Charles R. Pierce
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SOUTHERN COMPANY

March 31, 2014

Docket Nos.: 50-321
50-366

NL-14-0343

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Edwin I. Hatch Nuclear Plant – Units 1 and 2
Seismic Hazard and Screening Report for CEUS Sites

References:

1. NRC Letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 10 CFR 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. ML13101A379.
3. NRC Letter, EPRI 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. ML13106A331.
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. ML12333A170.
5. NRC Letter, Endorsement of EPRI Final Draft Report 1025287, Seismic Evaluation Guidance, dated February 15, 2013. ML12319A074.

Ladies and Gentlemen:

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 Evaluation 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 Evaluation 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

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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.

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

The attached Seismic Hazard Evaluation and Screening Report for the Edwin I. Hatch Nuclear Plant (HNP) site provides the information described in Section 4 of Reference 4 in accordance with the schedule identified in Reference 2.

This letter contains no NRC regulatory commitments. If you have any questions, please contact John Giddens at 205.992.7924.

Mr. C.R. Pierce states he is Director of Regulatory Affairs of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

C.R. Pierce

C.R. Pierce
Director – Regulatory Affairs

CRP/JMG/RCW

Sworn to and subscribed before me this 31 *day of* March*, 2014.*

Laura L. Crugdt
Notary Public

My commission expires: 10/8/2017

Enclosure 1: Edwin I. Hatch Nuclear Plant - Units 1 and 2
Seismic Hazard Reevaluation and Screening for Risk Evaluation

cc: Southern Nuclear Operating Company
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Mr. D. R. Vineyard, Vice President – Hatch
Mr. B. L. Ivey, Vice President – Regulatory Affairs
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U. S. Nuclear Regulatory Commission
Mr. V. M. McCree, Regional Administrator
Mr. E. D. Morris, Senior Resident Inspector - Hatch
Mr. R. E. Martin, Senior Project Manager – Hatch

State of Georgia
Mr. J. H. Turner, Environmental Director Protection Division

SOUTHERN COMPANY

Enclosure 1 to SNC Letter
NL-14-0343

Edwin I. Hatch Nuclear Plant
Units 1 and 2

Response to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Fukushima Near-Term Task Force Recommendation 2.1: Seismic for Seismic Hazard Reevaluation and Screening for Risk Evaluation

This report provides information in response to NRC's March 12, 2012, 10CFR50.54(f) letter requesting nuclear power plant licensees to perform seismic hazard reevaluation and screening for risk evaluation pursuant to the recommendations in NRC's Near-Term Task Force review of the accident at the Fukushima Dai-ichi nuclear facility.

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 Commission 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 50.54(f) letter (NRC, 2012) 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. Depending on the comparison between the reevaluated seismic hazard and the current design basis, the result is either no further risk evaluation or the performance of a seismic risk assessment. Risk assessment approaches acceptable to the staff include a seismic probabilistic risk assessment (SPRA), or a seismic margin assessment (SMA). Based upon the risk assessment results, the NRC staff will determine whether additional regulatory actions are necessary.

This report provides the information requested in items (1) through (7) of the "Requested Information" section and Attachment 1 of the 50.54(f) letter pertaining to NTTF Recommendation 2.1 for Plant Hatch Units 1 and 2, located in Appling County, Georgia. In providing this information, Southern Nuclear Operating Company (SNC) followed the guidance provided in the *Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (EPRI 1025287, 2013a). The Augmented Approach, *Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (EPRI 3002000704, 2013c), has been developed as the process for evaluating critical plant equipment as an interim action to demonstrate additional plant safety margin, prior to performing the complete plant seismic risk evaluations.

The original geologic and seismic siting investigations for Plant Hatch Unit 1 predate the Appendix A to 10 CFR Part 100 and General Design Criterion (GDC) 2 in Appendix A to 10 CFR Part 50, however, Unit 1 is considered to meet the intent of GDC 2. Plant Hatch Unit 2 was performed in accordance with Appendix A to 10 CFR Part 100 and meets General Design Criterion 2 in Appendix A to 10 CFR Part 50.

In response to the 50.54(f) letter and following the guidance provided in the SPID (EPRI 1025287, 2013a), a seismic hazard reevaluation was performed. For screening purposes, a Ground Motion Response Spectrum (GMRS) was developed.

Based on the results of the screening evaluation, Plant Hatch Units 1 and 2 screens in for a risk evaluation, a Spent Fuel evaluation, and a High Frequency evaluation as part of the risk evaluation.

2.0 Seismic Hazard Reevaluation

Plant Hatch Units 1 and 2 is located in Appling and Toombs Counties, Georgia, at the intersection of the Altamaha River with U.S. No.1. It is located about 98 miles southeast of Macon, Georgia, and about 73 miles northwest of Brunswick, Georgia.

The site is located in the Coastal Terraces subprovince of the Atlantic Coastal Plain physiographic province. The site is underlain by about 4,000 feet of relatively unconsolidated Mesozoic and Cenozoic sands, gravels, clays, marls, claystones, sandstones, and limestones. These strata, overlying basaltic basement rock of pre-Cretaceous age, dip and thicken seaward. No structural features affect the material underlying the site. No major or minor faults are near the site, nor were any local faults discovered during field mapping, exploratory drilling, and construction. The Hawthorn Formation of Miocene to Pilocene age is the foundation-bearing stratum for the major plant structures. It consists primarily of sand, clay, and cemented sands and clay layers. There are no zones of deformation, alteration, or weakness within the Hawthorn Formation.

The site is within a region of infrequent seismic activity. No earthquakes within 200 miles of the site, including those of the Charleston area about 150 miles from the site, produced Modified Mercalli intensities at the site greater than VI. Historically, reported earthquakes occurring in other areas have not produced intensities greater than VI at the site. The design basis earthquake (DBE) is conservatively selected as modified Mercalli Intensity VII. This intensity corresponds with the highest damage sustained at Savannah, Georgia, during the 1886 Charleston event. An intensity of VII (MM) is equivalent to 0.12 g on both the Neumann (1954) and Hershberger (1956) curves. However, a horizontal surface acceleration of 0.15 g is conservatively selected for the DBE. Hatch Unit 1 was licensed separately from Hatch Unit 2. As a result the DBE spectral shape for Unit 1 is the Housner spectral shape and Hatch Unit 2 DBE spectral shape is the Modified Newmark spectral shape.

2.1 Regional and Local Geology

The regional and site (local) geology is described in detail in HNP-1 and 2 FSAR (SNC, 2014e) Section 2.5.1.1 and 2.5.1.2, and is summarized herein. The Edwin I. Hatch Nuclear Plant is on the south bank of the Altamaha River about 10 miles north of Baxley, Georgia, and about 73 miles northwest of Brunswick, Georgia. The site is within the Atlantic Coastal Plain physiographic province. Within 200 miles of the site are parts of three other major physiographic provinces: the Blue Ridge, Piedmont, and East Gulf Coastal Plain. The first two provinces are associated with the Appalachian Mountain System. They are separated from the Coastal Plain province by the Fall Line, a break in slope represented by rapids in the major streams about 80 miles northwest of the site.

The Blue Ridge province trends northeastward across the northwest corner of Georgia. Elevations in the province range from a high of over 6,000 feet in North Carolina to less than 2,000 feet in Alabama where the Blue Ridge rocks dip below Coastal Plain sediments at the Fall

Line. In Georgia, local relief approaches 200 feet, with rounded summits nearly 4,000 feet above sea level. The summits and valleys in the province are distinctly nonlinear, reflecting both the lack of structural control and the erosive effects of the well-developed drainage system that flows generally transverse to the northeastern trend of the Appalachians. The boundary with the Piedmont province to the southeast is the Brevard Fault Zone and is marked by a somewhat obscured, northeast-trending topographic lineation in Georgia. The nearest approach of the Blue Ridge province to the site is about 185 miles.

The Piedmont is a rolling, southeast-sloping plain between the Blue Ridge on the northwest and the Coastal Plain provinces on the south and southeast. The plain's surface is broken by numerous hills and ridges that rise as monadnocks up to 1,000 feet high, although local relief is generally less than 200 feet. The seaward edge of the Piedmont province is marked by the Fall Line, where Piedmont rocks dip below the mostly unconsolidated material of the Coastal Plain provinces. The Piedmont is about 80 miles northwest of the site.

The Atlantic and East Gulf Coastal Plain provinces extend from the Fall Line to the Atlantic Ocean and Gulf of Mexico, respectively. The Atlantic Coastal Plain is characterized by nearly flat-lying terrace surfaces, underlain by limestone or unconsolidated sand and clay that occur as narrow belts parallel to the coast. By contrast, the wider subprovince belts of the East Gulf Coastal Plain consist of numerous ridges or cuestas separated by low valleys or inner lowlands. Rocks underlying the East Gulf subprovinces vary in their resistance to erosion and range from sandstone, shale, and limestone to softer clay, sand, and marl. The transition zone between the two major provinces is in central Georgia, about 60 miles west of the site, between the eastward flowing Ocmulgee River and the southward flowing Flint River.

Rocks underlying the upper Mesozoic and Cenozoic coastal plain deposits vary in age and lithology. The basement rocks in Georgia consist of Precambrian and Paleozoic high-grade metamorphics, granite, diorite, and some volcanic rhyolites in southeast Georgia. In the tri-state area of southeastern Alabama, southwestern Georgia, and northern Florida, the coastal plain sediments are underlain by tightly consolidated, clastic sedimentary rocks. The rocks contain many fossils which range in age from Cambrian to Silurian. A well drilled in Appling County, Georgia, less than 5 miles from the site, ended in basalt of probable Triassic age at a reported depth of 4,108 feet.

The top of basement rock beneath the East Gulf and Atlantic Coastal Plains represents a portion of the erosional surface developed on deformed Appalachian Belt rocks prior to or during the Jurassic. The surface is exposed inland from the Fall Line where the overlapping wedge of younger coastal plain material terminates. Geophysical data suggest the presence of general north-to-northeasterly trends in the basement underlying the Atlantic Coastal Plain. These trends may be due to lithologic or structural variations in the basement rocks, or to topographic relief developed on a pre-Cretaceous erosion surface. Seismic surveys and well borings reveal an irregular surface with a general seaward slope for the top of basement rocks underlying the Coastal Plain provinces.

Overlying the Paleozoic basement rocks, the Atlantic and East Gulf Coastal Plain sediments range in age from Triassic to Holocene. These sediments generally consist of alternating layers of relatively unconsolidated sand, sandstone, shale, clay, and limestone. Triassic deposits in the form of red beds occur in isolated grabens underlying the Atlantic Coastal Plain. No Jurassic strata are known to exist in the Atlantic Coastal Plain, and pre-Cretaceous rocks are not exposed in either Coastal Plain province.

Cretaceous through Holocene sediments are found at the surface in both coastal plain areas. The outcrop pattern, with bands of older strata lying landward of younger strata, reflects the gentle seaward dip of the deposits. In Georgia, this dip is between 5 and 50 feet/mile. Regionally, the dip increases with depth as a result of seaward thickening of the coastal plain deposits. The sediments consist of gravels, sands, silts, clays, marls, and their consolidated equivalents, such as sandstone and limestone. Numerous transgressions and regressions of the sea have resulted in the interfingering of marine and nonmarine deposits. The total thickness of these units ranges from a feather edge along the Fall Line to more than 7,500 feet in southwestern Georgia.

The site itself is within the Coastal Terraces subprovince of the Atlantic Coastal Plain physiographic province. The Coastal Terraces subprovince consists of at least seven terraces arranged in belts parallel to the Atlantic coast and extending from the Fall Line to the ocean. The nearly flat terrace surfaces slope gently seaward, although over 100 feet of relief may be developed near major stream valleys traversing the terraces. The terrace surfaces near the site are the Brandywine and Coharie Terraces, which are underlain by sandy clay and clayey sand of Pliocene to early Pleistocene ages. Over most of the site, the terrace surfaces have been destroyed by fluvial processes of the Altamaha River and its local tributaries. As a result, the southern part of the site occupies a gentle, dissected slope between the terraces to the south and the Altamaha River valley to the north, while the northern and eastern parts of the site are within the nearly flat Altamaha River flood plain.

During the initial geologic reconnaissance prior to preparation of the Unit 2 Preliminary Safety Analysis Report (PSAR), two areas of possible faulting were postulated to exist within 3 miles of the plant site. These areas are located about 2 miles south of the site near Bay Creek in Appling County and about 2.5 miles northeast of the site in southern Toombs County. Subsequent investigations concluded that no faulting exists in these areas. Observations cited as evidence for this faulting are more representative of deltaic and fluvial processes than of tectonic or structural origin.

In summary, the geologic conditions at the site are typical of the geology of the Atlantic Coastal Plain province. Deep borings 5 miles west of the site in Appling County and 10 miles north of the site in Toombs County indicate that pre-Cretaceous basement rock underlying the site consists of arkosic sandstone, and basalt or diabase. These lithologies are similar to Triassic age rocks found elsewhere along the Atlantic seaboard. Overlying the basement rocks are relatively unconsolidated sedimentary units ranging in age from Early Cretaceous to Holocene. These units dip southward and southeastward at 5 to 50 feet/mile and thicken downdip. Sea

level fluctuations resulted in erosion of some of the units after their deposition. Moderate relief was developed during low sea level stands and before deposition of the next stratigraphic sequence. The only structural feature near the site is the Southeast Georgia embayment, the inland edge of which is 11 miles east of the site. The embayment has had little or no influence on geologic formations underlying the site.

2.2 Probabilistic Seismic Hazard Analysis

2.2.1 Probabilistic Seismic Hazard Analysis Results

LCI (2013a) is the source of the information presented in the following section.

In accordance with the 50.54(f) letter and following the guidance in the SPID (EPRI 1025287, 2013a), a probabilistic seismic hazard analysis (PSHA) was completed (LCI, 2013a) using the recently developed Central and Eastern United States Seismic Source Characterization (CEUS-SSC) for Nuclear Facilities (CEUS-SSC, 2012) together with the updated EPRI Ground-Motion Model (GMM) for the CEUS (EPRI 3002000717, 2013b). For the PSHA, a lower-bound moment magnitude (M_w) of 5.0 was used, as specified in the 50.54(f) letter (NRC, 2012).

For the PSHA (LCI, 2013a), the CEUS-SSC background seismic sources out to a distance of 400 miles (640 km) around Hatch were included. This distance exceeds the 200 mile (320 km) recommendation contained in NRC (2007) 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 Matrgin (ECC-AM)
3. Extended Continental Crust – Gulf Coast (ECC_GC)
4. Gulf Highly Extended Crust (GHEX)
5. Mesozoic and younger extended prior – narrow (MESE-N)
6. Mesozoic and younger extended prior – wide (MESE-W)
7. Midcontinent-Craton alternative A (MIDC_A)
8. Midcontinent-Craton alternative B (MIDC_B)
9. Midcontinent-Craton alternative C (MIDC_C)
10. Midcontinent-Craton alternative D (MIDC_D)
11. Non-Mesozoic and younger extended prior – narrow (NMESE-N)
12. Non-Mesozoic and younger extended prior – wide (NMESE-W)
13. Paleozoic Extended Crust – narrow (PEZ_N)
14. Paleozoic Extended Crust – wide (PEZ_W)
15. Study region (STUDY_R)

Large magnitude CEUS-SSC (2012) Repeated Large Magnitude Earthquake (RLME) sources within 1,000 km of the site were included in the analysis. These sources are:

1. Charleston
2. Commerce

3. Eastern Rift Margin Fault northern segment (ERM-N)
4. Eastern Rift Margin Fault southern segment (ERM-S)
5. Marianna
6. New Madrid Fault System (NMFS)
7. Wabash Valley

For each of the above background and RLME sources, the mid-continent version of the updated CEUS EPRI GMM (EPRI 3002000717, 2013b) was used.

2.2.2 Base Rock Seismic Hazard Curves

Hazard curves at Hatch are calculated for base rock conditions (LCI, 2013a).

The procedure to develop probabilistic seismic hazard curves for hard rock follows standard techniques documented in the technical literature (e.g., McGuire, 2004). Separate seismic hazard calculations are conducted for the 7 spectral frequencies for which ground motion equations are available (100 Hz=peak ground acceleration or PGA, 25 Hz, 10 Hz, 5 Hz, 2.5 Hz, 1 Hz, and 0.5 Hz). As discussed in Section 2.2.1, ground motion equations from the updated EPRI Ground-Motion Model (GMM) for the CEUS (EPRI 3002000717, 2013b) were used for the calculation of base rock hazard. All spectral accelerations presented herein correspond to 5% of critical damping (LCI, 2013a). Figure 2.2.2-1 shows the mean base rock seismic hazard curves for the 7 spectral frequencies. The digital values for the mean and fractile hazard curves are provided in Table 2.2.2-1a through Table 2.2.2-1g.

Deaggregation of seismic hazard is calculated by determining the contribution by moment magnitude (M_w), distance (R), and number of logarithmic standard deviations from the median spectral amplitude (ε), grouping the contributions by M_w, R, and ε bin (LCI, 2013b). The contributions are calculated for individual seismic sources and are aggregated for all sources. The deaggregations are calculated by spectral frequency and mean annual frequency of exceedance (MAFE).

Deaggregation and determination of controlling magnitudes and distances (LCI, 2013b) follows the methodology presented in Regulatory Guide 1.208 (NRC, 2007). Log-distance is used in the calculation of the controlling distances and linear-magnitude is used in calculating the controlling magnitudes. When a substantial portion (> 5%) of the low frequency hazard (average of 1 and 2.5 Hz) is from distant sources (> 100 km), the controlling M_w and distances are determined only from contributions from hazard at distances greater than 100 km. The resulting mean magnitude and distance values from the controlling events are listed in Table 2.2.2-2 (LCI, 2013b).

Table 2.2.2-1a: Mean and Fractile Base Rock Seismic Hazard Curves for 100 Hz (PGA) at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	3.64E-02	2.01E-02	3.01E-02	3.68E-02	4.37E-02	4.77E-02
0.001	2.76E-02	1.32E-02	2.16E-02	2.76E-02	3.42E-02	3.95E-02
0.005	9.08E-03	3.90E-03	5.83E-03	8.47E-03	1.16E-02	1.79E-02
0.01	4.70E-03	1.77E-03	2.64E-03	4.19E-03	6.26E-03	1.07E-02
0.015	3.08E-03	9.65E-04	1.49E-03	2.64E-03	4.37E-03	7.45E-03
0.03	1.35E-03	2.46E-04	4.31E-04	1.01E-03	2.19E-03	3.90E-03
0.05	6.50E-04	7.23E-05	1.36E-04	3.79E-04	1.10E-03	2.29E-03
0.075	3.31E-04	2.53E-05	4.98E-05	1.55E-04	5.42E-04	1.34E-03
0.1	1.95E-04	1.11E-05	2.49E-05	8.00E-05	2.96E-04	8.47E-04
0.15	8.61E-05	3.05E-06	9.65E-06	3.23E-05	1.16E-04	3.90E-04
0.3	1.80E-05	2.76E-07	1.90E-06	7.34E-06	2.35E-05	6.93E-05
0.5	5.28E-06	4.63E-08	4.63E-07	2.57E-06	8.12E-06	1.92E-05
0.75	1.99E-06	1.18E-08	1.40E-07	1.04E-06	3.28E-06	7.34E-06
1.	9.83E-07	4.01E-09	5.83E-08	5.05E-07	1.67E-06	3.63E-06
1.5	3.44E-07	9.51E-10	1.51E-08	1.62E-07	6.00E-07	1.31E-06
3.	4.39E-08	1.60E-10	1.16E-09	1.55E-08	7.23E-08	1.82E-07
5.	7.20E-09	1.42E-10	2.13E-10	1.84E-09	1.07E-08	3.19E-08
7.5	1.39E-09	1.01E-10	1.42E-10	3.52E-10	1.84E-09	6.73E-09
10.	3.84E-10	9.37E-11	1.21E-10	1.62E-10	5.42E-10	2.04E-09

Table 2.2.2-1b: Mean and Fractile Base Rock Seismic Hazard Curves for 25 Hz (PGA) at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	4.03E-02	2.64E-02	3.42E-02	4.07E-02	4.63E-02	5.05E-02
0.001	3.29E-02	1.90E-02	2.72E-02	3.33E-02	3.90E-02	4.43E-02
0.005	1.39E-02	6.73E-03	9.79E-03	1.32E-02	1.74E-02	2.46E-02
0.01	8.18E-03	3.73E-03	5.27E-03	7.55E-03	1.04E-02	1.64E-02
0.015	5.77E-03	2.46E-03	3.47E-03	5.27E-03	7.55E-03	1.23E-02
0.03	2.95E-03	9.79E-04	1.49E-03	2.57E-03	4.19E-03	6.73E-03
0.05	1.65E-03	4.07E-04	6.54E-04	1.32E-03	2.60E-03	4.19E-03
0.075	9.74E-04	1.77E-04	3.01E-04	7.03E-04	1.62E-03	2.80E-03
0.1	6.40E-04	9.24E-05	1.64E-04	4.13E-04	1.08E-03	2.04E-03
0.15	3.30E-04	3.52E-05	6.54E-05	1.84E-04	5.50E-04	1.20E-03
0.3	8.75E-05	5.12E-06	1.38E-05	4.19E-05	1.31E-04	3.42E-04
0.5	2.87E-05	1.05E-06	4.37E-06	1.42E-05	4.19E-05	1.04E-04
0.75	1.13E-05	2.72E-07	1.60E-06	6.17E-06	1.79E-05	3.68E-05
1.	5.77E-06	1.04E-07	7.13E-07	3.42E-06	9.93E-06	1.90E-05
1.5	2.23E-06	2.46E-08	2.22E-07	1.40E-06	4.01E-06	7.34E-06
3.	4.03E-07	1.79E-09	2.64E-08	2.42E-07	7.55E-07	1.38E-06
5.	9.68E-08	3.33E-10	4.43E-09	5.05E-08	1.79E-07	3.42E-07
7.5	2.70E-08	1.60E-10	1.01E-09	1.18E-08	4.90E-08	1.04E-07
10.	9.98E-09	1.42E-10	3.68E-10	3.84E-09	1.74E-08	4.01E-08

Table 2.2.2-1c: Mean and Fractile Base Rock Seismic Hazard Curves for 10 Hz (PGA) at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	4.35E-02	3.33E-02	3.79E-02	4.37E-02	4.90E-02	5.27E-02
0.001	3.73E-02	2.64E-02	3.14E-02	3.73E-02	4.37E-02	4.70E-02
0.005	1.66E-02	8.98E-03	1.21E-02	1.64E-02	2.10E-02	2.53E-02
0.01	9.53E-03	4.70E-03	6.45E-03	9.11E-03	1.23E-02	1.62E-02
0.015	6.54E-03	3.05E-03	4.19E-03	6.17E-03	8.60E-03	1.16E-02
0.03	3.19E-03	1.21E-03	1.77E-03	2.92E-03	4.50E-03	6.26E-03
0.05	1.72E-03	5.05E-04	7.89E-04	1.49E-03	2.60E-03	3.84E-03
0.075	9.78E-04	2.16E-04	3.63E-04	7.77E-04	1.57E-03	2.46E-03
0.1	6.18E-04	1.11E-04	1.95E-04	4.56E-04	1.02E-03	1.72E-03
0.15	2.96E-04	3.95E-05	7.34E-05	1.90E-04	4.98E-04	9.37E-04
0.3	6.57E-05	5.42E-06	1.23E-05	3.52E-05	1.04E-04	2.35E-04
0.5	1.86E-05	9.51E-07	3.09E-06	1.01E-05	2.92E-05	6.36E-05
0.75	6.63E-06	2.10E-07	9.93E-07	3.79E-06	1.11E-05	2.16E-05
1.	3.19E-06	6.83E-08	4.01E-07	1.90E-06	5.58E-06	1.05E-05
1.5	1.14E-06	1.32E-08	1.11E-07	6.93E-07	2.10E-06	3.90E-06
3.	1.76E-07	8.85E-10	1.04E-08	9.51E-08	3.28E-07	6.09E-07
5.	3.67E-08	1.90E-10	1.49E-09	1.64E-08	6.64E-08	1.36E-07
7.5	9.06E-09	1.42E-10	3.42E-10	3.37E-09	1.55E-08	3.63E-08
10.	3.06E-09	1.42E-10	1.77E-10	1.05E-09	5.05E-09	1.32E-08

Table 2.2.2-1d: Mean and Fractile Base Rock Seismic Hazard Curves for 5 Hz (PGA) at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	4.37E-02	3.33E-02	3.79E-02	4.37E-02	4.98E-02	5.35E-02
0.001	3.76E-02	2.57E-02	3.05E-02	3.79E-02	4.43E-02	4.83E-02
0.005	1.58E-02	8.00E-03	1.11E-02	1.55E-02	2.07E-02	2.39E-02
0.01	8.40E-03	3.95E-03	5.50E-03	8.12E-03	1.13E-02	1.36E-02
0.015	5.46E-03	2.42E-03	3.42E-03	5.20E-03	7.45E-03	9.37E-03
0.03	2.45E-03	8.47E-04	1.31E-03	2.25E-03	3.57E-03	4.63E-03
0.05	1.24E-03	3.14E-04	5.27E-04	1.08E-03	1.92E-03	2.76E-03
0.075	6.55E-04	1.23E-04	2.22E-04	5.20E-04	1.08E-03	1.69E-03
0.1	3.88E-04	5.91E-05	1.11E-04	2.80E-04	6.45E-04	1.11E-03
0.15	1.66E-04	1.95E-05	3.79E-05	1.02E-04	2.72E-04	5.50E-04
0.3	2.95E-05	2.13E-06	5.05E-06	1.49E-05	4.43E-05	1.05E-04
0.5	7.06E-06	3.05E-07	1.04E-06	3.57E-06	1.10E-05	2.39E-05
0.75	2.22E-06	5.75E-08	2.64E-07	1.21E-06	3.73E-06	7.45E-06
1.	9.84E-07	1.64E-08	9.79E-08	5.50E-07	1.74E-06	3.33E-06
1.5	3.15E-07	2.84E-09	2.35E-08	1.69E-07	5.75E-07	1.10E-06
3.	4.01E-08	2.16E-10	1.62E-09	1.69E-08	7.13E-08	1.57E-07
5.	7.22E-09	1.42E-10	2.76E-10	2.32E-09	1.18E-08	3.01E-08
7.5	1.58E-09	1.21E-10	1.42E-10	4.56E-10	2.39E-09	7.03E-09
10.	4.90E-10	1.01E-10	1.32E-10	1.92E-10	7.45E-10	2.29E-09

Table 2.2.2-1e: Mean and Fractile Base Rock Seismic Hazard Curves for 2.5 Hz (PGA) at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	4.15E-02	3.05E-02	3.47E-02	4.13E-02	4.77E-02	5.20E-02
0.001	3.37E-02	2.22E-02	2.64E-02	3.33E-02	4.13E-02	4.56E-02
0.005	1.20E-02	6.09E-03	8.12E-03	1.16E-02	1.60E-02	1.90E-02
0.01	6.05E-03	2.72E-03	3.79E-03	5.75E-03	8.35E-03	1.04E-02
0.015	3.80E-03	1.51E-03	2.22E-03	3.57E-03	5.35E-03	6.83E-03
0.03	1.56E-03	4.13E-04	7.13E-04	1.38E-03	2.39E-03	3.28E-03
0.05	7.12E-04	1.25E-04	2.42E-04	5.75E-04	1.18E-03	1.79E-03
0.075	3.39E-04	4.25E-05	8.72E-05	2.35E-04	5.75E-04	9.93E-04
0.1	1.84E-04	1.84E-05	3.84E-05	1.10E-04	3.09E-04	6.00E-04
0.15	6.97E-05	5.05E-06	1.10E-05	3.33E-05	1.10E-04	2.57E-04
0.3	9.92E-06	4.07E-07	1.05E-06	3.57E-06	1.34E-05	3.68E-05
0.5	2.01E-06	4.50E-08	1.62E-07	7.13E-07	2.68E-06	6.73E-06
0.75	5.52E-07	6.93E-09	3.37E-08	2.07E-07	8.12E-07	1.95E-06
1.	2.24E-07	1.74E-09	1.10E-08	8.35E-08	3.57E-07	8.60E-07
1.5	6.44E-08	3.09E-10	2.16E-09	2.16E-08	1.08E-07	2.57E-07
3.	7.08E-09	1.42E-10	2.01E-10	1.53E-09	1.10E-08	3.09E-08
5.	1.14E-09	1.01E-10	1.42E-10	2.53E-10	1.53E-09	5.20E-09
7.5	2.27E-10	9.11E-11	1.01E-10	1.42E-10	3.37E-10	1.11E-09
10.	6.55E-11	9.11E-11	1.01E-10	1.42E-10	1.72E-10	4.01E-10

Table 2.2.2-1f: Mean and Fractile Base Rock Seismic Hazard Curves for 1.0 Hz at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	2.79E-02	1.51E-02	2.01E-02	2.84E-02	3.52E-02	4.01E-02
0.001	1.88E-02	9.24E-03	1.29E-02	1.87E-02	2.42E-02	2.88E-02
0.005	5.69E-03	2.16E-03	3.28E-03	5.35E-03	8.12E-03	1.02E-02
0.01	2.96E-03	8.00E-04	1.38E-03	2.64E-03	4.56E-03	6.09E-03
0.015	1.80E-03	3.73E-04	7.03E-04	1.53E-03	2.88E-03	4.07E-03
0.03	5.82E-04	6.73E-05	1.53E-04	4.31E-04	9.79E-04	1.62E-03
0.05	1.98E-04	1.42E-05	3.63E-05	1.21E-04	3.47E-04	6.45E-04
0.075	7.17E-05	3.63E-06	9.65E-06	3.63E-05	1.25E-04	2.57E-04
0.1	3.20E-05	1.29E-06	3.52E-06	1.40E-05	5.35E-05	1.21E-04
0.15	9.19E-06	2.80E-07	7.77E-07	3.33E-06	1.42E-05	3.68E-05
0.3	8.81E-07	1.49E-08	5.20E-08	2.68E-07	1.29E-06	3.57E-06
0.5	1.62E-07	1.40E-09	6.17E-09	4.25E-08	2.42E-07	6.83E-07
0.75	4.76E-08	2.60E-10	1.08E-09	9.79E-09	6.93E-08	2.22E-07
1.	2.07E-08	1.49E-10	3.47E-10	3.28E-09	2.76E-08	9.79E-08
1.5	6.28E-09	1.32E-10	1.49E-10	7.34E-10	7.03E-09	2.96E-08
3.	6.73E-10	9.11E-11	1.02E-10	1.42E-10	6.00E-10	2.88E-09
5.	1.03E-10	9.11E-11	1.01E-10	1.42E-10	1.64E-10	4.83E-10
7.5	1.98E-11	9.11E-11	9.11E-11	1.42E-10	1.42E-10	1.77E-10
10.	5.62E-12	9.11E-11	9.11E-11	1.42E-10	1.42E-10	1.42E-10

Table 2.2.2-1g: Mean and Fractile Base Rock Seismic Hazard Curves for 0.5 Hz at Hatch (LCI, 2013a)

SA(g)	Mean	0.05	0.16	0.50	0.84	0.95
0.0005	1.50E-02	8.35E-03	1.10E-02	1.46E-02	1.90E-02	2.25E-02
0.001	9.70E-03	4.90E-03	6.64E-03	9.37E-03	1.27E-02	1.55E-02
0.005	3.25E-03	7.55E-04	1.36E-03	2.92E-03	5.12E-03	6.93E-03
0.01	1.55E-03	1.92E-04	4.31E-04	1.20E-03	2.68E-03	4.07E-03
0.015	8.54E-04	7.03E-05	1.74E-04	5.83E-04	1.51E-03	2.57E-03
0.03	2.23E-04	8.60E-06	2.46E-05	1.11E-04	3.95E-04	8.47E-04
0.05	6.45E-05	1.40E-06	4.43E-06	2.29E-05	1.08E-04	2.72E-04
0.075	2.09E-05	3.01E-07	1.01E-06	5.35E-06	3.14E-05	9.24E-05
0.1	8.79E-06	9.65E-08	3.33E-07	1.77E-06	1.20E-05	3.90E-05
0.15	2.38E-06	1.79E-08	6.64E-08	3.63E-07	2.80E-06	1.02E-05
0.3	2.23E-07	8.23E-10	3.42E-09	2.53E-08	2.22E-07	1.01E-06
0.5	4.19E-08	1.57E-10	4.07E-10	3.52E-09	3.73E-08	2.13E-07
0.75	1.25E-08	1.25E-10	1.53E-10	7.55E-10	9.51E-09	6.36E-08
1.	5.49E-09	1.01E-10	1.42E-10	3.01E-10	3.47E-09	2.72E-08
1.5	1.70E-09	9.11E-11	1.04E-10	1.46E-10	8.23E-10	7.77E-09
3.	1.89E-10	9.11E-11	1.01E-10	1.42E-10	1.57E-10	7.13E-10
5.	3.01E-11	9.11E-11	9.11E-11	1.42E-10	1.42E-10	1.90E-10
7.5	5.99E-12	9.11E-11	9.11E-11	1.42E-10	1.42E-10	1.42E-10
10.	1.74E-12	9.11E-11	9.11E-11	1.42E-10	1.42E-10	1.42E-10

Table 2.2.2-2: Mean magnitude and distance values for the high frequency (HF) and low frequency (LF) cases (LCI, 2013b).

	10^{-4} UHRS	10^{-5} UHRS	10^{-6} UHRS
Low Frequency M_w	7.2*	7.3*	7.4*
Low Frequency R (km)	220*	200*	190*
High Frequency M_w	6.8	6.5	6.3
High Frequency R (km)	110	49	19

* M_w and R calculated for R>100 km per NRC (2007), because the contribution to hazard for R>100 km is more than 5% of the total hazard.

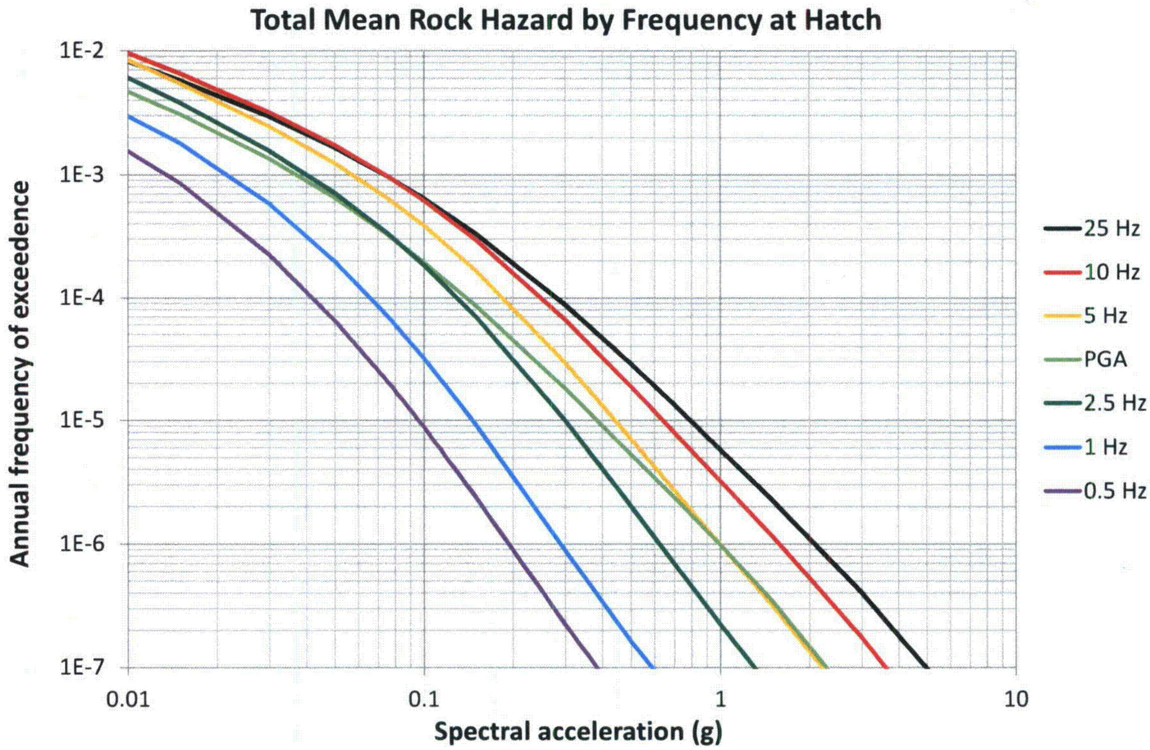

Figure 2.2.2-1: Mean base rock hazard curves for frequencies of 0.5, 1, 2.5, 5, 10, 25 and 100 (PGA) Hz at Hatch at 5% spectral damping.

