UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 31, 2023

Mr. James Barstow
Vice President, Nuclear Regulatory
Affairs and Support Services
Tennessee Valley Authority
1101 Market Street, LP 4A-C
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3; SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2; WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2 – STAFF ASSESSMENT OF UPDATED SEISMIC HAZARDS AT TVA SITES FOLLOWING THE NRC PROCESS FOR THE ONGOING ASSESSMENT OF NATURAL HAZARDS INFORMATION

Dear Mr. Barstow:

The purpose of this letter is to document the U.S. Nuclear Regulatory Commission (NRC) staff's assessment of seismic hazards at the Browns Ferry Nuclear Plant, Units 1, 2, and 3 (Browns Ferry), Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah), and Watts Bar Nuclear Plant, Units 1 and 2 (Watts Bar), following the process for the ongoing assessment of natural hazards information.

The enclosed seismic hazard reports provide the NRC staff's updated seismic hazard curves and response spectra for the Browns Ferry, Sequoyah, and Watts Bar plant sites that are based on the implementation of (1) a new seismic ground motion model for the central and eastern North America and (2) recent advances in site response analysis. The NRC staff's updated hazard curves and site amplification factors are included in the enclosed seismic hazard reports. The NRC staff conducted a screening evaluation that compared the updated seismic hazard curves contained in the attached report with previous seismic hazard curves developed by the Tennessee Valley Authority (TVA) for Browns Ferry, Sequoyah, and Watts Bar. Based on its comparison and evaluation of the updated seismic hazard curves in combination with an estimate of the Browns Ferry, Sequoyah, and Watts Bar, seismic capacity and available information on the consideration of seismic events in Browns Ferry's, Sequoyah's, and Watts Bar's approved risk-informed programs, the NRC staff has determined that no further regulatory evaluation of, or action to modify, the Browns Ferry, Sequoyah, and Watts Bar, plant seismic risk licensing basis is warranted.

Although the NRC staff is taking no further action at this time, the control point seismic hazard curves developed by the NRC staff for these reports may be considered in the context of potential future evaluations of the Browns Ferry, Sequoyah, and Watts Bar plant sites by the NRC staff (e.g., future license amendment requests) consistent with agency policy procedures (e.g., NRC Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests").

The NRC staff plans to make the enclosed Seismic Hazard Reports publicly available five working days from the date of this letter, pending the identification of any factual inaccuracies. If you have any questions, please contact me at (301) 415-1627 or via email at Kimberly.Green@nrc.gov.

Sincerely,

/RA/

Kimberly J. Green, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, 50-296
50-327, 50-328, 50-390, 50-391

Enclosures:
1. Browns Ferry Seismic Hazard Report
2. Sequoyah Seismic Hazard Report
3. Watts Bar Seismic Hazard Report

ENCLOSURE 1

BROWNS FERRY SEISMIC HAZARDS REPORT

Browns Ferry Seismic Hazard Report

Overview

This report provides the NRC staff's updated seismic hazard curves and response spectra for the Browns Ferry Nuclear Plant (Browns Ferry) site that are based on the implementation of (1) a new seismic ground motion model for the central and eastern United States (CEUS) and (2) recent advances in site response analysis. The NRC staff's updated hazard curves and site amplification factors are included in an appendix to this report.

