065E-06	2.4108	9.673E-07	3.5788	8.314E-07	4.9259	7.620E-07
3.2769	6.691E-07	1.3757	9.053E-07	1.7070	9.167E-07	2.5338	8.312E-07	3.7511	7.144E-07	5.1562	6.550E-07
3.4459	5.697E-07	1.4463	7.745E-07	1.7950	7.821E-07	2.6631	7.095E-07	3.9318	6.112E-07	5.3973	5.608E-07
3.6237	4.839E-07	1.5205	6.565E-07	1.8875	6.615E-07	2.7989	6.025E-07	4.1212	5.214E-07	5.6497	4.788E-07
3.8106	4.104E-07	1.5984	5.525E-07	1.9847	5.559E-07	2.9417	5.096E-07	4.3196	4.439E-07	5.9138	4.081E-07
4.0071	3.477E-07	1.6804	4.631E-07	2.0870	4.653E-07	3.0918	4.301E-07	4.5277	3.774E-07	6.1903	3.475E-07
4.2138	2.944E-07	1.7666	3.871E-07	2.1945	3.887E-07	3.2495	3.625E-07	4.7457	3.206E-07	6.4798	2.956E-07
4.4311	2.489E-07	1.8572	3.231E-07	2.3076	3.242E-07	3.4153	3.052E-07	4.9743	2.721E-07	6.7827	2.513E-07
4.6597	2.103E-07	1.9524	2.695E-07	2.4265	2.702E-07	3.5895	2.567E-07	5.2139	2.307E-07	7.0999	2.133E-07
4.9000	1.773E-07	2.0526	2.245E-07	2.5515	2.249E-07	3.7726	2.156E-07	5.4650	1.953E-07	7.4318	1.808E-07
5.1528	1.492E-07	2.1579	1.867E-07	2.6830	1.869E-07	3.9651	1.807E-07	5.7282	1.651E-07	7.7793	1.529E-07
5.4185	1.250E-07	2.2685	1.549E-07	2.8212	1.548E-07	4.1674	1.511E-07	6.0040	1.390E-07	8.1430	1.289E-07
5.6980	1.041E-07	2.3849	1.280E-07	2.9666	1.278E-07	4.3800	1.258E-07	6.2932	1.165E-07	8.5238	1.081E-07
5.9919	8.596E-08	2.5072	1.051E-07	3.1194	1.047E-07	4.6034	1.039E-07	6.5963	9.686E-08	8.9223	8.995E-08
6.3010	7.022E-08	2.6358	8.539E-08	3.2802	8.500E-08	4.8382	8.494E-08	6.9140	7.978E-08	9.3395	7.424E-08
6.6260	5.668E-08	2.7709	6.860E-08	3.4492	6.820E-08	5.0851	6.852E-08	7.2470	6.494E-08	9.7761	6.066E-08
6.9677	4.518E-08	2.9131	5.435E-08	3.6269	5.398E-08	5.3445	5.445E-08	7.5960	5.219E-08	10.2332	4.903E-08
7.3271	3.554E-08	3.0625	4.243E-08	3.8138	4.210E-08	5.6171	4.260E-08	7.9618	4.137E-08	10.7117	3.916E-08

Appendix A

Table A-1b: 0.5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0100	1.095E-03	0.0030	1.069E-03	0.0045	1.076E-03	0.0080	1.084E-03	0.0136	1.090E-03	0.0187	1.099E-03
0.0105	1.002E-03	0.0032	9.939E-04	0.0047	9.970E-04	0.0084	1.005E-03	0.0143	1.008E-03	0.0196	1.008E-03
0.0111	9.040E-04	0.0033	9.190E-04	0.0050	9.153E-04	0.0087	9.161E-04	0.0149	9.152E-04	0.0206	9.066E-04
0.0117	8.146E-04	0.0035	8.497E-04	0.0052	8.401E-04	0.0091	8.344E-04	0.0156	8.297E-04	0.0217	8.142E-04
0.0123	7.340E-04	0.0036	7.857E-04	0.0054	7.711E-04	0.0095	7.600E-04	0.0164	7.522E-04	0.0228	7.312E-04
0.0129	6.613E-04	0.0038	7.265E-04	0.0057	7.078E-04	0.0100	6.921E-04	0.0171	6.819E-04	0.0239	6.566E-04
0.0136	5.959E-04	0.0039	6.717E-04	0.0059	6.497E-04	0.0104	6.302E-04	0.0179	6.183E-04	0.0251	5.896E-04
0.0143	5.369E-04	0.0041	6.212E-04	0.0062	5.963E-04	0.0109	5.739E-04	0.0188	5.606E-04	0.0264	5.294E-04
0.0151	4.837E-04	0.0043	5.744E-04	0.0065	5.474E-04	0.0114	5.226E-04	0.0197	5.082E-04	0.0278	4.754E-04
0.0158	4.359E-04	0.0045	5.312E-04	0.0067	5.023E-04	0.0119	4.759E-04	0.0206	4.608E-04	0.0292	4.269E-04
0.0167	3.928E-04	0.0047	4.913E-04	0.0071	4.609E-04	0.0125	4.334E-04	0.0216	4.178E-04	0.0306	3.834E-04
0.0176	3.539E-04	0.0049	4.544E-04	0.0074	4.230E-04	0.0130	3.946E-04	0.0226	3.787E-04	0.0322	3.443E-04
0.0185	3.188E-04	0.0051	4.202E-04	0.0077	3.883E-04	0.0136	3.593E-04	0.0237	3.433E-04	0.0338	3.092E-04
0.0194	2.873E-04	0.0054	3.887E-04	0.0080	3.564E-04	0.0142	3.272E-04	0.0248	3.112E-04	0.0355	2.776E-04
0.0205	2.589E-04	0.0056	3.595E-04	0.0084	3.271E-04	0.0149	2.980E-04	0.0260	2.822E-04	0.0374	2.493E-04
0.0215	2.333E-04	0.0058	3.325E-04	0.0088	3.001E-04	0.0156	2.713E-04	0.0272	2.558E-04	0.0392	2.239E-04
0.0227	2.102E-04	0.0061	3.076E-04	0.0092	2.755E-04	0.0163	2.471E-04	0.0285	2.319E-04	0.0412	2.010E-04
0.0239	1.893E-04	0.0064	2.845E-04	0.0096	2.528E-04	0.0170	2.251E-04	0.0298	2.102E-04	0.0433	1.805E-04
0.0251	1.706E-04	0.0067	2.631E-04	0.0100	2.319E-04	0.0178	2.049E-04	0.0312	1.906E-04	0.0455	1.621E-04
0.0264	1.537E-04	0.0070	2.433E-04	0.0105	2.128E-04	0.0186	1.866E-04	0.0327	1.728E-04	0.0478	1.456E-04
0.0278	1.385E-04	0.0073	2.250E-04	0.0109	1.953E-04	0.0194	1.700E-04	0.0342	1.566E-04	0.0503	1.307E-04
0.0293	1.248E-04	0.0076	2.081E-04	0.0114	1.792E-04	0.0203	1.548E-04	0.0359	1.420E-04	0.0528	1.174E-04
0.0308	1.124E-04	0.0079	1.924E-04	0.0120	1.644E-04	0.0212	1.410E-04	0.0375	1.287E-04	0.0555	1.054E-04
0.0325	1.012E-04	0.0083	1.780E-04	0.0125	1.508E-04	0.0222	1.284E-04	0.0393	1.167E-04	0.0583	9.523E-05
0.0342	9.013E-05	0.0086	1.646E-04	0.0131	1.384E-04	0.0232	1.169E-04	0.0412	1.058E-04	0.0612	8.645E-05
0.0359	8.007E-05	0.0090	1.522E-04	0.0136	1.270E-04	0.0242	1.065E-04	0.0431	9.538E-05	0.0644	7.854E-05
0.0378	7.112E-05	0.0094	1.408E-04	0.0143	1.165E-04	0.0253	9.611E-05	0.0452	8.566E-05	0.0676	7.135E-05
0.0398	6.318E-05	0.0099	1.302E-04	0.0149	1.069E-04	0.0265	8.595E-05	0.0473	7.687E-05	0.0710	6.481E-05
0.0419	5.612E-05	0.0103	1.204E-04	0.0156	9.739E-05	0.0277	7.670E-05	0.0495	6.899E-05	0.0746	5.888E-05
0.0441	4.985E-05	0.0108	1.113E-04	0.0163	8.767E-05	0.0289	6.845E-05	0.0519	6.191E-05	0.0784	5.349E-05
0.0464	4.428E-05	0.0112	1.028E-04	0.0170	7.874E-05	0.0302	6.108E-05	0.0543	5.555E-05	0.0824	4.859E-05
0.0489	3.933E-05	0.0117	9.335E-05	0.0178	7.071E-05	0.0316	5.451E-05	0.0569	4.985E-05	0.0866	4.414E-05
0.0514	3.494E-05	0.0123	8.400E-05	0.0186	6.351E-05	0.0330	4.864E-05	0.0595	4.473E-05	0.0910	4.010E-05
0.0542	3.103E-05	0.0128	7.551E-05	0.0194	5.704E-05	0.0345	4.340E-05	0.0624	4.014E-05	0.0956	3.642E-05
0.0570	2.756E-05	0.0134	6.787E-05	0.0203	5.124E-05	0.0361	3.873E-05	0.0653	3.602E-05	0.1004	3.309E-05
0.0600	2.448E-05	0.0140	6.101E-05	0.0212	4.602E-05	0.0377	3.456E-05	0.0684	3.232E-05	0.1055	3.006E-05
0.0631	2.175E-05	0.0146	5.483E-05	0.0221	4.133E-05	0.0395	3.084E-05	0.0716	2.900E-05	0.1109	2.731E-05
0.0665	1.931E-05	0.0152	4.929E-05	0.0231	3.711E-05	0.0412	2.752E-05	0.0750	2.603E-05	0.1165	2.480E-05
0.0700	1.715E-05	0.0159	4.431E-05	0.0242	3.333E-05	0.0431	2.456E-05	0.0785	2.335E-05	0.1224	2.253E-05
0.0736	1.524E-05	0.0166	3.983E-05	0.0253	2.993E-05	0.0451	2.191E-05	0.0822	2.095E-05	0.1286	2.047E-05
0.0775	1.353E-05	0.0174	3.581E-05	0.0264	2.687E-05	0.0471	1.955E-05	0.0861	1.880E-05	0.1351	1.859E-05

Appendix A

Table A-1b: 0.5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0816	1.202E-05	0.0182	3.219E-05	0.0276	2.413E-05	0.0493	1.744E-05	0.0902	1.687E-05	0.1420	1.689E-05
0.0859	1.067E-05	0.0190	2.894E-05	0.0288	2.167E-05	0.0515	1.556E-05	0.0944	1.514E-05	0.1492	1.534E-05
0.0904	9.526E-06	0.0198	2.602E-05	0.0301	1.946E-05	0.0538	1.389E-05	0.0989	1.358E-05	0.1567	1.393E-05
0.0951	8.539E-06	0.0207	2.339E-05	0.0315	1.748E-05	0.0563	1.239E-05	0.1036	1.219E-05	0.1647	1.265E-05
0.1001	7.659E-06	0.0216	2.103E-05	0.0329	1.569E-05	0.0588	1.105E-05	0.1085	1.093E-05	0.1730	1.149E-05
0.1054	6.870E-06	0.0226	1.890E-05	0.0344	1.409E-05	0.0615	9.862E-06	0.1136	9.804E-06	0.1818	1.044E-05
0.1109	6.162E-06	0.0236	1.699E-05	0.0359	1.265E-05	0.0643	8.804E-06	0.1189	8.786E-06	0.1910	9.434E-06
0.1167	5.527E-06	0.0246	1.527E-05	0.0375	1.136E-05	0.0672	7.859E-06	0.1246	7.872E-06	0.2007	8.507E-06
0.1229	4.957E-06	0.0257	1.373E-05	0.0392	1.020E-05	0.0702	7.016E-06	0.1304	7.053E-06	0.2109	7.668E-06
0.1293	4.446E-06	0.0269	1.234E-05	0.0410	9.068E-06	0.0734	6.263E-06	0.1366	6.319E-06	0.2215	6.911E-06
0.1361	3.987E-06	0.0281	1.109E-05	0.0428	8.041E-06	0.0767	5.591E-06	0.1430	5.662E-06	0.2328	6.229E-06
0.1433	3.576E-06	0.0293	9.935E-06	0.0447	7.129E-06	0.0802	4.991E-06	0.1498	5.072E-06	0.2446	5.615E-06
0.1508	3.206E-06	0.0306	8.819E-06	0.0467	6.321E-06	0.0838	4.455E-06	0.1569	4.543E-06	0.2570	5.061E-06
0.1587	2.875E-06	0.0320	7.807E-06	0.0489	5.604E-06	0.0876	3.976E-06	0.1643	4.069E-06	0.2700	4.561E-06
0.1671	2.578E-06	0.0334	6.911E-06	0.0510	4.968E-06	0.0916	3.549E-06	0.1720	3.645E-06	0.2837	4.111E-06
0.1758	2.311E-06	0.0349	6.117E-06	0.0533	4.405E-06	0.0958	3.167E-06	0.1801	3.265E-06	0.2981	3.705E-06
0.1851	2.072E-06	0.0365	5.415E-06	0.0557	3.904E-06	0.1001	2.827E-06	0.1886	2.924E-06	0.3132	3.339E-06
0.1948	1.857E-06	0.0381	4.793E-06	0.0582	3.461E-06	0.1047	2.523E-06	0.1975	2.618E-06	0.3291	3.009E-06
0.2050	1.665E-06	0.0398	4.242E-06	0.0609	3.068E-06	0.1094	2.251E-06	0.2069	2.345E-06	0.3457	2.712E-06
0.2158	1.493E-06	0.0416	3.754E-06	0.0636	2.720E-06	0.1144	2.009E-06	0.2166	2.100E-06	0.3633	2.443E-06
0.2272	1.337E-06	0.0434	3.322E-06	0.0665	2.410E-06	0.1195	1.792E-06	0.2269	1.880E-06	0.3817	2.202E-06
0.2391	1.199E-06	0.0453	2.940E-06	0.0695	2.136E-06	0.1250	1.599E-06	0.2376	1.684E-06	0.4010	1.984E-06
0.2517	1.074E-06	0.0474	2.601E-06	0.0726	1.893E-06	0.1306	1.426E-06	0.2488	1.507E-06	0.4214	1.787E-06
0.2649	9.594E-07	0.0495	2.302E-06	0.0758	1.677E-06	0.1366	1.272E-06	0.2605	1.350E-06	0.4427	1.611E-06
0.2788	8.534E-07	0.0517	2.036E-06	0.0793	1.486E-06	0.1427	1.135E-06	0.2728	1.208E-06	0.4652	1.451E-06
0.2935	7.582E-07	0.0540	1.802E-06	0.0828	1.317E-06	0.1492	1.011E-06	0.2857	1.081E-06	0.4888	1.307E-06
0.3089	6.736E-07	0.0564	1.594E-06	0.0865	1.167E-06	0.1560	8.951E-07	0.2992	9.625E-07	0.5135	1.177E-06
0.3251	5.983E-07	0.0589	1.410E-06	0.0904	1.033E-06	0.1631	7.899E-07	0.3133	8.500E-07	0.5396	1.060E-06
0.3422	5.313E-07	0.0615	1.247E-06	0.0945	9.048E-07	0.1704	6.970E-07	0.3281	7.488E-07	0.5669	9.427E-07
0.3602	4.717E-07	0.0643	1.102E-06	0.0988	7.884E-07	0.1782	6.148E-07	0.3436	6.596E-07	0.5957	8.271E-07
0.3791	4.185E-07	0.0671	9.677E-07	0.1032	6.865E-07	0.1863	5.422E-07	0.3598	5.808E-07	0.6259	7.234E-07
0.3990	3.713E-07	0.0701	8.391E-07	0.1078	5.977E-07	0.1947	4.781E-07	0.3768	5.112E-07	0.6576	6.325E-07
0.4200	3.293E-07	0.0733	7.243E-07	0.1127	5.201E-07	0.2035	4.213E-07	0.3946	4.499E-07	0.6909	5.530E-07
0.4420	2.919E-07	0.0765	6.249E-07	0.1178	4.525E-07	0.2128	3.712E-07	0.4132	3.958E-07	0.7260	4.832E-07
0.4653	2.587E-07	0.0799	5.390E-07	0.1230	3.935E-07	0.2224	3.269E-07	0.4327	3.480E-07	0.7628	4.221E-07
0.4897	2.291E-07	0.0835	4.648E-07	0.1286	3.420E-07	0.2325	2.878E-07	0.4532	3.059E-07	0.8014	3.686E-07
0.5154	2.027E-07	0.0872	4.006E-07	0.1344	2.971E-07	0.2430	2.532E-07	0.4745	2.687E-07	0.8421	3.217E-07
0.5425	1.793E-07	0.0911	3.450E-07	0.1404	2.579E-07	0.2540	2.226E-07	0.4969	2.359E-07	0.8847	2.806E-07
0.5710	1.584E-07	0.0952	2.970E-07	0.1467	2.237E-07	0.2656	1.956E-07	0.5204	2.070E-07	0.9296	2.446E-07
0.6010	1.399E-07	0.0994	2.555E-07	0.1533	1.938E-07	0.2776	1.717E-07	0.5450	1.815E-07	0.9767	2.130E-07
0.6326	1.234E-07	0.1038	2.195E-07	0.1602	1.678E-07	0.2902	1.506E-07	0.5707	1.590E-07	1.0262	1.854E-07