2.3 Site Response Evaluation

Following the guidance contained in Seismic Enclosure 1 of the 3/12/2012 50.54(f) Request for Information and in the SPID (EPRI, 2013a) for nuclear power plant sites that are not sited on hard rock (defined as 2.83 km/sec or 9,200 feet/sec), a site response analysis was performed for Hatch Units 1 and 2.

2.3.1 Description of Subsurface Material

SNC Calculation SCNH-12-075 (SNC, 2013) is the source of the information presented in the following section.

Site specific subsurface data were obtained from subsurface explorations described in the FSAR (SNC, 2014e) and subsequent studies carried out for the independent spent fuel storage installation (ISFSI) foundations (SNC, 2011; Fugro, 1998; Mactec, 2011; and Idriss, 1998). However, these data are limited with regard to the determination of dynamic properties and a site specific shear-wave velocity (V_s) profile at depth. For example, with plant grade at elevation 129 feet mean sea level (note all elevations referred to herein are with respect to mean sea level), the previous site explorations extended to about an elevation of -30 feet at the plant area and elevation -100 feet at the ISFSI area. Data from these previous explorations included field and laboratory tests results on representative samples from soil borings.

The descriptions of geologic conditions below elevation of -100 feet, to a depth of about 4,100 feet, are summarized in the Unit 2 FSAR Section 2.5.1.2.2 (SNC, 2014e). As noted in the Unit 2 FSAR, these descriptions were developed from the logging of an oil test well located about 5 miles from the site. The Unit 2 FSAR Section 2.5.1.2.2 identifies the depth and thickness of each stratum along with a description of the various materials encountered. Bedrock, described as pre-Cretaceous, arkosic sandstone and basalt or diabase was indicated at the base (depth ≈ 4,100 feet) of the soil column. From the Unit 2 FSAR, it is not clear what methods were used or measurements were made in the oil test well to develop the description of these geologic conditions. There was no mention of shear wave V_s data from this oil test well. However, our experience indicates the description of the profile is consistent with typical Coastal Plain deposits in the southeastern United States.

A search of public records was made in an effort to obtain V_s data to characterize the soil column at the site. No recent nearby V_s data were found. Historic subsurface data from a deep borehole (#1 A.P. Snipes well) in Jeff Davis County about 27 miles southwest of the site were obtained from the State of Georgia Department of Natural resources (DNR). These data included gamma ray and sonic logs. Table 2.3.1-1 provides a summary of the borehole, the data available, and the proximity to the plant site.

As previously discussed, the Hatch site is located in the Atlantic Coastal Plain physiographic province. Sediments in this province were deposited as the continental margin subsided and the site environment changed from continental to marine. These coastal plain deposits strike in a northeast-southwest direction and dip to the southeast at about 5 to 50 feet per mile (SNC, 2014e). As a result of the regional subsidence, these deposits generally thicken from northwest to southeast. The physical properties of each stratigraphic unit along strike are considered similar. The #1 A.P. Snipes well is located approximately along strike and thus for purposes of developing the dynamic properties for the stratigraphy of the soil/rock column underlying the Hatch site, the geologic conditions encountered in this well were considered sufficiently similar to the conditions underlying the Hatch site.

The #1 A.P Snipes well is located about 27 miles southwest of the Hatch site. For the purposes of developing a deep profile, it was considered adequate given the nature of the Coastal Plain stratigraphy and the fact that it matched well with the stratigraphy described in the FSAR, particularly the depth to basement rock. The lithology of the #1 A.P. Snipes well was developed by interpreting gamma ray data from the borehole log as presented in Figure 2.3.1-1. The lithology in the borehole indicates alternating layers of sand, clayey sand, sandy clay, and marl to a depth of about 4,000 feet, where bedrock is encountered. This stratigraphy generally matches the site geologic column provided in the Unit 2 FSAR Figure 2.5-8, which shows interbedded sands, limestones, marl, calcareous sands and clays, over bedrock at a depth of about 4,100 feet. Note that while the #1 A.P. Snipes well includes gamma ray and sonic data to a depth of 11,410 feet, only the interpretation of data to a depth of about 7,000 feet is provided in Figure 2.3.1-1 given that the V_s velocities below this depth are calculated to be well in excess of 9,200 fps.

The Unit 2 FSAR Section 2.5.1.2.2 provides a description of the geologic conditions underlying the site to a depth of about 4,100 feet below plant grade based on an oil test well (GGS No. 148) drilled about 5 miles southwest of the site. This stratigraphy was extended based on data taken from the #1 A.P. Snipes well, as previously described. Generally, the materials underlying the site consist of alternating layers of uncemented sands, clays, cemented sands, hard clays and clayey sands, and indurated sediments, including limestone. These alternating layers vary within strata such that sand, clay, indurated sediments, and limestone may be present within the same geologic formation. In addition, the thicknesses of these materials vary. This variation in thickness and material type generally appears to be present throughout the soil/rock column as is typical of Coastal Plain geology. Based on experience with similar Coastal Plain geology, a variation in layer thickness of ± 10 percent is recommended. A best estimate summary of strata thicknesses and material descriptions is provided in Table 2.3.1-2. The adjusted depth to rock (Unit 2 FSAR Section 2.5.1.1.3 provides a depth of 4,108 ft based on original ground at about elevation 150 feet) based on the current site grade of about elevation 129 feet is 4087 feet. A variation of ± 200 feet is recommended for the depth to rock.

The groundwater level at the plant area is reported in the Unit 2 FSAR Section 2.5.4.6 to range from elevation 70 to 75 feet. In a recent ISFSI study (SNC, 2011) a design elevation of 75 feet is provided based on water level measurements taken in 2011. Thus, a groundwater elevation of 75 feet is recommended.

Table 2.3.1-1: Summary of Nearby Borehole

Well Identification, Approx Distance from Plant	Georgia Geologic Survey (GGS) Well Id.	Year Tested	Logs Available	Record Interval, Depth (ft)
#1 A.P. Snipes Well, 27 miles southwest	3457	1981	Gamma Ray Sonic	422 – 11,410 422 – 11,410

Table 2.3.1-2: Best Estimate Site Stratigraphy

Elevation [ft]		Depth (ft)		Thickness (ft)	Geologic Formation	Material Description
Top	Base	Top	Base			
129 / 110(1)	75 / 52(2)	0	54 / 58(3)	54 / 58(3)	Fill	Sand and silty sand / K-Krete(4)
129	-131	0	260	260(5)	Hawthorn	Upper portions, interbedded sands, cemented sands, and hard clay; lower portion, calcareous sands and clays, dense
-131	-291	260	420	160	Tampa	Sandy to clayey fossiliferous limestone; partly dolomitized
-291	-411	420	540	120	Undifferentiated (Oligocene epoch)	Massive calcitized fossiliferous, limestone
-411	-691	540	820	280	Ocala	Massive crystalline fossiliferous limestone
-691	-1,301	820	1,430	610	Lisbon	Sandy phosphatic dolomitic limestone
-1,301	-1,461	1,430	1,590	160	Tallahatta	Glauconitic calcareous sand and thin fossiliferous marl layers
-1,461	-1,551	1,590	1,680	90	Wilcox	Carbonaceous micaceous silty fossiliferous marl
-1,551	-1,866	1,680	1,995	315	Clayton	Massive crystalline limestone interbedded with carbonaceous micaceous glauconitic marly sand
-1,866	-2,821	1,995	2,950	955	Post-Tuscaloosa	Coquinoid phosphatic sand, carbonaceous fossiliferous glauconitic marl
-2,821	-3,731	2,950	3,860	910	Tuscaloosa	Carbonaceous glauconitic and fossiliferous sand and clay
-3,731	-3,958	3,860	4,087(6)	227	Undifferentiated (Comanchean epoch)	Sandy micaceous clay and arkosic sand
-3,958	N/A	4,087	N/A	N/A	Undifferentiated (Triassic period)	Basement Rock - Arkosic sandstone and basalt or diabase

Notes:
(1) Grade at Powerblock about elevation (El.) 129 ft, grade at Intake Structure (on landside) about El. 110 ft.
(2) Based on grade El. 129 ft, Reactor building El. 75 ft; Intake Structure El. 52 ft
(3) Based on grade of El. 129 ft at Powerblock and El. 110 ft at Intake Structure
(4) K-Krete used as backfill immediately around the Intake Structure on 3 sides
(5) Based on ground surface El. 129 ft,
(6) Based on ground surface El. 129 ft; assumed original ground at El. 150 ft, which results in depth to rock ≈ 4,108 ft as interpreted from the Unit 2 FSAR Section 2.5.1.1.3.

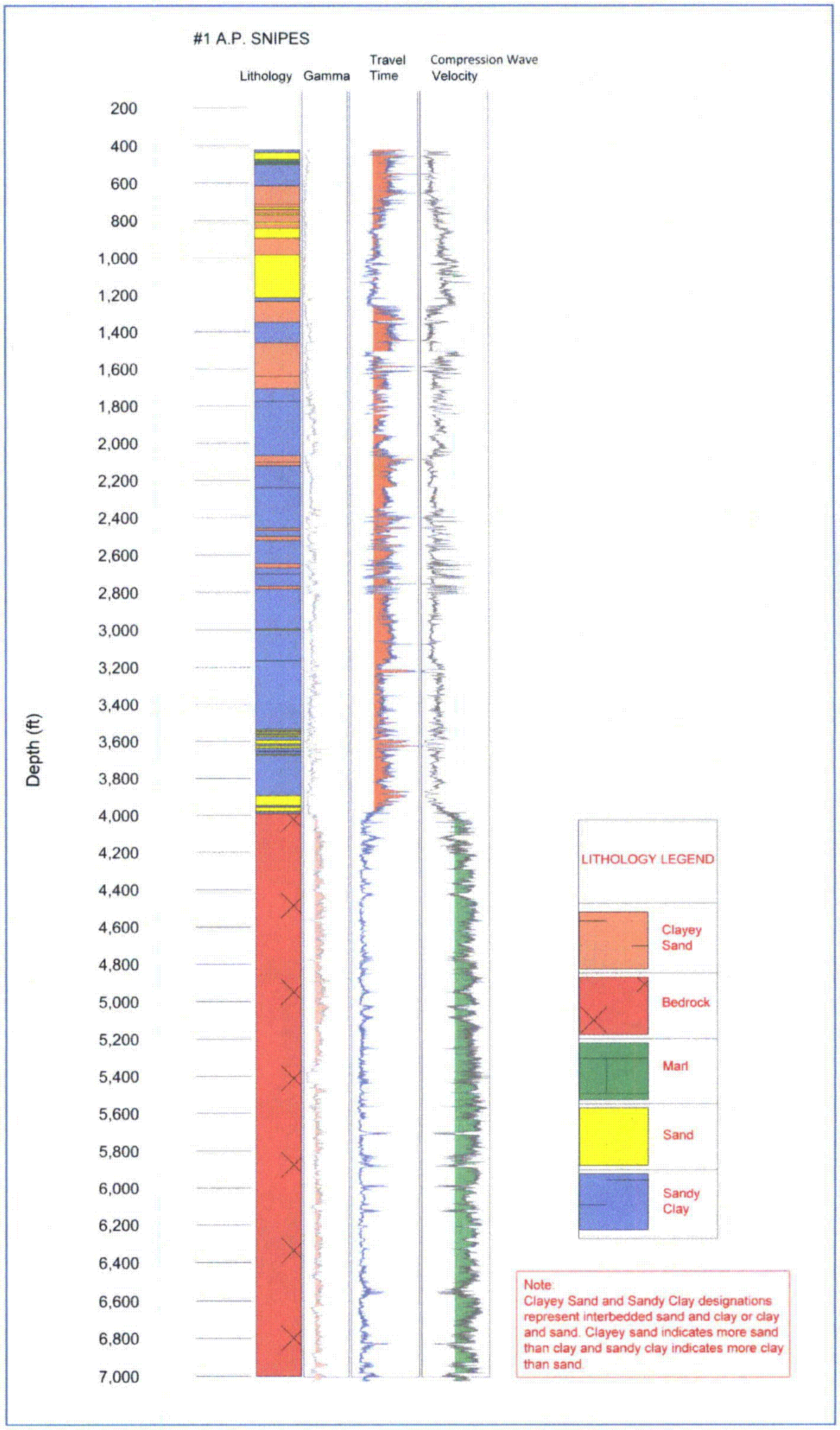

Figure 2.3.1-1: #1 A.P. Snipes Well Information (interpreted)

2.3.2 Development of Base Case Profile and Nonlinear Material Properties

SNC Calculation SCNH-12-075 (SNC, 2013) is the source of the information presented in the following section.

The base case profile for Hatch Units 1 and 2 was based on existing subsurface information contained in the FSAR for Units 1 and 2 (SNC, 2014e), additional and more recent information obtained for the investigations carried out for ISFSI (SNC, 2011; Fugro, 1998; Mactec, 2011; and Idriss, 1998), and nearby oil well data. The information is summarized below.

The shallower portions of the base case profile were developed with site-specific data; while the deeper portions of the profile were developed with nearby oil well exploration data. These data are consistent with experience in the similar Coastal Plain deposits. However, uncertainty in the soil/rock column, particularly V_s data, is accounted for using a logarithmic standard deviation of 0.35 (EPRI, 2013a) to develop the upper and lower bounds. The 10^{th} and 90^{th} percentile profiles (lower and upper ranges) presented are also developed per the SPID (EPRI, 2013a) guidance by subtracting and adding 0.45 in natural log units to V_s as discussed below.

Representative samples of the subsurface materials were tested in the laboratory to determine their classification in accordance with the Unified Soil Classification System (USCS, ASTM D-2487) during the explorations for Units 1 and 2 and recent investigations for the ISFSI (SNC, 2011; Mactec, 2011). In addition, representative samples of the backfill soils were tested to determine their classification, during backfill construction. Table 2.3.1-2 provides a material description for the predominate soil type of each major geologic unit.

Unit weight test results are available for the site soils. Unit 2 FSAR Table 2A-4 provides test results on representative samples from near surface soils in the plant area. Unit 2 FSAR Section 2A.9.2.6 provides laboratory and field test results for unit weight values of 128 pounds/ft^3 (pcf) and 132 pcf, respectively for the K-Krete at the intake structure. A unit weight value for K-Krete of 130 pcf is recommended. Based on the descriptions of the materials provided in the Unit 2 FSAR Section 2.5.1.2.2, and descriptions summarized in Table 2.3.1-2, a total unit weight value of 125 pcf is assigned to the underlying materials considering a distribution of sand, clay, limestone, siltstone, and sandstone. A total unit weight value of 165 pcf is assigned to the bedrock – the Triassic materials at the base of the soil column. Unit weight values are summarized in Table 2.3.2-1.

Shallow V_s data are available, but deep data (compression-wave velocity (V_p) data) are limited to an offsite, but nearby oil well. Unit 2 FSAR Figures 2A-5 and 2A-6 provide refraction data results in the plant area. Additional V_s data in proximity to the powerblock area are provided as a result of the investigations for the ISFSI pads (Fugro, 1998; Mactec, 2011; Idriss, 1998).

V_s values for K-Krete backfill are developed from Savannah River Site Geotechnical Services Department (2002), where several mix designs controlled low strength material (CLSM), which is very similar to K-Krete, were developed and tested. V_s values for the compacted backfill are

developed from empirical relationships as well as design and field measured V_s values for similar compacted materials.

Best estimate V_s values for the compacted backfill are mean values computed from empirical relationships developed by Hardin and Drnevich (1972) and Menq (2003) as well as design and field measured V_s values for Southern Nuclear's Vogtle Electric Generating Plant Units 3 and 4 Test Pad, which consisted of similar compacted coastal plain sands as used at Hatch.

A summary of the recommended V_s values (10^{th}, 16^{th}, 50^{th}, 84^{th}, and 90^{th} percentiles) for the In situ and K-Krete materials are summarized in Table 2.3.2-2 and for the compacted backfill in Table 2.3.2-3 in the form of a power function. Figures 2.3.2-1 and 2.3.2-2 depict the best estimate velocities for the in situ materials (full depth of the column and ground surface down to elevation -300 feet, respectively). Figure 2.3.2-3 depicts the best estimate V_s for the compacted backfill and K-Krete materials. For discussion of the lower range and upper range profiles, see section 2.3.3.

Poisson's ratio values were not provided in the FSAR (SNC, 2014e). Representative values were selected from Naval Facilities Engineering Command (1986), based on material descriptions provided in Table 2.3.1-2. A composite value of 0.25 was used for the materials below the Hawthorne and above the Triassic. The recommended values are provided in Table 2.3.2-1 herein.

2.3.2.1 Shear Modulus and Damping Curves

SNC Calculation SCNH-12-075 (SNC, 2013) is the source of the information presented in the following section.

No site specific data regarding shear modulus degradation and damping versus cyclic shear strain were available for either the backfill materials or the in situ soils and rock. Thus, published EPRI (1993) relationships are utilized.

For compacted backfill, the EPRI (1993) relationships for sands are recommended, using the depth range curves of 0-20 feet and 20-50 feet. These curves are equally likely to represent the non-linear behavior of the compacted backfill thus both curves are equally weighted and should be used to develop strain-dependent properties. For K-Krete, which can be characterized as cemented sand, the EPRI (1993) relationships for sands are recommended, using the depth range curves of 0-20 feet and 120-250 feet. These curves are equally likely to represent the non-linear behavior of the K-Krete backfill thus both curves are equally weighted and should be used to develop strain-dependent properties. These curves are tabulated in Table 2.3.2-4 and Table 2.3.2-5 (G/G_{max} and damping, respectively) and illustrated in Figure 2.3.2-4 and Figure 2.3.2-5. Note that all of the illustrated damping ratios are capped at 15 percent for the site response analysis.

For the in situ profile, the EPRI (1993) relationships for sands are recommended. Between the ground surface (site grade) and elevation 0 feet the depth range curves of 50-120 feet and 120-

250 feet, are recommended, both equally weighted. These curves are tabulated in Table 2.3.2-6 and Table 2.3.2-7 (G/G_{max} and damping, respectively) and illustrated in Figure 2.3.2-4 and Figure 2.3.2-5.

Between elevation 0 feet and elevation -150 feet the depth range curves of 120-250 feet and 250-500 feet, are recommended, both equally weighted. These curves are tabulated in Table 2.3.2-6 and Table 2.3.2-7 (G/G_{max} and damping, respectively) and illustrated in Figure 2.3.2-4 and Figure 2.3.2-5.

Between elevation -150 feet and elevation -380 feet (Tampa and Oligocene Formations) V_s ranges from about 2,700 to 4,100 fps (2,756 to 4,140 fps), increasing with depth. This material is assumed to be a more weathered rock than the materials encountered deeper in the profile. Thus, the Idriss and Boulanger (2010) curves for weathered rock are recommended (see Table 2.3.2 6 and Table 2.3.2 7 for G/G_{max} and damping, respectively).

From the Ocala (elevation -380 feet) to the top of the Triassic, the V_s profile generally exceeds 4,300 fps and increases with increasing depth. These materials are taken to be medium/competent rock and the shear modulus is assumed to remain constant with strain (no degradation). To determine damping ratios, kappa should be computed according to the procedure outlined in Appendix B of the SPID (EPRI, 2013a).

For the half space below the Triassic, where the V_s exceeds 9,200 fps a damping value of 1% is recommended.

Published relationships (Silva et al., 1996) along with studies at similar sites Southern Nuclear sites (Joseph M. Farley Nuclear Plant and Vogtle Electric Generating Plant) exhibiting similar Coastal Plain geology, are used to evaluate the logarithmic standard deviation (σ_{ln}) associated with G/G_{max} and damping. The guidelines, shown in Table 2.3.2-8, are recommended in applying uncertainties to G/G_{max} and damping for the shear strains (%) shown (adapted from Silva et al. (1996)).

2.3.2.2 Kappa

SNC Calculation SCNH-12-076 (SNC, 2014c) is the source of the information presented in the following section.

Based on the guidance in the Section B-5.1.3.1 of the SPID (EPRI, 2013a), the Hatch site is considered a deep soil site thus a median kappa value of 0.04 sec is considered for the site column. As specified in Section B-5.1.3.2 of the SPID (EPRI, 2013a), a natural log standard deviation of 0.4 was used to estimate the upper and lower range values of kappa. Table 2.3.2-9 summarizes the kappa values used for the site response analysis. This range encompasses the values (e.g., 0.060, 0.054, and 0.052 sec) listed in the SPID (EPRI, 2013a) for deep soil sites. An additional estimate of the total site kappa may be made using the empirical relationship provided by Campbell (2009). Using this relationship and a profile thickness of 4,087 ft, the

kappa of the soil column is estimated to be 0.075 sec and is significantly larger (indicating more damping) than the values selected for consideration.

In the site response analyses, the material above the depth of 509 ft is modeled as nonlinear with strain dependent shear-modulus reduction and material damping curves as discussed above in Section 2.3.2.1. Below the depth of 509 ft, the material is considered to be linear for all analyses with damping ratio calibrated to provide the proscribed total site kappa at the surface of the site.

Table 2.3.2-1: Summary of Total Unit Weight and Poisson's Ratio Values

Depth, ft		Thickness (ft)	Geologic Unit	Total Unit Weight (pcf)	Poisson's Ratio
Top	Base				
0 0	54(1) / 58(3)	54(1) / 58(3)	Fill K-Krete	125 130	0.35(2)
0	260	260	Hawthorn	125	0.33
260	420	160	Tampa	125	0.25
420	540	120	Undifferentiated (Oligocene epoch)	125	
540	820	280	Ocala	125	
820	1,430	610	Lisbon	125	
1,430	1,590	160	Tallahatta	125	
1,590	1,680	90	Wilcox	125	
1,680	1,995	315	Clayton	125	
1,995	2,950	955	Post-Tuscaloosa	125	
2,950	3,860	910	Tuscaloosa	125	
3,860	4,087(4)	227	Undifferentiated	125	
4,087	-	-	Triassic	165	0.25

(1) Compacted backfill at Powerblock (SNC, 2014e)
(2) Both compacted backfill and K-Krete,
(3) K-Krete backfill at Intake (SNC, 2014e)
(4) Depth to rock reported in Unit 2 FSAR is 4,108 ft, based on a ground surface elevation of 150 ft. Since site grade is now elevation 129 ft, that results in a depth of 4,087 ft.

Table 2.3.2-2: Summary Best Estimate Shear Wave Velocity Data

Area	Elevation Range (ft)		10th Percentile (ft/sec)	16th Percentile (ft/sec)	50th Percentile (ft/sec)	84th Percentile (ft/sec)	90th Percentile (ft/sec)
Powerblock (Compacted Backfill)	129	75	See Table 2.3.2-3, Figure 2.3.2-3				
Intake (K-Krete Backfill)	110	52	765	1,000	1,200	1,400	1885
Reactor Building / Control Building / Intake / Diesel Generator Building / Condensate Storage Tank / Main Stack/	129	120	555	613	870	1,235	1,364
	120	100	746	824	1,170	1,660	1,835
	100	80	800	884	1,255	1,781	1,968
	80	60	692	765	1,085	1,540	1,702
	60	40	759	839	1,190	1,689	1,866
	40	20	685	758	1,075	1,525	1,686
	20	10	803	888	1,260	1,788	1,976
	10	0	1,141	1,261	1,790	2,540	2,807
	0	-20	1,078	1,191	1,690	2,398	2,650
	-20	-40	1,192	1,318	1,870	2,654	2,933
	-40	-60	1,307	1,445	2,050	2,909	3,215
	-60	-80	1,422	1,571	2,230	3,165	3,497
	-80	-100	1,537	1,698	2,410	3,420	3,780
	-100	-150	1,537	1,698	2,410	3,420	3,780
	-150	-200	1,757	1,942	2,756	3,911	4,322
	-200	-250	1,978	2,186	3,102	4,402	4,865
	-250	-300	2,199	2,430	3,448	4,893	5,408
	-300	-350	2,419	2,674	3,794	5,384	5,950
	-350	-380	2,640	2,917	4,140	5,875	6,493
	-380	-658	2,772	3,064	4,348	6,170	6,819
	-658	-758	3,281	3,626	5,145	7,301	8,069
	-758	-958	3,749	4,143	5,879	8,343	9,220
	-958	-1,208	4,245	4,691	6,657	9,447	10,440
	-1,208	-1,458	2,900	3,205	4,548	6,454	7,133
	-1,458	-1,558	3,910	4,321	6,132	8,702	9,617
	-1,558	-1,858	3,458	3,822	5,423	7,696	8,505
	-1,858	-2,058	3,349	3,702	5,253	7,454	8,238
	-2,058	-2,358	2,962	3,274	4,646	6,593	7,286
	-2,358	-2,758	3,220	3,559	5,050	7,166	7,920
	-2,758	-3,158	2,938	3,247	4,608	6,539	7,227
	-3,158	-3,858	3,166	3,499	4,966	7,047	7,788
	-3,858	-3,958	3,371	3,725	5,286	7,501	8,290
	-3,958	-5,000	9,200				

Table 2.3.2-3: Shear Wave Velocity Profiles in Compacted Backfill

V_s Profile	Power Function to Determine V_s (ft/sec)
Compacted backfill best estimate	443.5855 x ($d^{0.26355}$)
Compacted backfill BE – 1σ	377.0476 x ($d^{0.26355}$)
Compacted backfill BE + 1 σ	510.1233 x ($d^{0.26355}$)
d = depth in feet and V_s is in units of fps σ = standard deviation	

Table 2.3.2-4: G/G_{max} vs Shear Strain for Compacted Backfill and K-Krete

Cyclic Shear Strain (%)	G/G_{max}				
	Compacted Backfill			K-Krete	
	EPRI 0-20	EPRI 20-50		EPRI 0-20	EPRI 120-250
0.000100	1.000	1.000		1.000	1.000
0.000316	1.000	1.000		1.000	1.000
0.001000	0.979	0.992		0.979	0.998
0.003162	0.903	0.94		0.903	0.972
0.010000	0.734	0.815		0.734	0.899
0.031623	0.488	0.589		0.488	0.726
0.100000	0.266	0.355		0.266	0.492
0.316228	0.113	0.161		0.113	0.266
1.000000	0.044	0.065		0.044	0.117

Table 2.3.2-5: Damping vs Shear Strain for Compacted Backfill and K-Krete

Cyclic Shear Strain (%)	Damping Ratio (%)				
	Compacted Backfill			K-Krete	
	EPRI 0-20	EPRI 20-50		EPRI 0-20	EPRI 120-250
0.000100	1.43	1.30		1.43	0.95
0.000316	1.43	1.30		1.43	0.95
0.001000	1.84	1.43		1.84	1.02
0.003162	2.76	2.04		2.76	1.33
0.010000	5.1	3.67		5.1	2.24
0.031623	9.39	7.14		9.39	4.49
0.100000	15.51	12.55		15.51	8.67
0.316228	22.25	19.39		22.25	15.1
1.000000	27.55	24.9		27.55	21.12

Table 2.3.2-6: G/G_{max} vs Shear Strain for In situ Materials

Cyclic Shear Strain (%)	EPRI 50-120	EPRI 120-250	EPRI 250-500	I/B Weathered Rock
0.00010	1.00	1.00	1.00	1.0
0.000316	1.00	1.00	1.00	1.0
0.00100	0.995	0.998	1.00	1.0
0.003162	0.951	0.972	0.98	0.992
0.01000	0.867	0.899	0.923	0.96
0.03162	0.665	0.726	0.774	0.90
0.10000	0.427	0.492	0.557	0.75
0.31623	0.21	0.266	0.315	0.55
1.00000	0.089	0.117	0.153	0.338

Table 2.3.2-7: Damping vs Shear Strain for In situ Materials

Cyclic Shear Strain (%)	EPRI 50-120	EPRI 120-250	EPRI 250-500	I/B Weathered Rock
0.00010	1.15	0.95	0.85	0.375
0.00032	1.15	0.95	0.85	-
0.00100	1.22	1.02	0.9	0.9
0.00316	1.63	1.33	1.02	-
0.01000	2.86	2.24	1.84	2.8
0.03162	5.51	4.49	3.57	5.0
0.10000	10.41	8.67	7.14	10.0
0.31623	17.04	15.1	13.27	-
1.00000	22.86	21.12	19.39	21.0

Table 2.3.2-8: Variation For G/G_{max} and D Relationships

Cyclic Shear Strain (%)	$\sigma_{ln,G/Gmax}$	$\sigma_{ln,D}$
0.0001	0	0.35
0.0003	varies linearly	0.35
0.0010		0.35
0.0032	0.04	0.35
0.0100	varies linearly	0.35
0.0316		varies linearly
0.1000	0.15	
0.3162	0.15	
1.0000	0.15	0.1
3.1623	0.15	-
10.0000	0.15	-

Table 2.3.2-9: Site Column Kappa Values Used for Site Response Analyses

Velocity Profiles	10th Percentile (sec)	50th Percentile (sec)	90th Percentile (sec)
Lower Range, Median, and Upper Range	0.024	0.040	0.067