Background

In response to the March 11, 2011, Great East Japan Earthquake and tsunami, which triggered an accident at the Fukushima Dai-ichi nuclear power plant, the U.S. Nuclear Regulatory Commission (NRC) established the Near-Term Task Force (NTTF) to conduct a systematic and methodical review of NRC processes and regulations and determine whether the agency should make additional improvements to its regulatory system. In SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (NRC, 2011), the NRC staff recommended a set of actions to clarify and strengthen the regulatory framework for protection against natural hazards. In particular, NTTF Recommendation 2.1 (NTTF R2.1) instructed the NRC staff to issue requests for information to all power reactor licensees pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) ("50.54(f) letter"). Enclosure 1 to the 50.54(f) letter requested that addressees reevaluate the seismic hazards at their sites, using present day NRC requirements and guidance to perform a probabilistic seismic hazard analysis (PSHA) and develop a site-specific ground motion response spectrum (GMRS). To comply with the 50.54(f) request, the Nuclear Energy Institute submitted Electric Power Research Institute (EPRI) Report 1025287, "Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima NTTF Recommendation 2.1 Seismic," dated November 27, 2012 (EPRI, 2012). Recipients of the 50.54(f) letter committed to following the SPID to develop seismic hazard and screening reports (SHSRs). By December 2017, the NRC staff had finished assessing the SHSRs for all operating U.S. nuclear power plants.

Under the process for the ongoing assessment of natural hazards information (POANHI), described in SECY-16-0144, "Proposed Resolution of Remaining Tier 2 and 3 Recommendations Resulting from the Fukushima Dai-ichi Accident," dated December 26, 2016 (NRC, 2016), the NRC staff continuously seeks out and integrates new natural hazards information for operating plants in the United States. The Office of Nuclear Reactor Regulation's Office Instruction LIC-208, "Process for the Ongoing Assessment of Natural Hazards Information," issued November 2019 (NRC, 2019), provides guidance to the staff on how to collect, integrate, and evaluate new information for consideration in its regulatory decision-making. This report presents the NRC staff's latest understanding of seismic hazards at the Browns Ferry site following the POANHI framework.

The Browns Ferry site is located on the northern shore of Wheeler Reservoir along the Tennessee River within the Interior Low Plateaus physiographic province and is founded on competent sedimentary rock (limestone, shale, and dolomite) of Paleozoic age, which is assumed to be about 1,500 meters thick.

Motivation

After evaluating the SHSR submittals, the NRC staff captured in NUREG/KM-0017, "Seismic Hazards Evaluations for U.S. Nuclear Power Plants: Near-Term Task Force Recommendation 2.1 Results," issued December 2021 (Munson et al., 2021), the information used to develop the GMRS at each of the U.S. nuclear power plants. This includes a compilation and synthesis of (1) information provided by licensees in their SHSRs, (2) information collected by the NRC staff during its reviews of the SHSRs, and (3) information subsequently collected by the NRC staff from the scientific and engineering literature pertaining to several of the nuclear power plant sites. In addition, NUREG/KM-0017 includes updated approaches and relationships, relative to those recommended by the SPID, that the NRC staff used to perform its analyses.

After the development of NUREG/KM-0017, a new Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 ground motion model (GMM) for Eastern North America called NGA-East was published by Goulet et al. (2018). In addition, the NRC staff also participated in a SSHAC Level 2 study, documented in Research Information Letter (RIL) 2021--15, "Documentation Report for SSHAC Level 2: Site Response," issued November 2021 (Rodriguez-Marek et al., 2021). This SSHAC Level 2 study implemented the SSHAC approach to performing site response analyses (SRAs). The SSHAC process, described most recently in NUREG-2213, "Updated Implementation Guidelines for SSHAC Hazard Studies," issued October 2018 (Ake et al., 2018), provides a structured and logical framework for the systematic evaluation of alternative data, models, and methods. This seismic hazard report for the Browns Ferry site incorporates the NGA-East GMM in place of the EPRI (2013) GMM and lessons learned from the SSHAC Level 2 SRA study (RIL 2021-15) into a PSHA to develop updated seismic hazard curves and a GMRS for the site.