Appendix A

Table A-1b: 0.5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.6659	1.087E-07	0.1085	1.885E-07	0.1674	1.451E-07	0.3033	1.319E-07	0.5976	1.391E-07	1.0783	1.612E-07
0.7008	9.557E-08	0.1133	1.616E-07	0.1750	1.252E-07	0.3171	1.154E-07	0.6258	1.215E-07	1.1329	1.400E-07
0.7377	8.281E-08	0.1184	1.384E-07	0.1828	1.080E-07	0.3315	1.008E-07	0.6554	1.060E-07	1.1904	1.214E-07
0.7764	7.095E-08	0.1236	1.183E-07	0.1910	9.275E-08	0.3465	8.716E-08	0.6863	9.221E-08	1.2507	1.052E-07
0.8172	6.052E-08	0.1291	1.009E-07	0.1996	7.862E-08	0.3622	7.408E-08	0.7187	7.835E-08	1.3141	9.052E-08
0.8602	5.143E-08	0.1349	8.497E-08	0.2086	6.608E-08	0.3786	6.244E-08	0.7527	6.583E-08	1.3807	7.590E-08
0.9054	4.351E-08	0.1409	7.045E-08	0.2180	5.531E-08	0.3958	5.241E-08	0.7882	5.508E-08	1.4507	6.298E-08
0.9529	3.662E-08	0.1472	5.793E-08	0.2278	4.606E-08	0.4137	4.376E-08	0.8254	4.585E-08	1.5243	5.200E-08
1.0030	3.061E-08	0.1538	4.734E-08	0.2380	3.812E-08	0.4325	3.632E-08	0.8644	3.793E-08	1.6015	4.267E-08
1.0557	2.538E-08	0.1606	3.840E-08	0.2487	3.131E-08	0.4521	2.991E-08	0.9052	3.114E-08	1.6827	3.474E-08
1.1112	2.082E-08	0.1678	3.085E-08	0.2599	2.547E-08	0.4726	2.438E-08	0.9479	2.530E-08	1.7680	2.801E-08
1.1696	1.685E-08	0.1752	2.449E-08	0.2716	2.045E-08	0.4940	1.962E-08	0.9926	2.030E-08	1.8577	2.229E-08
1.2310	1.339E-08	0.1831	1.911E-08	0.2838	1.613E-08	0.5164	1.552E-08	1.0395	1.600E-08	1.9519	1.744E-08
1.2957	1.037E-08	0.1912	1.457E-08	0.2966	1.243E-08	0.5398	1.199E-08	1.0886	1.231E-08	2.0508	1.331E-08
1.3638	7.747E-09	0.1997	1.074E-08	0.3099	9.257E-09	0.5643	8.940E-09	1.1399	9.150E-09	2.1548	9.799E-09
1.4354	5.460E-09	0.2086	7.505E-09	0.3239	6.531E-09	0.5899	6.318E-09	1.1937	6.435E-09	2.2640	6.819E-09
1.5109	3.468E-09	0.2179	4.776E-09	0.3385	4.191E-09	0.6166	4.058E-09	1.2501	4.104E-09	2.3788	4.289E-09
1.5903	1.732E-09	0.2276	2.473E-09	0.3537	2.182E-09	0.6446	2.111E-09	1.3091	2.105E-09	2.4994	2.139E-09

Appendix A

Table A-1c: 1 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0164	1.090E-03	0.0074	1.074E-03	0.0098	1.078E-03	0.0146	1.085E-03	0.0209	1.085E-03	0.0278	1.087E-03
0.0172	1.002E-03	0.0078	9.958E-04	0.0102	9.982E-04	0.0152	1.003E-03	0.0219	1.008E-03	0.0292	1.010E-03
0.0181	9.074E-04	0.0081	9.151E-04	0.0107	9.146E-04	0.0160	9.129E-04	0.0230	9.188E-04	0.0307	9.203E-04
0.0190	8.212E-04	0.0085	8.407E-04	0.0112	8.375E-04	0.0167	8.300E-04	0.0241	8.366E-04	0.0322	8.371E-04
0.0200	7.431E-04	0.0089	7.723E-04	0.0117	7.670E-04	0.0175	7.546E-04	0.0253	7.618E-04	0.0339	7.613E-04
0.0210	6.725E-04	0.0092	7.096E-04	0.0122	7.025E-04	0.0183	6.860E-04	0.0265	6.937E-04	0.0356	6.924E-04
0.0221	6.086E-04	0.0097	6.519E-04	0.0128	6.433E-04	0.0191	6.237E-04	0.0278	6.317E-04	0.0374	6.297E-04
0.0233	5.507E-04	0.0101	5.990E-04	0.0133	5.892E-04	0.0200	5.670E-04	0.0292	5.753E-04	0.0393	5.727E-04
0.0245	4.983E-04	0.0105	5.503E-04	0.0139	5.397E-04	0.0210	5.156E-04	0.0306	5.239E-04	0.0412	5.209E-04
0.0257	4.508E-04	0.0110	5.056E-04	0.0146	4.944E-04	0.0219	4.687E-04	0.0321	4.771E-04	0.0433	4.737E-04
0.0270	4.079E-04	0.0115	4.645E-04	0.0152	4.529E-04	0.0230	4.262E-04	0.0337	4.345E-04	0.0455	4.308E-04
0.0284	3.691E-04	0.0120	4.268E-04	0.0159	4.148E-04	0.0240	3.874E-04	0.0353	3.957E-04	0.0478	3.918E-04
0.0299	3.340E-04	0.0125	3.921E-04	0.0166	3.800E-04	0.0252	3.521E-04	0.0370	3.603E-04	0.0503	3.562E-04
0.0315	3.023E-04	0.0131	3.603E-04	0.0174	3.481E-04	0.0263	3.201E-04	0.0389	3.281E-04	0.0528	3.239E-04
0.0331	2.735E-04	0.0137	3.311E-04	0.0182	3.189E-04	0.0275	2.910E-04	0.0408	2.988E-04	0.0555	2.945E-04
0.0348	2.475E-04	0.0143	3.043E-04	0.0190	2.921E-04	0.0288	2.646E-04	0.0427	2.721E-04	0.0583	2.678E-04
0.0366	2.240E-04	0.0149	2.796E-04	0.0198	2.676E-04	0.0302	2.405E-04	0.0448	2.478E-04	0.0612	2.435E-04
0.0385	2.027E-04	0.0156	2.570E-04	0.0207	2.452E-04	0.0316	2.187E-04	0.0470	2.256E-04	0.0643	2.214E-04
0.0405	1.834E-04	0.0162	2.362E-04	0.0217	2.246E-04	0.0330	1.988E-04	0.0493	2.054E-04	0.0676	2.013E-04
0.0426	1.660E-04	0.0170	2.170E-04	0.0227	2.058E-04	0.0346	1.808E-04	0.0518	1.871E-04	0.0710	1.830E-04
0.0447	1.502E-04	0.0177	1.995E-04	0.0237	1.885E-04	0.0362	1.643E-04	0.0543	1.703E-04	0.0746	1.664E-04
0.0471	1.359E-04	0.0185	1.833E-04	0.0248	1.726E-04	0.0379	1.494E-04	0.0569	1.551E-04	0.0784	1.513E-04
0.0495	1.229E-04	0.0193	1.685E-04	0.0259	1.581E-04	0.0396	1.358E-04	0.0597	1.412E-04	0.0823	1.376E-04
0.0520	1.112E-04	0.0202	1.548E-04	0.0271	1.448E-04	0.0415	1.235E-04	0.0627	1.285E-04	0.0865	1.251E-04
0.0547	1.006E-04	0.0211	1.423E-04	0.0283	1.327E-04	0.0434	1.123E-04	0.0657	1.170E-04	0.0909	1.137E-04
0.0576	9.075E-05	0.0220	1.308E-04	0.0296	1.216E-04	0.0454	1.020E-04	0.0689	1.065E-04	0.0955	1.034E-04
0.0605	8.184E-05	0.0230	1.202E-04	0.0309	1.113E-04	0.0476	9.230E-05	0.0723	9.670E-05	0.1003	9.403E-05
0.0636	7.381E-05	0.0240	1.105E-04	0.0323	1.020E-04	0.0498	8.338E-05	0.0759	8.760E-05	0.1054	8.557E-05
0.0669	6.656E-05	0.0251	1.014E-04	0.0338	9.225E-05	0.0521	7.532E-05	0.0796	7.930E-05	0.1107	7.786E-05
0.0704	6.002E-05	0.0262	9.183E-05	0.0353	8.313E-05	0.0545	6.804E-05	0.0835	7.179E-05	0.1163	7.086E-05
0.0740	5.413E-05	0.0273	8.280E-05	0.0369	7.491E-05	0.0570	6.146E-05	0.0875	6.498E-05	0.1222	6.448E-05
0.0778	4.880E-05	0.0285	7.464E-05	0.0385	6.750E-05	0.0597	5.551E-05	0.0918	5.882E-05	0.1284	5.868E-05
0.0819	4.401E-05	0.0298	6.730E-05	0.0403	6.083E-05	0.0625	5.015E-05	0.0963	5.324E-05	0.1349	5.339E-05
0.0861	3.969E-05	0.0311	6.067E-05	0.0421	5.481E-05	0.0654	4.530E-05	0.1010	4.819E-05	0.1417	4.858E-05
0.0905	3.579E-05	0.0325	5.471E-05	0.0440	4.939E-05	0.0684	4.092E-05	0.1060	4.362E-05	0.1489	4.421E-05
0.0952	3.227E-05	0.0339	4.932E-05	0.0460	4.451E-05	0.0716	3.696E-05	0.1112	3.948E-05	0.1565	4.022E-05
0.1001	2.909E-05	0.0354	4.446E-05	0.0481	4.009E-05	0.0749	3.338E-05	0.1166	3.574E-05	0.1644	3.659E-05
0.1053	2.624E-05	0.0370	4.008E-05	0.0503	3.612E-05	0.0784	3.015E-05	0.1223	3.235E-05	0.1727	3.329E-05
0.1107	2.365E-05	0.0387	3.613E-05	0.0525	3.253E-05	0.0821	2.724E-05	0.1283	2.928E-05	0.1814	3.029E-05
0.1164	2.133E-05	0.0404	3.257E-05	0.0549	2.931E-05	0.0859	2.460E-05	0.1346	2.650E-05	0.1906	2.756E-05
0.1225	1.923E-05	0.0422	2.937E-05	0.0574	2.640E-05	0.0899	2.222E-05	0.1412	2.398E-05	0.2003	2.507E-05