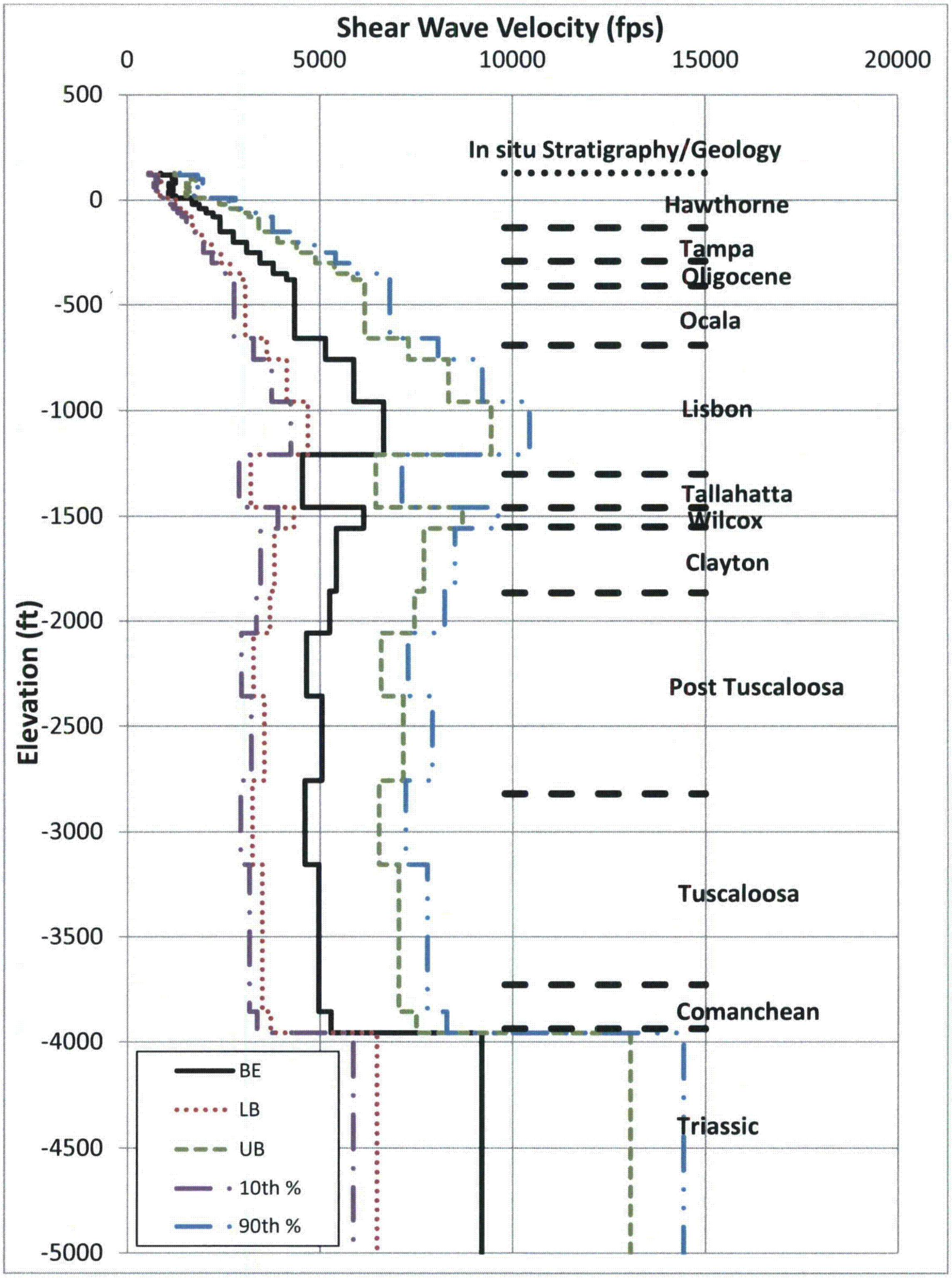

Figure 2.3.2-1: Full Depth Soil/Rock Column Shear Wave Velocity

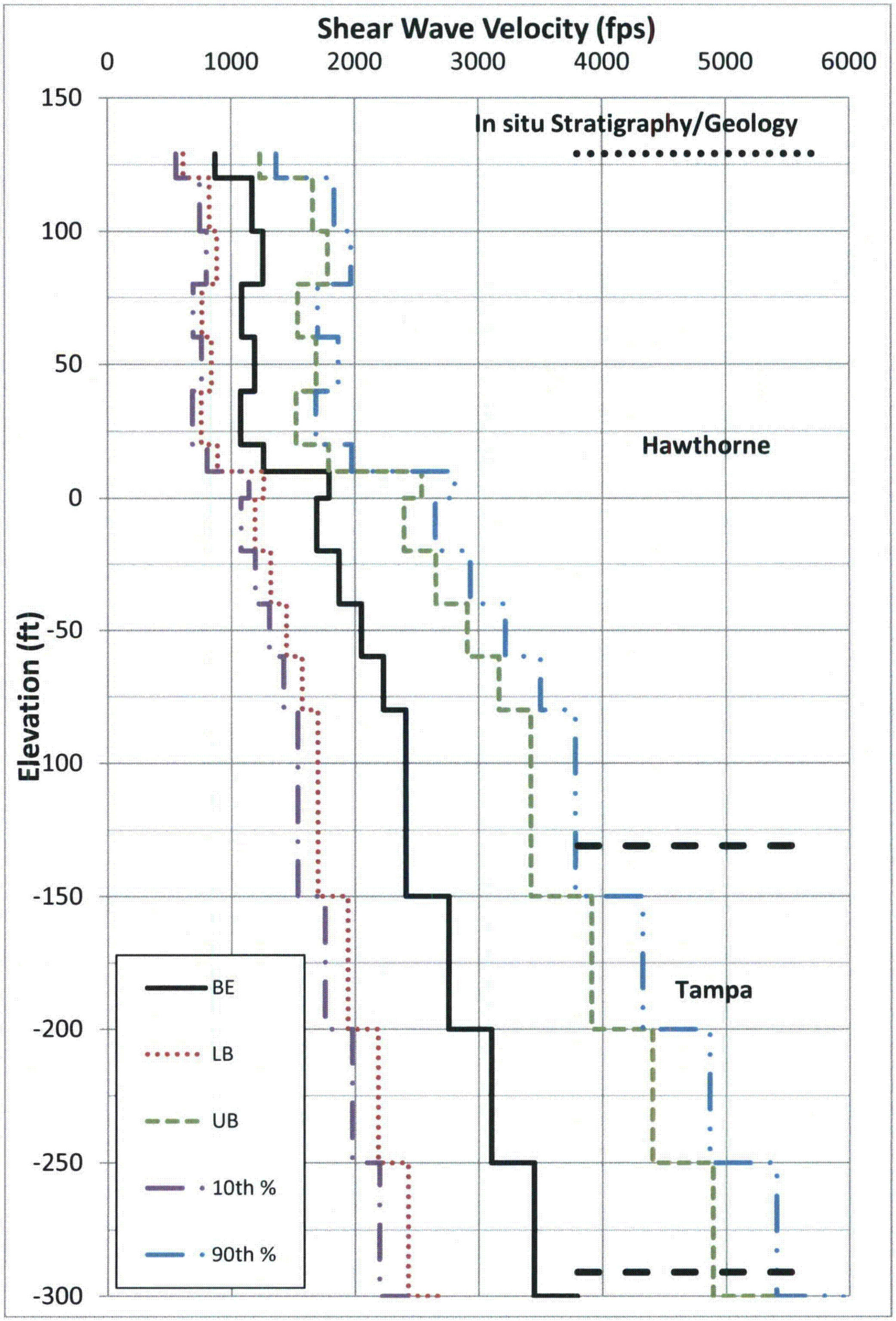

Figure 2.3.2-2: In situ Soil Column Shear Wave Velocity to Elevation -300 feet

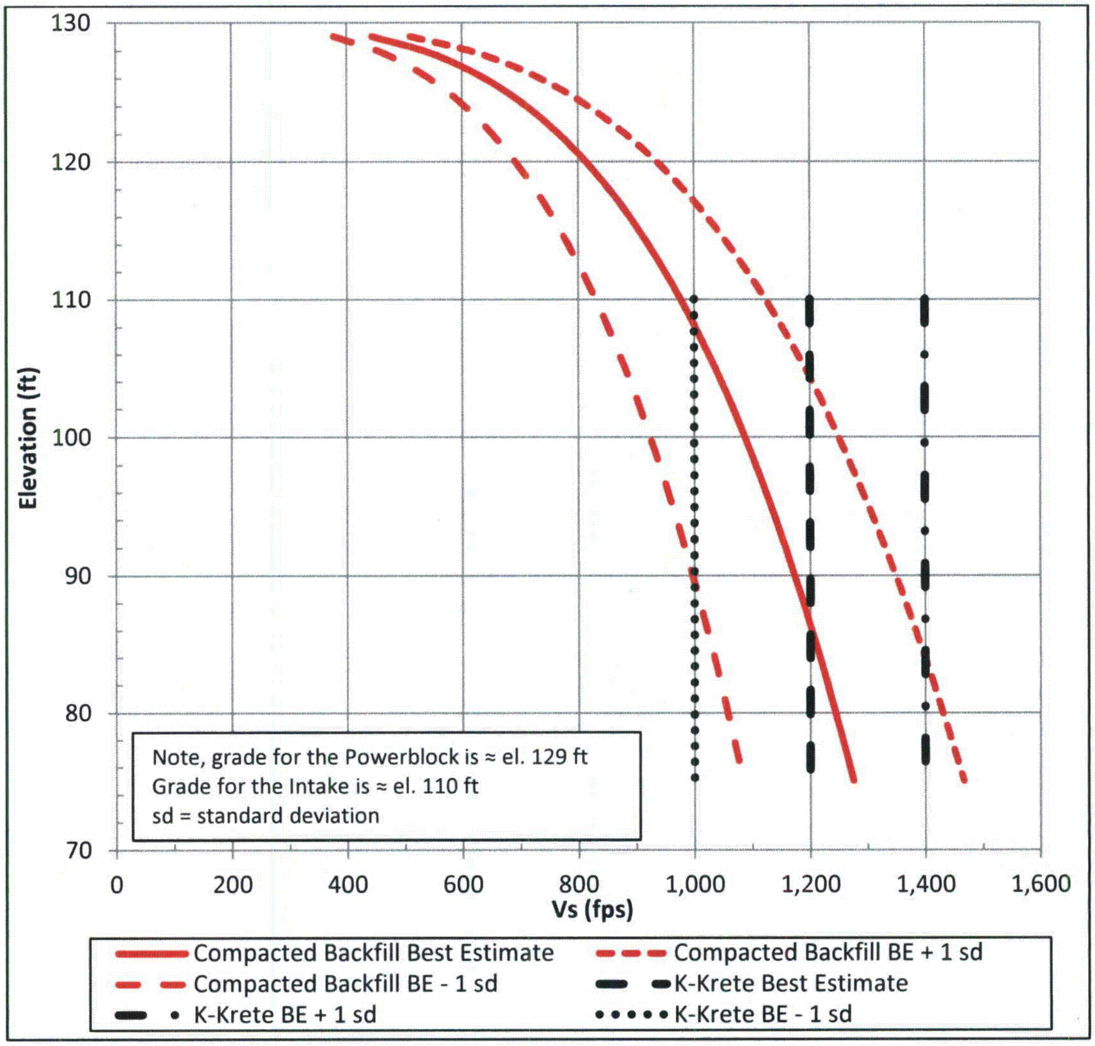

Figure 2.3.2-3: Backfill Shear Wave Velocity vs Elevation

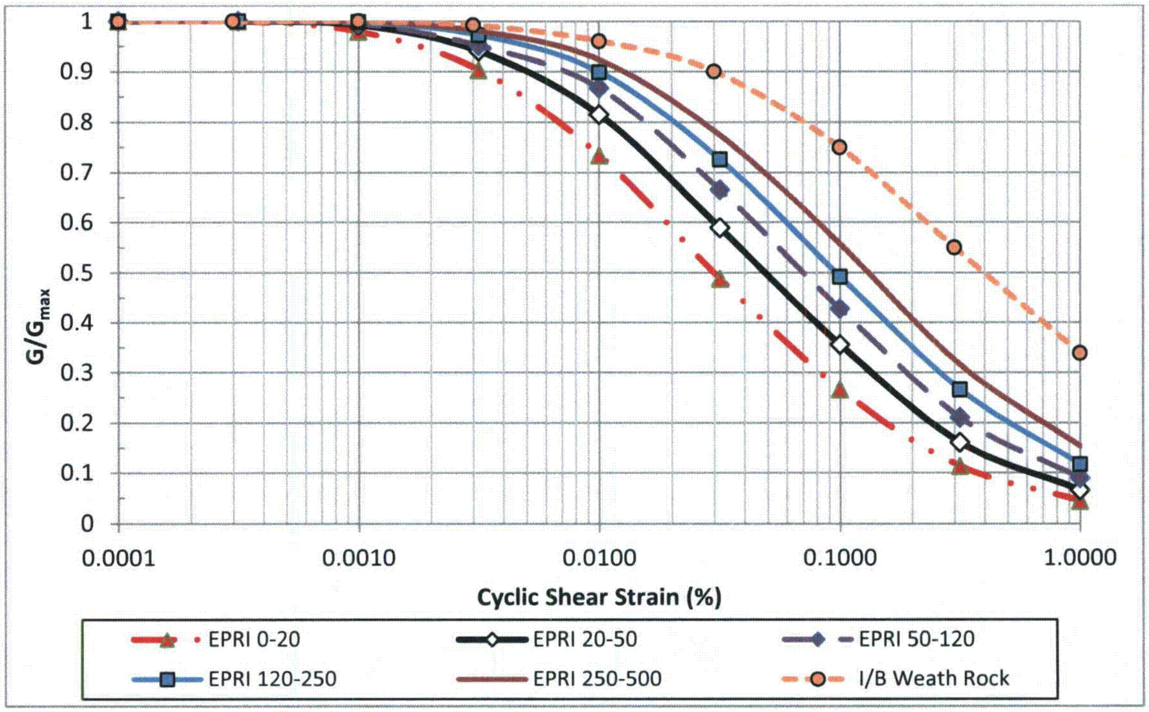

Figure 2.3.2-4: G/G_{max} vs Cyclic Shear Strain

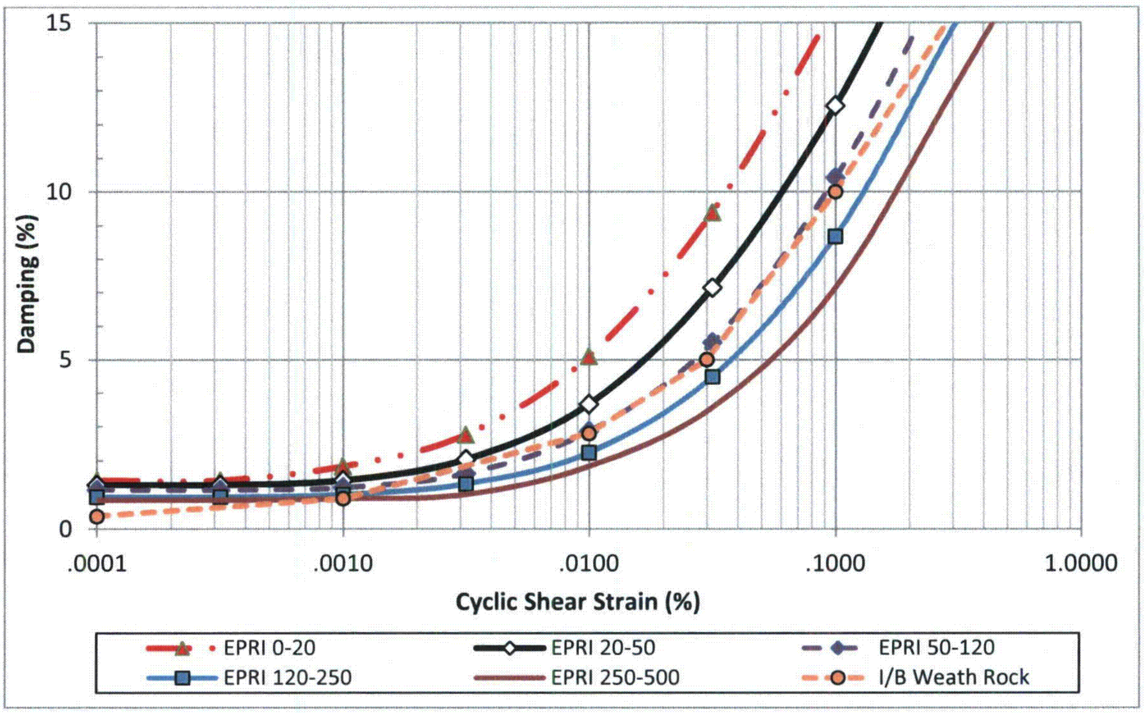

Figure 2.3.2-5: Material Damping vs Cyclic Shear Strain

2.3.3 Randomization of Base Case Profiles

SNC Calculation SCNH-12-074 (SNC, 2014a) is the source of the information presented in the following section.

To account for the aleatory variability in material properties that is expected to occur across a site at the scale of a typical nuclear facility, variability in the assumed V_s profiles has been incorporated in the site response calculations. For the Hatch site, simulated V_s profiles were developed from the base case profile, as presented in Section 2.3.2. The lower range and upper range profiles were defined by the 10^{th} and 90^{th} percentile Vs profiles as recommended by the SPID (EPRI, 2013a), shown in Figures 2.3.2-1 and 2.3.2-2. The simulation procedure generates a set of site-specific simulated soil profiles to represent the dynamic properties of the site while considering the uncertainty associated with each of these properties, and correlations between different parameters.

Consistent with the discussion in Appendix B of the SPID (EPRI, 2013a), the V_s simulation procedure made use of random field models which describe the statistical correlation between layering and V_s. The default randomization parameters developed by Toro (1996) for USGS C site conditions were used for this median profile, while USGS B and D were used for the upper-range and lower-range profiles, respectively. Sixty simulated V_s profiles were generated for each base case profile. These random V_s profiles were generated using a natural log standard deviation of 0.25 over the upper 90 ft and a natural log standard deviation of 0.15 below that depth. As specified in the SPID (EPRI, 2013a), correlation of V_s between layers was modeled using the USGS B, C, D correlation models, selected based on the Vs100, for the upper-range, median, and lower-range profiles, respectively. In the correlation model, a limit of +/- 2 standard deviations about the median value in each layer was assumed for the limits on random V_s fluctuations. All random velocities were limited to be less than or equal to 9200 ft/sec.

Given the limited geotechnical information available, the following alternatives were considered: three base case V_s models, two sets of curves are used to model the strain-dependent behavior of the soil layers, and three different total kappa values. The simulated V_s profiles for the lower-range, median, and upper-range V_s models is shown in Figures 2.3.3-1, 2.3.3-2, and 2.3.3-3.

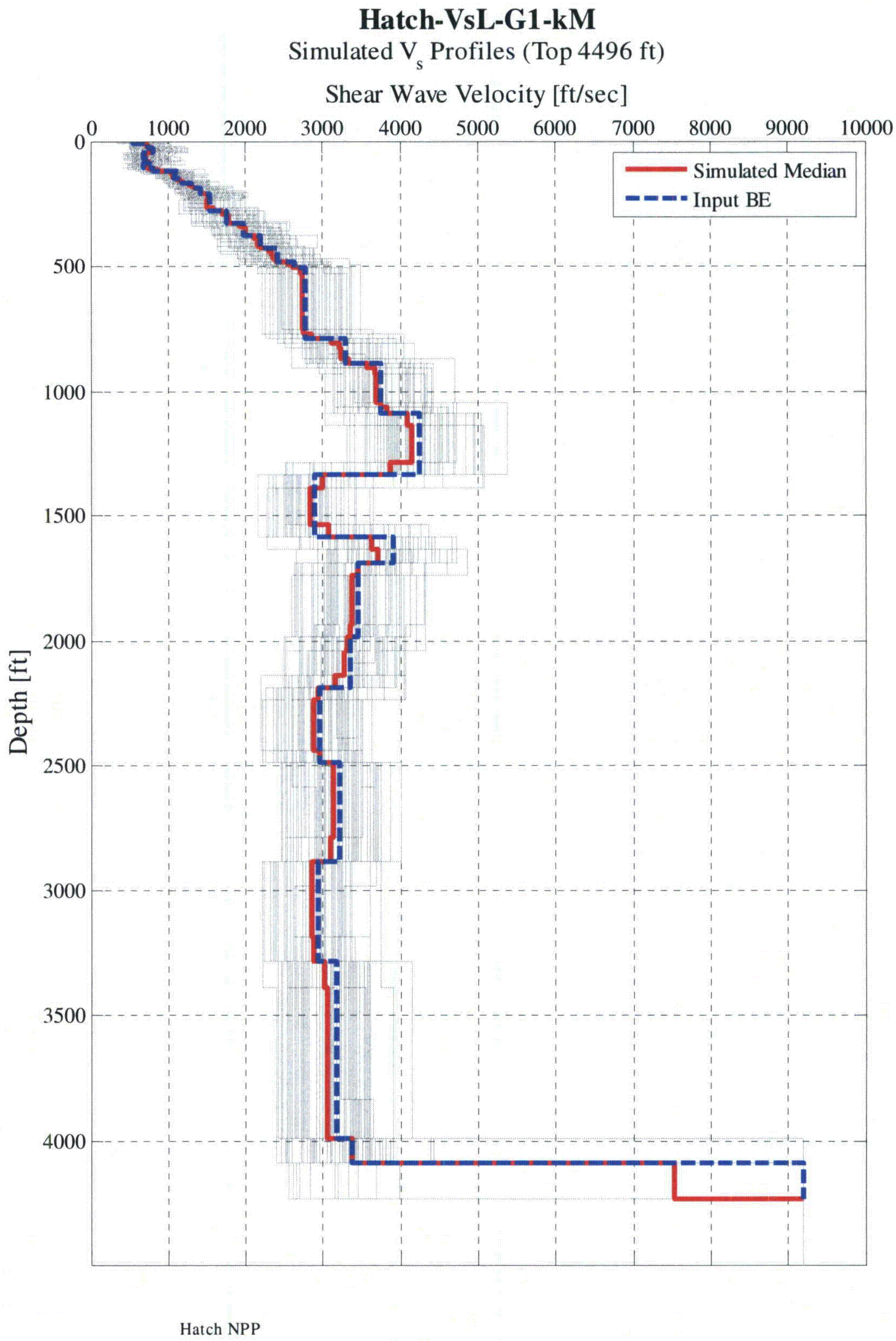

Figure 2.3.3-1: Simulated V_s profiles for the lower-range velocity model.

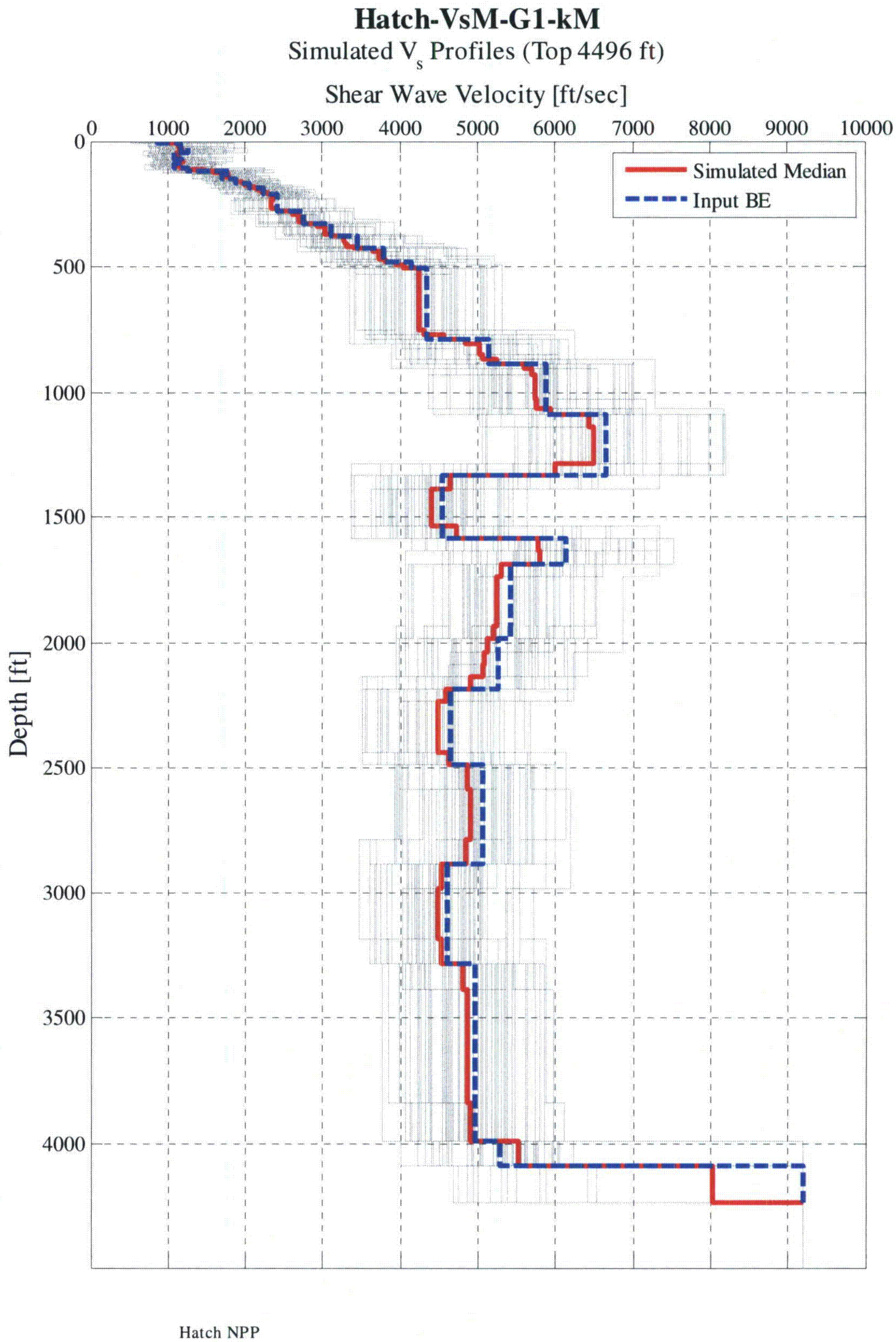

Figure 2.3.3-2: Simulated V_s profiles for the median velocity model.

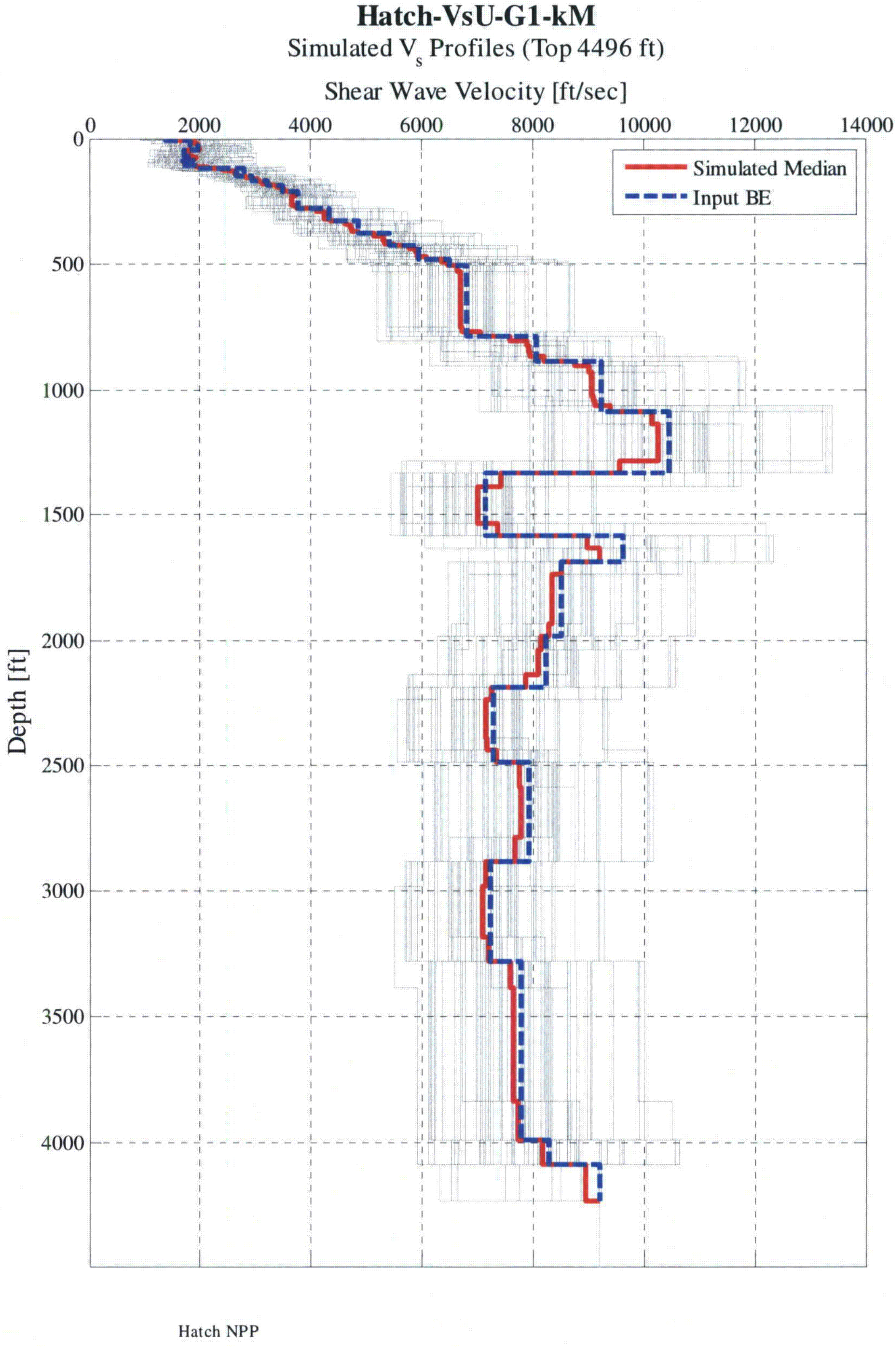

Figure 2.3.3-3: Simulated V_s profiles for the upper-range velocity model.

2.3.4 Input Spectra

SNC Calculation SCNH-13-092 (SNC, 2014b) and LCI (2013b) are the sources of the information presented in the following section.

Input base rock acceleration response spectra for the site amplification analysis are developed for a suite of high frequency (HF) and low frequency (LF) cases. These cases correspond to the UHRS ground motion values for MAFE levels of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, and 10^{-8}. Separate spectral shapes are developed for HF and LF.

The HF spectral shape was anchored to the corresponding UHRS values at 100 Hz, 25 Hz, 10 Hz, 5 Hz, and 2.5 Hz in order to reflect accurately the UHRS values. In between these frequencies, the spectrum is logarithmically interpolated using the average of the CEUS single and double corner spectral shape model given in NUREG/CR-6728 (McGuire et al., 2001) using the deaggregation information for the Hatch site (LCI, 2013b). For the MAFE level of 10^{-3} the deaggregation results for the 10^{-4} level are adopted and for MAFE levels of 10^{-7} and 10^{-8} the results for the 10^{-6} level are used. For frequencies between 0.5 Hz (2 sec) and 0.125 Hz (8 sec), the spectrum was extrapolated from the 0.5 Hz spectral value to a 0.125 Hz value with a 1/T shape, where T is period. For spectral frequencies below 0.125 Hz (8 sec) to 0.1 Hz (10 sec), $1/T^2$ spectral scaling is assumed and is consistent with conventional seismic building codes at Hatch.

For the LF response spectrum the spectral shape – again based on the NUREG/CR-6728 spectral shapes as given this time by the LF deaggregation information for the Hatch site -- is anchored to the UHRS values at 2.5 Hz, 1 Hz, and 0.5 Hz in order to reflect accurately the UHRS values. In between these frequencies, the spectrum is logarithmically interpolated using shapes anchored to the next higher and lower frequencies. Above 2.5 Hz, the spectral amplitudes are scaled using the spectral shape anchored to the 2.5 Hz amplitude. For frequencies between 0.5 Hz (2 sec) and 0.125 Hz (8 sec), the spectrum was extrapolated from the 0.5 Hz spectral value to a 0.125 Hz value with a 1/T shape, where T is period. For spectral frequencies below 0.125 Hz (8 sec) to 0.1 Hz (10 sec), $1/T^2$ spectral scaling is assumed and is consistent with conventional seismic building codes at Hatch.

For the LF response spectrum at MAFE of 10^{-3}, the above procedure results in the high-frequency end of the LF response spectrum exceeding the 10^{-3} HF response spectrum – including the PSHA values – at high-frequencies. Therefore, the LF spectral shape is anchored to the UHRS values at all seven ground motion frequencies (PGA (100 Hz), 25 Hz, 10 Hz, 5 Hz, 2.5 Hz, 1 Hz, and 0.5 Hz). For frequencies between 0.5 Hz (2 sec) and 0.125 Hz (8 sec), the spectrum was extrapolated from the 0.5 Hz spectral value to a 0.125 Hz value with a 1/T shape, where T is period. For spectral frequencies below 0.125 Hz (8 sec) to 0.1 Hz (10 sec), $1/T^2$ spectral scaling is assumed and is consistent with conventional seismic building codes at Hatch.

The HF and LF input spectra are plotted in Figure 2.3.4-1 for the MAFE levels of 10^{-4}, 10^{-5}, and 10^{-6}. The digital values corresponding to these HF and LF spectra are listed in Table 2.3.4-1 for

an interpolated set of 40 spectral frequencies that include the reference seven spectral frequencies of PGA (100 Hz), 25 Hz, 10 Hz, 5 Hz, 2.5 Hz, 1 Hz, and 0.5 Hz.

Table 2.3.4-1: Input HF and LF spectra for MAFE levels of 10^{-4}, 10^{-5}, and 10^{-6} at a suite of 40 spectra frequencies.

Freq. (Hz)	10^{-4} HF (g)	10^{-4} LF (g)	10^{-5} HF (g)	10^{-5} LF (g)	10^{-6} HF (g)	10^{-6} LF (g)
100	1.39E-01	1.39E-01	3.83E-01	2.96E-01	9.93E-01	6.06E-01
90	1.50E-01	1.50E-01	4.14E-01	3.22E-01	1.07E+00	6.59E-01
80	1.69E-01	1.69E-01	4.68E-01	3.66E-01	1.22E+00	7.50E-01
70	1.98E-01	1.98E-01	5.50E-01	4.34E-01	1.43E+00	8.89E-01
60	2.34E-01	2.34E-01	6.53E-01	5.19E-01	1.70E+00	1.06E+00
50	2.67E-01	2.66E-01	7.46E-01	6.00E-01	1.95E+00	1.23E+00
40	2.85E-01	2.84E-01	8.01E-01	6.53E-01	2.10E+00	1.34E+00
35	2.88E-01	2.87E-01	8.10E-01	6.67E-01	2.13E+00	1.37E+00
30	2.86E-01	2.86E-01	8.07E-01	6.73E-01	2.12E+00	1.38E+00
25	2.80E-01	2.80E-01	7.90E-01	6.70E-01	2.08E+00	1.37E+00
20	2.80E-01	2.78E-01	7.76E-01	6.57E-01	2.02E+00	1.35E+00
15	2.71E-01	2.69E-01	7.33E-01	6.26E-01	1.87E+00	1.28E+00
12.5	2.62E-01	2.60E-01	6.94E-01	5.99E-01	1.74E+00	1.23E+00
10	2.47E-01	2.47E-01	6.38E-01	5.62E-01	1.57E+00	1.15E+00
9	2.38E-01	2.38E-01	6.07E-01	5.43E-01	1.47E+00	1.11E+00
8	2.27E-01	2.27E-01	5.73E-01	5.20E-01	1.37E+00	1.07E+00
7	2.15E-01	2.15E-01	5.34E-01	4.95E-01	1.26E+00	1.02E+00
6	2.01E-01	2.01E-01	4.91E-01	4.65E-01	1.13E+00	9.56E-01
5	1.84E-01	1.84E-01	4.42E-01	4.29E-01	9.95E-01	8.85E-01
4	1.66E-01	1.66E-01	3.95E-01	3.87E-01	8.66E-01	7.99E-01
3.5	1.56E-01	1.56E-01	3.67E-01	3.61E-01	7.94E-01	7.48E-01
3	1.44E-01	1.43E-01	3.36E-01	3.33E-01	7.14E-01	6.90E-01
2.5	1.29E-01	1.29E-01	2.99E-01	2.99E-01	6.22E-01	6.22E-01
2	1.08E-01	1.15E-01	2.47E-01	2.63E-01	5.05E-01	5.39E-01
1.5	8.27E-02	9.48E-02	1.83E-01	2.14E-01	3.67E-01	4.32E-01
1.25	6.77E-02	8.14E-02	1.48E-01	1.82E-01	2.92E-01	3.65E-01
1	5.18E-02	6.57E-02	1.11E-01	1.46E-01	2.16E-01	2.89E-01
0.9	4.53E-02	6.24E-02	9.64E-02	1.40E-01	1.87E-01	2.78E-01
0.8	3.89E-02	5.84E-02	8.22E-02	1.32E-01	1.58E-01	2.63E-01
0.7	3.27E-02	5.36E-02	6.83E-02	1.22E-01	1.30E-01	2.43E-01
0.6	2.66E-02	4.80E-02	5.50E-02	1.10E-01	1.04E-01	2.20E-01
0.5	2.08E-02	4.17E-02	4.23E-02	9.58E-02	7.87E-02	1.93E-01
0.4	1.66E-02	3.34E-02	3.38E-02	7.66E-02	6.30E-02	1.54E-01
0.35	1.46E-02	2.92E-02	2.96E-02	6.71E-02	5.51E-02	1.35E-01
0.3	1.25E-02	2.50E-02	2.54E-02	5.75E-02	4.72E-02	1.16E-01
0.25	1.04E-02	2.09E-02	2.11E-02	4.79E-02	3.93E-02	9.65E-02
0.2	8.32E-03	1.67E-02	1.69E-02	3.83E-02	3.15E-02	7.72E-02
0.15	6.24E-03	1.25E-02	1.27E-02	2.87E-02	2.36E-02	5.79E-02
0.125	5.20E-03	1.04E-02	1.06E-02	2.40E-02	1.97E-02	4.83E-02
0.1	3.33E-03	6.67E-03	6.76E-03	1.53E-02	1.26E-02	3.09E-02

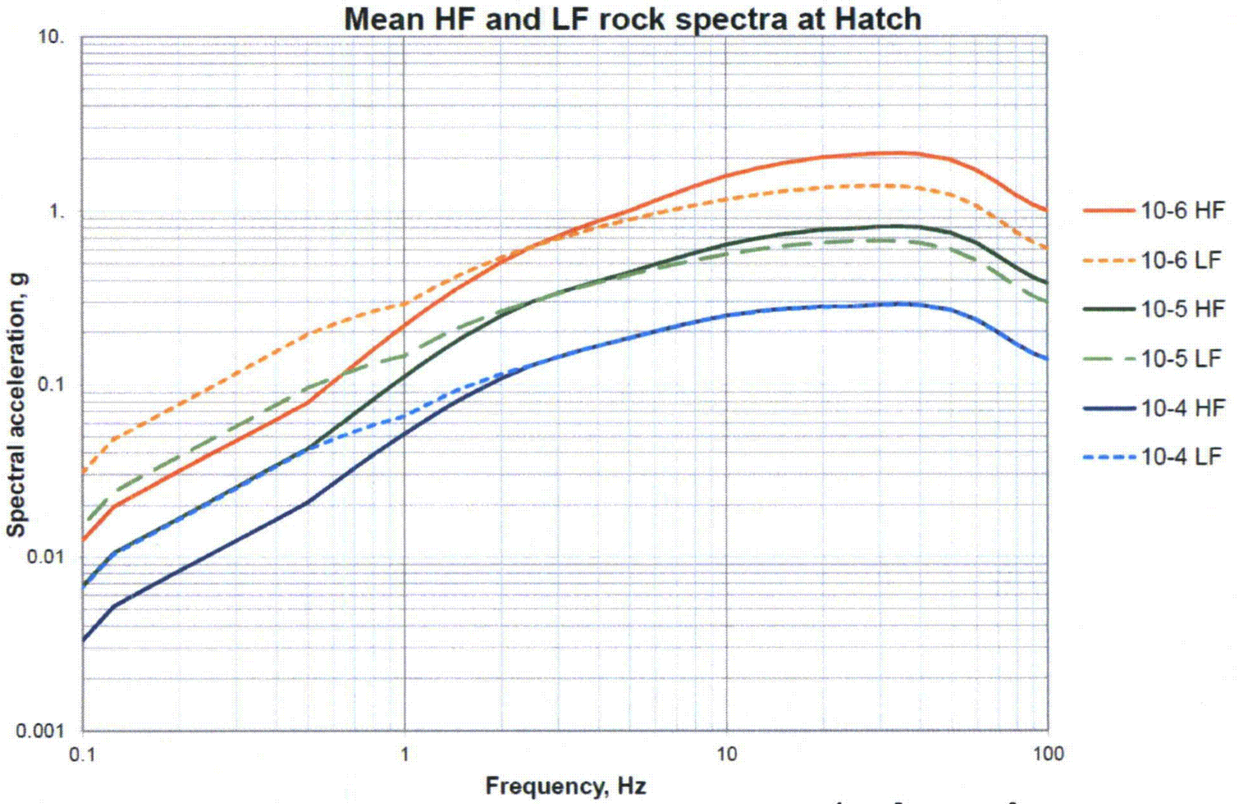

Figure 2.3.4-1: Input HF and LF spectra for MAFE levels of 10^{-4}, 10^{-5}, and 10^{-6} for a spectral damping of 5%.

2.3.5 Methodology

SNC Calculation SCNH-12-076 (SNC, 2014c) is the source of the information presented in the following section.

To perform the site response analyses for the Hatch site, a random vibration theory (RVT) approach was employed. This process utilizes a simple, efficient approach for computing site-specific amplification functions and is consistent with existing NRC guidance and the SPID (EPRI, 2013a). The guidance contained in Appendix B of the SPID (EPRI, 2013a) on incorporating epistemic uncertainty in shear-wave velocities, kappa, non-linear dynamic properties and source spectra for plants with limited at-site information was followed for the Hatch site. These columns and associated weight factors are presented in Table 2.3.5-1.

For each combination of the base profiles and its corresponding 60 randomized 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 weighted average amplification and total standard is computed using linear interpolation in log-log space from the 301 site amplification values.