Methods

Reference Rock Hazard

For the reference rock PSHA, the NRC staff used the distributed seismicity zones (DSZs) from the SSHAC Level 3 Central and Eastern United States Seismic Source Characterization for Nuclear Facilities (CEUS-SSC) model in NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, issued January 2012 (NRC, 2012). Specifically, the NRC staff selected the DSZs that are located within 500 kilometers of the site. For this reevaluation, the NRC staff used the SSHAC Level 2 update to the CEUS-SSC seismicity catalog and recurrence parameters (Gatlin, 2015), which primarily impact the DSZs that encompass Monticello Reservoir and Lake Keowee in South Carolina as well as the 1886 Charleston earthquake sequence. In addition, the NRC staff selected the RLME sources that are within 1,000 kilometers of the site. To develop the reference rock seismic hazard curves for the site, the NRC staff used the NGA-East GMM (2018) to compute the median and logarithmic

standard deviation of the spectral accelerations. Because the NGA-East GMM implements the rupture distance parameter, the NRC staff developed virtual rupture planes for each of the distributed source zones surrounding the site. For each virtual rupture, the NRC staff used the CEUS-SSC hazard input document (NRC, 2012) to specify the size of the rupture plane and the orientation of the rupture plane in terms of the strike and dip angles, dip direction, and rupture type (e.g., reverse and strike slip). In contrast, to develop the hazard curves for NUREG/KM-0017, the NRC staff used point source approximations for the CEUS-SSC and EPRI GMM (EPRI, 2013) combination.

Figure 1 shows the distribution of the virtual ruptures for one of the four alternative CEUS-SSC seismotectonic DSZ configurations along with the resulting 10-Hertz (Hz) mean hazard curves developed using the NGA-East GMM. In particular, Figure 1 shows the distribution of the surface projection of the updip segments of the virtual rupture planes for each of the six seismotectonic DSZs within 500 kilometers of the site. As expected, the Midcontinent Craton — Geometry A (MIDC-A) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} annual frequency of exceedance (AFE) level. Similarly, Figure 2 shows the distribution of the virtual ruptures for one of the three alternative CEUS-SSC maximum-magnitude DSZ configurations along with the resulting 10 Hz mean hazard curves developed using the NGA-East GMM. The Non-Mesozoic-and-Younger Extension—Narrow Configuration (NMESE-N) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 3 shows the RLME sources within 1,000 kilometers of the site, and their contribution to the 1 Hz reference rock mean hazard, from using the NGA-East GMM. The New Madrid Fault System RLME source is the largest contributor to the 1 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 4 shows the contribution from all of the DSZs relative to the RLMEs, as well as the total mean hazard for the 1 and 10 Hz mean reference rock hazard curves, from using the NGA-East GMM. For both the 1 and 10 Hz mean reference rock hazard curves, the RLME sources provide the largest contribution at the 10^{-4} AFE level. Finally, Figure 5 shows the mean 1,000-, 10,000-, and 100,000-year return period mean reference rock uniform hazard response spectra (UHRS) for the Browns Ferry site from using the EPRI GMM (blue) and the NGA-East GMM (red). For this reevaluation, the NRC staff used the NGA-East single station standard deviation and for the comparison shown in Figure 5, the NRC staff used the EPRI GMM ergodic standard deviation. As shown in Figure 5, the spectral accelerations from using the NGA-East GMM are higher than those from using the EPRI GMM, up to the spectral frequency of about 25 Hz. This result is due to the larger hazard that the New Madrid Fault System RLME contributes to the total mean hazard relative to the hazard from the DSZs for not just the lower frequencies (Figure 4 left) but also for the higher frequencies (Figure 4 right). The NGA-East GMM predicts higher median ground motions than the EPRI GMM for larger magnitude earthquakes and because the large and distant New Madrid Fault System RLME dominates the hazard for both the lower and higher spectral frequencies, the UHRS (see Figure 5) developed from using the NGA-East GMM have higher amplitudes than the UHRS developed using the EPRI GMM.

Site Response Analysis

SRAs, which are used to develop site adjustment (or amplification) factors ($SAFs$), depend on several factors, including the site strata (material type, stiffness, and thickness) and their response to dynamic loading. Because this information is site specific, the ability to accurately model the site response depends on the quantity and quality of site-specific geologic and geotechnical data available, and on the interpretation and use of these data to develop input models for assessing amplification (or deamplification) of ground motions. The resulting $SAFs$ are assessed for a wide range of input ground motions as part of understanding the changes in the soil and rock response as input ground motions increase.