Appendix A

Table A-1c: 1 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.1288	1.734E-05	0.0440	2.648E-05	0.0600	2.378E-05	0.0941	2.007E-05	0.1481	2.170E-05	0.2104	2.281E-05
0.1354	1.563E-05	0.0460	2.387E-05	0.0627	2.142E-05	0.0985	1.812E-05	0.1553	1.964E-05	0.2211	2.075E-05
0.1424	1.409E-05	0.0480	2.151E-05	0.0656	1.929E-05	0.1030	1.637E-05	0.1629	1.777E-05	0.2322	1.888E-05
0.1498	1.270E-05	0.0501	1.938E-05	0.0685	1.738E-05	0.1078	1.478E-05	0.1709	1.608E-05	0.2440	1.718E-05
0.1575	1.145E-05	0.0524	1.747E-05	0.0716	1.566E-05	0.1129	1.335E-05	0.1793	1.456E-05	0.2564	1.563E-05
0.1656	1.032E-05	0.0547	1.575E-05	0.0749	1.410E-05	0.1181	1.206E-05	0.1881	1.317E-05	0.2693	1.421E-05
0.1742	9.265E-06	0.0571	1.419E-05	0.0782	1.270E-05	0.1236	1.089E-05	0.1973	1.192E-05	0.2830	1.293E-05
0.1832	8.302E-06	0.0596	1.278E-05	0.0818	1.144E-05	0.1294	9.806E-06	0.2069	1.078E-05	0.2973	1.176E-05
0.1926	7.437E-06	0.0623	1.152E-05	0.0855	1.030E-05	0.1354	8.803E-06	0.2171	9.720E-06	0.3123	1.070E-05
0.2026	6.663E-06	0.0650	1.038E-05	0.0894	9.201E-06	0.1417	7.891E-06	0.2277	8.725E-06	0.3281	9.670E-06
0.2130	5.969E-06	0.0679	9.272E-06	0.0934	8.191E-06	0.1483	7.073E-06	0.2388	7.821E-06	0.3448	8.678E-06
0.2240	5.347E-06	0.0709	8.241E-06	0.0976	7.292E-06	0.1552	6.339E-06	0.2505	7.010E-06	0.3622	7.768E-06
0.2356	4.790E-06	0.0741	7.322E-06	0.1020	6.490E-06	0.1624	5.681E-06	0.2628	6.283E-06	0.3805	6.954E-06
0.2478	4.291E-06	0.0773	6.506E-06	0.1067	5.777E-06	0.1700	5.091E-06	0.2756	5.631E-06	0.3998	6.224E-06
0.2606	3.843E-06	0.0808	5.781E-06	0.1115	5.142E-06	0.1779	4.562E-06	0.2891	5.046E-06	0.4200	5.571E-06
0.2740	3.443E-06	0.0843	5.136E-06	0.1165	4.577E-06	0.1861	4.089E-06	0.3033	4.522E-06	0.4413	4.987E-06
0.2882	3.084E-06	0.0881	4.563E-06	0.1218	4.073E-06	0.1948	3.664E-06	0.3181	4.053E-06	0.4636	4.463E-06
0.3030	2.762E-06	0.0920	4.054E-06	0.1273	3.625E-06	0.2039	3.283E-06	0.3337	3.632E-06	0.4871	3.995E-06
0.3187	2.473E-06	0.0960	3.601E-06	0.1331	3.225E-06	0.2134	2.941E-06	0.3500	3.254E-06	0.5118	3.575E-06
0.3351	2.215E-06	0.1003	3.199E-06	0.1391	2.870E-06	0.2233	2.636E-06	0.3672	2.915E-06	0.5377	3.200E-06
0.3524	1.984E-06	0.1047	2.841E-06	0.1454	2.554E-06	0.2337	2.361E-06	0.3851	2.612E-06	0.5649	2.864E-06
0.3706	1.776E-06	0.1094	2.524E-06	0.1520	2.272E-06	0.2446	2.116E-06	0.4040	2.340E-06	0.5935	2.563E-06
0.3897	1.590E-06	0.1142	2.241E-06	0.1588	2.022E-06	0.2559	1.895E-06	0.4238	2.096E-06	0.6235	2.293E-06
0.4099	1.423E-06	0.1193	1.990E-06	0.1660	1.798E-06	0.2679	1.698E-06	0.4445	1.878E-06	0.6551	2.052E-06
0.4310	1.274E-06	0.1246	1.767E-06	0.1735	1.599E-06	0.2803	1.520E-06	0.4663	1.682E-06	0.6882	1.836E-06
0.4533	1.140E-06	0.1301	1.569E-06	0.1814	1.422E-06	0.2934	1.362E-06	0.4891	1.506E-06	0.7231	1.643E-06
0.4767	1.019E-06	0.1358	1.393E-06	0.1896	1.265E-06	0.3070	1.219E-06	0.5130	1.349E-06	0.7597	1.469E-06
0.5013	9.013E-07	0.1419	1.237E-06	0.1982	1.124E-06	0.3213	1.091E-06	0.5382	1.208E-06	0.7981	1.315E-06
0.5272	7.923E-07	0.1481	1.097E-06	0.2071	9.957E-07	0.3363	9.702E-07	0.5645	1.082E-06	0.8385	1.176E-06
0.5544	6.962E-07	0.1547	9.674E-07	0.2165	8.740E-07	0.3519	8.525E-07	0.5921	9.593E-07	0.8810	1.051E-06
0.5830	6.116E-07	0.1616	8.448E-07	0.2263	7.630E-07	0.3683	7.452E-07	0.6211	8.409E-07	0.9255	9.254E-07
0.6131	5.372E-07	0.1687	7.345E-07	0.2365	6.658E-07	0.3854	6.511E-07	0.6515	7.336E-07	0.9724	8.040E-07
0.6448	4.717E-07	0.1762	6.383E-07	0.2472	5.809E-07	0.4034	5.688E-07	0.6834	6.398E-07	1.0216	6.967E-07
0.6780	4.140E-07	0.1840	5.545E-07	0.2584	5.066E-07	0.4222	4.966E-07	0.7169	5.578E-07	1.0733	6.035E-07
0.7130	3.632E-07	0.1921	4.816E-07	0.2701	4.417E-07	0.4418	4.335E-07	0.7520	4.862E-07	1.1277	5.226E-07
0.7499	3.186E-07	0.2006	4.181E-07	0.2823	3.848E-07	0.4624	3.783E-07	0.7888	4.236E-07	1.1847	4.524E-07
0.7886	2.792E-07	0.2095	3.628E-07	0.2951	3.352E-07	0.4839	3.299E-07	0.8274	3.689E-07	1.2447	3.914E-07
0.8293	2.446E-07	0.2188	3.146E-07	0.3085	2.918E-07	0.5064	2.876E-07	0.8679	3.211E-07	1.3077	3.385E-07
0.8721	2.141E-07	0.2285	2.727E-07	0.3224	2.538E-07	0.5300	2.505E-07	0.9104	2.793E-07	1.3739	2.926E-07
0.9171	1.873E-07	0.2386	2.361E-07	0.3370	2.207E-07	0.5546	2.180E-07	0.9549	2.428E-07	1.4434	2.527E-07
0.9645	1.637E-07	0.2492	2.043E-07	0.3523	1.917E-07	0.5804	1.896E-07	1.0017	2.109E-07	1.5165	2.180E-07

Appendix A

Table A-1c: 1 Hz Seismic Hazard Curves at North Anna

Mean		5^{th} Fractile		16^{th} Fractile		50^{th} Fractile		84^{th} Fractile		95^{th} Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
1.0142	1.428E-07	0.2602	1.767E-07	0.3682	1.663E-07	0.6075	1.647E-07	1.0507	1.831E-07	1.5933	1.880E-07
1.0666	1.246E-07	0.2718	1.525E-07	0.3849	1.441E-07	0.6357	1.430E-07	1.1021	1.587E-07	1.6739	1.619E-07
1.1217	1.084E-07	0.2838	1.315E-07	0.4023	1.247E-07	0.6653	1.239E-07	1.1561	1.374E-07	1.7586	1.392E-07
1.1796	9.417E-08	0.2964	1.132E-07	0.4205	1.077E-07	0.6963	1.072E-07	1.2127	1.188E-07	1.8477	1.195E-07
1.2405	8.021E-08	0.3095	9.722E-08	0.4395	9.248E-08	0.7287	9.217E-08	1.2720	1.026E-07	1.9412	1.024E-07
1.3045	6.740E-08	0.3232	8.219E-08	0.4594	7.807E-08	0.7626	7.781E-08	1.3343	8.726E-08	2.0394	8.666E-08
1.3718	5.639E-08	0.3375	6.828E-08	0.4802	6.496E-08	0.7981	6.472E-08	1.3996	7.264E-08	2.1427	7.198E-08
1.4427	4.695E-08	0.3525	5.639E-08	0.5019	5.378E-08	0.8352	5.357E-08	1.4681	5.970E-08	2.2511	5.916E-08
1.5171	3.885E-08	0.3681	4.631E-08	0.5246	4.426E-08	0.8741	4.408E-08	1.5400	4.878E-08	2.3651	4.834E-08
1.5955	3.190E-08	0.3844	3.776E-08	0.5484	3.616E-08	0.9148	3.601E-08	1.6153	3.957E-08	2.4848	3.920E-08
1.6778	2.595E-08	0.4014	3.050E-08	0.5732	2.928E-08	0.9574	2.914E-08	1.6944	3.180E-08	2.6106	3.150E-08
1.7645	2.083E-08	0.4192	2.435E-08	0.5991	2.342E-08	1.0019	2.330E-08	1.7774	2.525E-08	2.7427	2.501E-08
1.8555	1.645E-08	0.4378	1.913E-08	0.6262	1.843E-08	1.0486	1.833E-08	1.8644	1.973E-08	2.8815	1.953E-08
1.9513	1.269E-08	0.4571	1.471E-08	0.6545	1.419E-08	1.0974	1.410E-08	1.9556	1.507E-08	3.0274	1.491E-08
2.0521	9.460E-09	0.4774	1.095E-08	0.6842	1.058E-08	1.1484	1.050E-08	2.0513	1.114E-08	3.1806	1.101E-08
2.1580	6.693E-09	0.4985	7.768E-09	0.7151	7.510E-09	1.2019	7.438E-09	2.1518	7.828E-09	3.3416	7.720E-09
2.2694	4.319E-09	0.5206	5.069E-09	0.7475	4.897E-09	1.2578	4.835E-09	2.2571	5.034E-09	3.5107	4.946E-09
2.3866	2.283E-09	0.5437	2.780E-09	0.7813	2.675E-09	1.3164	2.620E-09	2.3676	2.678E-09	3.6885	2.607E-09

Appendix A

Table A-1d: 2.5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0342	1.074E-03	0.0199	1.070E-03	0.0242	1.071E-03	0.0318	1.072E-03	0.0436	1.073E-03	0.0542	1.072E-03
0.0359	1.042E-03	0.0208	1.039E-03	0.0253	1.041E-03	0.0333	1.043E-03	0.0458	1.044E-03	0.0569	1.045E-03
0.0377	9.784E-04	0.0217	9.787E-04	0.0265	9.807E-04	0.0349	9.826E-04	0.0480	9.855E-04	0.0597	9.880E-04
0.0397	9.033E-04	0.0227	9.069E-04	0.0277	9.085E-04	0.0366	9.102E-04	0.0504	9.131E-04	0.0627	9.172E-04
0.0417	8.311E-04	0.0238	8.369E-04	0.0290	8.378E-04	0.0383	8.393E-04	0.0529	8.420E-04	0.0659	8.473E-04
0.0438	7.643E-04	0.0248	7.719E-04	0.0303	7.722E-04	0.0402	7.735E-04	0.0555	7.759E-04	0.0692	7.821E-04
0.0460	7.029E-04	0.0259	7.120E-04	0.0317	7.117E-04	0.0421	7.128E-04	0.0582	7.150E-04	0.0727	7.219E-04
0.0484	6.464E-04	0.0271	6.567E-04	0.0332	6.560E-04	0.0441	6.569E-04	0.0611	6.589E-04	0.0763	6.664E-04
0.0508	5.945E-04	0.0283	6.057E-04	0.0347	6.046E-04	0.0462	6.054E-04	0.0641	6.072E-04	0.0802	6.151E-04
0.0534	5.466E-04	0.0296	5.587E-04	0.0363	5.572E-04	0.0484	5.579E-04	0.0673	5.595E-04	0.0842	5.677E-04
0.0562	5.027E-04	0.0310	5.153E-04	0.0380	5.135E-04	0.0507	5.142E-04	0.0706	5.155E-04	0.0884	5.240E-04
0.0590	4.623E-04	0.0324	4.752E-04	0.0397	4.733E-04	0.0532	4.738E-04	0.0741	4.750E-04	0.0928	4.836E-04
0.0620	4.252E-04	0.0338	4.384E-04	0.0416	4.362E-04	0.0557	4.366E-04	0.0778	4.377E-04	0.0975	4.463E-04
0.0652	3.910E-04	0.0354	4.043E-04	0.0435	4.021E-04	0.0584	4.024E-04	0.0816	4.033E-04	0.1024	4.119E-04
0.0685	3.595E-04	0.0370	3.729E-04	0.0455	3.706E-04	0.0612	3.709E-04	0.0856	3.716E-04	0.1075	3.801E-04
0.0720	3.306E-04	0.0386	3.439E-04	0.0476	3.416E-04	0.0641	3.418E-04	0.0899	3.424E-04	0.1129	3.507E-04
0.0757	3.040E-04	0.0404	3.172E-04	0.0497	3.148E-04	0.0672	3.149E-04	0.0943	3.154E-04	0.1186	3.236E-04
0.0795	2.795E-04	0.0422	2.926E-04	0.0520	2.901E-04	0.0704	2.902E-04	0.0990	2.906E-04	0.1246	2.985E-04
0.0836	2.570E-04	0.0441	2.699E-04	0.0544	2.674E-04	0.0737	2.674E-04	0.1038	2.677E-04	0.1308	2.754E-04
0.0878	2.364E-04	0.0461	2.489E-04	0.0569	2.464E-04	0.0773	2.464E-04	0.1090	2.466E-04	0.1374	2.542E-04
0.0923	2.173E-04	0.0482	2.296E-04	0.0596	2.271E-04	0.0810	2.271E-04	0.1143	2.271E-04	0.1443	2.345E-04
0.0970	1.998E-04	0.0504	2.118E-04	0.0623	2.093E-04	0.0848	2.092E-04	0.1200	2.092E-04	0.1515	2.164E-04
0.1020	1.837E-04	0.0527	1.953E-04	0.0652	1.930E-04	0.0889	1.928E-04	0.1259	1.926E-04	0.1591	1.996E-04
0.1072	1.688E-04	0.0551	1.801E-04	0.0682	1.778E-04	0.0932	1.777E-04	0.1321	1.774E-04	0.1671	1.842E-04
0.1126	1.552E-04	0.0576	1.662E-04	0.0713	1.639E-04	0.0976	1.637E-04	0.1386	1.635E-04	0.1755	1.699E-04
0.1184	1.427E-04	0.0602	1.533E-04	0.0746	1.510E-04	0.1023	1.508E-04	0.1455	1.505E-04	0.1843	1.567E-04
0.1244	1.311E-04	0.0629	1.413E-04	0.0780	1.392E-04	0.1072	1.389E-04	0.1527	1.386E-04	0.1936	1.446E-04
0.1307	1.205E-04	0.0657	1.304E-04	0.0816	1.283E-04	0.1123	1.280E-04	0.1602	1.277E-04	0.2033	1.334E-04
0.1374	1.107E-04	0.0687	1.202E-04	0.0854	1.182E-04	0.1177	1.178E-04	0.1681	1.175E-04	0.2135	1.231E-04
0.1444	1.013E-04	0.0718	1.108E-04	0.0893	1.088E-04	0.1233	1.084E-04	0.1764	1.081E-04	0.2242	1.135E-04
0.1518	9.222E-05	0.0751	1.017E-04	0.0934	9.971E-05	0.1292	9.928E-05	0.1851	9.911E-05	0.2355	1.044E-04
0.1595	8.353E-05	0.0784	9.281E-05	0.0977	9.088E-05	0.1354	9.046E-05	0.1943	9.034E-05	0.2473	9.554E-05
0.1676	7.553E-05	0.0820	8.425E-05	0.1022	8.247E-05	0.1419	8.207E-05	0.2038	8.205E-05	0.2597	8.695E-05
0.1762	6.828E-05	0.0857	7.630E-05	0.1069	7.472E-05	0.1486	7.434E-05	0.2139	7.444E-05	0.2727	7.890E-05
0.1851	6.172E-05	0.0896	6.907E-05	0.1118	6.766E-05	0.1558	6.733E-05	0.2245	6.752E-05	0.2864	7.153E-05
0.1946	5.579E-05	0.0936	6.251E-05	0.1170	6.128E-05	0.1632	6.098E-05	0.2355	6.125E-05	0.3008	6.485E-05
0.2045	5.043E-05	0.0979	5.657E-05	0.1223	5.550E-05	0.1710	5.522E-05	0.2472	5.556E-05	0.3159	5.879E-05
0.2149	4.558E-05	0.1023	5.119E-05	0.1280	5.026E-05	0.1792	5.001E-05	0.2594	5.039E-05	0.3318	5.330E-05
0.2259	4.120E-05	0.1069	4.631E-05	0.1339	4.552E-05	0.1878	4.529E-05	0.2722	4.571E-05	0.3484	4.832E-05
0.2374	3.724E-05	0.1118	4.190E-05	0.1400	4.122E-05	0.1968	4.101E-05	0.2856	4.145E-05	0.3659	4.380E-05
0.2495	3.366E-05	0.1168	3.790E-05	0.1465	3.733E-05	0.2062	3.714E-05	0.2997	3.760E-05	0.3843	3.971E-05