Table 2.3.5-1: Alternative Base Site Columns and Weights

Shear Wave Velocity		Strain-Dependent Property Curves		Kappa		Base Soil Column Weight (WVs · wG · wk)	Base Soil Column Name
Profile	**Weight (wVs)**	**Profile**	**Weight (wG)**	**Profile**	**Weight (wk)**		
Lower (VsL)	0.3	Set 1 (G1)*	0.5	Lower (kL)	0.3	0.045	VsL_G1_kL
				Median (kM)	0.4	0.060	VsL_G1_kM
				Upper (kU)	0.3	0.045	VsL_G1_kU
		Set 2 (G2)**	0.5	Lower (kL)	0.3	0.045	VsL_G2_kL
				Median (kM)	0.4	0.060	VsL_G2_kM
				Upper (kU)	0.3	0.045	VsL_G2_kU
Median (VsM)	0.4	Set 1 (G1)	0.5	Lower (kL)	0.3	0.060	VsM_G1_kL
				Median (kM)	0.4	0.080	VsM_G1_kM
				Upper (kU)	0.3	0.060	VsM_G1_kU
		Set 2 (G2)	0.5	Lower (kL)	0.3	0.060	VsM_G2_kL
				Median (kM)	0.4	0.080	VsM_G2_kM
				Upper (kU)	0.3	0.060	VsM_G2_kU
Upper (VsU)	0.3	Set 1 (G1)	0.5	Lower (kL)	0.3	0.045	VsU_G1_kL
				Median (kM)	0.4	0.060	VsU_G1_kM
				Upper (kU)	0.3	0.045	VsU_G1_kU
		Set 2 (G2)	0.5	Lower (kL)	0.3	0.045	VsU_G2_kL
				Median (kM)	0.4	0.060	VsU_G2_kM
				Upper (kU)	0.3	0.045	VsU_G2_kU
					Total:	**1.000**	

*G1 designates the EPRI 20-50 ft strain-dependent property curves

*G2 designates the EPRI 50-120 ft strain-dependent property curves

2.3.6 Amplification Functions

SNC Calculation SCNH-12-076 (SNC, 2014c) is the source of the information presented in the following section.

The results of the site response analysis consist of amplification functions which describe the amplification (or de-amplification) of rock motions as a function of frequency and input bedrock amplitude. The amplification functions are represented in terms of a median (computed as the logarithmic mean) amplification value and an associated logarithmic standard deviation (sigma)

for each response spectral frequency and input rock amplitude. As an example, the median and logarithmic standard deviation for the VsM_G1_kM site column are shown in Figure 2.3.6-1 and Figure 2.3.6-2. The data associated for these figures are tabulated in Table 2.3.6-1 for the high-frequency (HF) and low-frequency (LF) input motions at mean-annual frequencies of exceedance (MAFE) of 10^{-4} and 10^{-5}. Similarly, the figures and data are provided for the VsM-G2_kM site column in Figure 2.3.6-3, Figure 2.3.6-4, and Table 2.3.6-2.

The weighted average amplification and total standard deviation are obtained by combining the results of each base profile using their associated weight factors using the method recommended by the SPID (EPRI, 2013a). The weighted average and total standard deviations are shown in Figure 2.3.6-5 and Figure 2.3.6-6. The associated data for the HF4, LF4, HF5, and LF5 is provided in Table 2.3.6-3. Note the tables in this section are provided in lieu of the submittal template Tables A.2-b1 and A.2-b2.

Additionally, the weighted average amplification and total standard deviation is reported at the seven frequencies of interest in Table A-2 in the Appendix.

At some frequencies, the calculated site amplification at high loading levels is less than the minimum value of 0.5 recommended by the SPID (EPRI 1025287, 2013a). The 0.5 limit is not considered in the calculation of the surface hazard as the intended purpose of this calculation is quantification of mean and fractile levels of the seismic response for plant risk assessment that requires a best assessment of the response with no added conservatism.

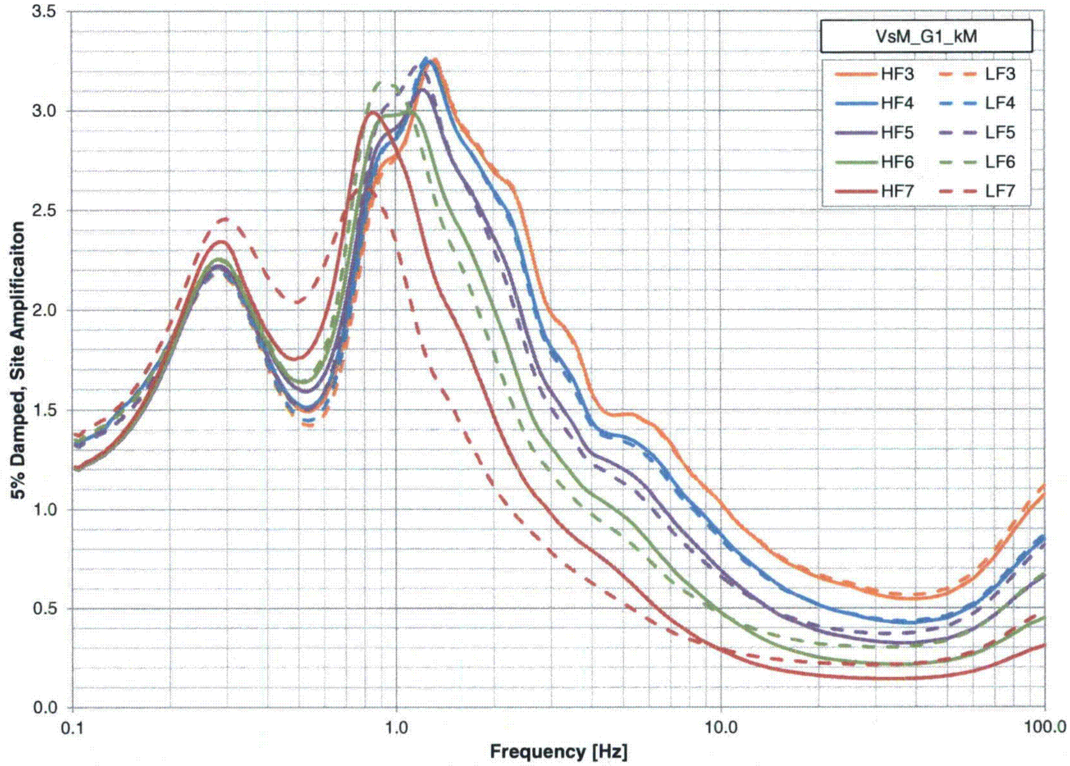

Figure 2.3.6-1: The logarithmic mean site amplification for the VsM_G1_kM site column for the considered input motions.

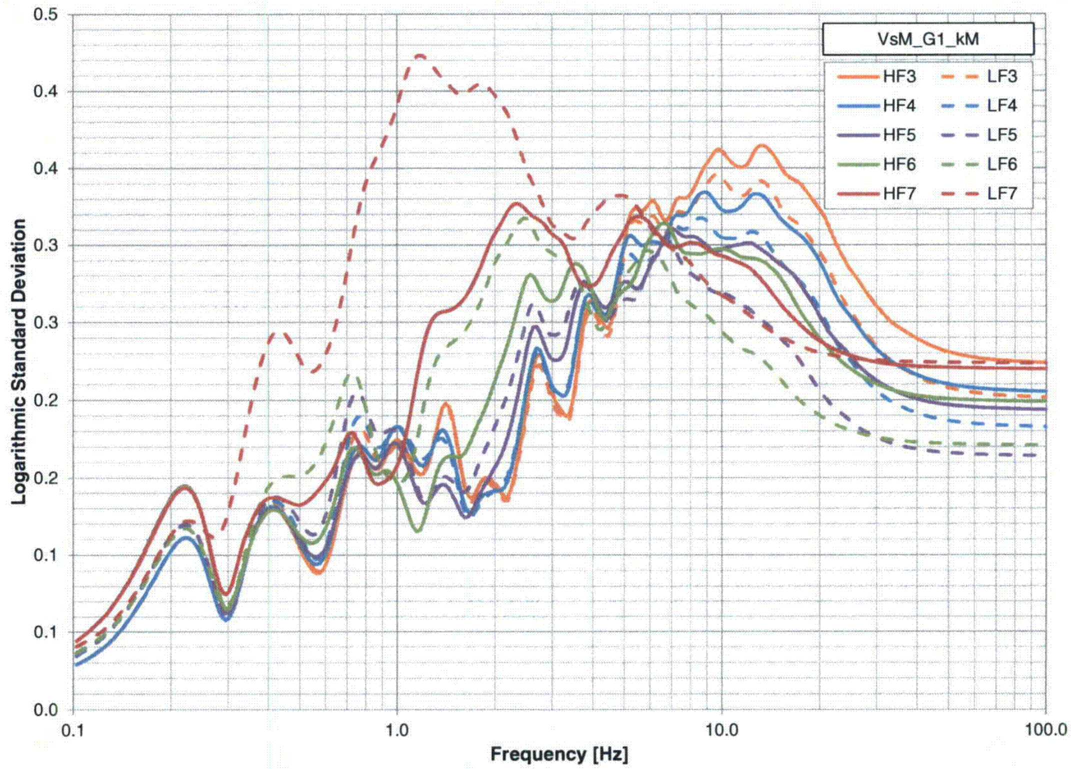

Figure 2.3.6-2: The logarithmic standard deviation of the site amplification for the VsM_G1_kM site column for the considered input motions.

Table 2.3.6-1: The logarithmic mean and standard deviation of the site amplification (for 5% damped PSA) computed for the VsM_G1_kM profile and the HF4, LF4, HF5, and LF5 input motions.

Frequency (Hz)	HF4		LF4		HF5		LF5	
	Median	Log SD	Median	Log-SD	Median	Log-SD	Median	Log-SD
0.100	1.322	0.028	1.312	0.033	1.191	0.043	1.314	0.034
0.125	1.402	0.040	1.385	0.047	1.270	0.061	1.388	0.048
0.167	1.627	0.075	1.583	0.084	1.505	0.104	1.588	0.085
0.200	1.834	0.103	1.798	0.112	1.758	0.137	1.806	0.112
0.300	2.198	0.059	2.172	0.060	2.202	0.062	2.192	0.062
0.400	1.772	0.130	1.736	0.133	1.825	0.129	1.767	0.135
0.500	1.526	0.108	1.462	0.113	1.602	0.109	1.508	0.121
0.600	1.582	0.100	1.508	0.105	1.669	0.105	1.585	0.125
0.700	1.935	0.154	1.860	0.170	2.035	0.151	1.995	0.190
0.800	2.468	0.168	2.418	0.185	2.558	0.162	2.609	0.196
0.900	2.786	0.167	2.775	0.171	2.848	0.161	2.973	0.178
1.000	2.855	0.183	2.880	0.183	2.909	0.172	3.075	0.179
1.250	3.241	0.163	3.266	0.165	3.090	0.135	3.176	0.137
1.500	2.944	0.161	2.945	0.155	2.746	0.136	2.755	0.146
2.000	2.599	0.142	2.587	0.142	2.367	0.157	2.306	0.183
2.500	2.219	0.206	2.187	0.206	1.915	0.231	1.820	0.252
3.000	1.810	0.209	1.782	0.207	1.589	0.226	1.507	0.242
4.000	1.443	0.266	1.421	0.262	1.281	0.269	1.227	0.267
5.000	1.364	0.299	1.340	0.289	1.199	0.276	1.130	0.264
6.000	1.286	0.301	1.256	0.290	1.091	0.286	1.019	0.287
7.000	1.159	0.315	1.127	0.310	0.957	0.310	0.897	0.301
8.000	1.041	0.324	1.016	0.313	0.852	0.305	0.799	0.282
9.000	0.956	0.334	0.930	0.315	0.766	0.299	0.724	0.273
10.000	0.870	0.323	0.846	0.305	0.690	0.297	0.659	0.269
12.500	0.719	0.333	0.705	0.308	0.557	0.301	0.547	0.256
15.000	0.618	0.318	0.610	0.290	0.468	0.288	0.474	0.240
20.000	0.515	0.290	0.515	0.259	0.384	0.254	0.407	0.206
25.000	0.469	0.253	0.472	0.225	0.349	0.228	0.380	0.186
30.000	0.439	0.233	0.445	0.206	0.329	0.212	0.370	0.176
35.000	0.426	0.222	0.435	0.197	0.322	0.205	0.369	0.171
40.000	0.425	0.216	0.435	0.192	0.322	0.201	0.375	0.168
45.000	0.436	0.212	0.447	0.189	0.332	0.198	0.391	0.167
50.000	0.448	0.210	0.460	0.187	0.343	0.197	0.406	0.166
60.000	0.508	0.208	0.521	0.185	0.390	0.195	0.468	0.165
70.000	0.599	0.207	0.613	0.184	0.462	0.195	0.559	0.165
80.000	0.699	0.206	0.717	0.183	0.541	0.194	0.661	0.165
90.000	0.786	0.206	0.806	0.183	0.611	0.194	0.750	0.164
100.000	0.849	0.205	0.871	0.183	0.661	0.194	0.817	0.164

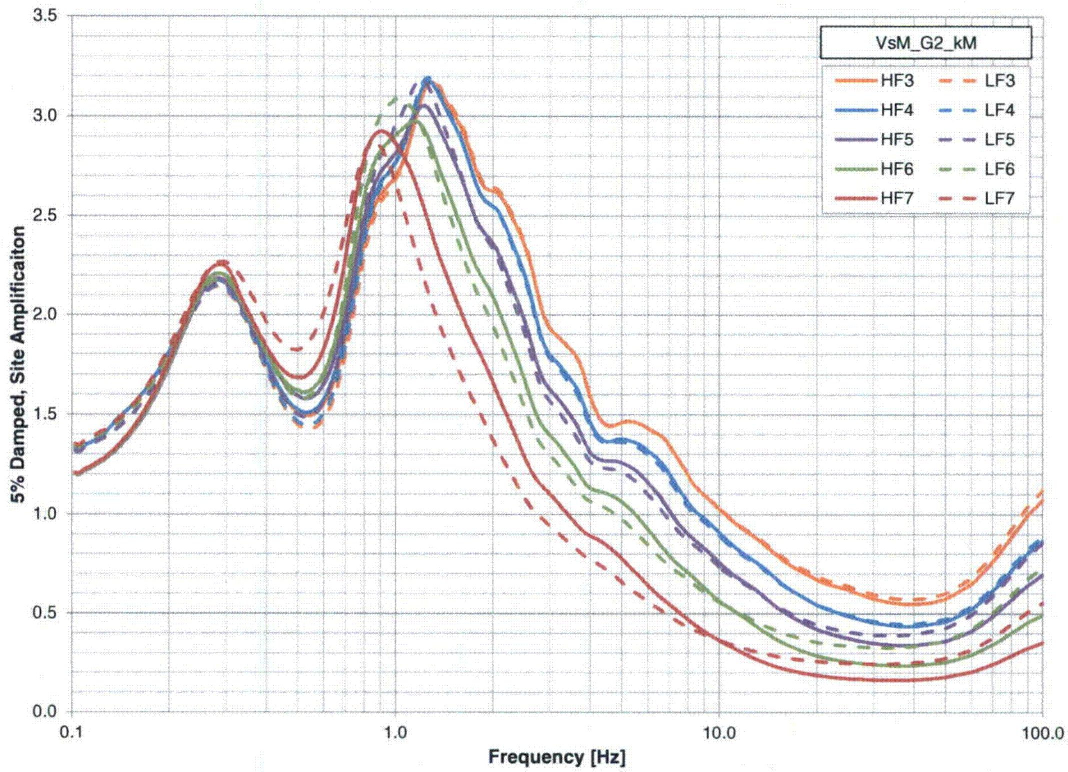

Figure 2.3.6-3: The logarithmic mean site amplification for the VsM_G2_kM site column for the considered input motions.

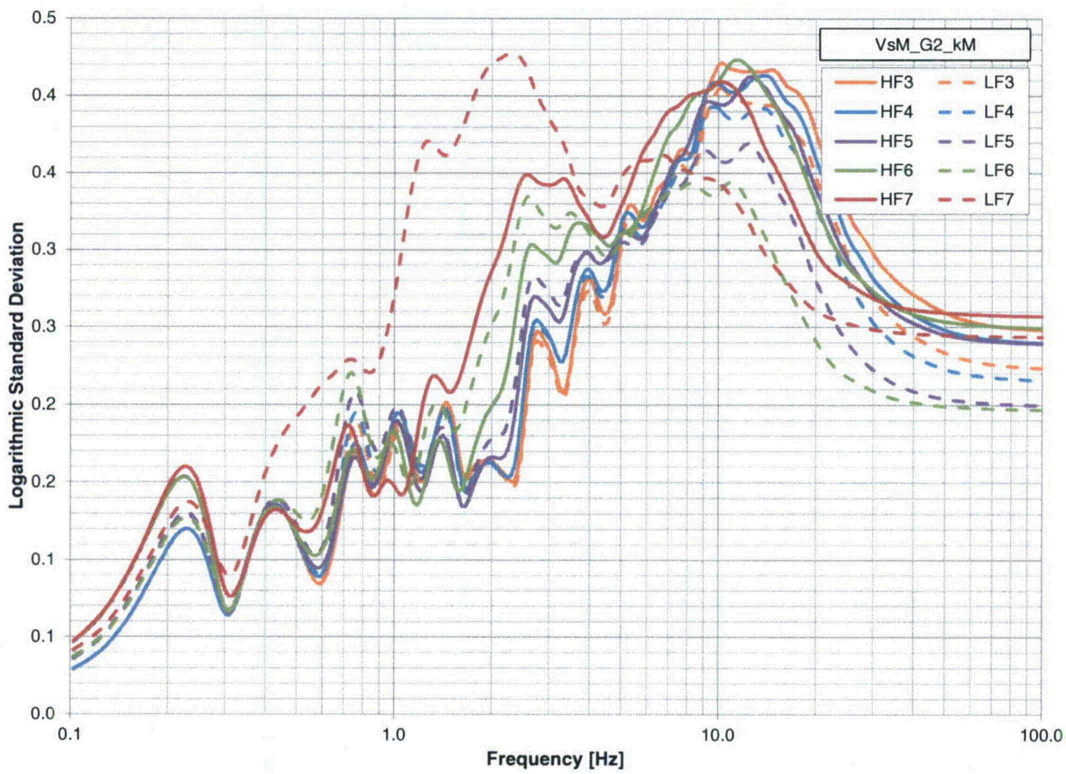

Figure 2.3.6-4: The logarithmic standard deviation of the site amplification for the VsM_G1_kM site column for the considered input motions.

Table 2.3.6-2: The logarithmic mean and standard deviation of the site amplification (for 5% damped PSA) computed for the VsM_G2_kM profile and the HF4, LF4, HF5, and LF5 input motions.

Frequency (Hz)	HF4		LF4		HF5		LF5	
	Median	Log SD	Median	Log SD	Median	Log SD	Median	Log SD
0.100	1.315	0.029	1.305	0.035	1.186	0.045	1.307	0.036
0.125	1.393	0.041	1.377	0.050	1.264	0.064	1.379	0.050
0.167	1.612	0.078	1.569	0.088	1.492	0.109	1.572	0.089
0.200	1.812	0.108	1.776	0.118	1.737	0.143	1.782	0.119
0.300	2.158	0.065	2.132	0.068	2.164	0.068	2.146	0.069
0.400	1.760	0.132	1.725	0.133	1.809	0.131	1.748	0.133
0.500	1.525	0.115	1.462	0.121	1.592	0.116	1.496	0.123
0.600	1.573	0.091	1.501	0.093	1.648	0.096	1.557	0.108
0.700	1.915	0.150	1.840	0.165	1.995	0.147	1.939	0.183
0.800	2.412	0.166	2.358	0.186	2.475	0.158	2.497	0.198
0.900	2.666	0.152	2.646	0.156	2.717	0.154	2.804	0.171
1.000	2.764	0.191	2.780	0.189	2.812	0.189	2.955	0.198
1.250	3.168	0.159	3.189	0.162	3.044	0.148	3.159	0.157
1.500	2.973	0.188	2.983	0.185	2.792	0.165	2.831	0.165
2.000	2.548	0.163	2.543	0.162	2.361	0.166	2.333	0.178
2.500	2.204	0.204	2.187	0.204	1.970	0.238	1.908	0.256
3.000	1.796	0.244	1.780	0.243	1.622	0.262	1.564	0.273
4.000	1.457	0.287	1.437	0.282	1.309	0.297	1.262	0.298
5.000	1.375	0.317	1.361	0.311	1.256	0.311	1.207	0.305
6.000	1.319	0.317	1.296	0.311	1.158	0.312	1.101	0.309
7.000	1.203	0.343	1.176	0.337	1.019	0.349	0.968	0.337
8.000	1.059	0.359	1.038	0.349	0.902	0.367	0.869	0.347
9.000	0.978	0.398	0.961	0.386	0.829	0.395	0.801	0.365
10.000	0.908	0.408	0.892	0.392	0.756	0.395	0.733	0.359
12.500	0.775	0.409	0.766	0.390	0.637	0.412	0.629	0.369
15.000	0.672	0.407	0.666	0.383	0.533	0.394	0.538	0.340
20.000	0.542	0.359	0.544	0.329	0.420	0.339	0.444	0.280
25.000	0.488	0.309	0.492	0.279	0.374	0.294	0.406	0.240
30.000	0.454	0.282	0.460	0.253	0.350	0.272	0.392	0.223
35.000	0.438	0.267	0.448	0.239	0.341	0.259	0.390	0.213
40.000	0.436	0.258	0.447	0.231	0.340	0.253	0.395	0.209
45.000	0.447	0.252	0.458	0.226	0.350	0.248	0.411	0.206
50.000	0.458	0.248	0.471	0.223	0.361	0.245	0.426	0.204
60.000	0.519	0.244	0.532	0.219	0.410	0.242	0.491	0.202
70.000	0.611	0.242	0.627	0.218	0.485	0.241	0.586	0.201
80.000	0.713	0.241	0.732	0.217	0.568	0.240	0.693	0.200
90.000	0.802	0.240	0.823	0.216	0.641	0.240	0.786	0.200
100.000	0.866	0.240	0.889	0.216	0.693	0.239	0.856	0.200

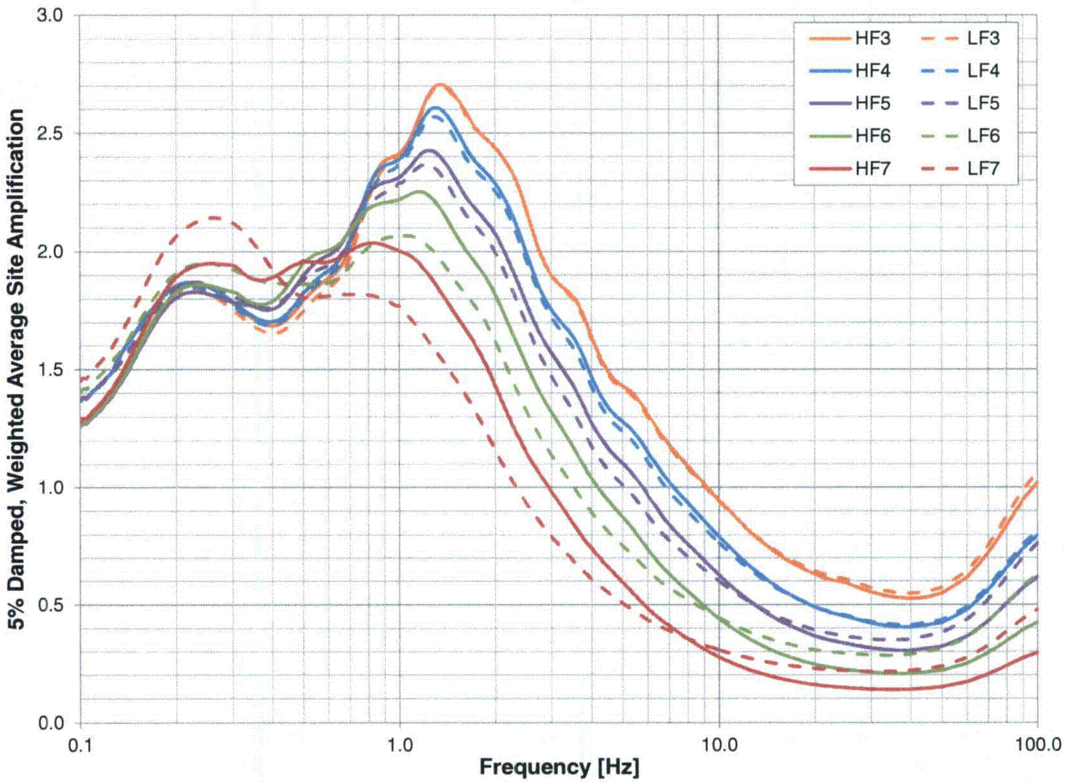

Figure 2.3.6-5: Weighted Average Median Amplification Factors at Ground Surface.

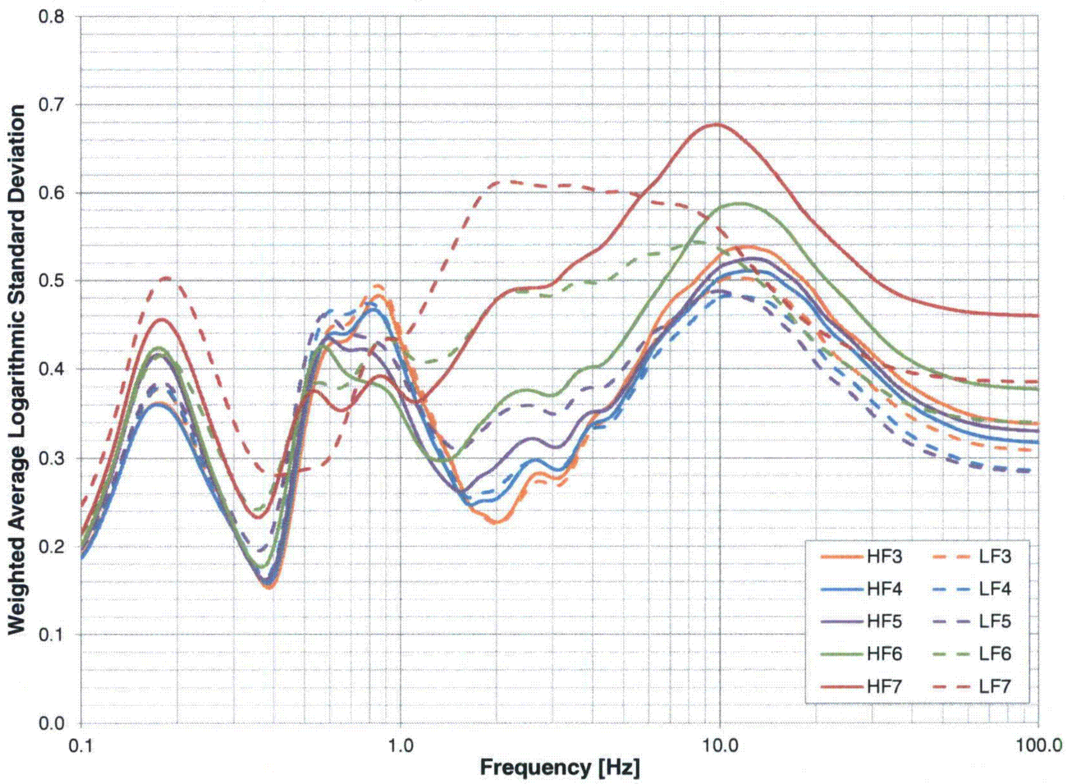

Figure 2.3.6-6: Total Logarithmic Standard Deviations for Amplification Functions at Ground Surface.

Table 2.3.6-3: The weighted average median and total logarithmic standard deviation of the site amplification (for 5% damped PSA) the HF4, LF4, HF5, and LF5 input motions.

Frequency (Hz)	HF4		LF4		HF5		LF5	
	Median	Log-SD	Median	Log-SD	Median	Log-SD	Median	Log-SD
0.100	1.365	0.187	1.367	0.197	1.258	0.198	1.371	0.200
0.125	1.482	0.258	1.475	0.266	1.378	0.284	1.480	0.270
0.167	1.752	0.359	1.720	0.374	1.672	0.412	1.730	0.380
0.200	1.853	0.344	1.832	0.362	1.805	0.390	1.847	0.369
0.300	1.789	0.219	1.773	0.223	1.788	0.220	1.814	0.232
0.400	1.704	0.164	1.688	0.177	1.756	0.172	1.767	0.222
0.500	1.823	0.345	1.798	0.373	1.899	0.358	1.877	0.406
0.600	1.919	0.438	1.896	0.464	1.983	0.434	1.939	0.460
0.700	2.047	0.442	2.022	0.462	2.089	0.420	2.041	0.439
0.800	2.265	0.465	2.229	0.473	2.239	0.420	2.182	0.434
0.900	2.361	0.453	2.326	0.456	2.290	0.401	2.246	0.422
1.000	2.386	0.411	2.370	0.416	2.311	0.370	2.288	0.397
1.250	2.595	0.323	2.559	0.329	2.425	0.295	2.363	0.334
1.500	2.522	0.265	2.476	0.271	2.307	0.263	2.226	0.309
2.000	2.287	0.254	2.253	0.266	2.073	0.291	1.996	0.346
2.500	1.997	0.294	1.968	0.295	1.780	0.321	1.695	0.359
3.000	1.755	0.288	1.722	0.288	1.568	0.312	1.468	0.349
4.000	1.471	0.338	1.427	0.333	1.274	0.352	1.176	0.379
5.000	1.280	0.366	1.239	0.358	1.103	0.375	1.009	0.400
6.000	1.152	0.414	1.109	0.404	0.965	0.420	0.881	0.436
7.000	1.021	0.446	0.982	0.432	0.841	0.449	0.774	0.453
8.000	0.932	0.467	0.897	0.450	0.757	0.475	0.705	0.469
9.000	0.857	0.487	0.826	0.468	0.688	0.499	0.648	0.483
10.000	0.791	0.503	0.763	0.480	0.625	0.514	0.598	0.487
12.500	0.663	0.510	0.648	0.480	0.513	0.524	0.509	0.477
15.000	0.579	0.503	0.572	0.468	0.441	0.515	0.452	0.456
20.000	0.488	0.463	0.490	0.425	0.366	0.471	0.391	0.406
25.000	0.449	0.426	0.453	0.390	0.334	0.436	0.365	0.375
30.000	0.421	0.398	0.427	0.363	0.314	0.408	0.353	0.349
35.000	0.407	0.375	0.416	0.341	0.306	0.384	0.350	0.328
40.000	0.404	0.358	0.414	0.324	0.304	0.368	0.353	0.315
45.000	0.413	0.347	0.424	0.314	0.313	0.357	0.367	0.306
50.000	0.423	0.339	0.434	0.307	0.322	0.350	0.380	0.300
60.000	0.478	0.328	0.490	0.296	0.365	0.339	0.437	0.291
70.000	0.562	0.322	0.576	0.290	0.431	0.335	0.521	0.287
80.000	0.656	0.320	0.672	0.288	0.505	0.332	0.616	0.286
90.000	0.737	0.318	0.756	0.286	0.569	0.331	0.699	0.285
100.000	0.796	0.317	0.816	0.285	0.616	0.330	0.761	0.284

2.3.7 Control Point Seismic Hazard Curves

SNC Calculation SCNH-13-093 (SNC, 2014d) is the source of the information presented in the following section.

The procedure to develop probabilistic site-specific control point hazard curves used in the present analysis follows the methodology described in McGuire et al. (2001) and Section B-6.0 of the SPID (EPRI 1025287, 2013a). 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 (PGA), 25, 10, 5, 2.5, 1, 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, 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 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 (McGuire et al., 2001) is used with an M_w of 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 5^{th}, 16^{th}, 50^{th}, 84^{th}, and 95^{th}) was used in the Method 3 approach (McGuire et al., 2001) 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 high frequency (HF) and low frequency (LF) input spectra. For frequencies equal to 5 Hz and higher the results from only the HF cases were used and for frequencies equal to 2.5 Hz and lower only the results from the LF cases were used. For frequencies between 2.5 Hz and 5 Hz the results from both the HF and LF cases were combined using weights that are computed based on the log interpolation of the difference in the given frequency value from the two end member values of 2.5 Hz and 5 Hz. The mean control point hazard curves for the seven reference spectral frequencies for the Hatch 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.

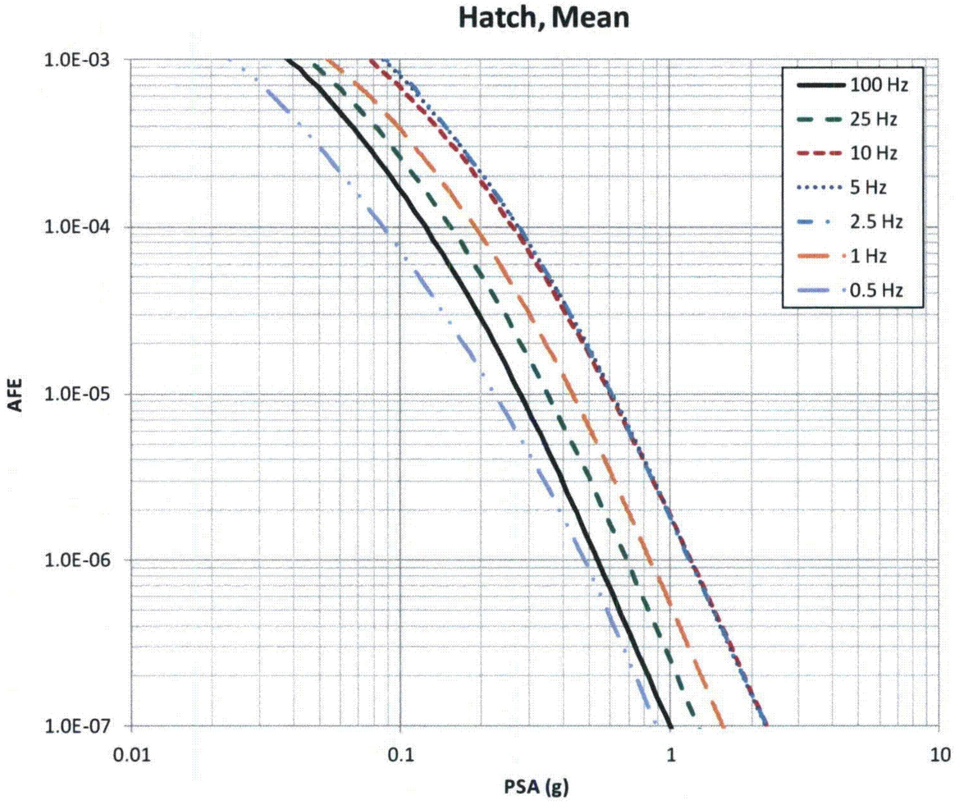

Figure 2.3.7-1: Control point mean hazard curves for spectral frequencies of 0.5, 1, 2.5, 5, 10, 25 and 100 Hz at the Hatch site. The hazard curve relates the pseudo-spectral acceleration (PSA) to the annual frequency of exceedance (AFE).

2.4 Control Point Response Spectra

SNC Calculation SCNH-13-093 (SNC, 2014d) is the source of the information presented in the following section.

The control point hazard curves described above and provided in Tables A-1a through A-1g of Appendix A for the seven reference frequencies 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 (NRC, 2007). The UHRS and GMRS spectral accelerations are shown Figure 2.4-1, as well as tabulated in Table 2.4-1.

Table 2.4-1. UHRS for 10^{-4} and 10^{-5} and GMRS at control point for Hatch.