The NRC staff followed the site response approach described in RIL 2021-15, which uses a logic tree for systematically identifying and propagating epistemic uncertainties in the SRA. As described in RIL 2021-15, to produce a truly probabilistic estimate of the seismic hazard at the control point elevation, it is necessary to estimate both the epistemic uncertainties and the aleatory variability of the soil and or rock dynamic response, and to propagate these through the SRA and the calculation of the site hazard curves.

Site Exploration. As described in the NTTF R2.1 SHSR submitted by the Tennessee Valley Authority (TVA; Shea, 2014) and summarized in section 2.3.12 of NUREG/KM-0017, the field investigations for Browns Ferry consisted of downhole and crosshole geophysical measurements of the uppermost soil and rock strata to a depth of 31 meters. In addition to the field investigations conducted for the initial siting of the plant, TVA performed a more recent surface geophysics program as part of its seismic probabilistic risk assessment (SPRA) NTTF R2.1 submittal (Polickoski, 2019) consisting of Spectral Analysis of Surface Waves (SASW) testing to estimate shear wave velocities (V_S) at the Browns Ferry site.

Basecase Profiles. TVA stated in its NTTF R2.1 SHSR (Shea, 2014) that the Browns Ferry site consists of a thin layer (about 15 m) of clay, clayey gravel, and gravel overlying about 15 m of fossiliferous limestone that grades into the Fort Payne Formation, which contains chert, cherty limestone and shale. The major structures of the Browns Ferry plant are founded on the Fort Payne Formation. For its site response analysis , TVA used the top of the Fort Payne Formation, which corresponds to an elevation of 156 m above mean sea level, as the control point elevation for the Brown Ferry site. Based on its field geophysical measurements (Polickoski, 2019), TVA estimated a V_S of about 1,830 meters/second (m/s) for the uppermost 2 meters of the Fort Payne Formation followed by a V_S of about 2,438 m/s from 2 to 6 meters and a V_S of 3,048 m/s from 6 to 24 meters. TVA then estimated a very thin 1-meter layer with a low V_S of about 991 m/s followed by an increase in V_S to about 2,652 m/s for 10 meters and then a final V_S of about 2,515 m/s for the remainder of the 1,023 meters of the profile. Other than the uppermost portion of the profile and the thin 1-meter layer at a depth of 24 meters, the majority of the basecase profile developed by TVA has V_S values that are close to the NGA-East reference condition V_S of 3,000 m/s. TVA stated (Polickoski, 2019) that the data collected through its geophysics program did not support the modeling of multiple basecase profiles and, as such, developed a single best-estimate basecase profile for its SPRA site response analysis.

As TVA conducted multiple recent geophysical field investigations to characterize the sedimentary strata beneath the Browns Ferry site, the NRC staff used TVA's layer thicknesses and V_S for its best-estimate basecase profile.

Based on (1) the heterogeneity of the stratigraphy of the Interior Low Plateaus physiographic province in the vicinity of the Browns Ferry site and (2) consistent with the NRC staff's effort to capture a wider range of uncertainty (RIL 2021-15), the NRC staff developed lower and upper basecase profiles by multiplying its best-estimate basecase profile by scale factors of 0.82 and 1.21, respectively, which corresponds to an epistemic logarithmic standard deviation of 0.15. The weights for the lower, best-estimate, and upper basecase profiles are 0.3, 0.4, and 0.3, respectively. Figure 6 shows the three lower, best-estimate, and upper basecase profiles used by the NRC staff. The lower epistemic value used by the NRC staff to determine the lower and upper basecase profiles is due to the staff's conclusion that the lithology of the sedimentary strata beneath Browns Ferry site likely has a low range in V_S.