Appendix A

Table A-1d: 2.5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.2622	3.042E-05	0.1221	3.430E-05	0.1532	3.381E-05	0.2160	3.363E-05	0.3145	3.410E-05	0.4036	3.599E-05
0.2755	2.749E-05	0.1276	3.103E-05	0.1603	3.062E-05	0.2264	3.046E-05	0.3300	3.093E-05	0.4238	3.263E-05
0.2896	2.485E-05	0.1334	2.807E-05	0.1676	2.772E-05	0.2372	2.758E-05	0.3463	2.805E-05	0.4451	2.958E-05
0.3043	2.246E-05	0.1395	2.539E-05	0.1754	2.511E-05	0.2485	2.497E-05	0.3634	2.544E-05	0.4674	2.681E-05
0.3198	2.030E-05	0.1458	2.297E-05	0.1834	2.273E-05	0.2604	2.262E-05	0.3814	2.307E-05	0.4909	2.431E-05
0.3361	1.834E-05	0.1524	2.078E-05	0.1919	2.058E-05	0.2729	2.048E-05	0.4002	2.093E-05	0.5156	2.203E-05
0.3533	1.658E-05	0.1593	1.880E-05	0.2007	1.864E-05	0.2860	1.854E-05	0.4199	1.898E-05	0.5414	1.997E-05
0.3713	1.498E-05	0.1665	1.701E-05	0.2099	1.687E-05	0.2996	1.679E-05	0.4407	1.721E-05	0.5686	1.810E-05
0.3902	1.354E-05	0.1740	1.538E-05	0.2196	1.528E-05	0.3140	1.520E-05	0.4624	1.561E-05	0.5972	1.641E-05
0.4101	1.223E-05	0.1819	1.391E-05	0.2297	1.384E-05	0.3290	1.376E-05	0.4853	1.416E-05	0.6271	1.487E-05
0.4310	1.104E-05	0.1901	1.259E-05	0.2403	1.253E-05	0.3447	1.246E-05	0.5092	1.283E-05	0.6586	1.348E-05
0.4530	9.923E-06	0.1987	1.137E-05	0.2513	1.133E-05	0.3612	1.127E-05	0.5343	1.163E-05	0.6917	1.221E-05
0.4760	8.866E-06	0.2077	1.025E-05	0.2629	1.022E-05	0.3785	1.016E-05	0.5607	1.051E-05	0.7264	1.105E-05
0.5003	7.885E-06	0.2171	9.177E-06	0.2750	9.157E-06	0.3966	9.101E-06	0.5884	9.444E-06	0.7629	9.949E-06
0.5258	7.004E-06	0.2269	8.175E-06	0.2877	8.164E-06	0.4156	8.108E-06	0.6174	8.426E-06	0.8012	8.890E-06
0.5526	6.219E-06	0.2372	7.266E-06	0.3009	7.262E-06	0.4355	7.208E-06	0.6479	7.492E-06	0.8414	7.893E-06
0.5807	5.522E-06	0.2479	6.454E-06	0.3147	6.456E-06	0.4563	6.407E-06	0.6799	6.655E-06	0.8836	6.994E-06
0.6103	4.903E-06	0.2591	5.733E-06	0.3292	5.740E-06	0.4781	5.693E-06	0.7135	5.910E-06	0.9280	6.196E-06
0.6414	4.353E-06	0.2709	5.092E-06	0.3444	5.103E-06	0.5010	5.059E-06	0.7487	5.248E-06	0.9746	5.489E-06
0.6741	3.865E-06	0.2831	4.523E-06	0.3602	4.536E-06	0.5250	4.496E-06	0.7856	4.660E-06	1.0235	4.861E-06
0.7085	3.432E-06	0.2959	4.017E-06	0.3768	4.032E-06	0.5501	3.995E-06	0.8244	4.138E-06	1.0749	4.306E-06
0.7446	3.046E-06	0.3093	3.567E-06	0.3942	3.584E-06	0.5764	3.550E-06	0.8651	3.674E-06	1.1288	3.814E-06
0.7825	2.704E-06	0.3233	3.168E-06	0.4123	3.186E-06	0.6040	3.154E-06	0.9078	3.262E-06	1.1855	3.378E-06
0.8224	2.400E-06	0.3379	2.813E-06	0.4313	2.831E-06	0.6329	2.802E-06	0.9526	2.895E-06	1.2450	2.992E-06
0.8643	2.130E-06	0.3532	2.498E-06	0.4511	2.517E-06	0.6631	2.490E-06	0.9997	2.570E-06	1.3075	2.649E-06
0.9084	1.890E-06	0.3692	2.218E-06	0.4719	2.236E-06	0.6949	2.211E-06	1.0490	2.282E-06	1.3731	2.346E-06
0.9547	1.677E-06	0.3859	1.969E-06	0.4936	1.988E-06	0.7281	1.964E-06	1.1008	2.025E-06	1.4420	2.078E-06
1.0033	1.487E-06	0.4034	1.748E-06	0.5163	1.766E-06	0.7629	1.745E-06	1.1551	1.797E-06	1.5144	1.840E-06
1.0544	1.319E-06	0.4216	1.552E-06	0.5401	1.569E-06	0.7994	1.549E-06	1.2121	1.595E-06	1.5904	1.629E-06
1.1082	1.170E-06	0.4407	1.377E-06	0.5649	1.394E-06	0.8377	1.375E-06	1.2720	1.415E-06	1.6703	1.442E-06
1.1647	1.033E-06	0.4606	1.221E-06	0.5910	1.238E-06	0.8777	1.220E-06	1.3348	1.255E-06	1.7541	1.276E-06
1.2240	9.040E-07	0.4815	1.080E-06	0.6181	1.096E-06	0.9197	1.079E-06	1.4007	1.111E-06	1.8422	1.128E-06
1.2864	7.851E-07	0.5033	9.480E-07	0.6466	9.635E-07	0.9637	9.464E-07	1.4698	9.764E-07	1.9347	9.904E-07
1.3519	6.794E-07	0.5260	8.251E-07	0.6764	8.398E-07	1.0098	8.220E-07	1.5424	8.494E-07	2.0318	8.614E-07
1.4208	5.873E-07	0.5498	7.139E-07	0.7075	7.271E-07	1.0582	7.094E-07	1.6185	7.333E-07	2.1338	7.435E-07
1.4933	5.075E-07	0.5747	6.163E-07	0.7400	6.278E-07	1.1088	6.107E-07	1.6984	6.312E-07	2.2409	6.399E-07
1.5693	4.383E-07	0.6007	5.316E-07	0.7741	5.417E-07	1.1618	5.254E-07	1.7822	5.429E-07	2.3534	5.503E-07
1.6493	3.785E-07	0.6279	4.583E-07	0.8097	4.671E-07	1.2174	4.518E-07	1.8702	4.667E-07	2.4715	4.731E-07
1.7334	3.265E-07	0.6563	3.949E-07	0.8470	4.026E-07	1.2756	3.883E-07	1.9625	4.011E-07	2.5956	4.066E-07
1.8217	2.815E-07	0.6860	3.401E-07	0.8860	3.468E-07	1.3367	3.335E-07	2.0594	3.444E-07	2.7259	3.491E-07
1.9145	2.426E-07	0.7171	2.927E-07	0.9268	2.985E-07	1.4006	2.863E-07	2.1610	2.956E-07	2.8627	2.997E-07

Appendix A

Table A-1d: 2.5 Hz Seismic Hazard Curves at North Anna

Mean		5^{th} Fractile		16^{th} Fractile		50^{th} Fractile		84^{th} Fractile		95^{th} Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
2.0121	2.088E-07	0.7495	2.518E-07	0.9694	2.568E-07	1.4676	2.456E-07	2.2677	2.535E-07	3.0064	2.570E-07
2.1147	1.796E-07	0.7834	2.163E-07	1.0140	2.206E-07	1.5378	2.105E-07	2.3797	2.173E-07	3.1573	2.202E-07
2.2224	1.543E-07	0.8189	1.856E-07	1.0607	1.894E-07	1.6114	1.801E-07	2.4971	1.859E-07	3.3158	1.885E-07
2.3357	1.323E-07	0.8559	1.591E-07	1.1095	1.625E-07	1.6885	1.540E-07	2.6204	1.589E-07	3.4823	1.611E-07
2.4547	1.132E-07	0.8947	1.362E-07	1.1606	1.391E-07	1.7693	1.315E-07	2.7497	1.357E-07	3.6571	1.376E-07
2.5798	9.631E-08	0.9351	1.162E-07	1.2140	1.188E-07	1.8539	1.119E-07	2.8855	1.155E-07	3.8407	1.172E-07
2.7113	8.104E-08	0.9775	9.860E-08	1.2699	1.008E-07	1.9426	9.454E-08	3.0279	9.766E-08	4.0335	9.907E-08
2.8494	6.737E-08	1.0217	8.251E-08	1.3283	8.453E-08	2.0355	7.881E-08	3.1774	8.147E-08	4.2359	8.269E-08
2.9947	5.552E-08	1.0679	6.799E-08	1.3895	6.968E-08	2.1329	6.475E-08	3.3342	6.690E-08	4.4486	6.790E-08
3.1473	4.543E-08	1.1162	5.534E-08	1.4534	5.665E-08	2.2349	5.267E-08	3.4988	5.430E-08	4.6719	5.505E-08
3.3077	3.690E-08	1.1667	4.464E-08	1.5203	4.561E-08	2.3419	4.250E-08	3.6715	4.369E-08	4.9064	4.423E-08
3.4762	2.968E-08	1.2195	3.568E-08	1.5903	3.637E-08	2.4539	3.398E-08	3.8528	3.482E-08	5.1527	3.520E-08
3.6534	2.357E-08	1.2747	2.818E-08	1.6635	2.867E-08	2.5713	2.684E-08	4.0429	2.742E-08	5.4114	2.767E-08
3.8395	1.840E-08	1.3324	2.192E-08	1.7400	2.224E-08	2.6943	2.087E-08	4.2425	2.124E-08	5.6830	2.139E-08
4.0352	1.403E-08	1.3927	1.668E-08	1.8201	1.688E-08	2.8232	1.586E-08	4.4519	1.608E-08	5.9683	1.616E-08
4.2409	1.032E-08	1.4557	1.230E-08	1.9039	1.242E-08	2.9583	1.166E-08	4.6717	1.177E-08	6.2679	1.180E-08
4.4570	7.196E-09	1.5216	8.642E-09	1.9915	8.692E-09	3.0998	8.143E-09	4.9023	8.170E-09	6.5825	8.171E-09
4.6841	4.554E-09	1.5904	5.592E-09	2.0832	5.595E-09	3.2481	5.206E-09	5.1443	5.175E-09	6.9130	5.150E-09