Frequency (Hz)	Mean UHRS (g) (AFE=10^{-4})	Mean UHRS (g) (AFE=10^{-5})	GMRS (g)
100.000	0.1244	0.2784	0.1422
90.000	0.1243	0.2784	0.1422
80.000	0.1248	0.2795	0.1427
70.000	0.1257	0.2815	0.1438
60.000	0.1270	0.2842	0.1452
50.000	0.1291	0.2894	0.1478
45.000	0.1317	0.2955	0.1508
40.000	0.1336	0.3002	0.1532
35.000	0.1378	0.3103	0.1583
30.000	0.1443	0.3271	0.1666
25.000	0.1538	0.3520	0.1790
20.000	0.1745	0.3985	0.2027
15.000	0.2107	0.4839	0.2459
12.500	0.2351	0.5401	0.2744
10.000	0.2610	0.5978	0.3039
9.000	0.2678	0.6115	0.3111
8.000	0.2723	0.6166	0.3142
7.000	0.2766	0.6196	0.3164
6.000	0.2807	0.6269	0.3203
5.000	0.2740	0.6098	0.3118
4.000	0.2739	0.6006	0.3080
3.000	0.2695	0.5906	0.3029
2.500	0.2751	0.6039	0.3096
2.000	0.2782	0.6173	0.3158
1.500	0.2563	0.5528	0.2844
1.250	0.2360	0.5177	0.2654
1.000	0.1893	0.4342	0.2206
0.900	0.1847	0.4280	0.2171
0.800	0.1673	0.3983	0.2009
0.700	0.1365	0.3390	0.1696
0.600	0.1142	0.2920	0.1452
0.500	0.0865	0.2245	0.1113
0.400	0.0593	0.1475	0.0737
0.300	0.0476	0.1154	0.0580
0.200	0.0354	0.0873	0.0437
0.167	0.0280	0.0691	0.0346
0.125	0.0168	0.0403	0.0203
0.100	0.0121	0.0288	0.0145

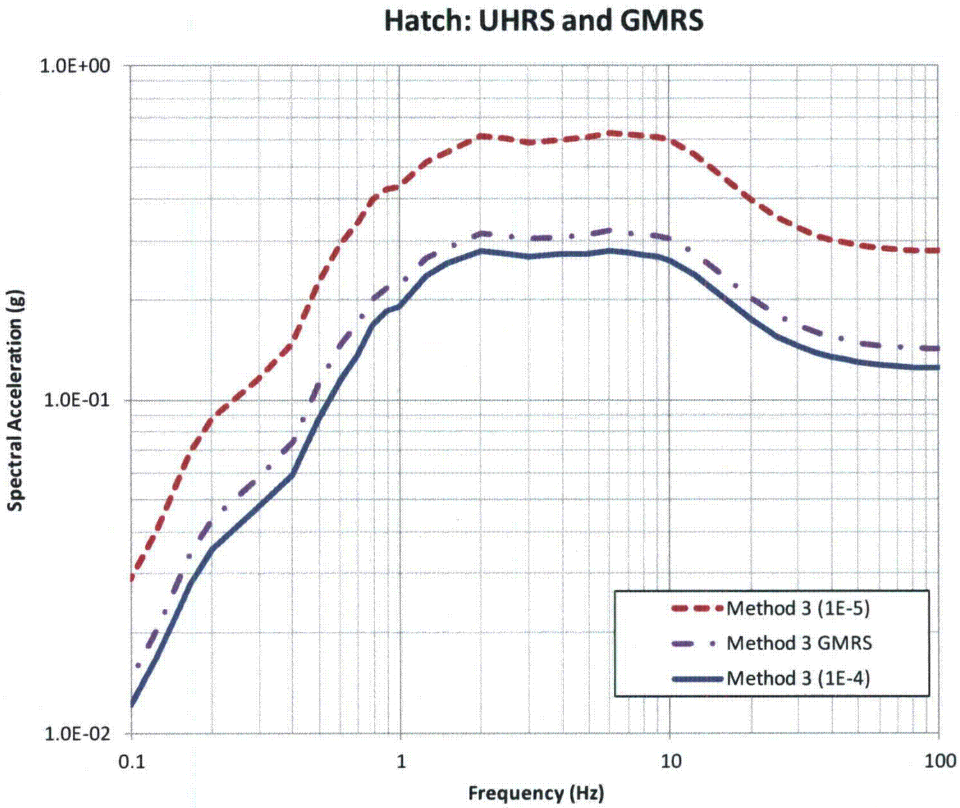

Figure 2.4-1: UHRS for 1E-4 and 1E-5 and GMRS at control point for Hatch.

3.0 Plant Design Basis and Beyond Design Basis Evaluation Ground Motion

The structural and seismic design basis for Plant Hatch Unit 1 is described in the Updated Hatch Unit 1 Final Safety Analysis Report (SNC, 2014e) in sections 12.3 Structural Design Bases and 12.6 Analysis of Seismic Class 1 Structures. The structural and seismic design basis for Plant Hatch Unit 2 is described in the Updated Hatch Unit 2 Final Safety Analysis Report (SNC, 2014e) in section 3.0 Design of Structures, Components, Equipment, and Systems and in Supplement 3.7A Seismic Design.

3.1 SSE Description of Spectral Shape

The Design Basis Earthquake (DBE) for Plant Hatch Unit 1 is described in the Updated Hatch Unit 1 Final Safety Analysis Report (SNC, 2014e) in section 2.5.8 Design Spectra. The DBE for Plant Hatch Unit 2 is described in the Updated Hatch Unit 2 Final Safety Analysis Report (SNC, 2014e) in section 2.5.2.10 and Supplement 3.7A.1.1.

The Plant Hatch site is within a region of infrequent seismic activity. No earthquakes within 200 miles of the site, including those of the Charleston area about 150 miles from the site, produced Modified Mercalli intensities at the site greater than VI. Historically, reported earthquakes occurring in other areas have not produced intensities greater than VI at the site. The design basis earthquake (DBE) is conservatively selected as modified Mercalli Intensity VII. This intensity corresponds with the highest damage sustained at Savannah, Georgia, during the 1886 Charleston event. An intensity of VII (MM) is equivalent to 0.12 g on both the Neumann (1954) and Hershberger (1956) curves. However, a horizontal surface acceleration of 0.15 g is conservatively selected for the DBE. Hatch Unit 1 was licensed separately from Hatch Unit 2. As a result the DBE spectral shape for Unit 1 is the Housner spectral shape and Hatch Unit 2 DBE spectral shape is the Modified Newmark spectral shape.

The Plant Hatch Unit1 DBE and the Hatch Unit 2 DBE horizontal spectra are provided in Table 3.1-1 and shown in Figure 3.3-1. (Plant Hatch Updated FSAR (SNC, 2014e): Unit 1 Figure 2.5-3 and Unit 2 Figure 3.7A-2; and McGaha, 1994)

Table 3.1-1 Horizontal DBE for Plant Hatch Units 1 and 2.

Hatch Unit 1 DBE		***Hatch Unit 2 DBE***	
Frequency (Hz)	**Spectral Acceleration (g)**	**Frequency (Hz)**	**Spectral Acceleration (g)**
0.10	0.015	0.10	0.007
0.33	0.051	0.14	0.015
0.50	0.069	0.22	0.036
0.67	0.092	0.33	0.050
1.00	0.128	0.50	0.080
1.11	0.133	0.70	0.110
1.25	0.150	1.00	0.160
1.43	0.165	1.25	0.200
1.67	0.178	1.50	0.240
2.00	0.206	2.00	0.320
2.22	0.216	2.50	0.320
2.50	0.221	3.00	0.320
2.86	0.225	4.00	0.320
3.33	0.221	5.00	0.320
4.00	0.221	6.00	0.320
5.00	0.216	7.70	0.260
6.67	0.206	8.30	0.240
8.00	0.188	10.00	0.210
10.00	0.169	11.10	0.200
11.11	0.163	12.50	0.180
12.50	0.156	14.30	0.165
14.29	0.150	16.00	0.150
16.67	0.150	100.00	0.150
20.00	0.150		
22.22	0.150		
25.00	0.150		
28.67	0.150		
33.33	0.150		

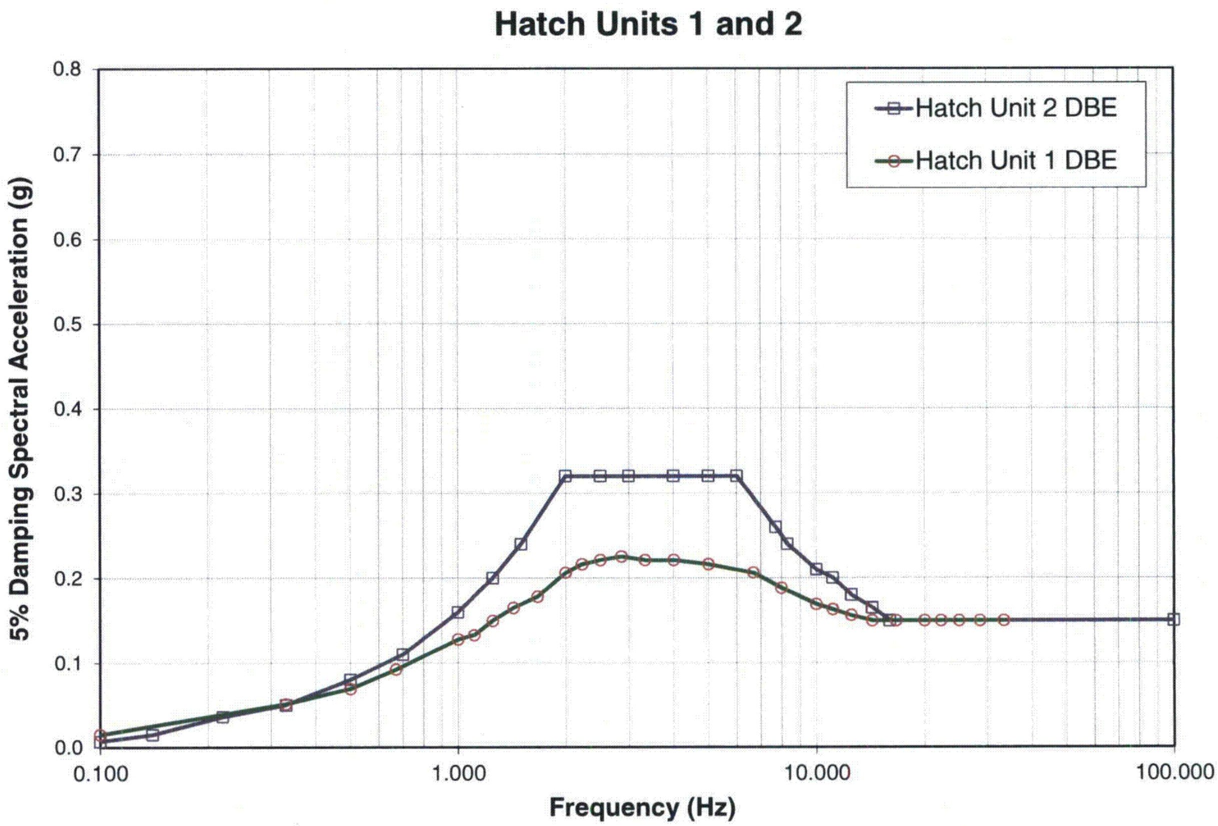

Figure 3.1-1 Horizontal DBE for Plant Hatch Units 1 and 2.

3.2 Control Point Elevation

The SSE control point elevation is defined at Elevation 129 feet which is general plant grade. There are safety related structures founded at plant grade. The SPID (EPRI, 2013a) section 2.4.2 Figure 2-2 is representative of the Hatch site conditions. Also Hatch Unit 2 FSAR (SNC, 2014e) section 3.7A.4.2 states there is a free field acceleration sensor in the free field which is surface mounted. This fact supports the location of the control point for the SSE and the GMRS is at general plant grade.

4.0 Screening Evaluation

In accordance with SPID (EPRI, 2013a) Section 3, a screening evaluation was performed as described below.

4.1 Risk Evaluation Screening (1 to 10 Hz)

In the 1 to 10 Hz part of the response spectrum, the GMRS exceeds the DBE. Therefore, Plant Hatch Units 1 and 2 screens in for a risk evaluation.

4.2 High Frequency Screening (> 10 Hz)

Above 10 Hz, the GMRS exceeds the DBE. The high frequency exceedances can be addressed in the risk evaluation discussed in 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 DBE. Therefore, Plant Hatch Units 1 and 2 screens in for a spent fuel pool evaluation.

5.0 Interim Actions

Based on the screening evaluation, the expedited seismic evaluation described in EPRI 3002000704 (EPRI 2113c) is being performed as proposed in a letter to NRC dated April 9, 2013 (ML131 01A379) and agreed to by NRC in a letter dated May 7, 2013 (ML13106A331).

Consistent with NRC letter dated February 20, 2014, [ML14030A046] the seismic hazard reevaluations presented herein are distinct from the current design and licensing bases of Plant Hatch Units 1 and 2. Therefore, the results do not call into question the operability or functionality of SSCs and are not reportable pursuant to10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and10 CFR 50.73, "Licensee event report system."

The NRC letter also requests that licensees provide an interim evaluation or actions to demonstrate that the plant can cope with the reevaluated hazard while the expedited approach and risk evaluations are conducted. In response to that request, NEI letter dated March 12, 2014 (NEI, 2014), provides seismic core damage risk estimates using the updated seismic hazards for the operating nuclear plants in the Central and Eastern United States. 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.

Plant Hatch Units 1 and 2 is included in the March 12, 2014 risk estimates (NEI, 2014). Using the methodology described in the NEI letter, all plants were shown to be below 10^{-4}/year; thus, the above conclusions apply.

Additional information is provided on the status of the recent 2.3 seismic walkdowns, expedited seismic evaluations, and a previous seismic margin assessment that demonstrates Plant Hatch Units 1 and 2 has been shown to have significant seismic margin beyond its seismic design basis.

The recent NTTF 2.3: Seismic Walkdowns provide additional assurance that Plant Hatch Units 1 and 2 is maintaining the seismic capacity of the plant. The past IPEEE Seismic Margin Assessment also provides additional assurance that Plant Hatch Units 1 and 2 has been shown to have a beyond the design basis High Confidence of a Low Probability of Failure (HCLPF) of at least 0.3g which is twice that of the Plant Hatch DBE (0.15g).

NTTF 2.3 Seismic Walkdowns

In the 2012 to 2014 time frame, the NTTF 2.3: Seismic Walkdowns were performed at Plant Hatch for a broad range of safety related equipment. Walkdowns for the remaining equipment that required an outage to access are complete and those reports will be submitted in 2014.

The NTTF 2.3: Seismic Walkdown Equipment List for Unit 1 included over 15 components that had seismic issues previously identified during the IPEEE program. The NTTF 2.3: Seismic Walkdown Equipment List for Unit 2 included 6 components that had seismic issues previously identified during the IPEEE program. The NTTF 2.3: Seismic Walkdown teams performed walkdowns and reviewed documentation to verify that the recommended resolutions to the IPEEE issues associated with these items had been implemented.

Beyond Design Basis Evaluations

IPEEE-Seismic

Hatch Unit 1 performed a full EPRI Seismic Margin Assessment (SMA) (EPRI NP-6041-SLR1, 1991a) as a trial BWR assessment of the EPRI SMA methodology and it is documented in EPRI NP-7217-SLV1 (1991b). This SMA included soil failure evaluation and a full relay evaluation. This SMA project was peer reviewed by several review panels. As part of the response to IPEEE-Seismic, Hatch Unit 2 performed a focus scope SMA in the mid 1990's. In addition Plant Hatch Unit 2 performed a full SQUG GIP relay review. The Review Level Earthquake (RLE) for both SMAs was a NUREG/CR 0098 type soil spectral shape with peak ground acceleration (PGA) of 0.3g. This ground motion spectrum is up to 2 times the Hatch Unit 2 DBE and even higher for the Hatch Unit 1 DBE. These seismic margin assessments resulted in some modifications that were made to correct issues identified to assure Hatch Units 1 and 2 had at least a seismic HCLPF spectrum of 0.3g. The NTTF 2.3: Seismic Walkdown verified that these modifications are still in place. It is noted that the previous Hatch HCLPF spectrum fully envelops the Hatch GMRS presented in section 2.4. For information the Hatch Units 1 and 2 HCLPF spectrum is provided in Table 5.0-1 and shown in Figure 5.0-1.

Table 5.0-1: IPEEE HCLPF.

Frequency (Hz)	Spectral Acceleration (g)
100	0.3
33	0.3
20	0.38
12.5	0.45
10	0.54
8	0.637
2	0.637
1	0.3
0.5	0.15

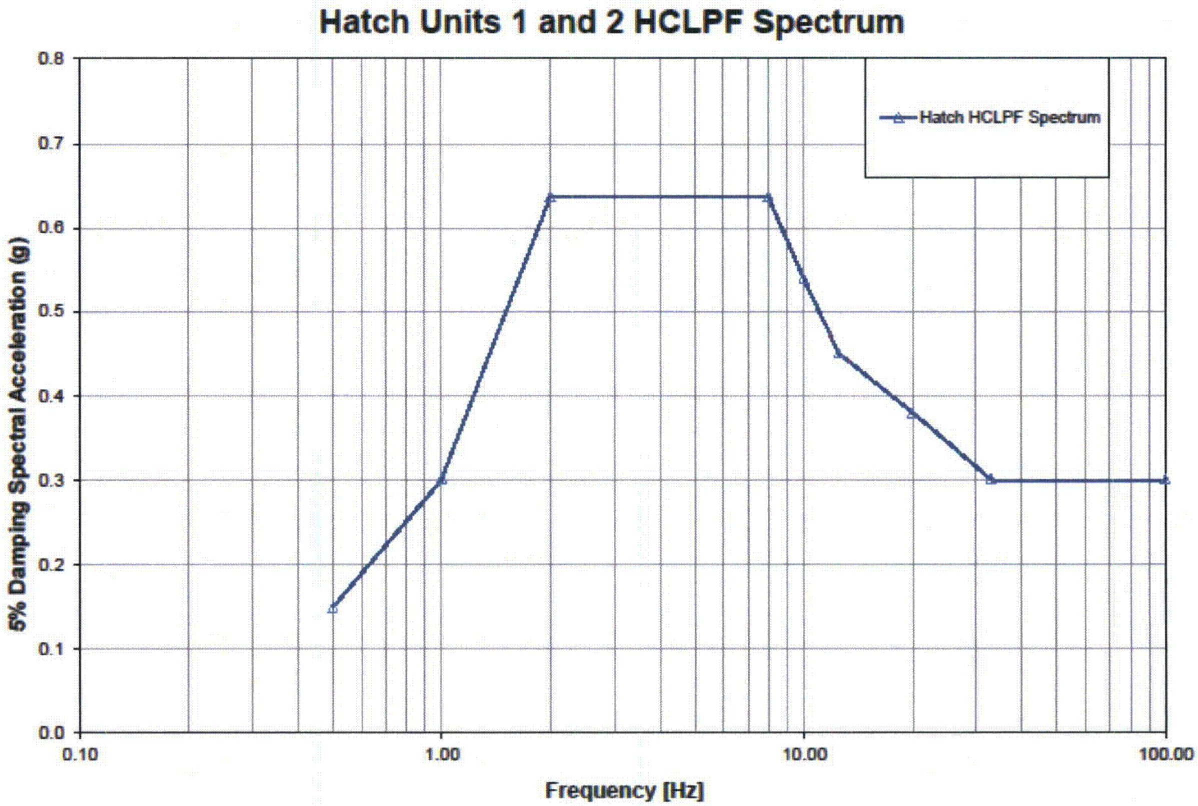

Figure 5.0-1: IPEEE HCLPF Spectrum.

ESEP

The Expedited Seismic Evaluation Process (ESEP) walkdowns and associated seismic margin evaluations of the Plant Hatch Unit 1 and 2 Expedited Seismic Equipment List (ESEL) were initiated the latter part of last year. The seismic demand used in the ESEP is 2 x Hatch ISRS which is equivalent to the IPEEE HCLPF ISRS. Walkdowns have been performed for all "accessible" equipment. Walkdowns are planned in the upcoming refueling outages for the remaining items that require an outage.

6.0 Conclusions

In accordance with the 50.54(f) (NRC, 2012) request for information, a seismic hazard and screening evaluation was performed for Plant Hatch Units 1 and 2. A GMRS was developed solely for purpose of screening for additional evaluations in accordance with the SPID (EPRI, 2013a).

Based on the results of the screening evaluation, Plant Hatch Units 1 and 2 screens in for a risk evaluation, a Spent Fuel Pool evaluation, and a High Frequency Evaluation as part of the risk evaluation.

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Appendix A

Table A-1a. 100 Hz (PGA) Seismic Hazard Curves at Hatch.

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0043	9.455E-03	0.0014	9.445E-03	0.0026	9.393E-03	0.0040	9.415E-03	0.0059	9.447E-03	0.0108	9.414E-03
0.0047	9.083E-03	0.0015	9.128E-03	0.0028	9.024E-03	0.0043	9.041E-03	0.0064	9.095E-03	0.0116	9.070E-03
0.0051	8.668E-03	0.0017	8.776E-03	0.0030	8.615E-03	0.0046	8.624E-03	0.0068	8.703E-03	0.0124	8.687E-03
0.0055	8.218E-03	0.0018	8.393E-03	0.0032	8.172E-03	0.0050	8.174E-03	0.0074	8.278E-03	0.0133	8.274E-03
0.0059	7.745E-03	0.0019	7.989E-03	0.0034	7.707E-03	0.0054	7.701E-03	0.0079	7.831E-03	0.0143	7.838E-03
0.0064	7.261E-03	0.0020	7.571E-03	0.0037	7.230E-03	0.0058	7.217E-03	0.0085	7.370E-03	0.0154	7.389E-03
0.0069	6.776E-03	0.0022	7.148E-03	0.0040	6.751E-03	0.0062	6.731E-03	0.0092	6.908E-03	0.0165	6.936E-03
0.0074	6.300E-03	0.0024	6.728E-03	0.0043	6.279E-03	0.0067	6.254E-03	0.0099	6.451E-03	0.0177	6.488E-03
0.0080	5.841E-03	0.0025	6.316E-03	0.0046	5.822E-03	0.0072	5.793E-03	0.0106	6.009E-03	0.0190	6.051E-03
0.0086	5.404E-03	0.0027	5.917E-03	0.0049	5.385E-03	0.0077	5.353E-03	0.0115	5.584E-03	0.0204	5.631E-03
0.0093	4.992E-03	0.0029	5.536E-03	0.0053	4.972E-03	0.0083	4.938E-03	0.0123	5.182E-03	0.0219	5.230E-03
0.0100	4.607E-03	0.0031	5.173E-03	0.0057	4.585E-03	0.0090	4.550E-03	0.0133	4.804E-03	0.0235	4.852E-03
0.0108	4.249E-03	0.0033	4.831E-03	0.0061	4.225E-03	0.0096	4.190E-03	0.0143	4.451E-03	0.0252	4.496E-03
0.0117	3.917E-03	0.0036	4.510E-03	0.0065	3.890E-03	0.0104	3.856E-03	0.0154	4.122E-03	0.0271	4.163E-03
0.0126	3.611E-03	0.0038	4.208E-03	0.0070	3.581E-03	0.0112	3.547E-03	0.0166	3.816E-03	0.0290	3.851E-03
0.0136	3.328E-03	0.0041	3.926E-03	0.0076	3.295E-03	0.0120	3.263E-03	0.0178	3.532E-03	0.0312	3.559E-03
0.0147	3.067E-03	0.0044	3.663E-03	0.0081	3.032E-03	0.0129	3.001E-03	0.0192	3.269E-03	0.0335	3.286E-03
0.0158	2.826E-03	0.0047	3.417E-03	0.0087	2.790E-03	0.0139	2.760E-03	0.0207	3.025E-03	0.0359	3.030E-03
0.0171	2.604E-03	0.0051	3.187E-03	0.0094	2.567E-03	0.0150	2.537E-03	0.0222	2.798E-03	0.0385	2.791E-03
0.0184	2.399E-03	0.0055	2.973E-03	0.0101	2.361E-03	0.0161	2.333E-03	0.0239	2.588E-03	0.0414	2.566E-03
0.0199	2.209E-03	0.0059	2.773E-03	0.0108	2.171E-03	0.0174	2.144E-03	0.0258	2.392E-03	0.0444	2.355E-03
0.0215	2.034E-03	0.0063	2.587E-03	0.0116	1.995E-03	0.0187	1.969E-03	0.0277	2.210E-03	0.0477	2.157E-03
0.0232	1.871E-03	0.0067	2.413E-03	0.0125	1.832E-03	0.0201	1.807E-03	0.0299	2.039E-03	0.0512	1.971E-03
0.0250	1.720E-03	0.0072	2.250E-03	0.0134	1.681E-03	0.0217	1.656E-03	0.0321	1.878E-03	0.0549	1.796E-03
0.0270	1.578E-03	0.0077	2.098E-03	0.0144	1.539E-03	0.0233	1.515E-03	0.0346	1.726E-03	0.0589	1.631E-03
0.0291	1.445E-03	0.0083	1.955E-03	0.0155	1.407E-03	0.0251	1.382E-03	0.0372	1.582E-03	0.0632	1.476E-03
0.0314	1.319E-03	0.0089	1.821E-03	0.0166	1.283E-03	0.0270	1.256E-03	0.0401	1.444E-03	0.0679	1.330E-03
0.0339	1.200E-03	0.0096	1.695E-03	0.0179	1.166E-03	0.0291	1.137E-03	0.0431	1.312E-03	0.0729	1.191E-03
0.0365	1.086E-03	0.0102	1.576E-03	0.0192	1.055E-03	0.0313	1.024E-03	0.0464	1.185E-03	0.0782	1.061E-03

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0394	9.782E-04	0.0110	1.463E-03	0.0206	9.510E-04	0.0337	9.170E-04	0.0500	1.063E-03	0.0839	9.384E-04
0.0425	8.754E-04	0.0118	1.355E-03	0.0222	8.527E-04	0.0362	8.152E-04	0.0538	9.470E-04	0.0901	8.236E-04
0.0459	7.782E-04	0.0126	1.251E-03	0.0238	7.606E-04	0.0390	7.193E-04	0.0579	8.367E-04	0.0967	7.169E-04
0.0495	6.871E-04	0.0136	1.151E-03	0.0256	6.748E-04	0.0420	6.297E-04	0.0623	7.330E-04	0.1038	6.187E-04
0.0534	6.026E-04	0.0145	1.055E-03	0.0275	5.952E-04	0.0452	5.469E-04	0.0671	6.366E-04	0.1114	5.294E-04
0.0577	5.250E-04	0.0156	9.617E-04	0.0296	5.222E-04	0.0486	4.711E-04	0.0722	5.482E-04	0.1195	4.491E-04
0.0622	4.546E-04	0.0167	8.722E-04	0.0318	4.557E-04	0.0524	4.028E-04	0.0777	4.683E-04	0.1283	3.780E-04
0.0671	3.916E-04	0.0179	7.865E-04	0.0341	3.956E-04	0.0564	3.420E-04	0.0837	3.970E-04	0.1377	3.157E-04
0.0724	3.357E-04	0.0192	7.051E-04	0.0367	3.417E-04	0.0607	2.884E-04	0.0901	3.342E-04	0.1478	2.619E-04
0.0782	2.865E-04	0.0206	6.283E-04	0.0394	2.937E-04	0.0653	2.419E-04	0.0970	2.796E-04	0.1586	2.159E-04
0.0843	2.437E-04	0.0221	5.566E-04	0.0423	2.513E-04	0.0703	2.019E-04	0.1044	2.327E-04	0.1703	1.770E-04
0.0910	2.064E-04	0.0237	4.905E-04	0.0455	2.140E-04	0.0756	1.678E-04	0.1124	1.927E-04	0.1828	1.444E-04
0.0982	1.742E-04	0.0255	4.300E-04	0.0488	1.813E-04	0.0814	1.390E-04	0.1209	1.589E-04	0.1962	1.173E-04
0.1059	1.465E-04	0.0273	3.752E-04	0.0525	1.529E-04	0.0876	1.148E-04	0.1302	1.305E-04	0.2105	9.479E-05
0.1143	1.226E-04	0.0293	3.259E-04	0.0564	1.283E-04	0.0943	9.453E-05	0.1401	1.069E-04	0.2260	7.627E-05
0.1233	1.021E-04	0.0314	2.820E-04	0.0606	1.071E-04	0.1015	7.766E-05	0.1508	8.721E-05	0.2425	6.109E-05
0.1331	8.452E-05	0.0337	2.431E-04	0.0651	8.901E-05	0.1093	6.364E-05	0.1624	7.097E-05	0.2603	4.869E-05
0.1436	6.958E-05	0.0362	2.087E-04	0.0699	7.361E-05	0.1176	5.203E-05	0.1748	5.758E-05	0.2794	3.861E-05
0.1549	5.693E-05	0.0388	1.784E-04	0.0751	6.059E-05	0.1266	4.245E-05	0.1881	4.659E-05	0.2999	3.047E-05
0.1672	4.630E-05	0.0416	1.519E-04	0.0807	4.966E-05	0.1363	3.455E-05	0.2025	3.759E-05	0.3219	2.393E-05
0.1804	3.743E-05	0.0446	1.286E-04	0.0867	4.054E-05	0.1467	2.807E-05	0.2180	3.023E-05	0.3455	1.870E-05
0.1946	3.009E-05	0.0478	1.083E-04	0.0932	3.297E-05	0.1579	2.277E-05	0.2346	2.424E-05	0.3708	1.455E-05
0.2100	2.405E-05	0.0513	9.063E-05	0.1001	2.672E-05	0.1699	1.843E-05	0.2526	1.936E-05	0.3980	1.129E-05
0.2266	1.912E-05	0.0550	7.537E-05	0.1076	2.159E-05	0.1829	1.490E-05	0.2719	1.541E-05	0.4271	8.723E-06
0.2445	1.512E-05	0.0590	6.227E-05	0.1156	1.739E-05	0.1968	1.202E-05	0.2926	1.222E-05	0.4585	6.726E-06
0.2638	1.190E-05	0.0633	5.109E-05	0.1242	1.397E-05	0.2119	9.688E-06	0.3150	9.650E-06	0.4921	5.176E-06
0.2846	9.316E-06	0.0679	4.164E-05	0.1334	1.120E-05	0.2281	7.791E-06	0.3391	7.590E-06	0.5281	3.979E-06
0.3071	7.254E-06	0.0728	3.371E-05	0.1433	8.951E-06	0.2455	6.252E-06	0.3650	5.946E-06	0.5669	3.057E-06
0.3314	5.620E-06	0.0781	2.711E-05	0.1540	7.140E-06	0.2642	5.003E-06	0.3929	4.641E-06	0.6084	2.349E-06
0.3575	4.332E-06	0.0838	2.167E-05	0.1655	5.683E-06	0.2844	3.991E-06	0.4229	3.610E-06	0.6530	1.806E-06
0.3858	3.324E-06	0.0898	1.721E-05	0.1778	4.513E-06	0.3061	3.173E-06	0.4552	2.799E-06	0.7009	1.391E-06

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.4162	2.539E-06	0.0964	1.359E-05	0.1910	3.575E-06	0.3295	2.513E-06	0.4900	2.164E-06	0.7523	1.073E-06
0.4491	1.932E-06	0.1033	1.066E-05	0.2052	2.825E-06	0.3546	1.982E-06	0.5274	1.669E-06	0.8074	8.301E-07
0.4846	1.465E-06	0.1108	8.314E-06	0.2205	2.225E-06	0.3817	1.556E-06	0.5677	1.285E-06	0.8666	6.438E-07
0.5229	1.108E-06	0.1189	6.440E-06	0.2369	1.746E-06	0.4108	1.216E-06	0.6111	9.875E-07	0.9301	5.009E-07
0.5642	8.360E-07	0.1275	4.956E-06	0.2545	1.365E-06	0.4422	9.454E-07	0.6578	7.581E-07	0.9983	3.909E-07
0.6088	6.298E-07	0.1368	3.788E-06	0.2734	1.061E-06	0.4759	7.315E-07	0.7081	5.816E-07	1.0715	3.060E-07
0.6568	4.741E-07	0.1467	2.877E-06	0.2938	8.203E-07	0.5123	5.631E-07	0.7622	4.460E-07	1.1501	2.403E-07
0.7087	3.568E-07	0.1573	2.170E-06	0.3156	6.304E-07	0.5514	4.313E-07	0.8204	3.421E-07	1.2344	1.892E-07
0.7647	2.687E-07	0.1687	1.627E-06	0.3391	4.812E-07	0.5935	3.289E-07	0.8831	2.625E-07	1.3249	1.492E-07
0.8251	2.026E-07	0.1810	1.213E-06	0.3644	3.649E-07	0.6388	2.496E-07	0.9506	2.016E-07	1.4220	1.179E-07
0.8903	1.530E-07	0.1941	8.995E-07	0.3915	2.747E-07	0.6876	1.888E-07	1.0232	1.549E-07	1.5262	9.317E-08
0.9606	1.158E-07	0.2082	6.637E-07	0.4206	2.055E-07	0.7400	1.423E-07	1.1014	1.192E-07	1.6381	7.365E-08
1.0365	8.794E-08	0.2233	4.874E-07	0.4519	1.527E-07	0.7965	1.070E-07	1.1856	9.179E-08	1.7582	5.817E-08
1.1184	6.692E-08	0.2395	3.564E-07	0.4855	1.128E-07	0.8574	8.026E-08	1.2762	7.072E-08	1.8871	4.588E-08
1.2067	5.105E-08	0.2568	2.595E-07	0.5216	8.280E-08	0.9228	6.015E-08	1.3737	5.449E-08	2.0254	3.610E-08
1.3020	3.900E-08	0.2755	1.881E-07	0.5605	6.048E-08	0.9933	4.504E-08	1.4787	4.197E-08	2.1739	2.832E-08
1.4049	2.983E-08	0.2954	1.358E-07	0.6022	4.395E-08	1.0691	3.370E-08	1.5917	3.228E-08	2.3333	2.213E-08
1.5158	2.281E-08	0.3169	9.754E-08	0.6470	3.179E-08	1.1507	2.521E-08	1.7133	2.478E-08	2.5043	1.722E-08
1.6356	1.743E-08	0.3399	6.974E-08	0.6951	2.290E-08	1.2386	1.884E-08	1.8442	1.896E-08	2.6879	1.333E-08
1.7648	1.328E-08	0.3645	4.961E-08	0.7468	1.643E-08	1.3331	1.406E-08	1.9852	1.444E-08	2.8849	1.026E-08
1.9042	1.008E-08	0.3909	3.511E-08	0.8024	1.174E-08	1.4349	1.047E-08	2.1369	1.095E-08	3.0964	7.847E-09
2.0546	7.612E-09	0.4193	2.471E-08	0.8621	8.356E-09	1.5444	7.770E-09	2.3002	8.253E-09	3.3234	5.960E-09
2.2169	5.713E-09	0.4497	1.730E-08	0.9262	5.925E-09	1.6623	5.745E-09	2.4759	6.176E-09	3.5671	4.492E-09
2.3920	4.255E-09	0.4823	1.204E-08	0.9951	4.185E-09	1.7893	4.225E-09	2.6651	4.584E-09	3.8286	3.358E-09
2.5809	3.141E-09	0.5173	8.323E-09	1.0692	2.942E-09	1.9259	3.087E-09	2.8688	3.373E-09	4.1092	2.488E-09
2.7848	2.296E-09	0.5549	5.716E-09	1.1487	2.058E-09	2.0729	2.239E-09	3.0880	2.457E-09	4.4105	1.825E-09
3.0048	1.660E-09	0.5951	3.896E-09	1.2342	1.432E-09	2.2311	1.609E-09	3.3240	1.771E-09	4.7338	1.326E-09
3.2421	1.185E-09	0.6383	2.634E-09	1.3260	9.900E-10	2.4015	1.145E-09	3.5780	1.262E-09	5.0808	9.522E-10
3.4982	8.354E-10	0.6846	1.765E-09	1.4247	6.794E-10	2.5848	8.054E-10	3.8514	8.885E-10	5.4533	6.760E-10
3.7746	5.806E-10	0.7342	1.170E-09	1.5307	4.624E-10	2.7821	5.597E-10	4.1457	6.172E-10	5.8531	4.741E-10
4.0727	3.975E-10	0.7875	7.679E-10	1.6445	3.118E-10	2.9945	3.839E-10	4.4625	4.228E-10	6.2821	3.281E-10

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
4.3944	2.679E-10	0.8446	4.978E-10	1.7669	2.081E-10	3.2232	2.595E-10	4.8035	2.854E-10	6.7427	2.240E-10
4.7415	1.775E-10	0.9059	3.186E-10	1.8984	1.373E-10	3.4692	1.729E-10	5.1705	1.897E-10	7.2369	1.508E-10
5.1161	1.157E-10	0.9716	2.011E-10	2.0396	8.945E-11	3.7341	1.133E-10	5.5656	1.241E-10	7.7675	9.997E-11
5.5202	7.399E-11	1.0420	1.251E-10	2.1914	5.751E-11	4.0192	7.307E-11	5.9909	7.986E-11	8.3369	6.527E-11
5.9562	4.645E-11	1.1176	7.659E-11	2.3544	3.645E-11	4.3260	4.631E-11	6.4487	5.050E-11	8.9481	4.194E-11
6.4267	2.861E-11	1.1987	4.614E-11	2.5296	2.276E-11	4.6563	2.883E-11	6.9415	3.137E-11	9.6040	2.650E-11
6.9344	1.727E-11	1.2856	2.732E-11	2.7178	1.399E-11	5.0118	1.762E-11	7.4719	1.913E-11	10.3081	1.647E-11
7.4821	1.022E-11	1.3789	1.590E-11	2.9200	8.454E-12	5.3944	1.057E-11	8.0429	1.145E-11	11.0637	1.005E-11
8.0732	5.918E-12	1.4789	9.076E-12	3.1372	5.022E-12	5.8062	6.216E-12	8.6575	6.720E-12	11.8748	6.029E-12

Table A-1b. 0.5 Hz Seismic Hazard Curves at Hatch.