Site Kappa. To estimate the site kappa (κ_0), which captures the overall attenuation (i.e., intrinsic and scattering attenuation) of the geologic profile, the NRC staff used the four Q_{ef}-V_S models from Campbell (2009), where Q_{ef} is the effective quality factor of shear waves, which captures both the frequency-independent component of intrinsic attenuation and small-scale scattering. For each of the four Q_{ef}-V_S models, the NRC staff estimated a Q_{ef} for each layer in the basecase profiles, then used the estimated Q_{ef}, V_S, and layer thickness to determine a κ_0 for each layer. Summing these κ_0 values for each layer and adding the reference value of 6 milliseconds (msec) provides an estimate of the total κ_0. The NRC staff used a weight of 0.25 for each of the four Q_{ef}-V_S models. Assuming a lognormal distribution for κ_0 with a logarithmic standard deviation of 0.2 from Xu et al. (2020), the NRC staff developed a nine-point discrete distribution. This results in 45 κ_0 values and associated weights for each of the basecase profiles, which the NRC staff then resampled using the approach from Miller and Rice (1983) to reduce the distribution to five representative values and associated weights. These five κ_0 values and weights, which are listed in Table 1, range from 6 msec to 22 msec for the three basecase profiles.

Nonlinear Dynamic Properties. For the equivalent linear (EQL) SRA, nonlinearity is incorporated using strain-compatible site properties (i.e., shear modulus and damping ratio) for each layer. The strain-compatible properties model both the shear modulus reduction and the increased damping that are expected as the intensity of shaking increases. To model the nonlinear response within 1-meter-thick lower velocity layer in the profile, the NRC staff used the EPRI rock modulus reduction and damping (MRD) curves (EPRI, 1993).

Table 2 provides the layer depths, lithologies, V_S, unit weights, and dynamic properties for the NRC staff's three basecase profiles. It is important to note that the NRC staff has adjusted the critical damping ratio values in each of the layers of the profiles, which are treated as having a linear response, so that each profile as a whole has the appropriate κ_0 value. Figure 7, which shows tornado plots for the reference rock peak ground acceleration (PGA) value of 0.64g, shows the site response logic tree nodes that contribute to the variance of the SAF. Each tornado plot in Figure 7 is associated with one of the four oscillator frequencies of 1, 5, 10, and 100 Hz. For each of the four frequencies, the epistemic uncertainty in the basecase V_S contributes the most to the variance in the SAF.

Input Motions. Input motions used for the SRA were generated as outcrop motions at the reference rock horizon, located at the bottom of the basecase profiles. The NRC staff used random vibration theory to generate the input motions after first developing an input Fourier amplitude spectrum (FAS) using seismological source theory (i.e., single-corner frequency Brune source spectrum). To develop the FAS, the NRC staff used the source and regional attenuation parameters recommended in the SPID for Eastern North American rock sites and then used random vibration theory to develop corresponding 5 percent damped acceleration response spectra. The NRC staff developed 12 input FAS assuming a magnitude ($\boldsymbol{M}$) of 6.5 and 12 different source-to-site distances, as recommended in the SPID.

Analysis Methodology. To develop $SAFs$ for the Browns Ferry site, the NRC staff used traditional EQL analysis and the recently developed kappa-corrected EQL analysis, which adjusts the high-frequency control point (i.e., top of profile) FAS from the EQL SRA to be consistent with the target κ_0 value. In particular, the NRC staff used the kappa-corrected EQL analysis methodology (Xu and Rathje, 2021) with the modification in which the EQL control point FAS remains unmodified below a specified transition frequency, and then a slope equal to the target κ_0 value is imposed at frequencies above the transition frequency (RIL 2021-15). To capture the uncertainty in this transition frequency value, the NRC staff selected three frequencies for which the FAS amplitude equals 5 percent, 11 percent, and 17 percent of its peak value, with weights of 0.2, 0.6, and 0.2, respectively.