Appendix A

Table A-1e: 5 Hz Seismic Hazard Curves at North Anna

Mean		5^{th} Fractile		16^{th} Fractile		50^{th} Fractile		84^{th} Fractile		95^{th} Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0613	1.062E-03	0.0348	1.061E-03	0.0417	1.061E-03	0.0568	1.061E-03	0.0809	1.061E-03	0.1034	1.063E-03
0.0643	1.051E-03	0.0365	1.050E-03	0.0437	1.050E-03	0.0595	1.050E-03	0.0848	1.050E-03	0.1084	1.053E-03
0.0676	1.033E-03	0.0382	1.031E-03	0.0457	1.032E-03	0.0624	1.032E-03	0.0888	1.034E-03	0.1137	1.036E-03
0.0709	1.008E-03	0.0400	1.006E-03	0.0479	1.007E-03	0.0654	1.009E-03	0.0931	1.011E-03	0.1191	1.013E-03
0.0745	9.736E-04	0.0419	9.725E-04	0.0502	9.737E-04	0.0685	9.762E-04	0.0976	9.792E-04	0.1249	9.805E-04
0.0782	9.323E-04	0.0438	9.317E-04	0.0526	9.333E-04	0.0718	9.369E-04	0.1023	9.408E-04	0.1309	9.413E-04
0.0821	8.849E-04	0.0459	8.849E-04	0.0551	8.867E-04	0.0753	8.914E-04	0.1072	8.963E-04	0.1373	8.956E-04
0.0862	8.333E-04	0.0481	8.338E-04	0.0577	8.359E-04	0.0789	8.417E-04	0.1124	8.471E-04	0.1439	8.452E-04
0.0905	7.799E-04	0.0503	7.806E-04	0.0604	7.831E-04	0.0827	7.897E-04	0.1178	7.956E-04	0.1509	7.922E-04
0.0950	7.266E-04	0.0527	7.274E-04	0.0633	7.301E-04	0.0867	7.375E-04	0.1234	7.436E-04	0.1581	7.387E-04
0.0998	6.751E-04	0.0552	6.755E-04	0.0663	6.784E-04	0.0908	6.865E-04	0.1294	6.926E-04	0.1658	6.863E-04
0.1048	6.261E-04	0.0578	6.261E-04	0.0695	6.291E-04	0.0952	6.378E-04	0.1356	6.437E-04	0.1738	6.362E-04
0.1100	5.801E-04	0.0605	5.796E-04	0.0728	5.828E-04	0.0997	5.918E-04	0.1421	5.975E-04	0.1822	5.889E-04
0.1155	5.373E-04	0.0634	5.363E-04	0.0762	5.395E-04	0.1045	5.488E-04	0.1490	5.542E-04	0.1910	5.447E-04
0.1213	4.975E-04	0.0663	4.960E-04	0.0798	4.993E-04	0.1095	5.089E-04	0.1562	5.140E-04	0.2002	5.036E-04
0.1273	4.606E-04	0.0695	4.587E-04	0.0836	4.621E-04	0.1148	4.717E-04	0.1637	4.765E-04	0.2099	4.656E-04
0.1337	4.264E-04	0.0727	4.242E-04	0.0876	4.276E-04	0.1203	4.372E-04	0.1715	4.417E-04	0.2200	4.303E-04
0.1404	3.947E-04	0.0762	3.923E-04	0.0918	3.956E-04	0.1261	4.053E-04	0.1798	4.096E-04	0.2307	3.977E-04
0.1474	3.654E-04	0.0798	3.627E-04	0.0961	3.661E-04	0.1322	3.756E-04	0.1885	3.796E-04	0.2418	3.676E-04
0.1547	3.383E-04	0.0835	3.354E-04	0.1007	3.388E-04	0.1385	3.481E-04	0.1975	3.519E-04	0.2535	3.397E-04
0.1625	3.131E-04	0.0874	3.102E-04	0.1055	3.134E-04	0.1451	3.226E-04	0.2070	3.262E-04	0.2657	3.140E-04
0.1706	2.898E-04	0.0916	2.869E-04	0.1105	2.900E-04	0.1521	2.990E-04	0.2170	3.023E-04	0.2786	2.902E-04
0.1791	2.683E-04	0.0959	2.653E-04	0.1158	2.684E-04	0.1594	2.771E-04	0.2274	2.802E-04	0.2920	2.682E-04
0.1880	2.483E-04	0.1004	2.453E-04	0.1213	2.484E-04	0.1671	2.568E-04	0.2384	2.597E-04	0.3062	2.479E-04
0.1974	2.298E-04	0.1051	2.268E-04	0.1270	2.298E-04	0.1751	2.380E-04	0.2499	2.407E-04	0.3209	2.291E-04
0.2073	2.127E-04	0.1101	2.098E-04	0.1330	2.126E-04	0.1835	2.205E-04	0.2619	2.230E-04	0.3364	2.117E-04
0.2177	1.968E-04	0.1152	1.940E-04	0.1394	1.967E-04	0.1923	2.043E-04	0.2745	2.067E-04	0.3527	1.957E-04
0.2285	1.821E-04	0.1207	1.793E-04	0.1460	1.819E-04	0.2015	1.893E-04	0.2877	1.916E-04	0.3697	1.808E-04
0.2400	1.685E-04	0.1263	1.658E-04	0.1529	1.683E-04	0.2112	1.754E-04	0.3015	1.775E-04	0.3876	1.670E-04
0.2519	1.558E-04	0.1323	1.532E-04	0.1602	1.556E-04	0.2214	1.624E-04	0.3161	1.644E-04	0.4063	1.543E-04
0.2645	1.441E-04	0.1385	1.415E-04	0.1678	1.439E-04	0.2320	1.504E-04	0.3313	1.523E-04	0.4260	1.424E-04
0.2777	1.331E-04	0.1451	1.307E-04	0.1758	1.329E-04	0.2431	1.392E-04	0.3472	1.410E-04	0.4466	1.314E-04
0.2916	1.228E-04	0.1519	1.205E-04	0.1841	1.226E-04	0.2548	1.287E-04	0.3639	1.304E-04	0.4681	1.211E-04
0.3062	1.131E-04	0.1590	1.110E-04	0.1929	1.130E-04	0.2670	1.188E-04	0.3814	1.204E-04	0.4907	1.114E-04
0.3215	1.040E-04	0.1665	1.020E-04	0.2020	1.040E-04	0.2798	1.095E-04	0.3998	1.110E-04	0.5145	1.023E-04
0.3375	9.530E-05	0.1744	9.361E-05	0.2116	9.551E-05	0.2933	1.007E-04	0.4190	1.021E-04	0.5393	9.367E-05
0.3544	8.712E-05	0.1826	8.572E-05	0.2217	8.755E-05	0.3074	9.242E-05	0.4392	9.355E-05	0.5654	8.559E-05
0.3721	7.942E-05	0.1912	7.834E-05	0.2322	8.008E-05	0.3221	8.457E-05	0.4603	8.552E-05	0.5927	7.801E-05
0.3907	7.222E-05	0.2002	7.147E-05	0.2433	7.313E-05	0.3376	7.722E-05	0.4825	7.796E-05	0.6213	7.097E-05
0.4102	6.555E-05	0.2096	6.512E-05	0.2548	6.669E-05	0.3538	7.035E-05	0.5057	7.089E-05	0.6514	6.445E-05
0.4307	5.941E-05	0.2195	5.928E-05	0.2669	6.075E-05	0.3708	6.399E-05	0.5300	6.432E-05	0.6828	5.847E-05

Appendix A

Table A-1e: 5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.4522	5.380E-05	0.2298	5.392E-05	0.2796	5.530E-05	0.3886	5.814E-05	0.5555	5.828E-05	0.7158	5.299E-05
0.4748	4.869E-05	0.2406	4.902E-05	0.2929	5.031E-05	0.4072	5.277E-05	0.5823	5.276E-05	0.7504	4.801E-05
0.4986	4.404E-05	0.2520	4.456E-05	0.3068	4.576E-05	0.4268	4.789E-05	0.6103	4.773E-05	0.7867	4.348E-05
0.5235	3.984E-05	0.2638	4.050E-05	0.3214	4.162E-05	0.4473	4.344E-05	0.6397	4.316E-05	0.8247	3.937E-05
0.5496	3.603E-05	0.2762	3.681E-05	0.3367	3.785E-05	0.4688	3.940E-05	0.6705	3.902E-05	0.8645	3.565E-05
0.5771	3.259E-05	0.2893	3.345E-05	0.3527	3.442E-05	0.4913	3.574E-05	0.7027	3.528E-05	0.9063	3.228E-05
0.6059	2.948E-05	0.3029	3.040E-05	0.3694	3.130E-05	0.5148	3.241E-05	0.7366	3.189E-05	0.9501	2.923E-05
0.6362	2.666E-05	0.3171	2.762E-05	0.3870	2.846E-05	0.5396	2.939E-05	0.7720	2.883E-05	0.9960	2.647E-05
0.6679	2.411E-05	0.3321	2.510E-05	0.4054	2.588E-05	0.5655	2.665E-05	0.8092	2.606E-05	1.0441	2.396E-05
0.7013	2.180E-05	0.3477	2.281E-05	0.4246	2.353E-05	0.5926	2.417E-05	0.8481	2.356E-05	1.0945	2.169E-05
0.7364	1.971E-05	0.3641	2.072E-05	0.4448	2.139E-05	0.6211	2.192E-05	0.8889	2.130E-05	1.1474	1.964E-05
0.7731	1.782E-05	0.3812	1.883E-05	0.4659	1.945E-05	0.6509	1.987E-05	0.9317	1.924E-05	1.2029	1.777E-05
0.8118	1.610E-05	0.3992	1.710E-05	0.4881	1.768E-05	0.6821	1.801E-05	0.9765	1.738E-05	1.2610	1.608E-05
0.8523	1.454E-05	0.4180	1.552E-05	0.5112	1.606E-05	0.7149	1.632E-05	1.0235	1.570E-05	1.3219	1.454E-05
0.8949	1.311E-05	0.4377	1.407E-05	0.5355	1.458E-05	0.7492	1.478E-05	1.0728	1.417E-05	1.3858	1.312E-05
0.9396	1.180E-05	0.4583	1.275E-05	0.5610	1.321E-05	0.7852	1.336E-05	1.1244	1.276E-05	1.4527	1.183E-05
0.9865	1.059E-05	0.4798	1.153E-05	0.5876	1.196E-05	0.8229	1.206E-05	1.1785	1.147E-05	1.5229	1.065E-05
1.0358	9.480E-06	0.5024	1.040E-05	0.6156	1.080E-05	0.8624	1.086E-05	1.2353	1.029E-05	1.5965	9.554E-06
1.0876	8.460E-06	0.5261	9.357E-06	0.6448	9.722E-06	0.9038	9.752E-06	1.2947	9.206E-06	1.6737	8.551E-06
1.1419	7.527E-06	0.5509	8.397E-06	0.6754	8.728E-06	0.9472	8.730E-06	1.3570	8.211E-06	1.7545	7.632E-06
1.1990	6.677E-06	0.5768	7.515E-06	0.7075	7.811E-06	0.9927	7.790E-06	1.4223	7.304E-06	1.8393	6.796E-06
1.2589	5.911E-06	0.6040	6.710E-06	0.7412	6.971E-06	1.0403	6.931E-06	1.4908	6.480E-06	1.9282	6.038E-06
1.3217	5.223E-06	0.6324	5.978E-06	0.7764	6.205E-06	1.0903	6.152E-06	1.5625	5.736E-06	2.0213	5.357E-06
1.3878	4.610E-06	0.6622	5.318E-06	0.8133	5.513E-06	1.1426	5.448E-06	1.6377	5.071E-06	2.1190	4.747E-06
1.4571	4.066E-06	0.6934	4.726E-06	0.8519	4.892E-06	1.1975	4.819E-06	1.7165	4.477E-06	2.2214	4.204E-06
1.5299	3.584E-06	0.7260	4.197E-06	0.8924	4.336E-06	1.2550	4.257E-06	1.7991	3.950E-06	2.3287	3.720E-06
1.6063	3.159E-06	0.7602	3.726E-06	0.9348	3.841E-06	1.3152	3.760E-06	1.8857	3.484E-06	2.4412	3.292E-06
1.6866	2.783E-06	0.7960	3.306E-06	0.9792	3.402E-06	1.3784	3.319E-06	1.9765	3.072E-06	2.5592	2.913E-06
1.7708	2.452E-06	0.8335	2.934E-06	1.0257	3.012E-06	1.4445	2.929E-06	2.0716	2.708E-06	2.6828	2.577E-06
1.8593	2.160E-06	0.8728	2.602E-06	1.0744	2.666E-06	1.5139	2.585E-06	2.1713	2.386E-06	2.8125	2.279E-06
1.9522	1.901E-06	0.9139	2.308E-06	1.1255	2.360E-06	1.5866	2.280E-06	2.2758	2.102E-06	2.9483	2.015E-06
2.0497	1.672E-06	0.9569	2.046E-06	1.1790	2.087E-06	1.6627	2.010E-06	2.3853	1.851E-06	3.0908	1.780E-06
2.1521	1.469E-06	1.0019	1.813E-06	1.2350	1.846E-06	1.7426	1.771E-06	2.5001	1.629E-06	3.2401	1.572E-06
2.2596	1.290E-06	1.0491	1.604E-06	1.2937	1.631E-06	1.8262	1.559E-06	2.6204	1.432E-06	3.3967	1.385E-06
2.3725	1.129E-06	1.0985	1.418E-06	1.3551	1.438E-06	1.9139	1.371E-06	2.7465	1.256E-06	3.5608	1.219E-06
2.4911	9.861E-07	1.1503	1.249E-06	1.4195	1.265E-06	2.0058	1.202E-06	2.8787	1.100E-06	3.7329	1.069E-06
2.6155	8.586E-07	1.2044	1.097E-06	1.4870	1.109E-06	2.1021	1.051E-06	3.0173	9.605E-07	3.9132	9.348E-07
2.7462	7.454E-07	1.2611	9.595E-07	1.5576	9.695E-07	2.2030	9.162E-07	3.1625	8.364E-07	4.1023	8.145E-07
2.8834	6.452E-07	1.3205	8.355E-07	1.6316	8.435E-07	2.3088	7.958E-07	3.3147	7.260E-07	4.3005	7.071E-07
3.0274	5.570E-07	1.3827	7.241E-07	1.7091	7.306E-07	2.4197	6.887E-07	3.4742	6.284E-07	4.5083	6.116E-07
3.1787	4.798E-07	1.4478	6.246E-07	1.7904	6.300E-07	2.5358	5.940E-07	3.6414	5.425E-07	4.7261	5.275E-07

Appendix A

Table A-1e: 5 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
3.3375	4.126E-07	1.5160	5.365E-07	1.8754	5.410E-07	2.6576	5.108E-07	3.8167	4.673E-07	4.9545	4.538E-07
3.5042	3.543E-07	1.5874	4.592E-07	1.9645	4.631E-07	2.7852	4.382E-07	4.0003	4.018E-07	5.1938	3.896E-07
3.6792	3.039E-07	1.6621	3.919E-07	2.0579	3.952E-07	2.9189	3.752E-07	4.1929	3.450E-07	5.4448	3.340E-07
3.8631	2.604E-07	1.7404	3.337E-07	2.1556	3.366E-07	3.0590	3.207E-07	4.3946	2.959E-07	5.7079	2.859E-07
4.0560	2.228E-07	1.8224	2.836E-07	2.2581	2.861E-07	3.2059	2.738E-07	4.6061	2.535E-07	5.9837	2.445E-07
4.2587	1.903E-07	1.9082	2.406E-07	2.3654	2.428E-07	3.3598	2.334E-07	4.8278	2.168E-07	6.2728	2.087E-07
4.4714	1.623E-07	1.9980	2.037E-07	2.4777	2.057E-07	3.5211	1.985E-07	5.0602	1.851E-07	6.5758	1.779E-07
4.6948	1.380E-07	2.0921	1.721E-07	2.5955	1.739E-07	3.6902	1.685E-07	5.3037	1.576E-07	6.8936	1.511E-07
4.9294	1.169E-07	2.1906	1.449E-07	2.7188	1.465E-07	3.8673	1.426E-07	5.5589	1.338E-07	7.2267	1.280E-07
5.1756	9.849E-08	2.2938	1.216E-07	2.8480	1.230E-07	4.0530	1.202E-07	5.8265	1.130E-07	7.5758	1.080E-07
5.4342	8.253E-08	2.4018	1.015E-07	2.9833	1.028E-07	4.2476	1.007E-07	6.1069	9.491E-08	7.9419	9.049E-08
5.7057	6.866E-08	2.5149	8.422E-08	3.1250	8.525E-08	4.4515	8.380E-08	6.4008	7.914E-08	8.3256	7.535E-08
5.9907	5.665E-08	2.6333	6.939E-08	3.2735	7.022E-08	4.6653	6.917E-08	6.7088	6.544E-08	8.7279	6.224E-08
6.2900	4.631E-08	2.7573	5.668E-08	3.4290	5.733E-08	4.8892	5.654E-08	7.0317	5.359E-08	9.1496	5.094E-08
6.6042	3.746E-08	2.8872	4.584E-08	3.5920	4.633E-08	5.1240	4.572E-08	7.3701	4.340E-08	9.5916	4.125E-08
6.9342	2.994E-08	3.0231	3.665E-08	3.7626	3.700E-08	5.3700	3.651E-08	7.7248	3.472E-08	10.0551	3.302E-08
7.2806	2.358E-08	3.1655	2.892E-08	3.9414	2.914E-08	5.6278	2.874E-08	8.0966	2.737E-08	10.5409	2.606E-08
7.6443	1.826E-08	3.3145	2.246E-08	4.1287	2.258E-08	5.8980	2.225E-08	8.4862	2.123E-08	11.0502	2.022E-08