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.00095	1.056E-02	0.00040	1.056E-02	0.00057	1.054E-02	0.00090	1.052E-02	0.0015	1.054E-02	0.0024	1.057E-02
0.00103	1.051E-02	0.00042	1.051E-02	0.00061	1.050E-02	0.00097	1.048E-02	0.0016	1.049E-02	0.0026	1.052E-02
0.00111	1.044E-02	0.00045	1.045E-02	0.00065	1.044E-02	0.00103	1.041E-02	0.0018	1.043E-02	0.0028	1.045E-02
0.00120	1.034E-02	0.00048	1.036E-02	0.00070	1.035E-02	0.00111	1.033E-02	0.0019	1.034E-02	0.0030	1.036E-02
0.00129	1.021E-02	0.00052	1.024E-02	0.00074	1.024E-02	0.00118	1.022E-02	0.0020	1.022E-02	0.0032	1.023E-02
0.00139	1.003E-02	0.00055	1.010E-02	0.00079	1.009E-02	0.00126	1.008E-02	0.0022	1.007E-02	0.0034	1.007E-02
0.00150	9.811E-03	0.00059	9.913E-03	0.00085	9.917E-03	0.00135	9.909E-03	0.0023	9.889E-03	0.0037	9.865E-03
0.00162	9.547E-03	0.00063	9.692E-03	0.00091	9.702E-03	0.00145	9.700E-03	0.0025	9.666E-03	0.0039	9.620E-03
0.00175	9.241E-03	0.00067	9.433E-03	0.00097	9.451E-03	0.00155	9.454E-03	0.0027	9.404E-03	0.0042	9.335E-03
0.00189	8.895E-03	0.00072	9.138E-03	0.00104	9.165E-03	0.00165	9.174E-03	0.0028	9.106E-03	0.0046	9.011E-03
0.00204	8.518E-03	0.00077	8.810E-03	0.00111	8.846E-03	0.00177	8.863E-03	0.0030	8.777E-03	0.0049	8.654E-03
0.00220	8.118E-03	0.00082	8.455E-03	0.00118	8.501E-03	0.00189	8.525E-03	0.0033	8.420E-03	0.0052	8.271E-03
0.00237	7.704E-03	0.00088	8.078E-03	0.00126	8.133E-03	0.00202	8.166E-03	0.0035	8.045E-03	0.0056	7.870E-03
0.00256	7.284E-03	0.00094	7.686E-03	0.00135	7.751E-03	0.00216	7.794E-03	0.0037	7.656E-03	0.0060	7.458E-03
0.00276	6.868E-03	0.00100	7.287E-03	0.00144	7.361E-03	0.00231	7.413E-03	0.0040	7.262E-03	0.0065	7.044E-03
0.00298	6.460E-03	0.00107	6.887E-03	0.00154	6.969E-03	0.00247	7.032E-03	0.0043	6.870E-03	0.0070	6.633E-03
0.00322	6.066E-03	0.00115	6.491E-03	0.00165	6.581E-03	0.00265	6.654E-03	0.0046	6.484E-03	0.0075	6.233E-03
0.00347	5.690E-03	0.00123	6.106E-03	0.00176	6.202E-03	0.00283	6.285E-03	0.0049	6.108E-03	0.0080	5.847E-03
0.00375	5.332E-03	0.00131	5.734E-03	0.00188	5.835E-03	0.00303	5.928E-03	0.0053	5.747E-03	0.0086	5.478E-03
0.00404	4.995E-03	0.00140	5.378E-03	0.00201	5.484E-03	0.00324	5.586E-03	0.0057	5.403E-03	0.0093	5.128E-03
0.00436	4.677E-03	0.00150	5.039E-03	0.00215	5.149E-03	0.00346	5.259E-03	0.0061	5.075E-03	0.0099	4.798E-03
0.00471	4.379E-03	0.00160	4.719E-03	0.00229	4.831E-03	0.00370	4.949E-03	0.0065	4.765E-03	0.0107	4.487E-03
0.00508	4.099E-03	0.00171	4.417E-03	0.00245	4.531E-03	0.00396	4.655E-03	0.0070	4.473E-03	0.0115	4.195E-03
0.00548	3.837E-03	0.00183	4.134E-03	0.00262	4.249E-03	0.00423	4.378E-03	0.0075	4.198E-03	0.0123	3.921E-03
0.00591	3.592E-03	0.00195	3.868E-03	0.00280	3.984E-03	0.00453	4.117E-03	0.0080	3.940E-03	0.0132	3.665E-03
0.00638	3.362E-03	0.00209	3.618E-03	0.00299	3.734E-03	0.00484	3.871E-03	0.0086	3.697E-03	0.0142	3.426E-03
0.00688	3.147E-03	0.00223	3.385E-03	0.00319	3.500E-03	0.00518	3.640E-03	0.0092	3.469E-03	0.0152	3.202E-03
0.00743	2.946E-03	0.00238	3.166E-03	0.00341	3.281E-03	0.00554	3.422E-03	0.0099	3.255E-03	0.0163	2.993E-03
0.00801	2.757E-03	0.00255	2.962E-03	0.00365	3.075E-03	0.00592	3.217E-03	0.0106	3.055E-03	0.0176	2.797E-03
0.00865	2.581E-03	0.00272	2.771E-03	0.00390	2.883E-03	0.00633	3.025E-03	0.0113	2.866E-03	0.0188	2.614E-03

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.00933	2.416E-03	0.00291	2.591E-03	0.00416	2.702E-03	0.00677	2.844E-03	0.0121	2.689E-03	0.0202	2.443E-03
0.01007	2.261E-03	0.00311	2.424E-03	0.00445	2.532E-03	0.00724	2.674E-03	0.0130	2.523E-03	0.0217	2.282E-03
0.01086	2.116E-03	0.00333	2.267E-03	0.00475	2.373E-03	0.00775	2.514E-03	0.0139	2.367E-03	0.0233	2.133E-03
0.01172	1.979E-03	0.00356	2.120E-03	0.00508	2.224E-03	0.00828	2.363E-03	0.0149	2.221E-03	0.0250	1.992E-03
0.01265	1.851E-03	0.00380	1.981E-03	0.00543	2.083E-03	0.00886	2.221E-03	0.0160	2.083E-03	0.0269	1.860E-03
0.01365	1.730E-03	0.00406	1.851E-03	0.00580	1.951E-03	0.00947	2.087E-03	0.0171	1.952E-03	0.0289	1.736E-03
0.01472	1.616E-03	0.00434	1.729E-03	0.00619	1.827E-03	0.01013	1.961E-03	0.0183	1.830E-03	0.0310	1.619E-03
0.01589	1.507E-03	0.00464	1.613E-03	0.00662	1.709E-03	0.01084	1.842E-03	0.0196	1.713E-03	0.0333	1.507E-03
0.01714	1.402E-03	0.00496	1.503E-03	0.00707	1.597E-03	0.01159	1.729E-03	0.0211	1.603E-03	0.0357	1.400E-03
0.01850	1.301E-03	0.00530	1.399E-03	0.00756	1.490E-03	0.01239	1.621E-03	0.0226	1.497E-03	0.0383	1.298E-03
0.01996	1.203E-03	0.00566	1.299E-03	0.00807	1.388E-03	0.01325	1.518E-03	0.0242	1.396E-03	0.0412	1.199E-03
0.02154	1.108E-03	0.00605	1.203E-03	0.00863	1.290E-03	0.01417	1.418E-03	0.0259	1.298E-03	0.0442	1.103E-03
0.02324	1.016E-03	0.00647	1.111E-03	0.00922	1.196E-03	0.01516	1.323E-03	0.0277	1.204E-03	0.0474	1.011E-03
0.02507	9.253E-04	0.00692	1.022E-03	0.00985	1.104E-03	0.01621	1.229E-03	0.0297	1.112E-03	0.0509	9.208E-04
0.02705	8.378E-04	0.00739	9.374E-04	0.01053	1.016E-03	0.01734	1.139E-03	0.0319	1.023E-03	0.0547	8.340E-04
0.02919	7.535E-04	0.00790	8.559E-04	0.01125	9.307E-04	0.01854	1.050E-03	0.0341	9.358E-04	0.0587	7.508E-04
0.03150	6.733E-04	0.00844	7.781E-04	0.01202	8.485E-04	0.01983	9.637E-04	0.0366	8.517E-04	0.0630	6.715E-04
0.03399	5.978E-04	0.00902	7.044E-04	0.01284	7.696E-04	0.02121	8.797E-04	0.0392	7.706E-04	0.0677	5.968E-04
0.03667	5.275E-04	0.00964	6.348E-04	0.01372	6.945E-04	0.02268	7.984E-04	0.0420	6.931E-04	0.0727	5.271E-04
0.03957	4.630E-04	0.01031	5.698E-04	0.01466	6.235E-04	0.02426	7.203E-04	0.0450	6.196E-04	0.0780	4.628E-04
0.04270	4.044E-04	0.01102	5.095E-04	0.01567	5.570E-04	0.02594	6.460E-04	0.0482	5.506E-04	0.0837	4.042E-04
0.04607	3.518E-04	0.01178	4.540E-04	0.01674	4.954E-04	0.02774	5.760E-04	0.0516	4.865E-04	0.0899	3.513E-04
0.04971	3.050E-04	0.01259	4.033E-04	0.01789	4.386E-04	0.02967	5.107E-04	0.0553	4.276E-04	0.0965	3.040E-04
0.05364	2.637E-04	0.01345	3.573E-04	0.01911	3.869E-04	0.03173	4.506E-04	0.0593	3.740E-04	0.1036	2.621E-04
0.05788	2.274E-04	0.01438	3.157E-04	0.02042	3.402E-04	0.03393	3.957E-04	0.0635	3.258E-04	0.1113	2.252E-04
0.06245	1.957E-04	0.01537	2.785E-04	0.02182	2.982E-04	0.03629	3.461E-04	0.0681	2.827E-04	0.1194	1.930E-04
0.06739	1.680E-04	0.01642	2.451E-04	0.02332	2.608E-04	0.03881	3.016E-04	0.0729	2.445E-04	0.1282	1.650E-04
0.07271	1.439E-04	0.01755	2.154E-04	0.02491	2.275E-04	0.04150	2.621E-04	0.0782	2.108E-04	0.1377	1.406E-04
0.07846	1.230E-04	0.01876	1.888E-04	0.02662	1.981E-04	0.04439	2.270E-04	0.0837	1.812E-04	0.1478	1.195E-04
0.08466	1.048E-04	0.02005	1.652E-04	0.02844	1.721E-04	0.04747	1.962E-04	0.0897	1.554E-04	0.1587	1.013E-04
0.09135	8.899E-05	0.02143	1.441E-04	0.03039	1.492E-04	0.05077	1.690E-04	0.0961	1.329E-04	0.1704	8.557E-05

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.09856	7.534E-05	0.02291	1.254E-04	0.03248	1.290E-04	0.05429	1.453E-04	0.1030	1.134E-04	0.1829	7.203E-05
0.10635	6.356E-05	0.02448	1.088E-04	0.03470	1.113E-04	0.05806	1.245E-04	0.1104	9.641E-05	0.1964	6.039E-05
0.11476	5.343E-05	0.02617	9.399E-05	0.03708	9.568E-05	0.06210	1.063E-04	0.1183	8.172E-05	0.2108	5.042E-05
0.12382	4.476E-05	0.02797	8.090E-05	0.03962	8.201E-05	0.06641	9.046E-05	0.1267	6.904E-05	0.2264	4.190E-05
0.13361	3.737E-05	0.02989	6.934E-05	0.04233	7.005E-05	0.07102	7.669E-05	0.1358	5.812E-05	0.2430	3.465E-05
0.14417	3.110E-05	0.03195	5.918E-05	0.04523	5.961E-05	0.07596	6.475E-05	0.1455	4.874E-05	0.2609	2.851E-05
0.15556	2.580E-05	0.03415	5.030E-05	0.04833	5.054E-05	0.08123	5.445E-05	0.1559	4.072E-05	0.2801	2.334E-05
0.16785	2.133E-05	0.03650	4.257E-05	0.05164	4.268E-05	0.08687	4.559E-05	0.1670	3.389E-05	0.3007	1.900E-05
0.18111	1.758E-05	0.03901	3.588E-05	0.05518	3.590E-05	0.09291	3.801E-05	0.1790	2.809E-05	0.3229	1.538E-05
0.19542	1.445E-05	0.04169	3.013E-05	0.05896	3.009E-05	0.09936	3.157E-05	0.1918	2.320E-05	0.3467	1.239E-05
0.21087	1.183E-05	0.04456	2.521E-05	0.06300	2.514E-05	0.10626	2.612E-05	0.2055	1.908E-05	0.3722	9.928E-06
0.22753	9.647E-06	0.04762	2.103E-05	0.06732	2.093E-05	0.11364	2.154E-05	0.2201	1.563E-05	0.3996	7.912E-06
0.24551	7.835E-06	0.05090	1.749E-05	0.07193	1.737E-05	0.12153	1.770E-05	0.2359	1.275E-05	0.4290	6.274E-06
0.26491	6.334E-06	0.05440	1.450E-05	0.07686	1.438E-05	0.12997	1.450E-05	0.2527	1.036E-05	0.4606	4.949E-06
0.28584	5.095E-06	0.05815	1.198E-05	0.08213	1.187E-05	0.13900	1.184E-05	0.2708	8.374E-06	0.4945	3.885E-06
0.30842	4.076E-06	0.06215	9.880E-06	0.08776	9.776E-06	0.14866	9.651E-06	0.2902	6.741E-06	0.5309	3.034E-06
0.33280	3.242E-06	0.06642	8.123E-06	0.09377	8.033E-06	0.15898	7.843E-06	0.3109	5.400E-06	0.5699	2.359E-06
0.35909	2.563E-06	0.07099	6.660E-06	0.10020	6.585E-06	0.17002	6.358E-06	0.3331	4.305E-06	0.6119	1.826E-06
0.38747	2.014E-06	0.07588	5.445E-06	0.10706	5.387E-06	0.18183	5.142E-06	0.3569	3.414E-06	0.6569	1.408E-06
0.41808	1.573E-06	0.08110	4.440E-06	0.11440	4.398E-06	0.19446	4.146E-06	0.3824	2.693E-06	0.7053	1.083E-06
0.45112	1.221E-06	0.08668	3.611E-06	0.12223	3.583E-06	0.20797	3.335E-06	0.4098	2.113E-06	0.7572	8.307E-07
0.48677	9.418E-07	0.09264	2.929E-06	0.13061	2.913E-06	0.22241	2.674E-06	0.4391	1.649E-06	0.8130	6.368E-07
0.52523	7.219E-07	0.09902	2.370E-06	0.13956	2.364E-06	0.23786	2.137E-06	0.4705	1.280E-06	0.8728	4.886E-07
0.56673	5.498E-07	0.10583	1.914E-06	0.14912	1.915E-06	0.25438	1.702E-06	0.5041	9.882E-07	0.9371	3.758E-07
0.61152	4.161E-07	0.11311	1.542E-06	0.15934	1.548E-06	0.27205	1.351E-06	0.5401	7.586E-07	1.0060	2.902E-07
0.65984	3.132E-07	0.12089	1.240E-06	0.17026	1.249E-06	0.29094	1.068E-06	0.5787	5.792E-07	1.0801	2.254E-07
0.71198	2.345E-07	0.12921	9.955E-07	0.18192	1.006E-06	0.31115	8.408E-07	0.6201	4.398E-07	1.1596	1.761E-07
0.76823	1.748E-07	0.13810	7.980E-07	0.19439	8.083E-07	0.33276	6.591E-07	0.6644	3.322E-07	1.2450	1.385E-07
0.82894	1.301E-07	0.14760	6.387E-07	0.20771	6.479E-07	0.35587	5.144E-07	0.7119	2.498E-07	1.3366	1.095E-07
0.89444	9.678E-08	0.15776	5.104E-07	0.22194	5.180E-07	0.38059	3.997E-07	0.7628	1.870E-07	1.4350	8.704E-08
0.96512	7.217E-08	0.16861	4.072E-07	0.23715	4.128E-07	0.40702	3.090E-07	0.8173	1.396E-07	1.5407	6.943E-08

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
1.04138	5.406E-08	0.18022	3.243E-07	0.25340	3.279E-07	0.43529	2.377E-07	0.8757	1.040E-07	1.6541	5.552E-08
1.12367	4.075E-08	0.19262	2.578E-07	0.27076	2.595E-07	0.46552	1.820E-07	0.9383	7.753E-08	1.7758	4.445E-08
1.21246	3.094E-08	0.20587	2.045E-07	0.28931	2.045E-07	0.49786	1.386E-07	1.0054	5.788E-08	1.9066	3.559E-08
1.30826	2.365E-08	0.22003	1.618E-07	0.30914	1.604E-07	0.53243	1.049E-07	1.0773	4.335E-08	2.0469	2.847E-08
1.41164	1.817E-08	0.23517	1.276E-07	0.33032	1.251E-07	0.56941	7.895E-08	1.1543	3.262E-08	2.1976	2.273E-08
1.52318	1.402E-08	0.25135	1.003E-07	0.35295	9.709E-08	0.60896	5.904E-08	1.2368	2.466E-08	2.3594	1.810E-08
1.64354	1.083E-08	0.26865	7.849E-08	0.37714	7.488E-08	0.65126	4.386E-08	1.3252	1.872E-08	2.5330	1.436E-08
1.77341	8.352E-09	0.28713	6.116E-08	0.40298	5.737E-08	0.69649	3.235E-08	1.4199	1.426E-08	2.7195	1.133E-08

Table A-1c: 1 Hz Seismic Hazard Curves at Hatch.

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0023	1.067E-02	0.00089	1.059E-02	0.0013	1.060E-02	0.0022	1.063E-02	0.0037	1.066E-02	0.0051	1.069E-02
0.0025	1.064E-02	0.00095	1.058E-02	0.0014	1.058E-02	0.0024	1.061E-02	0.0039	1.064E-02	0.0055	1.066E-02
0.0027	1.061E-02	0.00102	1.055E-02	0.0015	1.056E-02	0.0025	1.058E-02	0.0042	1.061E-02	0.0059	1.063E-02
0.0029	1.057E-02	0.00109	1.051E-02	0.0016	1.052E-02	0.0027	1.054E-02	0.0045	1.057E-02	0.0063	1.059E-02
0.0031	1.051E-02	0.00116	1.047E-02	0.0017	1.048E-02	0.0029	1.049E-02	0.0048	1.052E-02	0.0067	1.054E-02
0.0033	1.044E-02	0.00124	1.041E-02	0.0019	1.042E-02	0.0031	1.043E-02	0.0051	1.045E-02	0.0072	1.046E-02
0.0036	1.034E-02	0.00132	1.033E-02	0.0020	1.034E-02	0.0033	1.035E-02	0.0055	1.036E-02	0.0077	1.037E-02
0.0038	1.022E-02	0.00141	1.024E-02	0.0021	1.025E-02	0.0035	1.025E-02	0.0058	1.026E-02	0.0082	1.026E-02
0.0041	1.007E-02	0.00150	1.012E-02	0.0023	1.013E-02	0.0038	1.013E-02	0.0063	1.013E-02	0.0088	1.012E-02
0.0044	9.893E-03	0.00160	9.985E-03	0.0024	9.995E-03	0.0040	9.986E-03	0.0067	9.969E-03	0.0094	9.954E-03
0.0048	9.685E-03	0.00171	9.823E-03	0.0026	9.834E-03	0.0043	9.816E-03	0.0071	9.786E-03	0.0101	9.758E-03
0.0051	9.444E-03	0.00182	9.636E-03	0.0027	9.648E-03	0.0046	9.619E-03	0.0076	9.574E-03	0.0108	9.533E-03
0.0055	9.173E-03	0.00195	9.423E-03	0.0029	9.436E-03	0.0049	9.395E-03	0.0081	9.333E-03	0.0115	9.277E-03
0.0059	8.872E-03	0.00208	9.184E-03	0.0031	9.198E-03	0.0052	9.144E-03	0.0087	9.065E-03	0.0123	8.992E-03
0.0063	8.544E-03	0.00221	8.921E-03	0.0033	8.936E-03	0.0055	8.868E-03	0.0093	8.771E-03	0.0132	8.681E-03
0.0068	8.194E-03	0.00236	8.635E-03	0.0035	8.651E-03	0.0059	8.569E-03	0.0099	8.453E-03	0.0141	8.345E-03
0.0073	7.825E-03	0.00252	8.330E-03	0.0038	8.346E-03	0.0063	8.249E-03	0.0106	8.114E-03	0.0151	7.990E-03
0.0078	7.444E-03	0.00269	8.008E-03	0.0040	8.024E-03	0.0067	7.913E-03	0.0113	7.760E-03	0.0162	7.619E-03
0.0084	7.055E-03	0.00287	7.672E-03	0.0043	7.689E-03	0.0072	7.564E-03	0.0121	7.393E-03	0.0173	7.237E-03
0.0090	6.663E-03	0.00306	7.328E-03	0.0046	7.343E-03	0.0077	7.206E-03	0.0130	7.019E-03	0.0185	6.849E-03
0.0097	6.274E-03	0.00326	6.978E-03	0.0049	6.992E-03	0.0082	6.843E-03	0.0138	6.643E-03	0.0198	6.460E-03
0.0104	5.891E-03	0.00348	6.627E-03	0.0052	6.640E-03	0.0087	6.480E-03	0.0148	6.267E-03	0.0211	6.074E-03
0.0112	5.519E-03	0.00372	6.278E-03	0.0055	6.288E-03	0.0093	6.119E-03	0.0158	5.897E-03	0.0226	5.696E-03
0.0120	5.160E-03	0.00396	5.934E-03	0.0059	5.942E-03	0.0100	5.766E-03	0.0169	5.536E-03	0.0242	5.329E-03
0.0129	4.817E-03	0.00423	5.599E-03	0.0063	5.604E-03	0.0106	5.421E-03	0.0180	5.186E-03	0.0259	4.975E-03
0.0138	4.491E-03	0.00451	5.273E-03	0.0067	5.275E-03	0.0113	5.088E-03	0.0193	4.850E-03	0.0277	4.636E-03
0.0148	4.183E-03	0.00481	4.960E-03	0.0071	4.959E-03	0.0121	4.769E-03	0.0206	4.529E-03	0.0296	4.315E-03
0.0159	3.893E-03	0.00513	4.660E-03	0.0076	4.656E-03	0.0129	4.464E-03	0.0220	4.225E-03	0.0317	4.011E-03
0.0171	3.620E-03	0.00548	4.374E-03	0.0081	4.367E-03	0.0138	4.175E-03	0.0235	3.937E-03	0.0339	3.725E-03
0.0184	3.366E-03	0.00584	4.103E-03	0.0086	4.093E-03	0.0147	3.901E-03	0.0251	3.666E-03	0.0363	3.457E-03

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0197	3.128E-03	0.00623	3.847E-03	0.0092	3.833E-03	0.0157	3.643E-03	0.0269	3.411E-03	0.0388	3.207E-03
0.0212	2.906E-03	0.00665	3.604E-03	0.0098	3.588E-03	0.0167	3.400E-03	0.0287	3.173E-03	0.0415	2.973E-03
0.0227	2.699E-03	0.00710	3.376E-03	0.0105	3.358E-03	0.0178	3.172E-03	0.0307	2.950E-03	0.0444	2.755E-03
0.0244	2.506E-03	0.00757	3.162E-03	0.0112	3.141E-03	0.0190	2.958E-03	0.0328	2.742E-03	0.0475	2.551E-03
0.0262	2.326E-03	0.00808	2.960E-03	0.0119	2.938E-03	0.0203	2.758E-03	0.0350	2.548E-03	0.0508	2.362E-03
0.0281	2.158E-03	0.00862	2.771E-03	0.0127	2.747E-03	0.0217	2.571E-03	0.0374	2.366E-03	0.0543	2.185E-03
0.0302	2.000E-03	0.00919	2.593E-03	0.0135	2.567E-03	0.0231	2.395E-03	0.0400	2.196E-03	0.0581	2.019E-03
0.0324	1.853E-03	0.00981	2.426E-03	0.0144	2.399E-03	0.0247	2.230E-03	0.0427	2.036E-03	0.0622	1.864E-03
0.0348	1.715E-03	0.01046	2.269E-03	0.0154	2.240E-03	0.0263	2.076E-03	0.0456	1.887E-03	0.0665	1.718E-03
0.0374	1.585E-03	0.01116	2.121E-03	0.0164	2.091E-03	0.0281	1.931E-03	0.0488	1.746E-03	0.0712	1.581E-03
0.0401	1.462E-03	0.01191	1.982E-03	0.0175	1.951E-03	0.0300	1.794E-03	0.0521	1.614E-03	0.0761	1.452E-03
0.0431	1.346E-03	0.01270	1.850E-03	0.0186	1.819E-03	0.0320	1.665E-03	0.0557	1.489E-03	0.0814	1.331E-03
0.0462	1.236E-03	0.01355	1.726E-03	0.0199	1.693E-03	0.0341	1.543E-03	0.0595	1.371E-03	0.0871	1.216E-03
0.0497	1.132E-03	0.01446	1.608E-03	0.0212	1.575E-03	0.0364	1.427E-03	0.0635	1.259E-03	0.0932	1.107E-03
0.0533	1.033E-03	0.01543	1.496E-03	0.0226	1.462E-03	0.0389	1.318E-03	0.0679	1.152E-03	0.0997	1.004E-03
0.0572	9.392E-04	0.01646	1.389E-03	0.0241	1.355E-03	0.0415	1.214E-03	0.0726	1.052E-03	0.1066	9.075E-04
0.0614	8.508E-04	0.01756	1.288E-03	0.0257	1.254E-03	0.0443	1.115E-03	0.0775	9.564E-04	0.1140	8.165E-04
0.0660	7.674E-04	0.01873	1.191E-03	0.0274	1.157E-03	0.0472	1.022E-03	0.0828	8.662E-04	0.1220	7.313E-04
0.0708	6.892E-04	0.01999	1.099E-03	0.0292	1.064E-03	0.0504	9.330E-04	0.0885	7.813E-04	0.1305	6.518E-04
0.0760	6.161E-04	0.02132	1.011E-03	0.0311	9.766E-04	0.0538	8.489E-04	0.0946	7.015E-04	0.1396	5.782E-04
0.0816	5.483E-04	0.02275	9.273E-04	0.0332	8.931E-04	0.0574	7.694E-04	0.1011	6.270E-04	0.1493	5.103E-04
0.0877	4.857E-04	0.02427	8.476E-04	0.0354	8.140E-04	0.0612	6.947E-04	0.1080	5.578E-04	0.1598	4.481E-04
0.0941	4.283E-04	0.02589	7.721E-04	0.0377	7.393E-04	0.0653	6.246E-04	0.1154	4.939E-04	0.1709	3.915E-04
0.1010	3.760E-04	0.02762	7.007E-04	0.0402	6.689E-04	0.0697	5.592E-04	0.1233	4.352E-04	0.1828	3.404E-04
0.1085	3.287E-04	0.02947	6.336E-04	0.0428	6.029E-04	0.0744	4.986E-04	0.1317	3.817E-04	0.1956	2.945E-04
0.1165	2.862E-04	0.03144	5.707E-04	0.0457	5.413E-04	0.0794	4.427E-04	0.1407	3.332E-04	0.2092	2.536E-04
0.1250	2.482E-04	0.03354	5.122E-04	0.0487	4.842E-04	0.0847	3.913E-04	0.1504	2.895E-04	0.2238	2.173E-04
0.1342	2.144E-04	0.03578	4.580E-04	0.0519	4.314E-04	0.0904	3.445E-04	0.1607	2.505E-04	0.2394	1.853E-04
0.1441	1.845E-04	0.03817	4.081E-04	0.0554	3.829E-04	0.0964	3.021E-04	0.1717	2.157E-04	0.2561	1.573E-04
0.1547	1.582E-04	0.04073	3.623E-04	0.0590	3.387E-04	0.1029	2.638E-04	0.1835	1.850E-04	0.2739	1.329E-04
0.1661	1.351E-04	0.04345	3.206E-04	0.0629	2.985E-04	0.1098	2.295E-04	0.1960	1.579E-04	0.2930	1.117E-04

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.1784	1.149E-04	0.04635	2.828E-04	0.0671	2.621E-04	0.1172	1.989E-04	0.2095	1.342E-04	0.3135	9.349E-05
0.1915	9.732E-05	0.04945	2.487E-04	0.0715	2.294E-04	0.1250	1.717E-04	0.2238	1.136E-04	0.3353	7.781E-05
0.2056	8.206E-05	0.05276	2.180E-04	0.0763	2.001E-04	0.1334	1.476E-04	0.2391	9.567E-05	0.3587	6.443E-05
0.2207	6.887E-05	0.05629	1.905E-04	0.0813	1.740E-04	0.1423	1.265E-04	0.2555	8.020E-05	0.3837	5.307E-05
0.2370	5.752E-05	0.06005	1.661E-04	0.0867	1.508E-04	0.1519	1.079E-04	0.2730	6.691E-05	0.4105	4.349E-05
0.2544	4.779E-05	0.06407	1.443E-04	0.0924	1.302E-04	0.1621	9.167E-05	0.2917	5.554E-05	0.4391	3.545E-05
0.2732	3.951E-05	0.06835	1.250E-04	0.0985	1.120E-04	0.1729	7.756E-05	0.3117	4.586E-05	0.4697	2.875E-05
0.2933	3.248E-05	0.07292	1.079E-04	0.1050	9.607E-05	0.1845	6.534E-05	0.3331	3.768E-05	0.5024	2.320E-05
0.3149	2.657E-05	0.07779	9.290E-05	0.1120	8.208E-05	0.1969	5.480E-05	0.3559	3.079E-05	0.5375	1.863E-05
0.3380	2.161E-05	0.08300	7.968E-05	0.1194	6.987E-05	0.2101	4.574E-05	0.3803	2.504E-05	0.5750	1.491E-05
0.3629	1.748E-05	0.08855	6.811E-05	0.1273	5.925E-05	0.2242	3.801E-05	0.4063	2.025E-05	0.6150	1.188E-05
0.3897	1.407E-05	0.09447	5.800E-05	0.1357	5.004E-05	0.2392	3.143E-05	0.4342	1.630E-05	0.6579	9.428E-06
0.4183	1.126E-05	0.10078	4.920E-05	0.1447	4.209E-05	0.2552	2.587E-05	0.4639	1.306E-05	0.7038	7.462E-06
0.4492	8.970E-06	0.10752	4.158E-05	0.1542	3.527E-05	0.2724	2.118E-05	0.4957	1.042E-05	0.7529	5.891E-06
0.4822	7.110E-06	0.11471	3.499E-05	0.1644	2.942E-05	0.2906	1.726E-05	0.5296	8.279E-06	0.8054	4.639E-06
0.5177	5.610E-06	0.12238	2.934E-05	0.1753	2.444E-05	0.3101	1.400E-05	0.5659	6.553E-06	0.8615	3.647E-06
0.5558	4.408E-06	0.13056	2.449E-05	0.1869	2.022E-05	0.3309	1.130E-05	0.6047	5.170E-06	0.9216	2.862E-06
0.5968	3.449E-06	0.13929	2.037E-05	0.1993	1.666E-05	0.3531	9.081E-06	0.6461	4.067E-06	0.9859	2.244E-06
0.6407	2.689E-06	0.14860	1.687E-05	0.2125	1.367E-05	0.3768	7.263E-06	0.6904	3.191E-06	1.0546	1.758E-06
0.6879	2.090E-06	0.15854	1.391E-05	0.2265	1.116E-05	0.4020	5.783E-06	0.7377	2.499E-06	1.1281	1.377E-06
0.7385	1.619E-06	0.16914	1.143E-05	0.2415	9.082E-06	0.4290	4.585E-06	0.7882	1.953E-06	1.2068	1.079E-06
0.7929	1.252E-06	0.18044	9.355E-06	0.2575	7.356E-06	0.4577	3.621E-06	0.8422	1.524E-06	1.2910	8.458E-07
0.8513	9.650E-07	0.19251	7.625E-06	0.2745	5.933E-06	0.4884	2.848E-06	0.8999	1.188E-06	1.3810	6.639E-07
0.9140	7.427E-07	0.20538	6.191E-06	0.2926	4.765E-06	0.5212	2.233E-06	0.9616	9.249E-07	1.4773	5.221E-07
0.9813	5.708E-07	0.21911	5.007E-06	0.3120	3.811E-06	0.5561	1.744E-06	1.0274	7.196E-07	1.5803	4.115E-07
1.0535	4.381E-07	0.23376	4.033E-06	0.3326	3.034E-06	0.5934	1.359E-06	1.0978	5.597E-07	1.6904	3.253E-07
1.1311	3.361E-07	0.24939	3.236E-06	0.3546	2.406E-06	0.6332	1.056E-06	1.1730	4.351E-07	1.8083	2.580E-07
1.2144	2.577E-07	0.26606	2.586E-06	0.3781	1.900E-06	0.6756	8.184E-07	1.2534	3.384E-07	1.9344	2.053E-07
1.3038	1.977E-07	0.28385	2.058E-06	0.4031	1.494E-06	0.7209	6.330E-07	1.3393	2.632E-07	2.0693	1.639E-07
1.3998	1.518E-07	0.30283	1.631E-06	0.4297	1.170E-06	0.7693	4.887E-07	1.4310	2.049E-07	2.2136	1.312E-07
1.5028	1.167E-07	0.32308	1.287E-06	0.4582	9.124E-07	0.8208	3.767E-07	1.5290	1.596E-07	2.3679	1.054E-07

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
1.6135	8.987E-08	0.34468	1.011E-06	0.4885	7.089E-07	0.8759	2.899E-07	1.6338	1.245E-07	2.5330	8.486E-08
1.7323	6.941E-08	0.36772	7.912E-07	0.5208	5.488E-07	0.9346	2.228E-07	1.7457	9.732E-08	2.7096	6.843E-08
1.8598	5.376E-08	0.39231	6.163E-07	0.5552	4.233E-07	0.9972	1.710E-07	1.8653	7.618E-08	2.8986	5.525E-08
1.9968	4.177E-08	0.41854	4.780E-07	0.5919	3.255E-07	1.0641	1.310E-07	1.9931	5.974E-08	3.1007	4.463E-08
2.1438	3.255E-08	0.44652	3.691E-07	0.6311	2.494E-07	1.1354	1.003E-07	2.1296	4.692E-08	3.3169	3.603E-08
2.3016	2.544E-08	0.47638	2.838E-07	0.6728	1.906E-07	1.2116	7.660E-08	2.2755	3.691E-08	3.5482	2.907E-08
2.4711	1.993E-08	0.50823	2.172E-07	0.7173	1.452E-07	1.2928	5.843E-08	2.4314	2.907E-08	3.7956	2.342E-08
2.6530	1.563E-08	0.61155	1.000E-07	0.7824	1.000E-07	1.3795	4.450E-08	2.5980	2.291E-08	4.0602	1.882E-08

Table A-1d: 2.5 Hz Seismic Hazard Curves at Hatch.