To capture the spatial variability in site properties across the site, the NRC staff generated randomized V_S profiles around each of the basecase profiles using the Toro (1995) model, which quantifies the aleatory variability through a depth-dependent standard deviation of the natural log of the velocities. The logarithmic standard deviation values used by the NRC staff for the Browns Ferry site were based on site-specific data and are shown in Table 2. In addition to randomizing the V_S profiles, the NRC staff also randomized the MRD curves following the logit function approach used in the SPID and described in RIL 2021-15.

For each terminal branch of the site response logic tree, the NRC staff developed 60 randomized profiles and then determined the SAF by dividing the computed control point response spectrum by the outcrop response spectrum for the reference condition. Next, the NRC staff computed a median and logarithmic standard deviation for the SAF, using the 60 $SAFs$ from the randomized profiles, for each terminal branch of the logic tree. To facilitate implementing the SAF medians and logarithmic standard deviations into the PSHA seismic hazard integral, the NRC staff reduced the median SAFs from the over 200 logic tree terminal branches to seven discrete fractiles and weights using the resampling procedure outlined by Miller and Rice (1983). As recommended by Rodriguez-Marek et al. (2021), to ensure that estimates of the SRA capture enough epistemic uncertainty in the median SAF, the NRC staff implemented a minimum logarithmic standard deviation value of 0.15, which causes the seven median SAF fractiles to spread apart if necessary.

Finally, because the SAF logarithmic standard deviation for each spectral frequency does not vary significantly across the terminal branches of the logic tree, the NRC staff used a single mean value for each frequency. In addition, to avoid double-counting the aleatory variability already captured by the GMM, the NRC staff adjusted the SAF logarithmic standard deviation to include only the portion of the standard deviation associated with the nonlinear site response.

Figure 8 shows the seven median SAF values (top) and the average logarithmic standard deviation (bottom) as a function of input reference rock spectral acceleration for the 1 and 10 Hz spectral frequencies. As shown in Figure 8, the median $SAFs$ range from about 0.8 to 1.5 and remain constant with higher input spectral accelerations. The lower half of Figure 8 shows both the total and the nonlinear values of the SAF logarithmic standard deviation, the latter of which are implemented into the PSHA hazard integral. Figure 9 shows the seven median SAF values versus frequency at the 10^{-4} AFE spectral acceleration value for each of the 23 NGA-East GMM spectral frequencies as well for PGA, which is plotted at 200 Hz. Overall, the Browns Ferry site produces a flat SAF from about 0.1 Hz to 3 Hz and then falls off over the higher frequencies out to about 40 Hz.

Control Point Hazard and Ground Motion Response Spectra

The NRC staff calculated the mean control point hazard for the Browns Ferry site using Convolution Approach 3 from NUREG/CR-6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines," issued October 2001 (McGuire et al., 2001), which convolves the predetermined mean reference condition hazard with the $SAFs$. For each NGA-East GMM spectral frequency, the NRC staff convolved the mean reference condition hazard curve with the seven $SAFs$ to determine the final mean control point hazard. Using the mean control point hazard curves, the NRC staff then determined the 10^{-4} and 10^{-5} UHRS in order to calculate the final GMRS for the site, which are provided in Table 3. Figure 10 shows this final GMRS (red curve) compared to the GMRS (black curve) developed for NUREG/KM-0017, the GMRS (blue curve) in TVA's SHSR (Shea, 2014) and the GMRS (purple curve) in TVA's seismic probabilistic risk assessment (SPRA; Polickoski, 2019). The years in the legend for Figure 10 show when the GMRS were developed either by TVA or the NRC staff. As shown in Figure 10, the final GMRS from this study is higher than the previous GMRS for the frequencies out to about 20 Hz and then is lower than the previous GMRS above 20 Hz. The higher spectral accelerations for the updated GMRS up to 20 Hz are due to the NGA-East GMM, which predicts higher median ground motions for the larger magnitude RLMEs, which dominate both the low and higher spectral frequencies, relative to the EPRI GMM (see Figure 5) for the Browns Ferry site. Based on a sensitivity analysis, the NRC staff found that the lower spectral accelerations in the upper frequencies for the updated GMRS developed by this study and the previous GMRS are due to the higher κ_0 values estimated for the Browns Ferry site (see Table 1), compared to the lower κ_0 values estimated for the previous studies.