Appendix A

Table A-1f: 10 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.0939	1.069E-03	0.0492	1.072E-03	0.0591	1.071E-03	0.0852	1.068E-03	0.1297	1.068E-03	0.1700	1.072E-03
0.0986	1.066E-03	0.0516	1.070E-03	0.0621	1.068E-03	0.0894	1.065E-03	0.1359	1.066E-03	0.1782	1.070E-03
0.1036	1.063E-03	0.0541	1.066E-03	0.0651	1.064E-03	0.0937	1.062E-03	0.1425	1.062E-03	0.1868	1.066E-03
0.1088	1.057E-03	0.0568	1.059E-03	0.0683	1.058E-03	0.0983	1.056E-03	0.1493	1.057E-03	0.1958	1.060E-03
0.1143	1.049E-03	0.0596	1.051E-03	0.0717	1.050E-03	0.1031	1.048E-03	0.1565	1.050E-03	0.2052	1.052E-03
0.1200	1.037E-03	0.0625	1.038E-03	0.0752	1.038E-03	0.1082	1.037E-03	0.1641	1.039E-03	0.2151	1.041E-03
0.1260	1.021E-03	0.0656	1.021E-03	0.0789	1.021E-03	0.1134	1.022E-03	0.1720	1.025E-03	0.2255	1.027E-03
0.1324	1.001E-03	0.0688	1.000E-03	0.0828	1.001E-03	0.1190	1.003E-03	0.1803	1.006E-03	0.2364	1.008E-03
0.1390	9.757E-04	0.0722	9.742E-04	0.0869	9.752E-04	0.1248	9.793E-04	0.1889	9.836E-04	0.2478	9.840E-04
0.1460	9.460E-04	0.0757	9.433E-04	0.0912	9.450E-04	0.1309	9.512E-04	0.1980	9.564E-04	0.2598	9.557E-04
0.1534	9.117E-04	0.0794	9.077E-04	0.0957	9.102E-04	0.1373	9.185E-04	0.2076	9.249E-04	0.2723	9.230E-04
0.1611	8.735E-04	0.0833	8.680E-04	0.1004	8.714E-04	0.1440	8.820E-04	0.2176	8.893E-04	0.2854	8.860E-04
0.1692	8.321E-04	0.0874	8.252E-04	0.1054	8.294E-04	0.1511	8.422E-04	0.2281	8.503E-04	0.2992	8.455E-04
0.1777	7.884E-04	0.0917	7.801E-04	0.1106	7.852E-04	0.1585	8.000E-04	0.2390	8.087E-04	0.3136	8.023E-04
0.1867	7.435E-04	0.0962	7.339E-04	0.1160	7.398E-04	0.1662	7.563E-04	0.2506	7.654E-04	0.3288	7.575E-04
0.1961	6.984E-04	0.1009	6.876E-04	0.1217	6.941E-04	0.1744	7.121E-04	0.2626	7.213E-04	0.3446	7.118E-04
0.2059	6.538E-04	0.1058	6.419E-04	0.1277	6.491E-04	0.1829	6.682E-04	0.2753	6.772E-04	0.3613	6.663E-04
0.2163	6.106E-04	0.1110	5.976E-04	0.1340	6.054E-04	0.1918	6.253E-04	0.2885	6.339E-04	0.3787	6.216E-04
0.2272	5.690E-04	0.1165	5.553E-04	0.1406	5.635E-04	0.2012	5.840E-04	0.3024	5.920E-04	0.3970	5.784E-04
0.2386	5.296E-04	0.1222	5.152E-04	0.1476	5.238E-04	0.2110	5.445E-04	0.3170	5.518E-04	0.4161	5.372E-04
0.2506	4.925E-04	0.1282	4.775E-04	0.1548	4.864E-04	0.2214	5.071E-04	0.3323	5.137E-04	0.4362	4.982E-04
0.2632	4.576E-04	0.1345	4.423E-04	0.1625	4.513E-04	0.2322	4.719E-04	0.3483	4.778E-04	0.4572	4.616E-04
0.2765	4.250E-04	0.1411	4.095E-04	0.1705	4.187E-04	0.2435	4.390E-04	0.3650	4.441E-04	0.4793	4.274E-04
0.2904	3.946E-04	0.1480	3.790E-04	0.1789	3.882E-04	0.2555	4.081E-04	0.3826	4.127E-04	0.5024	3.955E-04
0.3050	3.664E-04	0.1553	3.508E-04	0.1877	3.599E-04	0.2679	3.794E-04	0.4011	3.833E-04	0.5267	3.660E-04
0.3203	3.402E-04	0.1629	3.246E-04	0.1969	3.337E-04	0.2811	3.527E-04	0.4204	3.560E-04	0.5521	3.385E-04
0.3364	3.157E-04	0.1709	3.003E-04	0.2067	3.093E-04	0.2948	3.278E-04	0.4406	3.306E-04	0.5787	3.131E-04
0.3534	2.930E-04	0.1793	2.779E-04	0.2168	2.867E-04	0.3092	3.046E-04	0.4618	3.070E-04	0.6066	2.896E-04
0.3712	2.720E-04	0.1881	2.571E-04	0.2275	2.657E-04	0.3243	2.831E-04	0.4841	2.851E-04	0.6359	2.678E-04
0.3898	2.524E-04	0.1973	2.379E-04	0.2388	2.462E-04	0.3402	2.631E-04	0.5074	2.647E-04	0.6666	2.477E-04
0.4094	2.343E-04	0.2070	2.200E-04	0.2505	2.281E-04	0.3568	2.445E-04	0.5319	2.458E-04	0.6987	2.291E-04
0.4300	2.174E-04	0.2171	2.035E-04	0.2629	2.113E-04	0.3743	2.271E-04	0.5575	2.282E-04	0.7324	2.118E-04
0.4517	2.017E-04	0.2278	1.882E-04	0.2758	1.958E-04	0.3926	2.110E-04	0.5843	2.119E-04	0.7678	1.958E-04
0.4744	1.872E-04	0.2389	1.740E-04	0.2894	1.813E-04	0.4118	1.960E-04	0.6125	1.966E-04	0.8048	1.810E-04
0.4983	1.736E-04	0.2507	1.608E-04	0.3037	1.679E-04	0.4319	1.820E-04	0.6420	1.824E-04	0.8437	1.672E-04
0.5234	1.609E-04	0.2630	1.485E-04	0.3187	1.553E-04	0.4530	1.690E-04	0.6729	1.692E-04	0.8844	1.544E-04
0.5497	1.491E-04	0.2759	1.371E-04	0.3344	1.437E-04	0.4752	1.567E-04	0.7053	1.569E-04	0.9270	1.424E-04
0.5773	1.379E-04	0.2894	1.264E-04	0.3509	1.328E-04	0.4984	1.454E-04	0.7393	1.453E-04	0.9717	1.313E-04
0.6064	1.275E-04	0.3036	1.165E-04	0.3682	1.227E-04	0.5228	1.346E-04	0.7749	1.345E-04	1.0186	1.209E-04
0.6369	1.177E-04	0.3185	1.073E-04	0.3863	1.132E-04	0.5484	1.246E-04	0.8122	1.243E-04	1.0678	1.111E-04
0.6690	1.085E-04	0.3341	9.862E-05	0.4054	1.043E-04	0.5752	1.151E-04	0.8513	1.147E-04	1.1193	1.020E-04

Appendix A

Table A-1f: 10 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.7026	9.979E-05	0.3505	9.057E-05	0.4253	9.598E-05	0.6033	1.062E-04	0.8923	1.057E-04	1.1733	9.346E-05
0.7380	9.162E-05	0.3677	8.308E-05	0.4463	8.822E-05	0.6328	9.778E-05	0.9353	9.714E-05	1.2299	8.548E-05
0.7751	8.393E-05	0.3857	7.610E-05	0.4683	8.097E-05	0.6638	8.986E-05	0.9803	8.911E-05	1.2892	7.803E-05
0.8141	7.672E-05	0.4047	6.964E-05	0.4914	7.422E-05	0.6962	8.241E-05	1.0276	8.157E-05	1.3514	7.110E-05
0.8551	6.999E-05	0.4245	6.366E-05	0.5156	6.795E-05	0.7303	7.543E-05	1.0771	7.449E-05	1.4166	6.468E-05
0.8981	6.373E-05	0.4453	5.813E-05	0.5410	6.214E-05	0.7660	6.891E-05	1.1289	6.790E-05	1.4850	5.874E-05
0.9433	5.793E-05	0.4672	5.305E-05	0.5677	5.677E-05	0.8035	6.284E-05	1.1833	6.176E-05	1.5566	5.328E-05
0.9907	5.258E-05	0.4901	4.838E-05	0.5957	5.182E-05	0.8428	5.722E-05	1.2403	5.608E-05	1.6317	4.827E-05
1.0406	4.768E-05	0.5141	4.410E-05	0.6251	4.728E-05	0.8840	5.203E-05	1.3000	5.086E-05	1.7104	4.370E-05
1.0929	4.319E-05	0.5394	4.019E-05	0.6559	4.312E-05	0.9272	4.727E-05	1.3627	4.607E-05	1.7930	3.953E-05
1.1479	3.911E-05	0.5658	3.661E-05	0.6882	3.931E-05	0.9726	4.291E-05	1.4283	4.169E-05	1.8795	3.574E-05
1.2057	3.539E-05	0.5936	3.335E-05	0.7221	3.583E-05	1.0201	3.893E-05	1.4971	3.770E-05	1.9701	3.231E-05
1.2663	3.202E-05	0.6227	3.037E-05	0.7577	3.265E-05	1.0700	3.530E-05	1.5692	3.407E-05	2.0652	2.919E-05
1.3301	2.896E-05	0.6533	2.766E-05	0.7951	2.975E-05	1.1223	3.200E-05	1.6448	3.078E-05	2.1648	2.637E-05
1.3970	2.619E-05	0.6853	2.518E-05	0.8343	2.710E-05	1.1772	2.900E-05	1.7240	2.780E-05	2.2693	2.382E-05
1.4673	2.368E-05	0.7189	2.292E-05	0.8754	2.469E-05	1.2348	2.628E-05	1.8070	2.510E-05	2.3787	2.150E-05
1.5411	2.140E-05	0.7542	2.086E-05	0.9186	2.249E-05	1.2952	2.381E-05	1.8941	2.266E-05	2.4935	1.940E-05
1.6186	1.933E-05	0.7912	1.898E-05	0.9639	2.047E-05	1.3585	2.156E-05	1.9853	2.044E-05	2.6138	1.751E-05
1.7001	1.745E-05	0.8300	1.726E-05	1.0114	1.863E-05	1.4250	1.952E-05	2.0809	1.844E-05	2.7399	1.578E-05
1.7856	1.575E-05	0.8707	1.568E-05	1.0612	1.694E-05	1.4946	1.765E-05	2.1812	1.661E-05	2.8721	1.421E-05
1.8755	1.419E-05	0.9135	1.423E-05	1.1135	1.539E-05	1.5677	1.596E-05	2.2862	1.496E-05	3.0107	1.279E-05
1.9698	1.277E-05	0.9583	1.290E-05	1.1684	1.397E-05	1.6444	1.442E-05	2.3963	1.346E-05	3.1559	1.149E-05
2.0689	1.148E-05	1.0053	1.168E-05	1.2260	1.265E-05	1.7248	1.300E-05	2.5118	1.209E-05	3.3082	1.031E-05
2.1730	1.030E-05	1.0546	1.056E-05	1.2865	1.144E-05	1.8092	1.171E-05	2.6327	1.084E-05	3.4678	9.231E-06
2.2824	9.215E-06	1.1064	9.519E-06	1.3499	1.033E-05	1.8977	1.052E-05	2.7595	9.702E-06	3.6351	8.253E-06
2.3972	8.232E-06	1.1606	8.567E-06	1.4165	9.292E-06	1.9905	9.432E-06	2.8925	8.668E-06	3.8104	7.366E-06
2.5178	7.336E-06	1.2176	7.693E-06	1.4863	8.343E-06	2.0878	8.440E-06	3.0318	7.729E-06	3.9943	6.563E-06
2.6445	6.524E-06	1.2773	6.893E-06	1.5596	7.470E-06	2.1899	7.535E-06	3.1778	6.878E-06	4.1870	5.837E-06
2.7776	5.790E-06	1.3400	6.164E-06	1.6364	6.671E-06	2.2970	6.712E-06	3.3309	6.108E-06	4.3890	5.184E-06
2.9173	5.130E-06	1.4057	5.501E-06	1.7171	5.943E-06	2.4093	5.965E-06	3.4913	5.415E-06	4.6007	4.598E-06
3.0641	4.537E-06	1.4747	4.902E-06	1.8018	5.282E-06	2.5272	5.291E-06	3.6595	4.792E-06	4.8227	4.073E-06
3.2183	4.007E-06	1.5470	4.361E-06	1.8906	4.685E-06	2.6507	4.684E-06	3.8357	4.235E-06	5.0554	3.605E-06
3.3802	3.535E-06	1.6229	3.876E-06	1.9838	4.149E-06	2.7804	4.141E-06	4.0205	3.738E-06	5.2993	3.188E-06
3.5503	3.116E-06	1.7025	3.442E-06	2.0816	3.669E-06	2.9164	3.656E-06	4.2141	3.296E-06	5.5549	2.817E-06
3.7289	2.744E-06	1.7861	3.053E-06	2.1842	3.240E-06	3.0590	3.224E-06	4.4171	2.903E-06	5.8229	2.487E-06
3.9165	2.415E-06	1.8737	2.707E-06	2.2919	2.859E-06	3.2086	2.841E-06	4.6299	2.555E-06	6.1039	2.194E-06
4.1136	2.123E-06	1.9656	2.398E-06	2.4049	2.520E-06	3.3655	2.501E-06	4.8529	2.247E-06	6.3983	1.935E-06
4.3206	1.865E-06	2.0621	2.122E-06	2.5234	2.220E-06	3.5301	2.199E-06	5.0866	1.974E-06	6.7070	1.704E-06
4.5380	1.636E-06	2.1632	1.877E-06	2.6478	1.953E-06	3.7027	1.933E-06	5.3316	1.733E-06	7.0306	1.498E-06
4.7663	1.434E-06	2.2693	1.658E-06	2.7783	1.716E-06	3.8838	1.696E-06	5.5884	1.519E-06	7.3698	1.316E-06
5.0061	1.254E-06	2.3807	1.461E-06	2.9153	1.506E-06	4.0737	1.486E-06	5.8576	1.330E-06	7.7254	1.153E-06