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0060	1.079E-02	0.0027	1.070E-02	0.0038	1.074E-02	0.0058	1.077E-02	0.0083	1.077E-02	0.0104	1.075E-02
0.0064	1.079E-02	0.0029	1.070E-02	0.0040	1.074E-02	0.0062	1.077E-02	0.0088	1.076E-02	0.0111	1.075E-02
0.0069	1.078E-02	0.0030	1.069E-02	0.0043	1.073E-02	0.0066	1.077E-02	0.0094	1.076E-02	0.0119	1.074E-02
0.0074	1.077E-02	0.0032	1.068E-02	0.0045	1.073E-02	0.0070	1.076E-02	0.0101	1.075E-02	0.0127	1.073E-02
0.0079	1.075E-02	0.0034	1.067E-02	0.0048	1.071E-02	0.0075	1.074E-02	0.0107	1.073E-02	0.0136	1.071E-02
0.0085	1.072E-02	0.0037	1.065E-02	0.0052	1.068E-02	0.0080	1.071E-02	0.0115	1.070E-02	0.0145	1.068E-02
0.0091	1.066E-02	0.0039	1.061E-02	0.0055	1.064E-02	0.0085	1.066E-02	0.0123	1.065E-02	0.0155	1.062E-02
0.0097	1.056E-02	0.0041	1.055E-02	0.0058	1.057E-02	0.0091	1.058E-02	0.0131	1.056E-02	0.0166	1.054E-02
0.0104	1.042E-02	0.0044	1.046E-02	0.0062	1.047E-02	0.0097	1.047E-02	0.0140	1.044E-02	0.0177	1.042E-02
0.0111	1.023E-02	0.0047	1.033E-02	0.0066	1.033E-02	0.0103	1.031E-02	0.0149	1.027E-02	0.0189	1.025E-02
0.0119	9.974E-03	0.0050	1.017E-02	0.0070	1.013E-02	0.0110	1.010E-02	0.0159	1.005E-02	0.0203	1.002E-02
0.0127	9.654E-03	0.0053	9.953E-03	0.0075	9.891E-03	0.0118	9.825E-03	0.0170	9.764E-03	0.0217	9.730E-03
0.0136	9.271E-03	0.0056	9.688E-03	0.0080	9.592E-03	0.0125	9.496E-03	0.0182	9.419E-03	0.0231	9.382E-03
0.0146	8.833E-03	0.0060	9.373E-03	0.0085	9.240E-03	0.0134	9.111E-03	0.0194	9.020E-03	0.0247	8.981E-03
0.0156	8.353E-03	0.0063	9.011E-03	0.0091	8.840E-03	0.0143	8.679E-03	0.0207	8.575E-03	0.0265	8.536E-03
0.0167	7.846E-03	0.0067	8.611E-03	0.0096	8.403E-03	0.0152	8.211E-03	0.0222	8.098E-03	0.0283	8.061E-03
0.0179	7.328E-03	0.0072	8.181E-03	0.0103	7.940E-03	0.0162	7.722E-03	0.0237	7.603E-03	0.0302	7.571E-03
0.0192	6.812E-03	0.0076	7.734E-03	0.0109	7.463E-03	0.0173	7.223E-03	0.0253	7.103E-03	0.0323	7.077E-03
0.0205	6.310E-03	0.0081	7.279E-03	0.0116	6.984E-03	0.0184	6.728E-03	0.0270	6.610E-03	0.0346	6.592E-03
0.0220	5.831E-03	0.0086	6.827E-03	0.0124	6.513E-03	0.0197	6.246E-03	0.0288	6.134E-03	0.0369	6.124E-03
0.0235	5.380E-03	0.0091	6.385E-03	0.0132	6.059E-03	0.0210	5.785E-03	0.0308	5.680E-03	0.0395	5.680E-03
0.0252	4.958E-03	0.0097	5.960E-03	0.0141	5.625E-03	0.0224	5.349E-03	0.0329	5.253E-03	0.0422	5.262E-03
0.0270	4.567E-03	0.0103	5.556E-03	0.0150	5.217E-03	0.0239	4.940E-03	0.0351	4.854E-03	0.0451	4.871E-03
0.0289	4.205E-03	0.0110	5.173E-03	0.0159	4.834E-03	0.0254	4.560E-03	0.0375	4.483E-03	0.0483	4.507E-03
0.0309	3.871E-03	0.0117	4.815E-03	0.0170	4.477E-03	0.0271	4.208E-03	0.0401	4.139E-03	0.0516	4.169E-03
0.0331	3.564E-03	0.0124	4.479E-03	0.0181	4.145E-03	0.0289	3.882E-03	0.0428	3.821E-03	0.0551	3.856E-03
0.0355	3.280E-03	0.0132	4.166E-03	0.0192	3.837E-03	0.0309	3.581E-03	0.0457	3.527E-03	0.0590	3.566E-03
0.0380	3.020E-03	0.0140	3.875E-03	0.0205	3.552E-03	0.0329	3.303E-03	0.0489	3.256E-03	0.0630	3.296E-03
0.0406	2.779E-03	0.0149	3.604E-03	0.0218	3.288E-03	0.0351	3.046E-03	0.0522	3.005E-03	0.0674	3.046E-03
0.0435	2.558E-03	0.0159	3.351E-03	0.0232	3.043E-03	0.0374	2.810E-03	0.0557	2.773E-03	0.0720	2.814E-03

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0466	2.355E-03	0.0168	3.117E-03	0.0247	2.817E-03	0.0399	2.591E-03	0.0595	2.559E-03	0.0770	2.598E-03
0.0499	2.167E-03	0.0179	2.898E-03	0.0263	2.607E-03	0.0426	2.390E-03	0.0636	2.360E-03	0.0823	2.397E-03
0.0534	1.993E-03	0.0190	2.695E-03	0.0280	2.413E-03	0.0454	2.204E-03	0.0679	2.176E-03	0.0880	2.209E-03
0.0572	1.833E-03	0.0202	2.506E-03	0.0298	2.233E-03	0.0484	2.032E-03	0.0725	2.004E-03	0.0941	2.034E-03
0.0612	1.684E-03	0.0215	2.330E-03	0.0318	2.067E-03	0.0516	1.872E-03	0.0775	1.844E-03	0.1006	1.870E-03
0.0655	1.545E-03	0.0229	2.167E-03	0.0338	1.912E-03	0.0551	1.724E-03	0.0827	1.694E-03	0.1075	1.717E-03
0.0702	1.414E-03	0.0243	2.014E-03	0.0360	1.767E-03	0.0587	1.585E-03	0.0884	1.553E-03	0.1150	1.574E-03
0.0751	1.291E-03	0.0258	1.872E-03	0.0384	1.633E-03	0.0626	1.455E-03	0.0944	1.420E-03	0.1229	1.438E-03
0.0804	1.175E-03	0.0275	1.739E-03	0.0409	1.507E-03	0.0668	1.332E-03	0.1008	1.293E-03	0.1314	1.311E-03
0.0861	1.063E-03	0.0292	1.614E-03	0.0435	1.388E-03	0.0712	1.216E-03	0.1077	1.173E-03	0.1405	1.189E-03
0.0922	9.578E-04	0.0310	1.496E-03	0.0463	1.275E-03	0.0760	1.104E-03	0.1150	1.058E-03	0.1502	1.074E-03
0.0987	8.577E-04	0.0330	1.385E-03	0.0493	1.168E-03	0.0810	9.981E-04	0.1228	9.495E-04	0.1605	9.646E-04
0.1057	7.634E-04	0.0351	1.279E-03	0.0525	1.066E-03	0.0864	8.968E-04	0.1312	8.466E-04	0.1716	8.608E-04
0.1131	6.755E-04	0.0373	1.177E-03	0.0559	9.685E-04	0.0921	8.007E-04	0.1401	7.500E-04	0.1835	7.628E-04
0.1211	5.945E-04	0.0396	1.080E-03	0.0595	8.754E-04	0.0983	7.102E-04	0.1497	6.600E-04	0.1962	6.712E-04
0.1297	5.208E-04	0.0421	9.867E-04	0.0634	7.871E-04	0.1048	6.260E-04	0.1599	5.772E-04	0.2097	5.864E-04
0.1388	4.544E-04	0.0448	8.971E-04	0.0675	7.038E-04	0.1118	5.485E-04	0.1708	5.018E-04	0.2242	5.088E-04
0.1486	3.951E-04	0.0476	8.115E-04	0.0719	6.259E-04	0.1192	4.781E-04	0.1824	4.340E-04	0.2397	4.386E-04
0.1591	3.428E-04	0.0506	7.304E-04	0.0765	5.538E-04	0.1271	4.148E-04	0.1948	3.735E-04	0.2562	3.759E-04
0.1704	2.967E-04	0.0538	6.540E-04	0.0815	4.877E-04	0.1356	3.586E-04	0.2081	3.202E-04	0.2739	3.204E-04
0.1824	2.563E-04	0.0571	5.829E-04	0.0867	4.277E-04	0.1446	3.091E-04	0.2222	2.734E-04	0.2929	2.718E-04
0.1953	2.210E-04	0.0607	5.173E-04	0.0924	3.737E-04	0.1542	2.657E-04	0.2374	2.326E-04	0.3131	2.296E-04
0.2091	1.901E-04	0.0646	4.573E-04	0.0983	3.255E-04	0.1644	2.279E-04	0.2535	1.972E-04	0.3347	1.932E-04
0.2238	1.630E-04	0.0686	4.030E-04	0.1047	2.827E-04	0.1754	1.950E-04	0.2708	1.666E-04	0.3578	1.620E-04
0.2396	1.393E-04	0.0730	3.542E-04	0.1115	2.450E-04	0.1870	1.664E-04	0.2892	1.402E-04	0.3825	1.353E-04
0.2566	1.186E-04	0.0775	3.105E-04	0.1187	2.118E-04	0.1994	1.415E-04	0.3089	1.174E-04	0.4090	1.125E-04
0.2747	1.004E-04	0.0824	2.717E-04	0.1264	1.826E-04	0.2127	1.199E-04	0.3299	9.793E-05	0.4372	9.314E-05
0.2941	8.457E-05	0.0876	2.371E-04	0.1346	1.571E-04	0.2268	1.011E-04	0.3524	8.127E-05	0.4674	7.676E-05
0.3149	7.082E-05	0.0931	2.065E-04	0.1433	1.347E-04	0.2419	8.487E-05	0.3764	6.710E-05	0.4997	6.295E-05
0.3371	5.896E-05	0.0990	1.794E-04	0.1526	1.151E-04	0.2580	7.080E-05	0.4020	5.511E-05	0.5342	5.135E-05
0.3609	4.879E-05	0.1052	1.554E-04	0.1625	9.799E-05	0.2751	5.871E-05	0.4294	4.502E-05	0.5711	4.168E-05

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.3864	4.015E-05	0.1119	1.342E-04	0.1730	8.306E-05	0.2934	4.839E-05	0.4586	3.660E-05	0.6105	3.365E-05
0.4137	3.286E-05	0.1189	1.155E-04	0.1842	7.007E-05	0.3129	3.965E-05	0.4899	2.960E-05	0.6527	2.704E-05
0.4429	2.677E-05	0.1264	9.906E-05	0.1961	5.882E-05	0.3337	3.230E-05	0.5232	2.383E-05	0.6978	2.163E-05
0.4742	2.170E-05	0.1344	8.460E-05	0.2088	4.912E-05	0.3559	2.619E-05	0.5588	1.911E-05	0.7460	1.725E-05
0.5077	1.752E-05	0.1428	7.194E-05	0.2224	4.081E-05	0.3796	2.114E-05	0.5969	1.527E-05	0.7975	1.371E-05
0.5435	1.409E-05	0.1518	6.091E-05	0.2368	3.374E-05	0.4048	1.700E-05	0.6375	1.216E-05	0.8525	1.087E-05
0.5819	1.130E-05	0.1614	5.136E-05	0.2521	2.777E-05	0.4317	1.362E-05	0.6809	9.665E-06	0.9114	8.611E-06
0.6230	9.026E-06	0.1715	4.313E-05	0.2684	2.275E-05	0.4604	1.089E-05	0.7273	7.668E-06	0.9744	6.815E-06
0.6670	7.191E-06	0.1823	3.608E-05	0.2858	1.856E-05	0.4910	8.690E-06	0.7768	6.076E-06	1.0417	5.394E-06
0.7141	5.714E-06	0.1938	3.007E-05	0.3043	1.509E-05	0.5236	6.919E-06	0.8297	4.812E-06	1.1136	4.270E-06
0.7645	4.529E-06	0.2060	2.497E-05	0.3240	1.222E-05	0.5585	5.500E-06	0.8862	3.811E-06	1.1905	3.382E-06
0.8185	3.583E-06	0.2190	2.067E-05	0.3450	9.863E-06	0.5956	4.365E-06	0.9465	3.019E-06	1.2728	2.681E-06
0.8764	2.829E-06	0.2328	1.705E-05	0.3674	7.936E-06	0.6352	3.460E-06	1.0109	2.393E-06	1.3607	2.128E-06
0.9383	2.231E-06	0.2474	1.402E-05	0.3912	6.365E-06	0.6774	2.739E-06	1.0798	1.899E-06	1.4546	1.691E-06
1.0045	1.758E-06	0.2630	1.148E-05	0.4165	5.089E-06	0.7224	2.167E-06	1.1533	1.508E-06	1.5551	1.344E-06
1.0755	1.384E-06	0.2796	9.367E-06	0.4435	4.057E-06	0.7704	1.713E-06	1.2318	1.199E-06	1.6625	1.070E-06
1.1514	1.089E-06	0.2972	7.612E-06	0.4722	3.225E-06	0.8216	1.353E-06	1.3157	9.543E-07	1.7773	8.531E-07
1.2327	8.566E-07	0.3159	6.160E-06	0.5028	2.556E-06	0.8762	1.070E-06	1.4052	7.604E-07	1.9001	6.808E-07
1.3198	6.739E-07	0.3358	4.964E-06	0.5353	2.020E-06	0.9345	8.455E-07	1.5009	6.066E-07	2.0313	5.439E-07
1.4130	5.303E-07	0.3569	3.983E-06	0.5700	1.592E-06	0.9966	6.687E-07	1.6031	4.844E-07	2.1716	4.352E-07
1.5128	4.174E-07	0.3794	3.184E-06	0.6069	1.252E-06	1.0628	5.292E-07	1.7123	3.872E-07	2.3216	3.487E-07
1.6197	3.287E-07	0.4033	2.534E-06	0.6462	9.815E-07	1.1335	4.192E-07	1.8288	3.099E-07	2.4819	2.797E-07
1.7340	2.589E-07	0.4287	2.010E-06	0.6881	7.679E-07	1.2088	3.324E-07	1.9534	2.483E-07	2.6534	2.248E-07
1.8565	2.041E-07	0.4557	1.589E-06	0.7327	5.995E-07	1.2892	2.637E-07	2.0863	1.991E-07	2.8366	1.809E-07
1.9876	1.611E-07	0.4843	1.251E-06	0.7801	4.673E-07	1.3749	2.094E-07	2.2284	1.599E-07	3.0325	1.458E-07
2.1280	1.272E-07	0.5148	9.823E-07	0.8306	3.636E-07	1.4663	1.663E-07	2.3801	1.285E-07	3.2420	1.176E-07
2.2783	1.005E-07	0.5473	7.687E-07	0.8844	2.826E-07	1.5637	1.322E-07	2.5422	1.034E-07	3.4659	9.500E-08
2.4392	7.953E-08	0.5817	5.996E-07	0.9417	2.194E-07	1.6677	1.051E-07	2.7152	8.331E-08	3.7053	7.681E-08
2.6115	6.299E-08	0.6183	4.662E-07	1.0027	1.702E-07	1.7785	8.353E-08	2.9001	6.716E-08	3.9612	6.213E-08
2.7959	4.994E-08	0.6573	3.614E-07	1.0677	1.319E-07	1.8967	6.640E-08	3.0976	5.419E-08	4.2347	5.027E-08
2.9934	3.963E-08	0.6987	2.792E-07	1.1368	1.022E-07	2.0228	5.278E-08	3.3084	4.373E-08	4.5272	4.067E-08

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
3.2048	3.147E-08	0.7427	2.151E-07	1.2104	7.917E-08	2.1573	4.194E-08	3.5337	3.530E-08	4.8399	3.289E-08
3.4311	2.501E-08	0.7894	1.652E-07	1.2888	6.127E-08	2.3007	3.332E-08	3.7743	2.849E-08	5.1742	2.657E-08
3.6735	1.988E-08	0.8391	1.266E-07	1.3723	4.740E-08	2.4536	2.645E-08	4.0313	2.298E-08	5.5315	2.144E-08
3.9329	1.580E-08	0.8920	9.678E-08	1.4612	3.664E-08	2.6167	2.099E-08	4.3057	1.852E-08	5.9136	1.728E-08
4.2107	1.255E-08	0.9481	7.383E-08	1.5558	2.830E-08	2.7906	1.665E-08	4.5989	1.491E-08	6.3220	1.389E-08
4.5081	9.963E-09	1.0078	5.622E-08	1.6566	2.183E-08	2.9761	1.319E-08	4.9120	1.198E-08	6.7586	1.114E-08
4.8265	7.897E-09	1.0713	4.273E-08	1.7639	1.682E-08	3.1739	1.044E-08	5.2464	9.602E-09	7.2254	8.917E-09
5.1673	6.248E-09	1.1388	3.244E-08	1.8781	1.295E-08	3.3849	8.248E-09	5.6036	7.679E-09	7.7244	7.112E-09

Table A-1e: 5 Hz Seismic Hazard Curves at Hatch.

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0083	1.036E-02	0.0037	1.029E-02	0.0055	1.033E-02	0.0080	1.035E-02	0.0113	1.034E-02	0.0140	1.033E-02
0.0089	1.021E-02	0.0039	1.016E-02	0.0059	1.018E-02	0.0086	1.020E-02	0.0121	1.019E-02	0.0150	1.019E-02
0.0095	1.001E-02	0.0042	9.990E-03	0.0063	1.000E-02	0.0091	1.001E-02	0.0129	1.001E-02	0.0160	1.000E-02
0.0102	9.778E-03	0.0044	9.792E-03	0.0067	9.783E-03	0.0098	9.781E-03	0.0138	9.782E-03	0.0172	9.785E-03
0.0109	9.501E-03	0.0047	9.561E-03	0.0072	9.528E-03	0.0105	9.516E-03	0.0148	9.520E-03	0.0184	9.527E-03
0.0117	9.185E-03	0.0051	9.296E-03	0.0077	9.237E-03	0.0112	9.212E-03	0.0158	9.219E-03	0.0197	9.232E-03
0.0126	8.830E-03	0.0054	9.000E-03	0.0082	8.911E-03	0.0120	8.873E-03	0.0169	8.882E-03	0.0211	8.901E-03
0.0135	8.443E-03	0.0057	8.675E-03	0.0087	8.554E-03	0.0128	8.502E-03	0.0181	8.514E-03	0.0226	8.538E-03
0.0145	8.030E-03	0.0061	8.325E-03	0.0093	8.171E-03	0.0137	8.104E-03	0.0194	8.119E-03	0.0242	8.150E-03
0.0155	7.597E-03	0.0065	7.954E-03	0.0099	7.767E-03	0.0146	7.686E-03	0.0207	7.704E-03	0.0259	7.742E-03
0.0166	7.152E-03	0.0069	7.569E-03	0.0106	7.349E-03	0.0157	7.255E-03	0.0222	7.277E-03	0.0277	7.321E-03
0.0178	6.704E-03	0.0074	7.174E-03	0.0113	6.924E-03	0.0167	6.819E-03	0.0238	6.844E-03	0.0297	6.894E-03
0.0191	6.260E-03	0.0079	6.776E-03	0.0121	6.498E-03	0.0179	6.383E-03	0.0254	6.412E-03	0.0318	6.469E-03
0.0205	5.826E-03	0.0084	6.380E-03	0.0129	6.076E-03	0.0191	5.954E-03	0.0272	5.987E-03	0.0341	6.051E-03
0.0220	5.406E-03	0.0089	5.990E-03	0.0138	5.665E-03	0.0205	5.538E-03	0.0291	5.575E-03	0.0365	5.645E-03
0.0236	5.006E-03	0.0095	5.610E-03	0.0147	5.268E-03	0.0219	5.138E-03	0.0312	5.179E-03	0.0391	5.254E-03
0.0253	4.627E-03	0.0102	5.245E-03	0.0157	4.888E-03	0.0234	4.758E-03	0.0333	4.802E-03	0.0418	4.882E-03
0.0271	4.270E-03	0.0108	4.895E-03	0.0167	4.528E-03	0.0250	4.399E-03	0.0357	4.446E-03	0.0448	4.530E-03
0.0291	3.938E-03	0.0115	4.563E-03	0.0179	4.188E-03	0.0268	4.062E-03	0.0382	4.111E-03	0.0480	4.199E-03
0.0312	3.628E-03	0.0123	4.250E-03	0.0191	3.870E-03	0.0286	3.747E-03	0.0409	3.799E-03	0.0514	3.889E-03
0.0334	3.341E-03	0.0131	3.955E-03	0.0203	3.573E-03	0.0306	3.454E-03	0.0437	3.508E-03	0.0550	3.600E-03
0.0359	3.076E-03	0.0140	3.678E-03	0.0217	3.298E-03	0.0328	3.183E-03	0.0468	3.238E-03	0.0589	3.330E-03
0.0385	2.831E-03	0.0149	3.420E-03	0.0232	3.042E-03	0.0350	2.932E-03	0.0501	2.987E-03	0.0631	3.079E-03
0.0413	2.604E-03	0.0159	3.178E-03	0.0247	2.804E-03	0.0375	2.700E-03	0.0536	2.755E-03	0.0676	2.845E-03
0.0442	2.395E-03	0.0169	2.953E-03	0.0264	2.585E-03	0.0401	2.485E-03	0.0574	2.539E-03	0.0724	2.628E-03
0.0475	2.201E-03	0.0180	2.744E-03	0.0281	2.381E-03	0.0429	2.286E-03	0.0614	2.339E-03	0.0775	2.425E-03
0.0509	2.022E-03	0.0192	2.548E-03	0.0300	2.193E-03	0.0458	2.101E-03	0.0657	2.152E-03	0.0830	2.236E-03
0.0546	1.856E-03	0.0204	2.366E-03	0.0320	2.018E-03	0.0490	1.930E-03	0.0703	1.979E-03	0.0889	2.059E-03
0.0585	1.701E-03	0.0218	2.196E-03	0.0342	1.856E-03	0.0524	1.771E-03	0.0753	1.816E-03	0.0952	1.893E-03
0.0628	1.557E-03	0.0232	2.038E-03	0.0365	1.705E-03	0.0561	1.623E-03	0.0806	1.664E-03	0.1020	1.737E-03

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0673	1.422E-03	0.0247	1.890E-03	0.0389	1.564E-03	0.0600	1.484E-03	0.0862	1.521E-03	0.1092	1.590E-03
0.0722	1.296E-03	0.0264	1.751E-03	0.0415	1.433E-03	0.0641	1.354E-03	0.0923	1.387E-03	0.1170	1.452E-03
0.0774	1.177E-03	0.0281	1.620E-03	0.0443	1.310E-03	0.0686	1.232E-03	0.0987	1.260E-03	0.1253	1.322E-03
0.0830	1.066E-03	0.0299	1.497E-03	0.0473	1.195E-03	0.0733	1.118E-03	0.1057	1.140E-03	0.1342	1.198E-03
0.0890	9.609E-04	0.0319	1.381E-03	0.0505	1.087E-03	0.0784	1.010E-03	0.1131	1.027E-03	0.1437	1.082E-03
0.0955	8.628E-04	0.0340	1.272E-03	0.0539	9.860E-04	0.0839	9.090E-04	0.1210	9.204E-04	0.1539	9.721E-04
0.1024	7.712E-04	0.0362	1.168E-03	0.0575	8.914E-04	0.0897	8.143E-04	0.1295	8.209E-04	0.1648	8.689E-04
0.1098	6.860E-04	0.0386	1.070E-03	0.0614	8.030E-04	0.0959	7.259E-04	0.1386	7.280E-04	0.1765	7.723E-04
0.1178	6.073E-04	0.0411	9.778E-04	0.0655	7.207E-04	0.1026	6.438E-04	0.1483	6.420E-04	0.1890	6.825E-04
0.1263	5.351E-04	0.0438	8.903E-04	0.0699	6.443E-04	0.1097	5.681E-04	0.1587	5.629E-04	0.2024	5.995E-04
0.1355	4.692E-04	0.0467	8.078E-04	0.0746	5.738E-04	0.1174	4.988E-04	0.1699	4.908E-04	0.2168	5.234E-04
0.1453	4.096E-04	0.0498	7.303E-04	0.0796	5.089E-04	0.1255	4.357E-04	0.1818	4.255E-04	0.2322	4.542E-04
0.1558	3.560E-04	0.0530	6.577E-04	0.0849	4.496E-04	0.1342	3.787E-04	0.1946	3.669E-04	0.2486	3.918E-04
0.1671	3.083E-04	0.0565	5.902E-04	0.0906	3.957E-04	0.1435	3.276E-04	0.2082	3.147E-04	0.2663	3.360E-04
0.1792	2.659E-04	0.0602	5.277E-04	0.0967	3.469E-04	0.1535	2.822E-04	0.2228	2.686E-04	0.2852	2.866E-04
0.1922	2.285E-04	0.0642	4.701E-04	0.1032	3.031E-04	0.1642	2.421E-04	0.2385	2.282E-04	0.3054	2.431E-04
0.2061	1.957E-04	0.0684	4.173E-04	0.1101	2.638E-04	0.1756	2.068E-04	0.2552	1.930E-04	0.3271	2.051E-04
0.2210	1.669E-04	0.0729	3.692E-04	0.1175	2.288E-04	0.1878	1.760E-04	0.2731	1.626E-04	0.3503	1.722E-04
0.2371	1.419E-04	0.0777	3.256E-04	0.1254	1.978E-04	0.2008	1.492E-04	0.2923	1.364E-04	0.3751	1.439E-04
0.2542	1.201E-04	0.0828	2.862E-04	0.1338	1.704E-04	0.2148	1.260E-04	0.3128	1.139E-04	0.4017	1.196E-04
0.2726	1.013E-04	0.0882	2.509E-04	0.1428	1.463E-04	0.2297	1.060E-04	0.3348	9.479E-05	0.4302	9.889E-05
0.2924	8.501E-05	0.0940	2.192E-04	0.1524	1.251E-04	0.2456	8.881E-05	0.3583	7.855E-05	0.4607	8.136E-05
0.3136	7.101E-05	0.1002	1.910E-04	0.1626	1.066E-04	0.2627	7.409E-05	0.3835	6.483E-05	0.4934	6.658E-05
0.3363	5.903E-05	0.1067	1.658E-04	0.1736	9.047E-05	0.2809	6.155E-05	0.4104	5.329E-05	0.5284	5.419E-05
0.3606	4.882E-05	0.1137	1.435E-04	0.1852	7.648E-05	0.3005	5.091E-05	0.4392	4.362E-05	0.5659	4.386E-05
0.3868	4.016E-05	0.1212	1.238E-04	0.1976	6.439E-05	0.3213	4.192E-05	0.4700	3.557E-05	0.6061	3.532E-05
0.4148	3.288E-05	0.1292	1.063E-04	0.2109	5.398E-05	0.3436	3.437E-05	0.5030	2.889E-05	0.6491	2.828E-05
0.4448	2.677E-05	0.1376	9.102E-05	0.2251	4.506E-05	0.3675	2.806E-05	0.5383	2.338E-05	0.6951	2.254E-05
0.4771	2.170E-05	0.1467	7.760E-05	0.2402	3.745E-05	0.3930	2.282E-05	0.5761	1.885E-05	0.7444	1.788E-05
0.5116	1.750E-05	0.1563	6.588E-05	0.2563	3.099E-05	0.4203	1.849E-05	0.6165	1.514E-05	0.7973	1.412E-05
0.5487	1.405E-05	0.1665	5.568E-05	0.2735	2.554E-05	0.4495	1.492E-05	0.6598	1.213E-05	0.8538	1.111E-05

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.5884	1.123E-05	0.1775	4.686E-05	0.2919	2.096E-05	0.4807	1.201E-05	0.7061	9.684E-06	0.9144	8.718E-06
0.6311	8.942E-06	0.1891	3.926E-05	0.3115	1.713E-05	0.5141	9.634E-06	0.7557	7.713E-06	0.9793	6.823E-06
0.6768	7.091E-06	0.2015	3.275E-05	0.3324	1.394E-05	0.5498	7.709E-06	0.8087	6.129E-06	1.0487	5.331E-06
0.7258	5.603E-06	0.2148	2.720E-05	0.3547	1.131E-05	0.5880	6.153E-06	0.8655	4.860E-06	1.1232	4.160E-06
0.7784	4.412E-06	0.2288	2.248E-05	0.3785	9.138E-06	0.6289	4.900E-06	0.9262	3.848E-06	1.2028	3.245E-06
0.8348	3.463E-06	0.2439	1.851E-05	0.4039	7.357E-06	0.6725	3.894E-06	0.9913	3.042E-06	1.2882	2.531E-06
0.8952	2.711E-06	0.2599	1.517E-05	0.4310	5.904E-06	0.7193	3.089E-06	1.0608	2.401E-06	1.3796	1.975E-06
0.9601	2.116E-06	0.2769	1.237E-05	0.4600	4.721E-06	0.7692	2.445E-06	1.1353	1.894E-06	1.4774	1.543E-06
1.0296	1.649E-06	0.2951	1.005E-05	0.4909	3.762E-06	0.8226	1.932E-06	1.2150	1.493E-06	1.5822	1.207E-06
1.1042	1.282E-06	0.3145	8.126E-06	0.5238	2.988E-06	0.8798	1.525E-06	1.3003	1.176E-06	1.6945	9.466E-07
1.1842	9.955E-07	0.3351	6.541E-06	0.5590	2.365E-06	0.9409	1.201E-06	1.3915	9.267E-07	1.8147	7.441E-07
1.2700	7.723E-07	0.3571	5.240E-06	0.5965	1.866E-06	1.0062	9.445E-07	1.4892	7.301E-07	1.9435	5.866E-07
1.3620	5.988E-07	0.3805	4.179E-06	0.6366	1.467E-06	1.0761	7.417E-07	1.5938	5.755E-07	2.0813	4.639E-07
1.4606	4.643E-07	0.4055	3.317E-06	0.6793	1.149E-06	1.1508	5.817E-07	1.7056	4.540E-07	2.2290	3.681E-07
1.5665	3.602E-07	0.4321	2.620E-06	0.7249	8.973E-07	1.2308	4.557E-07	1.8254	3.586E-07	2.3871	2.930E-07
1.6799	2.797E-07	0.4604	2.059E-06	0.7736	6.982E-07	1.3163	3.565E-07	1.9535	2.836E-07	2.5565	2.340E-07
1.8016	2.176E-07	0.4907	1.611E-06	0.8255	5.415E-07	1.4077	2.787E-07	2.0906	2.246E-07	2.7379	1.874E-07
1.9321	1.695E-07	0.5229	1.254E-06	0.8810	4.186E-07	1.5054	2.177E-07	2.2374	1.782E-07	2.9321	1.505E-07
2.0721	1.324E-07	0.5572	9.708E-07	0.9401	3.225E-07	1.6100	1.700E-07	2.3944	1.417E-07	3.1401	1.211E-07
2.2222	1.037E-07	0.5937	7.481E-07	1.0032	2.477E-07	1.7218	1.328E-07	2.5625	1.128E-07	3.3629	9.766E-08
2.3832	8.145E-08	0.6327	5.736E-07	1.0706	1.897E-07	1.8414	1.037E-07	2.7424	8.997E-08	3.6015	7.882E-08
2.5558	6.413E-08	0.6742	4.376E-07	1.1424	1.449E-07	1.9693	8.100E-08	2.9349	7.185E-08	3.8570	6.364E-08
2.7410	5.061E-08	0.7185	3.322E-07	1.2192	1.104E-07	2.1061	6.332E-08	3.1409	5.743E-08	4.1306	5.138E-08
2.9395	4.003E-08	0.7656	2.510E-07	1.3010	8.385E-08	2.2523	4.954E-08	3.3613	4.592E-08	4.4237	4.145E-08
3.1525	3.171E-08	0.8158	1.887E-07	1.3884	6.356E-08	2.4088	3.880E-08	3.5973	3.672E-08	4.7375	3.340E-08
3.3808	2.514E-08	0.8694	1.412E-07	1.4816	4.808E-08	2.5761	3.040E-08	3.8498	2.935E-08	5.0736	2.686E-08
3.6257	1.994E-08	0.9264	1.051E-07	1.5810	3.631E-08	2.7550	2.384E-08	4.1200	2.343E-08	5.4336	2.155E-08
3.8884	1.581E-08	0.9872	7.796E-08	1.6872	2.737E-08	2.9463	1.870E-08	4.4092	1.868E-08	5.8191	1.725E-08
4.1701	1.252E-08	1.0520	5.756E-08	1.8005	2.060E-08	3.1510	1.467E-08	4.7187	1.485E-08	6.2319	1.376E-08
4.4721	9.897E-09	1.1211	4.233E-08	1.9213	1.549E-08	3.3698	1.150E-08	5.0499	1.178E-08	6.6740	1.093E-08
4.7961	7.804E-09	1.1946	3.101E-08	2.0503	1.164E-08	3.6039	9.004E-09	5.4044	9.315E-09	7.1475	8.654E-09

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
5.1435	6.134E-09	1.2730	2.263E-08	2.1880	8.736E-09	3.8542	7.039E-09	5.7838	7.337E-09	7.6546	6.819E-09
5.5161	4.803E-09	1.3566	1.645E-08	2.3349	6.553E-09	4.1218	5.490E-09	6.1898	5.755E-09	8.1976	5.348E-09
5.9157	3.744E-09	1.4456	1.192E-08	2.4917	4.912E-09	4.4081	4.270E-09	6.6242	4.493E-09	8.7792	4.173E-09
6.3443	2.904E-09	1.5404	8.610E-09	2.6590	3.679E-09	4.7143	3.310E-09	7.0892	3.490E-09	9.4021	3.239E-09
6.8039	2.240E-09	1.6415	6.196E-09	2.8375	2.753E-09	5.0417	2.555E-09	7.5868	2.696E-09	10.0691	2.499E-09
7.2967	1.717E-09	1.7492	4.444E-09	3.0280	2.058E-09	5.3919	1.963E-09	8.1194	2.071E-09	10.7835	1.916E-09
7.8253	1.308E-09	1.8640	3.177E-09	3.2313	1.536E-09	5.7663	1.501E-09	8.6893	1.581E-09	11.5485	1.460E-09
8.3922	9.894E-10	1.9863	2.263E-09	3.4482	1.144E-09	6.1668	1.140E-09	9.2993	1.199E-09	12.3678	1.105E-09

Table A-1f: 10 Hz Seismic Hazard Curves at Hatch.

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	AFE	PSA (g)	AFE	PSA (g)	AFE	PSA (g)	AFE	PSA (g)	AFE	PSA (g)	AFE
0.0094	8.584E-03	0.0043	8.536E-03	0.0062	8.498E-03	0.0090	8.526E-03	0.0126	8.581E-03	0.0177	8.585E-03
0.0101	8.252E-03	0.0045	8.242E-03	0.0066	8.178E-03	0.0096	8.197E-03	0.0136	8.260E-03	0.0190	8.267E-03
0.0109	7.902E-03	0.0049	7.933E-03	0.0071	7.841E-03	0.0103	7.849E-03	0.0146	7.922E-03	0.0204	7.931E-03
0.0117	7.536E-03	0.0052	7.611E-03	0.0076	7.490E-03	0.0111	7.488E-03	0.0157	7.569E-03	0.0220	7.580E-03
0.0126	7.160E-03	0.0055	7.279E-03	0.0081	7.129E-03	0.0119	7.116E-03	0.0168	7.205E-03	0.0236	7.219E-03
0.0136	6.777E-03	0.0059	6.940E-03	0.0087	6.762E-03	0.0128	6.738E-03	0.0181	6.834E-03	0.0253	6.850E-03
0.0146	6.392E-03	0.0063	6.598E-03	0.0093	6.392E-03	0.0137	6.357E-03	0.0194	6.461E-03	0.0272	6.479E-03
0.0157	6.009E-03	0.0068	6.255E-03	0.0100	6.023E-03	0.0147	5.978E-03	0.0209	6.089E-03	0.0292	6.109E-03
0.0169	5.631E-03	0.0072	5.914E-03	0.0107	5.658E-03	0.0158	5.605E-03	0.0224	5.721E-03	0.0314	5.742E-03
0.0182	5.262E-03	0.0077	5.578E-03	0.0115	5.301E-03	0.0170	5.239E-03	0.0241	5.361E-03	0.0337	5.383E-03
0.0196	4.906E-03	0.0082	5.250E-03	0.0123	4.953E-03	0.0182	4.885E-03	0.0259	5.012E-03	0.0362	5.034E-03
0.0211	4.563E-03	0.0088	4.931E-03	0.0131	4.618E-03	0.0196	4.544E-03	0.0278	4.675E-03	0.0389	4.697E-03
0.0227	4.235E-03	0.0094	4.622E-03	0.0141	4.296E-03	0.0210	4.218E-03	0.0299	4.352E-03	0.0418	4.373E-03
0.0244	3.925E-03	0.0100	4.326E-03	0.0151	3.990E-03	0.0226	3.909E-03	0.0321	4.044E-03	0.0448	4.064E-03
0.0263	3.632E-03	0.0107	4.043E-03	0.0162	3.699E-03	0.0242	3.616E-03	0.0345	3.752E-03	0.0482	3.771E-03
0.0283	3.356E-03	0.0114	3.774E-03	0.0173	3.425E-03	0.0260	3.340E-03	0.0370	3.477E-03	0.0517	3.494E-03
0.0305	3.098E-03	0.0122	3.519E-03	0.0185	3.167E-03	0.0279	3.082E-03	0.0398	3.218E-03	0.0556	3.232E-03
0.0328	2.857E-03	0.0131	3.278E-03	0.0199	2.925E-03	0.0300	2.840E-03	0.0427	2.975E-03	0.0597	2.985E-03
0.0353	2.632E-03	0.0140	3.051E-03	0.0213	2.699E-03	0.0322	2.615E-03	0.0459	2.747E-03	0.0641	2.753E-03
0.0380	2.423E-03	0.0149	2.837E-03	0.0228	2.488E-03	0.0345	2.404E-03	0.0493	2.534E-03	0.0688	2.536E-03
0.0409	2.228E-03	0.0159	2.636E-03	0.0244	2.291E-03	0.0371	2.209E-03	0.0529	2.334E-03	0.0739	2.332E-03
0.0440	2.046E-03	0.0170	2.448E-03	0.0261	2.108E-03	0.0398	2.026E-03	0.0569	2.147E-03	0.0794	2.140E-03
0.0473	1.877E-03	0.0182	2.272E-03	0.0280	1.937E-03	0.0427	1.857E-03	0.0611	1.972E-03	0.0853	1.960E-03
0.0509	1.719E-03	0.0194	2.106E-03	0.0300	1.778E-03	0.0459	1.699E-03	0.0656	1.808E-03	0.0916	1.791E-03
0.0548	1.572E-03	0.0207	1.951E-03	0.0321	1.629E-03	0.0492	1.551E-03	0.0705	1.654E-03	0.0984	1.633E-03
0.0590	1.434E-03	0.0221	1.806E-03	0.0344	1.491E-03	0.0529	1.414E-03	0.0757	1.510E-03	0.1056	1.484E-03
0.0635	1.306E-03	0.0236	1.670E-03	0.0369	1.363E-03	0.0568	1.286E-03	0.0814	1.375E-03	0.1135	1.345E-03
0.0683	1.186E-03	0.0252	1.542E-03	0.0395	1.243E-03	0.0609	1.167E-03	0.0874	1.248E-03	0.1219	1.214E-03
0.0735	1.074E-03	0.0270	1.421E-03	0.0423	1.131E-03	0.0654	1.056E-03	0.0939	1.129E-03	0.1309	1.092E-03
0.0791	9.693E-04	0.0288	1.308E-03	0.0453	1.027E-03	0.0702	9.520E-04	0.1008	1.018E-03	0.1406	9.786E-04

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0851	8.719E-04	0.0308	1.202E-03	0.0485	9.301E-04	0.0754	8.556E-04	0.1083	9.139E-04	0.1510	8.727E-04
0.0916	7.814E-04	0.0329	1.103E-03	0.0520	8.401E-04	0.0810	7.663E-04	0.1164	8.170E-04	0.1621	7.746E-04
0.0985	6.974E-04	0.0351	1.009E-03	0.0557	7.566E-04	0.0869	6.835E-04	0.1250	7.272E-04	0.1741	6.841E-04
0.1060	6.199E-04	0.0375	9.213E-04	0.0597	6.792E-04	0.0933	6.073E-04	0.1343	6.442E-04	0.1870	6.011E-04
0.1141	5.485E-04	0.0401	8.391E-04	0.0639	6.078E-04	0.1002	5.372E-04	0.1443	5.679E-04	0.2009	5.252E-04
0.1228	4.832E-04	0.0428	7.621E-04	0.0685	5.419E-04	0.1075	4.731E-04	0.1550	4.980E-04	0.2157	4.564E-04
0.1322	4.237E-04	0.0457	6.903E-04	0.0733	4.815E-04	0.1155	4.148E-04	0.1665	4.345E-04	0.2317	3.943E-04
0.1422	3.698E-04	0.0488	6.234E-04	0.0785	4.263E-04	0.1240	3.619E-04	0.1788	3.771E-04	0.2489	3.388E-04
0.1531	3.213E-04	0.0521	5.613E-04	0.0841	3.760E-04	0.1331	3.144E-04	0.1921	3.256E-04	0.2673	2.893E-04
0.1647	2.777E-04	0.0557	5.039E-04	0.0901	3.303E-04	0.1429	2.718E-04	0.2064	2.796E-04	0.2871	2.457E-04
0.1772	2.390E-04	0.0595	4.508E-04	0.0965	2.891E-04	0.1534	2.338E-04	0.2217	2.389E-04	0.3083	2.074E-04
0.1907	2.046E-04	0.0635	4.021E-04	0.1034	2.520E-04	0.1647	2.003E-04	0.2381	2.030E-04	0.3311	1.741E-04
0.2053	1.744E-04	0.0679	3.574E-04	0.1108	2.188E-04	0.1768	1.707E-04	0.2558	1.716E-04	0.3556	1.454E-04
0.2209	1.480E-04	0.0725	3.166E-04	0.1187	1.892E-04	0.1898	1.449E-04	0.2748	1.444E-04	0.3820	1.207E-04
0.2377	1.249E-04	0.0774	2.795E-04	0.1271	1.629E-04	0.2038	1.224E-04	0.2952	1.209E-04	0.4102	9.966E-05
0.2558	1.050E-04	0.0827	2.459E-04	0.1362	1.398E-04	0.2188	1.030E-04	0.3171	1.007E-04	0.4406	8.186E-05
0.2753	8.781E-05	0.0883	2.156E-04	0.1459	1.194E-04	0.2349	8.624E-05	0.3406	8.346E-05	0.4732	6.690E-05
0.2962	7.310E-05	0.0944	1.884E-04	0.1562	1.016E-04	0.2521	7.192E-05	0.3659	6.888E-05	0.5082	5.441E-05
0.3188	6.057E-05	0.1008	1.640E-04	0.1674	8.605E-05	0.2707	5.972E-05	0.3931	5.659E-05	0.5459	4.403E-05
0.3431	4.995E-05	0.1077	1.422E-04	0.1793	7.260E-05	0.2906	4.939E-05	0.4223	4.629E-05	0.5863	3.547E-05
0.3692	4.100E-05	0.1150	1.229E-04	0.1920	6.099E-05	0.3120	4.068E-05	0.4536	3.771E-05	0.6297	2.845E-05
0.3973	3.349E-05	0.1228	1.058E-04	0.2057	5.103E-05	0.3350	3.338E-05	0.4873	3.059E-05	0.6763	2.273E-05
0.4275	2.724E-05	0.1312	9.068E-05	0.2203	4.251E-05	0.3596	2.728E-05	0.5235	2.472E-05	0.7263	1.808E-05
0.4601	2.205E-05	0.1401	7.742E-05	0.2360	3.527E-05	0.3861	2.221E-05	0.5623	1.989E-05	0.7801	1.433E-05
0.4951	1.777E-05	0.1497	6.583E-05	0.2528	2.913E-05	0.4145	1.802E-05	0.6041	1.596E-05	0.8378	1.132E-05
0.5328	1.426E-05	0.1599	5.574E-05	0.2708	2.397E-05	0.4450	1.457E-05	0.6489	1.275E-05	0.8998	8.909E-06
0.5734	1.139E-05	0.1708	4.699E-05	0.2901	1.963E-05	0.4777	1.174E-05	0.6971	1.016E-05	0.9664	6.993E-06
0.6170	9.062E-06	0.1824	3.943E-05	0.3107	1.602E-05	0.5129	9.426E-06	0.7488	8.066E-06	1.0380	5.475E-06
0.6640	7.182E-06	0.1949	3.295E-05	0.3329	1.301E-05	0.5506	7.546E-06	0.8044	6.386E-06	1.1148	4.277E-06
0.7146	5.671E-06	0.2081	2.740E-05	0.3566	1.053E-05	0.5912	6.023E-06	0.8641	5.043E-06	1.1973	3.334E-06
0.7690	4.462E-06	0.2223	2.268E-05	0.3819	8.487E-06	0.6347	4.795E-06	0.9282	3.972E-06	1.2859	2.595E-06

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.8275	3.499E-06	0.2375	1.868E-05	0.4091	6.814E-06	0.6814	3.806E-06	0.9971	3.122E-06	1.3811	2.017E-06
0.8905	2.736E-06	0.2537	1.532E-05	0.4383	5.449E-06	0.7315	3.014E-06	1.0711	2.448E-06	1.4834	1.567E-06
0.9583	2.134E-06	0.2709	1.250E-05	0.4695	4.342E-06	0.7853	2.381E-06	1.1506	1.917E-06	1.5931	1.216E-06
1.0313	1.659E-06	0.2894	1.015E-05	0.5029	3.446E-06	0.8431	1.877E-06	1.2361	1.498E-06	1.7111	9.435E-07
1.1098	1.288E-06	0.3091	8.202E-06	0.5387	2.726E-06	0.9052	1.477E-06	1.3278	1.169E-06	1.8377	7.321E-07
1.1943	9.974E-07	0.3302	6.595E-06	0.5770	2.148E-06	0.9718	1.159E-06	1.4264	9.118E-07	1.9737	5.682E-07
1.2852	7.711E-07	0.3527	5.277E-06	0.6181	1.687E-06	1.0433	9.083E-07	1.5322	7.101E-07	2.1198	4.413E-07
1.3831	5.952E-07	0.3767	4.202E-06	0.6621	1.321E-06	1.1201	7.104E-07	1.6460	5.526E-07	2.2767	3.429E-07
1.4884	4.588E-07	0.4024	3.329E-06	0.7092	1.030E-06	1.2025	5.546E-07	1.7682	4.297E-07	2.4453	2.667E-07
1.6017	3.533E-07	0.4298	2.625E-06	0.7597	8.010E-07	1.2910	4.323E-07	1.8994	3.339E-07	2.6263	2.077E-07
1.7237	2.719E-07	0.4591	2.060E-06	0.8138	6.208E-07	1.3860	3.364E-07	2.0404	2.594E-07	2.8206	1.620E-07
1.8549	2.090E-07	0.4904	1.609E-06	0.8717	4.796E-07	1.4880	2.614E-07	2.1918	2.015E-07	3.0294	1.264E-07
1.9961	1.607E-07	0.5238	1.250E-06	0.9337	3.693E-07	1.5975	2.027E-07	2.3545	1.565E-07	3.2537	9.885E-08
2.1481	1.234E-07	0.5595	9.670E-07	1.0002	2.836E-07	1.7151	1.570E-07	2.5293	1.215E-07	3.4945	7.737E-08
2.3116	9.484E-08	0.5976	7.444E-07	1.0714	2.171E-07	1.8413	1.214E-07	2.7171	9.431E-08	3.7531	6.063E-08
2.4876	7.286E-08	0.6383	5.704E-07	1.1477	1.657E-07	1.9768	9.377E-08	2.9187	7.323E-08	4.0309	4.756E-08
2.6770	5.598E-08	0.6818	4.350E-07	1.2294	1.261E-07	2.1222	7.230E-08	3.1354	5.686E-08	4.3293	3.734E-08
2.8809	4.303E-08	0.7283	3.302E-07	1.3169	9.572E-08	2.2784	5.567E-08	3.3681	4.414E-08	4.6497	2.932E-08
3.1002	3.308E-08	0.7779	2.496E-07	1.4106	7.245E-08	2.4461	4.281E-08	3.6181	3.427E-08	4.9939	2.304E-08
3.3362	2.543E-08	0.8309	1.878E-07	1.5110	5.469E-08	2.6261	3.287E-08	3.8867	2.660E-08	5.3636	1.810E-08
3.5902	1.956E-08	0.8875	1.407E-07	1.6186	4.117E-08	2.8193	2.521E-08	4.1752	2.064E-08	5.7606	1.421E-08
3.8636	1.504E-08	0.9480	1.050E-07	1.7338	3.092E-08	3.0268	1.931E-08	4.4851	1.600E-08	6.1869	1.114E-08
4.1577	1.156E-08	1.0126	7.797E-08	1.8572	2.316E-08	3.2495	1.477E-08	4.8180	1.239E-08	6.6449	8.729E-09
4.4743	8.885E-09	1.0816	5.769E-08	1.9894	1.730E-08	3.4887	1.128E-08	5.1757	9.590E-09	7.1367	6.826E-09
4.8150	6.822E-09	1.1553	4.252E-08	2.1310	1.290E-08	3.7454	8.599E-09	5.5599	7.409E-09	7.6650	5.326E-09
5.1815	5.232E-09	1.2341	3.122E-08	2.2827	9.587E-09	4.0210	6.547E-09	5.9725	5.713E-09	8.2323	4.145E-09
5.5760	4.006E-09	1.3181	2.284E-08	2.4452	7.109E-09	4.3169	4.976E-09	6.4159	4.396E-09	8.8417	3.217E-09
6.0006	3.060E-09	1.4080	1.665E-08	2.6193	5.259E-09	4.6346	3.774E-09	6.8921	3.373E-09	9.4961	2.488E-09
6.4574	2.332E-09	1.5039	1.209E-08	2.8057	3.881E-09	4.9756	2.856E-09	7.4037	2.580E-09	10.1990	1.917E-09
6.9491	1.772E-09	1.6064	8.753E-09	3.0055	2.856E-09	5.3418	2.156E-09	7.9533	1.967E-09	10.9539	1.472E-09
7.4782	1.342E-09	1.7159	6.316E-09	3.2194	2.097E-09	5.7349	1.623E-09	8.5436	1.494E-09	11.7647	1.125E-09

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
8.0475	1.012E-09	1.8328	4.543E-09	3.4486	1.535E-09	6.1569	1.218E-09	9.1778	1.130E-09	12.6355	8.556E-10
8.6602	7.596E-10	1.9577	3.257E-09	3.6940	1.121E-09	6.6100	9.109E-10	9.8590	8.508E-10	13.5707	6.476E-10
9.3196	5.676E-10	2.0911	2.327E-09	3.9570	8.162E-10	7.0964	6.786E-10	10.5909	6.374E-10	14.5752	4.877E-10
10.0291	4.219E-10	2.2336	1.658E-09	4.2387	5.926E-10	7.6186	5.035E-10	11.3770	4.751E-10	15.6540	3.652E-10
10.7927	3.118E-10	2.3858	1.177E-09	4.5404	4.289E-10	8.1793	3.718E-10	12.2215	3.522E-10	16.8127	2.719E-10
11.6144	2.291E-10	2.5483	8.329E-10	4.8636	3.094E-10	8.7812	2.733E-10	13.1286	2.595E-10	18.0572	2.013E-10
12.4987	1.672E-10	2.7220	5.873E-10	5.2098	2.224E-10	9.4274	1.998E-10	14.1032	1.901E-10	19.3937	1.480E-10
13.4503	1.213E-10	2.9074	4.126E-10	5.5806	1.593E-10	10.1211	1.453E-10	15.1500	1.384E-10	20.8292	1.082E-10

Table A-1g: 25 Hz Seismic Hazard Curves at Hatch.

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0077	6.448E-03	0.0027	6.558E-03	0.0048	6.226E-03	0.0071	6.309E-03	0.0105	6.485E-03	0.0190	6.330E-03
0.0083	6.021E-03	0.0029	6.180E-03	0.0052	5.808E-03	0.0076	5.883E-03	0.0114	6.072E-03	0.0205	5.919E-03
0.0090	5.606E-03	0.0031	5.809E-03	0.0056	5.404E-03	0.0082	5.470E-03	0.0123	5.670E-03	0.0221	5.519E-03
0.0098	5.207E-03	0.0034	5.450E-03	0.0060	5.015E-03	0.0089	5.074E-03	0.0133	5.283E-03	0.0238	5.133E-03
0.0106	4.827E-03	0.0036	5.106E-03	0.0065	4.646E-03	0.0096	4.697E-03	0.0143	4.913E-03	0.0256	4.765E-03
0.0114	4.469E-03	0.0039	4.777E-03	0.0070	4.296E-03	0.0104	4.341E-03	0.0155	4.563E-03	0.0276	4.415E-03
0.0124	4.132E-03	0.0042	4.465E-03	0.0075	3.968E-03	0.0112	4.008E-03	0.0167	4.233E-03	0.0298	4.084E-03
0.0134	3.818E-03	0.0045	4.171E-03	0.0081	3.661E-03	0.0121	3.696E-03	0.0181	3.924E-03	0.0321	3.772E-03
0.0145	3.525E-03	0.0048	3.893E-03	0.0088	3.376E-03	0.0130	3.407E-03	0.0195	3.634E-03	0.0345	3.480E-03
0.0157	3.253E-03	0.0052	3.633E-03	0.0094	3.111E-03	0.0141	3.138E-03	0.0211	3.365E-03	0.0372	3.205E-03
0.0170	3.001E-03	0.0056	3.389E-03	0.0102	2.866E-03	0.0152	2.889E-03	0.0228	3.114E-03	0.0401	2.948E-03
0.0184	2.768E-03	0.0060	3.161E-03	0.0109	2.638E-03	0.0164	2.659E-03	0.0246	2.880E-03	0.0432	2.707E-03
0.0199	2.552E-03	0.0065	2.947E-03	0.0118	2.428E-03	0.0177	2.447E-03	0.0266	2.662E-03	0.0465	2.482E-03
0.0215	2.352E-03	0.0070	2.748E-03	0.0127	2.233E-03	0.0191	2.250E-03	0.0287	2.458E-03	0.0501	2.270E-03
0.0233	2.166E-03	0.0075	2.561E-03	0.0137	2.052E-03	0.0207	2.067E-03	0.0310	2.268E-03	0.0540	2.071E-03
0.0252	1.993E-03	0.0080	2.387E-03	0.0147	1.885E-03	0.0223	1.897E-03	0.0335	2.090E-03	0.0582	1.885E-03
0.0273	1.832E-03	0.0086	2.224E-03	0.0159	1.729E-03	0.0241	1.739E-03	0.0362	1.922E-03	0.0627	1.710E-03
0.0295	1.681E-03	0.0093	2.071E-03	0.0171	1.584E-03	0.0260	1.592E-03	0.0391	1.764E-03	0.0676	1.545E-03
0.0320	1.540E-03	0.0100	1.927E-03	0.0184	1.448E-03	0.0281	1.454E-03	0.0422	1.614E-03	0.0728	1.391E-03
0.0346	1.406E-03	0.0107	1.792E-03	0.0198	1.321E-03	0.0303	1.324E-03	0.0456	1.472E-03	0.0784	1.246E-03
0.0374	1.281E-03	0.0116	1.665E-03	0.0213	1.203E-03	0.0328	1.202E-03	0.0493	1.337E-03	0.0845	1.111E-03
0.0405	1.162E-03	0.0124	1.544E-03	0.0230	1.091E-03	0.0354	1.088E-03	0.0533	1.209E-03	0.0910	9.847E-04
0.0439	1.050E-03	0.0134	1.430E-03	0.0248	9.872E-04	0.0382	9.796E-04	0.0575	1.088E-03	0.0981	8.678E-04
0.0475	9.445E-04	0.0144	1.321E-03	0.0267	8.897E-04	0.0413	8.782E-04	0.0622	9.731E-04	0.1057	7.600E-04
0.0514	8.450E-04	0.0155	1.218E-03	0.0287	7.987E-04	0.0446	7.831E-04	0.0672	8.650E-04	0.1138	6.612E-04
0.0556	7.517E-04	0.0166	1.119E-03	0.0309	7.139E-04	0.0481	6.943E-04	0.0726	7.638E-04	0.1226	5.713E-04
0.0602	6.647E-04	0.0179	1.025E-03	0.0333	6.352E-04	0.0519	6.119E-04	0.0784	6.698E-04	0.1321	4.902E-04
0.0652	5.843E-04	0.0192	9.360E-04	0.0359	5.626E-04	0.0561	5.359E-04	0.0847	5.832E-04	0.1424	4.175E-04
0.0705	5.105E-04	0.0207	8.511E-04	0.0387	4.959E-04	0.0606	4.664E-04	0.0915	5.042E-04	0.1534	3.532E-04
0.0763	4.433E-04	0.0222	7.707E-04	0.0416	4.350E-04	0.0654	4.034E-04	0.0989	4.328E-04	0.1652	2.966E-04

Mean		*5th Fractile*		*16th Fractile*		*50th Fractile*		*84th Fractile*		*95th Fractile*	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.0826	3.826E-04	0.0239	6.949E-04	0.0448	3.796E-04	0.0706	3.468E-04	0.1068	3.690E-04	0.1780	2.474E-04
0.0894	3.284E-04	0.0257	6.237E-04	0.0483	3.297E-04	0.0763	2.963E-04	0.1154	3.124E-04	0.1918	2.050E-04
0.0968	2.803E-04	0.0276	5.573E-04	0.0520	2.850E-04	0.0823	2.518E-04	0.1247	2.628E-04	0.2066	1.688E-04
0.1048	2.380E-04	0.0297	4.957E-04	0.0560	2.452E-04	0.0889	2.128E-04	0.1347	2.198E-04	0.2226	1.381E-04
0.1134	2.010E-04	0.0319	4.389E-04	0.0603	2.099E-04	0.0960	1.789E-04	0.1455	1.827E-04	0.2399	1.123E-04
0.1227	1.689E-04	0.0343	3.868E-04	0.0650	1.788E-04	0.1037	1.497E-04	0.1572	1.511E-04	0.2584	9.078E-05
0.1328	1.412E-04	0.0369	3.395E-04	0.0700	1.516E-04	0.1119	1.247E-04	0.1698	1.243E-04	0.2784	7.297E-05
0.1438	1.175E-04	0.0397	2.966E-04	0.0754	1.279E-04	0.1209	1.035E-04	0.1835	1.018E-04	0.3000	5.834E-05
0.1556	9.725E-05	0.0427	2.580E-04	0.0812	1.075E-04	0.1305	8.549E-05	0.1982	8.297E-05	0.3232	4.638E-05
0.1684	8.008E-05	0.0459	2.234E-04	0.0875	8.988E-05	0.1409	7.037E-05	0.2141	6.734E-05	0.3482	3.668E-05
0.1823	6.558E-05	0.0494	1.926E-04	0.0942	7.483E-05	0.1522	5.771E-05	0.2313	5.443E-05	0.3751	2.885E-05
0.1973	5.341E-05	0.0531	1.652E-04	0.1015	6.203E-05	0.1643	4.716E-05	0.2499	4.381E-05	0.4042	2.258E-05
0.2136	4.325E-05	0.0571	1.411E-04	0.1093	5.120E-05	0.1774	3.840E-05	0.2700	3.512E-05	0.4354	1.759E-05
0.2312	3.482E-05	0.0614	1.199E-04	0.1177	4.208E-05	0.1916	3.116E-05	0.2917	2.804E-05	0.4691	1.363E-05
0.2502	2.788E-05	0.0660	1.013E-04	0.1268	3.444E-05	0.2069	2.520E-05	0.3151	2.229E-05	0.5054	1.051E-05
0.2708	2.219E-05	0.0710	8.511E-05	0.1365	2.808E-05	0.2234	2.031E-05	0.3405	1.765E-05	0.5445	8.076E-06
0.2931	1.756E-05	0.0763	7.111E-05	0.1471	2.280E-05	0.2412	1.632E-05	0.3678	1.391E-05	0.5867	6.180E-06
0.3173	1.382E-05	0.0821	5.906E-05	0.1584	1.844E-05	0.2605	1.307E-05	0.3974	1.092E-05	0.6321	4.712E-06
0.3434	1.081E-05	0.0883	4.876E-05	0.1706	1.486E-05	0.2813	1.043E-05	0.4293	8.535E-06	0.6810	3.582E-06
0.3717	8.411E-06	0.0949	4.000E-05	0.1838	1.193E-05	0.3037	8.290E-06	0.4638	6.640E-06	0.7337	2.716E-06
0.4023	6.510E-06	0.1021	3.262E-05	0.1979	9.536E-06	0.3280	6.569E-06	0.5011	5.143E-06	0.7904	2.056E-06
0.4354	5.011E-06	0.1097	2.643E-05	0.2132	7.596E-06	0.3541	5.186E-06	0.5414	3.966E-06	0.8516	1.554E-06
0.4713	3.838E-06	0.1180	2.129E-05	0.2296	6.027E-06	0.3824	4.079E-06	0.5849	3.045E-06	0.9175	1.173E-06
0.5101	2.925E-06	0.1269	1.704E-05	0.2473	4.763E-06	0.4129	3.196E-06	0.6319	2.328E-06	0.9885	8.857E-07
0.5521	2.219E-06	0.1365	1.355E-05	0.2664	3.749E-06	0.4459	2.494E-06	0.6826	1.773E-06	1.0650	6.690E-07
0.5976	1.675E-06	0.1467	1.072E-05	0.2869	2.938E-06	0.4815	1.938E-06	0.7375	1.346E-06	1.1474	5.058E-07
0.6468	1.260E-06	0.1578	8.427E-06	0.3090	2.292E-06	0.5199	1.500E-06	0.7967	1.018E-06	1.2362	3.831E-07
0.7001	9.434E-07	0.1697	6.586E-06	0.3328	1.780E-06	0.5614	1.155E-06	0.8608	7.672E-07	1.3318	2.907E-07
0.7578	7.042E-07	0.1824	5.118E-06	0.3584	1.376E-06	0.6062	8.860E-07	0.9299	5.769E-07	1.4349	2.212E-07
0.8202	5.241E-07	0.1962	3.954E-06	0.3861	1.058E-06	0.6545	6.764E-07	1.0047	4.330E-07	1.5459	1.689E-07
0.8877	3.891E-07	0.2110	3.037E-06	0.4158	8.093E-07	0.7068	5.141E-07	1.0854	3.244E-07	1.6655	1.293E-07

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
0.9608	2.883E-07	0.2268	2.320E-06	0.4479	6.156E-07	0.7632	3.890E-07	1.1726	2.429E-07	1.7944	9.934E-08
1.0400	2.133E-07	0.2439	1.762E-06	0.4824	4.656E-07	0.8241	2.930E-07	1.2668	1.817E-07	1.9333	7.655E-08
1.1256	1.578E-07	0.2623	1.330E-06	0.5195	3.501E-07	0.8898	2.198E-07	1.3686	1.360E-07	2.0829	5.915E-08
1.2183	1.167E-07	0.2820	9.990E-07	0.5596	2.617E-07	0.9609	1.642E-07	1.4786	1.018E-07	2.2440	4.581E-08
1.3187	8.631E-08	0.3033	7.458E-07	0.6027	1.944E-07	1.0375	1.222E-07	1.5974	7.629E-08	2.4177	3.553E-08
1.4273	6.393E-08	0.3261	5.536E-07	0.6492	1.436E-07	1.1203	9.060E-08	1.7258	5.723E-08	2.6048	2.759E-08
1.5449	4.741E-08	0.3507	4.086E-07	0.6992	1.054E-07	1.2097	6.698E-08	1.8645	4.298E-08	2.8063	2.143E-08
1.6721	3.522E-08	0.3771	2.998E-07	0.7531	7.690E-08	1.3063	4.939E-08	2.0143	3.232E-08	3.0235	1.663E-08
1.8098	2.620E-08	0.4055	2.186E-07	0.8111	5.578E-08	1.4105	3.633E-08	2.1762	2.431E-08	3.2574	1.289E-08
1.9589	1.952E-08	0.4360	1.585E-07	0.8736	4.022E-08	1.5231	2.667E-08	2.3510	1.829E-08	3.5095	9.964E-09
2.1202	1.456E-08	0.4688	1.142E-07	0.9409	2.884E-08	1.6447	1.954E-08	2.5399	1.376E-08	3.7810	7.681E-09
2.2948	1.086E-08	0.5042	8.179E-08	1.0134	2.057E-08	1.7759	1.429E-08	2.7440	1.033E-08	4.0736	5.898E-09
2.4838	8.089E-09	0.5421	5.820E-08	1.0915	1.459E-08	1.9176	1.044E-08	2.9645	7.742E-09	4.3888	4.509E-09
2.6884	6.018E-09	0.5829	4.114E-08	1.1756	1.029E-08	2.0707	7.607E-09	3.2028	5.783E-09	4.7284	3.429E-09
2.9098	4.464E-09	0.6268	2.890E-08	1.2662	7.224E-09	2.2359	5.530E-09	3.4601	4.302E-09	5.0943	2.592E-09
3.1495	3.298E-09	0.6740	2.016E-08	1.3638	5.044E-09	2.4144	4.008E-09	3.7382	3.184E-09	5.4885	1.947E-09
3.4089	2.424E-09	0.7248	1.397E-08	1.4689	3.503E-09	2.6070	2.895E-09	4.0385	2.342E-09	5.9132	1.451E-09
3.6896	1.770E-09	0.7794	9.614E-09	1.5821	2.420E-09	2.8151	2.081E-09	4.3631	1.711E-09	6.3708	1.074E-09
3.9935	1.283E-09	0.8381	6.569E-09	1.7040	1.663E-09	3.0397	1.487E-09	4.7137	1.240E-09	6.8637	7.874E-10
4.3224	9.226E-10	0.9012	4.456E-09	1.8353	1.136E-09	3.2823	1.056E-09	5.0924	8.910E-10	7.3948	5.723E-10
4.6784	6.570E-10	0.9691	3.000E-09	1.9768	7.715E-10	3.5443	7.445E-10	5.5016	6.342E-10	7.9670	4.119E-10
5.0638	4.630E-10	1.0420	2.005E-09	2.1291	5.206E-10	3.8271	5.203E-10	5.9437	4.468E-10	8.5835	2.934E-10
5.4808	3.227E-10	1.1205	1.329E-09	2.2932	3.489E-10	4.1325	3.602E-10	6.4214	3.113E-10	9.2477	2.068E-10
5.9322	2.222E-10	1.2049	8.731E-10	2.4699	2.321E-10	4.4623	2.468E-10	6.9374	2.144E-10	9.9633	1.441E-10
6.4208	1.510E-10	1.2956	5.688E-10	2.6602	1.532E-10	4.8184	1.673E-10	7.4948	1.459E-10	10.7343	9.916E-11
6.9496	1.013E-10	1.3932	3.672E-10	2.8652	1.003E-10	5.2030	1.120E-10	8.0971	9.801E-11	11.5649	6.742E-11
7.5220	6.700E-11	1.4981	2.347E-10	3.0860	6.504E-11	5.6182	7.405E-11	8.7477	6.496E-11	12.4597	4.525E-11
8.1416	4.366E-11	1.6109	1.486E-10	3.3239	4.178E-11	6.0666	4.831E-11	9.4507	4.246E-11	13.4239	2.996E-11
8.8121	2.803E-11	1.7322	9.304E-11	3.5800	2.656E-11	6.5507	3.108E-11	10.2101	2.735E-11	14.4626	1.957E-11
9.5379	1.771E-11	1.8627	5.762E-11	3.8559	1.670E-11	7.0735	1.971E-11	11.0305	1.736E-11	15.5817	1.260E-11
10.3234	1.101E-11	2.0029	3.528E-11	4.1530	1.037E-11	7.6380	1.232E-11	11.9169	1.085E-11	16.7874	7.998E-12

Mean		***5th Fractile***		***16th Fractile***		***50th Fractile***		***84th Fractile***		***95th Fractile***	
PSA (g)	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**	**PSA (g)**	**AFE**
11.1737	6.733E-12	2.1538	2.134E-11	4.4731	6.369E-12	8.2475	7.580E-12	12.8745	6.678E-12	18.0864	5.001E-12
12.0940	4.048E-12	2.3160	1.275E-11	4.8178	3.860E-12	8.9057	4.591E-12	13.9090	4.044E-12	19.4859	3.080E-12
13.0901	2.392E-12	2.4904	7.517E-12	5.1891	2.309E-12	9.6164	2.737E-12	15.0267	2.409E-12	20.9938	1.868E-12
14.1682	1.389E-12	2.6779	4.374E-12	5.5889	1.362E-12	10.3839	1.605E-12	16.2342	1.411E-12	22.6182	1.115E-12
15.3351	7.922E-13	2.8796	2.511E-12	6.0196	7.924E-13	11.2125	9.258E-13	17.5387	8.129E-13	24.3684	6.551E-13
16.5981	4.437E-13	3.0964	1.421E-12	6.4835	4.543E-13	12.1073	5.251E-13	18.9481	4.603E-13	26.2541	3.788E-13
17.9652	2.440E-13	3.3296	7.928E-13	6.9832	2.566E-13	13.0736	2.928E-13	20.4707	2.562E-13	28.2856	2.155E-13
19.4448	1.318E-13	3.5803	4.359E-13	7.5213	1.428E-13	14.1169	1.605E-13	22.1156	1.401E-13	30.4743	1.206E-13

Table A-2: Weighted average median and logarithmic standard deviation of amplification factors for Hatch Units 1 and 2.

Motion Name	0.5 Hz Input PSA (g)	0.5 Hz Median	0.5 Hz Log SD	1.0 Hz Input PSA (g)	1.0 Hz Median	1.0 Hz Log SD	2.5 Hz Input PSA (g)	2.5 Hz Median	2.5 Hz Log SD	5.0 Hz Input PSA (g)	5.0 Hz Median	5.0 Hz Log SD
HF3	0.0065	1.793	0.330	0.0161	2.410	0.432	0.0401	2.177	0.272	0.0573	1.428	0.381
LF3	0.0135	1.746	0.344	0.0215	2.400	0.442	0.0401	2.181	0.264	0.0573	1.416	0.367
HF4	0.0208	1.823	0.345	0.0518	2.386	0.411	0.1290	1.997	0.294	0.1840	1.280	0.366
LF4	0.0417	1.798	0.373	0.0657	2.370	0.416	0.1290	1.968	0.295	0.1840	1.239	0.358
HF5	0.0423	1.899	0.358	0.1110	2.311	0.370	0.2990	1.780	0.321	0.4420	1.103	0.375
LF5	0.0958	1.877	0.406	0.1460	2.288	0.397	0.2990	1.695	0.359	0.4290	1.009	0.400
HF6	0.0787	1.949	0.378	0.2160	2.218	0.353	0.6220	1.520	0.376	0.9950	0.875	0.431
LF6	0.1930	1.861	0.369	0.2890	2.075	0.424	0.6220	1.327	0.487	0.8850	0.752	0.513
HF7	0.1645	1.959	0.366	0.4524	2.002	0.374	1.3000	1.151	0.491	2.2063	0.594	0.568
LF7	0.3833	1.805	0.287	0.5866	1.769	0.433	1.3000	0.932	0.610	1.8493	0.506	0.601

Motion Name	10.0 Hz Input PSA (g)	10.0 Hz Median	10.0 Hz Log SD	25.0 Hz Input PSA (g)	25.0 Hz Median	25.0 Hz Log SD	100.0 Hz (PGA) Input PSA (g)	100.0 Hz (PGA) Median	100.0 Hz (PGA) Log SD
HF3	0.0738	0.943	0.528	0.0735	0.591	0.441	0.0370	1.018	0.338
LF3	0.0738	0.937	0.499	0.0735	0.607	0.404	0.0370	1.062	0.308
HF4	0.2470	0.791	0.503	0.2800	0.449	0.426	0.1390	0.796	0.317
LF4	0.2470	0.763	0.480	0.2800	0.453	0.390	0.1390	0.816	0.285
HF5	0.6380	0.625	0.514	0.7900	0.334	0.436	0.3830	0.616	0.330
LF5	0.5620	0.598	0.487	0.6700	0.365	0.375	0.2960	0.761	0.284
HF6	1.5700	0.440	0.582	2.0800	0.222	0.477	0.9930	0.423	0.377
LF6	1.1500	0.444	0.535	1.3700	0.292	0.404	0.6060	0.627	0.339
HF7	3.6068	0.276	0.676	4.9421	0.145	0.529	2.2738	0.295	0.459
LF7	2.4105	0.307	0.557	2.8683	0.218	0.425	1.2669	0.479	0.385