Appendix A

Table A-1f: 10 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
5.2580	1.094E-06	2.4975	1.286E-06	3.0590	1.320E-06	4.2729	1.301E-06	6.1397	1.162E-06	8.0981	1.008E-06
5.5226	9.531E-07	2.6200	1.129E-06	3.2098	1.154E-06	4.4819	1.136E-06	6.4354	1.014E-06	8.4888	8.796E-07
5.8004	8.279E-07	2.7485	9.891E-07	3.3681	1.006E-06	4.7011	9.895E-07	6.7454	8.819E-07	8.8983	7.654E-07
6.0923	7.172E-07	2.8834	8.636E-07	3.5341	8.754E-07	4.9310	8.598E-07	7.0703	7.656E-07	9.3276	6.642E-07
6.3988	6.195E-07	3.0248	7.518E-07	3.7083	7.593E-07	5.1721	7.451E-07	7.4108	6.631E-07	9.7776	5.748E-07
6.7208	5.337E-07	3.1732	6.522E-07	3.8912	6.566E-07	5.4251	6.439E-07	7.7678	5.728E-07	10.2493	4.960E-07
7.0589	4.586E-07	3.3289	5.640E-07	4.0830	5.661E-07	5.6904	5.549E-07	8.1419	4.936E-07	10.7438	4.270E-07
7.4141	3.930E-07	3.4922	4.861E-07	4.2843	4.866E-07	5.9687	4.769E-07	8.5341	4.243E-07	11.2622	3.666E-07
7.7871	3.359E-07	3.6636	4.176E-07	4.4955	4.170E-07	6.2606	4.087E-07	8.9451	3.638E-07	11.8055	3.141E-07
8.1790	2.865E-07	3.8433	3.577E-07	4.7171	3.564E-07	6.5667	3.493E-07	9.3760	3.113E-07	12.3751	2.684E-07
8.5905	2.438E-07	4.0319	3.055E-07	4.9496	3.037E-07	6.8879	2.978E-07	9.8276	2.657E-07	12.9721	2.289E-07
9.0227	2.070E-07	4.2297	2.602E-07	5.1936	2.581E-07	7.2247	2.533E-07	10.3009	2.263E-07	13.5980	1.948E-07
9.4767	1.753E-07	4.4372	2.209E-07	5.4497	2.187E-07	7.5781	2.148E-07	10.7971	1.923E-07	14.2540	1.654E-07
9.9535	1.480E-07	4.6549	1.870E-07	5.7183	1.848E-07	7.9487	1.817E-07	11.3171	1.629E-07	14.9417	1.400E-07
10.4543	1.245E-07	4.8832	1.577E-07	6.0002	1.556E-07	8.3374	1.531E-07	11.8622	1.376E-07	15.6625	1.182E-07
10.9803	1.044E-07	5.1228	1.325E-07	6.2960	1.306E-07	8.7451	1.286E-07	12.4336	1.158E-07	16.4182	9.946E-08
11.5328	8.709E-08	5.3741	1.108E-07	6.6064	1.090E-07	9.1728	1.074E-07	13.0325	9.703E-08	17.2103	8.332E-08
12.1131	7.227E-08	5.6378	9.214E-08	6.9321	9.053E-08	9.6214	8.931E-08	13.6602	8.090E-08	18.0406	6.950E-08

Appendix A

Table A-1g: 25 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.1066	1.067E-03	0.0504	1.072E-03	0.0613	1.069E-03	0.0934	1.066E-03	0.1544	1.068E-03	0.2076	1.071E-03
0.1122	1.064E-03	0.0530	1.068E-03	0.0645	1.065E-03	0.0982	1.063E-03	0.1622	1.064E-03	0.2182	1.066E-03
0.1181	1.058E-03	0.0558	1.063E-03	0.0679	1.060E-03	0.1033	1.057E-03	0.1704	1.057E-03	0.2293	1.059E-03
0.1243	1.047E-03	0.0587	1.053E-03	0.0714	1.050E-03	0.1086	1.047E-03	0.1790	1.047E-03	0.2410	1.047E-03
0.1309	1.032E-03	0.0617	1.038E-03	0.0752	1.036E-03	0.1142	1.033E-03	0.1880	1.032E-03	0.2533	1.030E-03
0.1378	1.011E-03	0.0649	1.015E-03	0.0791	1.014E-03	0.1201	1.013E-03	0.1974	1.011E-03	0.2662	1.008E-03
0.1451	9.823E-04	0.0683	9.844E-04	0.0832	9.847E-04	0.1263	9.862E-04	0.2074	9.835E-04	0.2797	9.788E-04
0.1527	9.474E-04	0.0719	9.460E-04	0.0876	9.484E-04	0.1328	9.529E-04	0.2178	9.503E-04	0.2940	9.435E-04
0.1608	9.064E-04	0.0756	9.011E-04	0.0921	9.060E-04	0.1397	9.135E-04	0.2288	9.113E-04	0.3089	9.022E-04
0.1692	8.608E-04	0.0796	8.515E-04	0.0970	8.589E-04	0.1469	8.694E-04	0.2404	8.676E-04	0.3247	8.564E-04
0.1782	8.123E-04	0.0837	7.995E-04	0.1020	8.093E-04	0.1544	8.222E-04	0.2525	8.206E-04	0.3412	8.073E-04
0.1876	7.625E-04	0.0881	7.473E-04	0.1074	7.590E-04	0.1624	7.736E-04	0.2652	7.719E-04	0.3586	7.565E-04
0.1974	7.130E-04	0.0927	6.963E-04	0.1130	7.097E-04	0.1708	7.249E-04	0.2786	7.228E-04	0.3768	7.056E-04
0.2079	6.651E-04	0.0975	6.477E-04	0.1189	6.622E-04	0.1796	6.774E-04	0.2926	6.746E-04	0.3960	6.558E-04
0.2188	6.193E-04	0.1026	6.018E-04	0.1251	6.171E-04	0.1888	6.319E-04	0.3073	6.282E-04	0.4162	6.079E-04
0.2304	5.761E-04	0.1080	5.590E-04	0.1316	5.748E-04	0.1986	5.888E-04	0.3228	5.842E-04	0.4374	5.626E-04
0.2425	5.356E-04	0.1136	5.190E-04	0.1385	5.352E-04	0.2088	5.483E-04	0.3391	5.427E-04	0.4597	5.201E-04
0.2553	4.979E-04	0.1195	4.819E-04	0.1457	4.981E-04	0.2196	5.105E-04	0.3562	5.039E-04	0.4831	4.805E-04
0.2688	4.629E-04	0.1258	4.474E-04	0.1533	4.635E-04	0.2309	4.752E-04	0.3741	4.677E-04	0.5077	4.438E-04
0.2829	4.302E-04	0.1323	4.153E-04	0.1613	4.313E-04	0.2428	4.423E-04	0.3930	4.340E-04	0.5335	4.099E-04
0.2979	3.999E-04	0.1392	3.855E-04	0.1698	4.011E-04	0.2553	4.117E-04	0.4128	4.027E-04	0.5607	3.785E-04
0.3136	3.717E-04	0.1465	3.577E-04	0.1786	3.730E-04	0.2685	3.832E-04	0.4336	3.736E-04	0.5892	3.495E-04
0.3301	3.455E-04	0.1541	3.319E-04	0.1879	3.467E-04	0.2823	3.567E-04	0.4555	3.467E-04	0.6192	3.227E-04
0.3475	3.211E-04	0.1622	3.079E-04	0.1978	3.223E-04	0.2969	3.320E-04	0.4784	3.217E-04	0.6508	2.980E-04
0.3658	2.985E-04	0.1706	2.855E-04	0.2081	2.996E-04	0.3122	3.091E-04	0.5025	2.984E-04	0.6839	2.751E-04
0.3851	2.774E-04	0.1795	2.647E-04	0.2190	2.784E-04	0.3283	2.877E-04	0.5278	2.769E-04	0.7187	2.541E-04
0.4054	2.578E-04	0.1889	2.453E-04	0.2304	2.588E-04	0.3452	2.678E-04	0.5544	2.569E-04	0.7553	2.346E-04
0.4268	2.396E-04	0.1987	2.274E-04	0.2424	2.405E-04	0.3630	2.493E-04	0.5824	2.384E-04	0.7938	2.166E-04
0.4493	2.226E-04	0.2091	2.107E-04	0.2551	2.236E-04	0.3817	2.320E-04	0.6117	2.212E-04	0.8342	2.000E-04
0.4730	2.069E-04	0.2200	1.953E-04	0.2684	2.078E-04	0.4014	2.159E-04	0.6426	2.052E-04	0.8767	1.846E-04
0.4980	1.923E-04	0.2315	1.810E-04	0.2824	1.931E-04	0.4221	2.010E-04	0.6750	1.903E-04	0.9214	1.704E-04
0.5242	1.786E-04	0.2435	1.676E-04	0.2972	1.795E-04	0.4439	1.870E-04	0.7090	1.765E-04	0.9683	1.572E-04
0.5519	1.659E-04	0.2562	1.553E-04	0.3127	1.668E-04	0.4668	1.740E-04	0.7447	1.637E-04	1.0176	1.449E-04
0.5810	1.540E-04	0.2696	1.438E-04	0.3291	1.549E-04	0.4908	1.618E-04	0.7822	1.517E-04	1.0694	1.334E-04
0.6116	1.429E-04	0.2837	1.331E-04	0.3462	1.439E-04	0.5161	1.504E-04	0.8217	1.404E-04	1.1239	1.228E-04
0.6439	1.324E-04	0.2984	1.231E-04	0.3643	1.335E-04	0.5427	1.398E-04	0.8631	1.299E-04	1.1811	1.127E-04
0.6779	1.226E-04	0.3140	1.137E-04	0.3834	1.238E-04	0.5707	1.297E-04	0.9066	1.200E-04	1.2412	1.033E-04
0.7136	1.133E-04	0.3304	1.050E-04	0.4034	1.146E-04	0.6001	1.203E-04	0.9522	1.106E-04	1.3044	9.450E-05

Appendix A

Table A-1g: 25 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
0.7512	1.044E-04	0.3476	9.676E-05	0.4244	1.059E-04	0.6311	1.113E-04	1.0002	1.017E-04	1.3709	8.624E-05
0.7909	9.592E-05	0.3657	8.907E-05	0.4466	9.772E-05	0.6636	1.027E-04	1.0506	9.329E-05	1.4407	7.851E-05
0.8326	8.792E-05	0.3848	8.188E-05	0.4699	9.001E-05	0.6978	9.463E-05	1.1036	8.538E-05	1.5140	7.133E-05
0.8765	8.036E-05	0.4049	7.517E-05	0.4945	8.274E-05	0.7338	8.696E-05	1.1592	7.793E-05	1.5911	6.467E-05
0.9227	7.324E-05	0.4260	6.892E-05	0.5203	7.593E-05	0.7717	7.970E-05	1.2176	7.096E-05	1.6721	5.854E-05
0.9714	6.660E-05	0.4482	6.314E-05	0.5475	6.957E-05	0.8114	7.288E-05	1.2790	6.447E-05	1.7573	5.293E-05
1.0226	6.043E-05	0.4716	5.781E-05	0.5761	6.367E-05	0.8533	6.650E-05	1.3434	5.847E-05	1.8468	4.781E-05
1.0765	5.476E-05	0.4962	5.290E-05	0.6062	5.820E-05	0.8973	6.058E-05	1.4112	5.296E-05	1.9408	4.315E-05
1.1333	4.955E-05	0.5220	4.839E-05	0.6378	5.317E-05	0.9435	5.511E-05	1.4823	4.791E-05	2.0396	3.893E-05
1.1931	4.481E-05	0.5493	4.426E-05	0.6712	4.855E-05	0.9922	5.009E-05	1.5570	4.331E-05	2.1435	3.511E-05
1.2560	4.050E-05	0.5779	4.048E-05	0.7062	4.431E-05	1.0433	4.550E-05	1.6354	3.914E-05	2.2527	3.167E-05
1.3222	3.659E-05	0.6081	3.702E-05	0.7431	4.044E-05	1.0971	4.131E-05	1.7179	3.535E-05	2.3674	2.855E-05
1.3919	3.306E-05	0.6398	3.385E-05	0.7819	3.690E-05	1.1537	3.750E-05	1.8044	3.193E-05	2.4879	2.574E-05
1.4654	2.986E-05	0.6731	3.096E-05	0.8228	3.367E-05	1.2132	3.403E-05	1.8954	2.883E-05	2.6146	2.321E-05
1.5426	2.697E-05	0.7082	2.831E-05	0.8657	3.072E-05	1.2757	3.088E-05	1.9909	2.603E-05	2.7478	2.091E-05
1.6240	2.436E-05	0.7452	2.588E-05	0.9109	2.803E-05	1.3415	2.803E-05	2.0912	2.351E-05	2.8877	1.884E-05
1.7096	2.199E-05	0.7840	2.367E-05	0.9585	2.557E-05	1.4107	2.543E-05	2.1966	2.122E-05	3.0347	1.697E-05
1.7998	1.986E-05	0.8249	2.164E-05	1.0086	2.333E-05	1.4834	2.307E-05	2.3073	1.914E-05	3.1893	1.526E-05
1.8947	1.792E-05	0.8679	1.978E-05	1.0613	2.128E-05	1.5599	2.093E-05	2.4236	1.726E-05	3.3517	1.372E-05
1.9946	1.616E-05	0.9132	1.807E-05	1.1167	1.940E-05	1.6403	1.898E-05	2.5457	1.556E-05	3.5223	1.231E-05
2.0998	1.456E-05	0.9608	1.650E-05	1.1750	1.768E-05	1.7249	1.720E-05	2.6740	1.400E-05	3.7017	1.103E-05
2.2106	1.309E-05	1.0109	1.505E-05	1.2364	1.611E-05	1.8139	1.557E-05	2.8088	1.259E-05	3.8902	9.851E-06
2.3272	1.176E-05	1.0636	1.371E-05	1.3010	1.465E-05	1.9074	1.408E-05	2.9504	1.130E-05	4.0883	8.783E-06
2.4499	1.054E-05	1.1191	1.247E-05	1.3689	1.331E-05	2.0057	1.271E-05	3.0990	1.011E-05	4.2965	7.812E-06
2.5791	9.412E-06	1.1775	1.131E-05	1.4404	1.206E-05	2.1091	1.144E-05	3.2552	9.034E-06	4.5153	6.931E-06
2.7151	8.388E-06	1.2389	1.023E-05	1.5157	1.091E-05	2.2179	1.028E-05	3.4193	8.051E-06	4.7452	6.135E-06
2.8583	7.454E-06	1.3035	9.213E-06	1.5949	9.822E-06	2.3322	9.199E-06	3.5916	7.157E-06	4.9868	5.419E-06
3.0090	6.606E-06	1.3714	8.272E-06	1.6782	8.818E-06	2.4525	8.209E-06	3.7726	6.348E-06	5.2407	4.779E-06
3.1677	5.840E-06	1.4430	7.400E-06	1.7658	7.888E-06	2.5789	7.300E-06	3.9627	5.618E-06	5.5076	4.209E-06
3.3348	5.153E-06	1.5182	6.597E-06	1.8580	7.030E-06	2.7119	6.472E-06	4.1624	4.963E-06	5.7881	3.703E-06
3.5107	4.538E-06	1.5974	5.862E-06	1.9551	6.244E-06	2.8517	5.720E-06	4.3722	4.379E-06	6.0828	3.255E-06
3.6958	3.993E-06	1.6807	5.196E-06	2.0572	5.530E-06	2.9987	5.044E-06	4.5926	3.859E-06	6.3926	2.860E-06
3.8907	3.509E-06	1.7683	4.596E-06	2.1647	4.885E-06	3.1534	4.438E-06	4.8240	3.397E-06	6.7181	2.511E-06
4.0959	3.082E-06	1.8605	4.059E-06	2.2777	4.307E-06	3.3159	3.899E-06	5.0671	2.989E-06	7.0602	2.204E-06
4.3119	2.705E-06	1.9576	3.580E-06	2.3967	3.792E-06	3.4869	3.422E-06	5.3225	2.627E-06	7.4197	1.933E-06
4.5393	2.373E-06	2.0596	3.156E-06	2.5219	3.335E-06	3.6667	3.001E-06	5.5907	2.309E-06	7.7975	1.694E-06
4.7787	2.080E-06	2.1671	2.780E-06	2.6536	2.931E-06	3.8558	2.629E-06	5.8725	2.027E-06	8.1946	1.484E-06
5.0308	1.822E-06	2.2801	2.447E-06	2.7922	2.574E-06	4.0546	2.302E-06	6.1684	1.778E-06	8.6119	1.297E-06

Appendix A

Table A-1g: 25 Hz Seismic Hazard Curves at North Anna

Mean		5th Fractile		16th Fractile		50th Fractile		84th Fractile		95th Fractile	
PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP	PSA (g)	AEP
5.2961	1.594E-06	2.3990	2.153E-06	2.9380	2.258E-06	4.2636	2.014E-06	6.4793	1.557E-06	9.0504	1.132E-06
5.5754	1.392E-06	2.5241	1.892E-06	3.0915	1.981E-06	4.4834	1.760E-06	6.8058	1.362E-06	9.5113	9.859E-07
5.8694	1.213E-06	2.6557	1.661E-06	3.2530	1.735E-06	4.7146	1.536E-06	7.1488	1.188E-06	9.9956	8.569E-07
6.1789	1.055E-06	2.7942	1.456E-06	3.4229	1.517E-06	4.9577	1.339E-06	7.5091	1.034E-06	10.5046	7.430E-07
6.5048	9.143E-07	2.9399	1.273E-06	3.6017	1.324E-06	5.2133	1.164E-06	7.8875	8.963E-07	11.0395	6.427E-07
6.8479	7.900E-07	3.0932	1.110E-06	3.7898	1.152E-06	5.4821	1.009E-06	8.2850	7.748E-07	11.6017	5.546E-07
7.2090	6.804E-07	3.2545	9.639E-07	3.9877	9.989E-07	5.7647	8.722E-07	8.7026	6.674E-07	12.1924	4.775E-07
7.5892	5.841E-07	3.4242	8.342E-07	4.1960	8.634E-07	6.0620	7.515E-07	9.1411	5.729E-07	12.8133	4.104E-07
7.9894	4.999E-07	3.6028	7.191E-07	4.4152	7.433E-07	6.3745	6.454E-07	9.6018	4.902E-07	13.4658	3.520E-07
8.4108	4.265E-07	3.7907	6.173E-07	4.6458	6.372E-07	6.7032	5.524E-07	10.0857	4.181E-07	14.1515	3.015E-07
8.8544	3.631E-07	3.9884	5.277E-07	4.8885	5.442E-07	7.0488	4.714E-07	10.5940	3.556E-07	14.8721	2.579E-07
9.3213	3.084E-07	4.1964	4.495E-07	5.1438	4.629E-07	7.4122	4.012E-07	11.1279	3.018E-07	15.6294	2.203E-07
9.8129	2.614E-07	4.4152	3.816E-07	5.4125	3.924E-07	7.7944	3.405E-07	11.6887	2.556E-07	16.4253	1.878E-07
10.3304	2.211E-07	4.6455	3.229E-07	5.6952	3.316E-07	8.1963	2.883E-07	12.2778	2.160E-07	17.2617	1.600E-07
10.8752	1.866E-07	4.8877	2.725E-07	5.9927	2.794E-07	8.6189	2.435E-07	12.8965	1.821E-07	18.1407	1.360E-07
11.4488	1.572E-07	5.1426	2.293E-07	6.3057	2.347E-07	9.0633	2.052E-07	13.5465	1.533E-07	19.0645	1.154E-07
12.0526	1.319E-07	5.4108	1.923E-07	6.6350	1.967E-07	9.5306	1.724E-07	14.2292	1.286E-07	20.0353	9.763E-08
12.6882	1.104E-07	5.6929	1.607E-07	6.9816	1.641E-07	10.0220	1.443E-07	14.9463	1.077E-07	21.0555	8.240E-08
13.3574	9.201E-08	5.9898	1.338E-07	7.3462	1.364E-07	10.5387	1.203E-07	15.6995	8.981E-08	22.1277	6.930E-08
14.0618	7.630E-08	6.3022	1.107E-07	7.7300	1.128E-07	11.0820	9.976E-08	16.4907	7.461E-08	23.2545	5.805E-08
14.8034	6.290E-08	6.6308	9.106E-08	8.1337	9.262E-08	11.6534	8.222E-08	17.3218	6.169E-08	24.4387	4.839E-08
15.5841	5.149E-08	6.9766	7.430E-08	8.5585	7.550E-08	12.2543	6.725E-08	18.1948	5.071E-08	25.6831	4.010E-08
16.4060	4.180E-08	7.3405	6.007E-08	9.0056	6.097E-08	12.8861	5.453E-08	19.1117	4.139E-08	26.9910	3.299E-08
17.2712	3.360E-08	7.7233	4.804E-08	9.4760	4.871E-08	13.5505	4.376E-08	20.0749	3.351E-08	28.3654	2.691E-08

Appendix A

Table A-2a: Computed median and logarithmic standard deviation of the site amplification at frequencies of 0.5, 1.0, 2.5, 5.0, 10, 25, and 100 Hz for the single-corner seismological model

Frequency	0.5 Hz			1.0 Hz			2.5 Hz			5.0 Hz		
Motion Name	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD
G001	7.04E-03	1.01E+00	6.04E-03	1.28E-02	1.01E+00	1.06E-02	2.05E-02	1.05E+00	3.97E-02	2.38E-02	1.20E+00	1.43E-01
G005	1.46E-02	1.02E+00	1.13E-02	3.05E-02	1.02E+00	1.57E-02	6.04E-02	1.07E+00	4.46E-02	8.86E-02	1.22E+00	1.49E-01
G010	2.03E-02	1.02E+00	1.31E-02	4.41E-02	1.03E+00	1.72E-02	9.27E-02	1.07E+00	4.57E-02	1.44E-01	1.23E+00	1.50E-01
G020	3.16E-02	1.03E+00	1.44E-02	7.05E-02	1.03E+00	1.82E-02	1.54E-01	1.07E+00	4.62E-02	2.47E-01	1.23E+00	1.50E-01
G030	4.09E-02	1.03E+00	1.50E-02	9.22E-02	1.03E+00	1.86E-02	2.04E-01	1.08E+00	4.65E-02	3.33E-01	1.23E+00	1.50E-01
G040	5.05E-02	1.03E+00	1.54E-02	1.15E-01	1.04E+00	1.89E-02	2.57E-01	1.08E+00	4.67E-02	4.24E-01	1.24E+00	1.51E-01
G050	5.88E-02	1.03E+00	1.57E-02	1.34E-01	1.04E+00	1.91E-02	3.03E-01	1.08E+00	4.68E-02	5.03E-01	1.24E+00	1.51E-01
G075	8.04E-02	1.03E+00	1.61E-02	1.85E-01	1.04E+00	1.95E-02	4.24E-01	1.08E+00	4.70E-02	7.10E-01	1.24E+00	1.51E-01
G100	1.00E-01	1.03E+00	1.64E-02	2.33E-01	1.04E+00	1.97E-02	5.35E-01	1.08E+00	4.72E-02	9.02E-01	1.24E+00	1.51E-01
G125	1.21E-01	1.03E+00	1.66E-02	2.82E-01	1.04E+00	1.99E-02	6.51E-01	1.08E+00	4.73E-02	1.10E+00	1.24E+00	1.51E-01
G150	1.41E-01	1.03E+00	1.67E-02	3.30E-01	1.04E+00	2.00E-02	7.65E-01	1.08E+00	4.74E-02	1.30E+00	1.24E+00	1.52E-01

Frequency	10 Hz			25 Hz			100 Hz		
Motion Name	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD
G001	2.22E-02	1.52E+00	2.12E-01	1.32E-02	1.32E+00	1.11E-01	1.05E-02	1.26E+00	1.06E-01
G005	1.14E-01	1.57E+00	2.23E-01	1.01E-01	1.40E+00	1.78E-01	5.13E-02	1.42E+00	1.11E-01
G010	2.01E-01	1.58E+00	2.24E-01	2.08E-01	1.39E+00	1.89E-01	1.01E-01	1.43E+00	1.04E-01
G020	3.60E-01	1.58E+00	2.25E-01	4.08E-01	1.39E+00	1.94E-01	2.03E-01	1.43E+00	1.02E-01
G030	4.96E-01	1.58E+00	2.25E-01	5.84E-01	1.39E+00	1.96E-01	2.97E-01	1.42E+00	1.01E-01
G040	6.40E-01	1.59E+00	2.25E-01	7.73E-01	1.39E+00	1.98E-01	4.02E-01	1.42E+00	1.01E-01
G050	7.65E-01	1.59E+00	2.26E-01	9.39E-01	1.39E+00	1.99E-01	4.95E-01	1.42E+00	1.01E-01
G075	1.09E+00	1.59E+00	2.26E-01	1.38E+00	1.39E+00	2.00E-01	7.47E-01	1.41E+00	1.02E-01
G100	1.40E+00	1.59E+00	2.26E-01	1.79E+00	1.39E+00	2.01E-01	9.87E-01	1.41E+00	1.03E-01
G125	1.72E+00	1.59E+00	2.27E-01	2.22E+00	1.39E+00	2.01E-01	1.24E+00	1.41E+00	1.04E-01
G150	2.03E+00	1.59E+00	2.27E-01	2.65E+00	1.39E+00	2.02E-01	1.49E+00	1.41E+00	1.04E-01

Appendix A

Table A-2b: Computed median and logarithmic standard deviation of the site amplification at frequencies of 0.5, 1.0, 2.5, 5.0, 10, 25, and 100 Hz for the double-corner seismological model

Frequency	0.5 Hz			1.0 Hz			2.5 Hz			5.0 Hz		
Motion Name	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD
G001	2.26E-03	1.01E+00	9.67E-03	6.72E-03	1.02E+00	1.50E-02	2.00E-02	1.06E+00	4.62E-02	2.74E-02	1.21E+00	1.50E-01
G005	4.56E-03	1.02E+00	1.47E-02	1.53E-02	1.03E+00	1.90E-02	5.64E-02	1.08E+00	4.96E-02	9.82E-02	1.23E+00	1.54E-01
G010	6.16E-03	1.03E+00	1.63E-02	2.15E-02	1.04E+00	2.01E-02	8.45E-02	1.08E+00	5.01E-02	1.57E-01	1.24E+00	1.54E-01
G020	9.00E-03	1.03E+00	1.70E-02	3.22E-02	1.04E+00	2.09E-02	1.32E-01	1.08E+00	5.03E-02	2.56E-01	1.24E+00	1.54E-01
G030	1.17E-02	1.03E+00	1.70E-02	4.22E-02	1.04E+00	2.12E-02	1.76E-01	1.09E+00	5.05E-02	3.47E-01	1.25E+00	1.54E-01
G040	1.42E-02	1.04E+00	1.70E-02	5.17E-02	1.04E+00	2.15E-02	2.18E-01	1.09E+00	5.05E-02	4.35E-01	1.25E+00	1.54E-01
G050	1.64E-02	1.04E+00	1.69E-02	6.03E-02	1.04E+00	2.16E-02	2.56E-01	1.09E+00	5.06E-02	5.14E-01	1.25E+00	1.54E-01
G075	2.20E-02	1.04E+00	1.68E-02	8.15E-02	1.04E+00	2.19E-02	3.50E-01	1.09E+00	5.07E-02	7.12E-01	1.25E+00	1.54E-01
G100	2.74E-02	1.04E+00	1.67E-02	1.02E-01	1.04E+00	2.20E-02	4.41E-01	1.09E+00	5.08E-02	9.04E-01	1.25E+00	1.54E-01
G125	3.26E-02	1.04E+00	1.67E-02	1.22E-01	1.05E+00	2.22E-02	5.29E-01	1.09E+00	5.08E-02	1.09E+00	1.25E+00	1.54E-01
G150	3.81E-02	1.04E+00	1.68E-02	1.42E-01	1.05E+00	2.23E-02	6.21E-01	1.09E+00	5.09E-02	1.28E+00	1.25E+00	1.55E-01

Frequency	10 Hz			25 Hz			100 Hz		
Motion Name	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD	Input PSA [g]	Median	Log-SD
G001	2.54E-02	1.55E+00	2.19E-01	1.35E-02	1.37E+00	1.21E-01	1.07E-02	1.32E+00	1.29E-01
G005	1.28E-01	1.58E+00	2.26E-01	1.04E-01	1.41E+00	1.74E-01	5.24E-02	1.45E+00	1.22E-01
G010	2.26E-01	1.59E+00	2.27E-01	2.21E-01	1.41E+00	1.88E-01	1.03E-01	1.46E+00	1.13E-01
G020	3.89E-01	1.59E+00	2.27E-01	4.27E-01	1.40E+00	1.94E-01	2.02E-01	1.46E+00	1.07E-01
G030	5.40E-01	1.60E+00	2.28E-01	6.22E-01	1.40E+00	1.97E-01	3.00E-01	1.45E+00	1.05E-01
G040	6.87E-01	1.60E+00	2.28E-01	8.15E-01	1.40E+00	1.98E-01	4.02E-01	1.44E+00	1.04E-01
G050	8.20E-01	1.60E+00	2.28E-01	9.92E-01	1.40E+00	1.99E-01	4.97E-01	1.44E+00	1.04E-01
G075	1.15E+00	1.60E+00	2.28E-01	1.44E+00	1.40E+00	2.01E-01	7.46E-01	1.43E+00	1.04E-01
G100	1.48E+00	1.60E+00	2.29E-01	1.88E+00	1.40E+00	2.02E-01	9.95E-01	1.43E+00	1.05E-01
G125	1.79E+00	1.60E+00	2.29E-01	2.31E+00	1.40E+00	2.03E-01	1.24E+00	1.42E+00	1.05E-01
G150	2.12E+00	1.60E+00	2.29E-01	2.77E+00	1.40E+00	2.03E-01	1.50E+00	1.42E+00	1.06E-01