Data Tables

Appendix A provides the data tables for the Browns Ferry site. Tables A-1, A-2, and A-3 give the reference rock mean hazard curves for 23 spectral frequencies ranging from 0.1 to 100 Hz and for PGA. Tables A-4 through A-27 give the SAF medians and logarithmic standard deviations for the 23 spectral frequencies and for PGA. Tables A-28, A-29, and A-30 give the control point hazard mean hazard curves for the 23 spectral frequencies and for PGA.

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Table 1 Site Kappa (κ_0) Values for Each Basecase Profile

Shallow Profile Kappa Distribution					
Lower Case		Base Case		Upper Case	
κ_0 (sec)	Weight	κ_0 (sec)	Weight	κ_0 (sec)	Weight
0.009	0.101	0.007	0.101	0.006	0.101
0.012	0.244	0.010	0.244	0.008	0.244
0.015	0.309	0.012	0.309	0.011	0.309
0.018	0.244	0.016	0.244	0.014	0.244
0.022	0.101	0.019	0.101	0.017	0.101

Table 2 Layer Depths, Shear Wave Velocities (V_S), Unit Weights, and Dynamic Properties for Browns Ferry

		***Vs* (m/s)**			***Vs***	**Unit**	**Dynamic Properties**
Layer #	**Depth (m)**	**LR (0.3)**	**BC (0.4)**	**UR (0.3)**	**Sigma (ln)**	**Weight (kN/m^3)**	**Alt 1. (1.0)**
1	2	1509	1829	2216	0.25	25	Linear
2	6	2012	2438	2955	0.25	25	Linear
3	24	2516	3048	3693	0.15	25	Linear
4	25	818	991	1200	0.15	21	EPRI Rock
5	35	2189	2652	3213	0.15	25	Linear
6	1058	2075	2515	3047	0.15	25	Linear

LR = lower range; BC = basecase; UR = upper range; ln = natural log; Alt. = Alternative
EPRI Rock = EPRI, 1993 rock
For LR, BC, UR and Alt.: Values in parentheses refer to weights for site response analysis logic tree branches.

Table 3 GMRS and UHRS for Browns Ferry

Frequency (Hz)	UHRS 1E-4 (g)	GMRS (g)	UHRS 1E-5 (g)
0.100	0.020443	0.023100	0.045046
0.133	0.029822	0.032700	0.063398
0.200	0.046927	0.051300	0.099296
0.250	0.060975	0.067100	0.130166
0.333	0.090196	0.098600	0.191033
0.500	0.140929	0.153300	0.296547
0.667	0.160891	0.181500	0.354232
1.000	0.215872	0.232800	0.449140
1.333	0.258356	0.281000	0.543435
2.000	0.315858	0.340100	0.656168
2.500	0.348696	0.384300	0.745690
3.333	0.411447	0.451400	0.874783
4.000	0.453811	0.497600	0.964296
5.000	0.467797	0.516800	1.003426
6.667	0.501034	0.567300	1.108289
10.000	0.526255	0.615600	1.212456
13.333	0.497125	0.588800	1.163243
20.000	0.396428	0.488500	0.974670
25.000	0.328591	0.410300	0.821260
33.333	0.248295	0.314500	0.631735
40.000	0.221245	0.279800	0.561987
50.000	0.213350	0.268200	0.537851
100.000	0.181320	0.211900	0.417309
PGA	0.198625	0.246100	0.491685

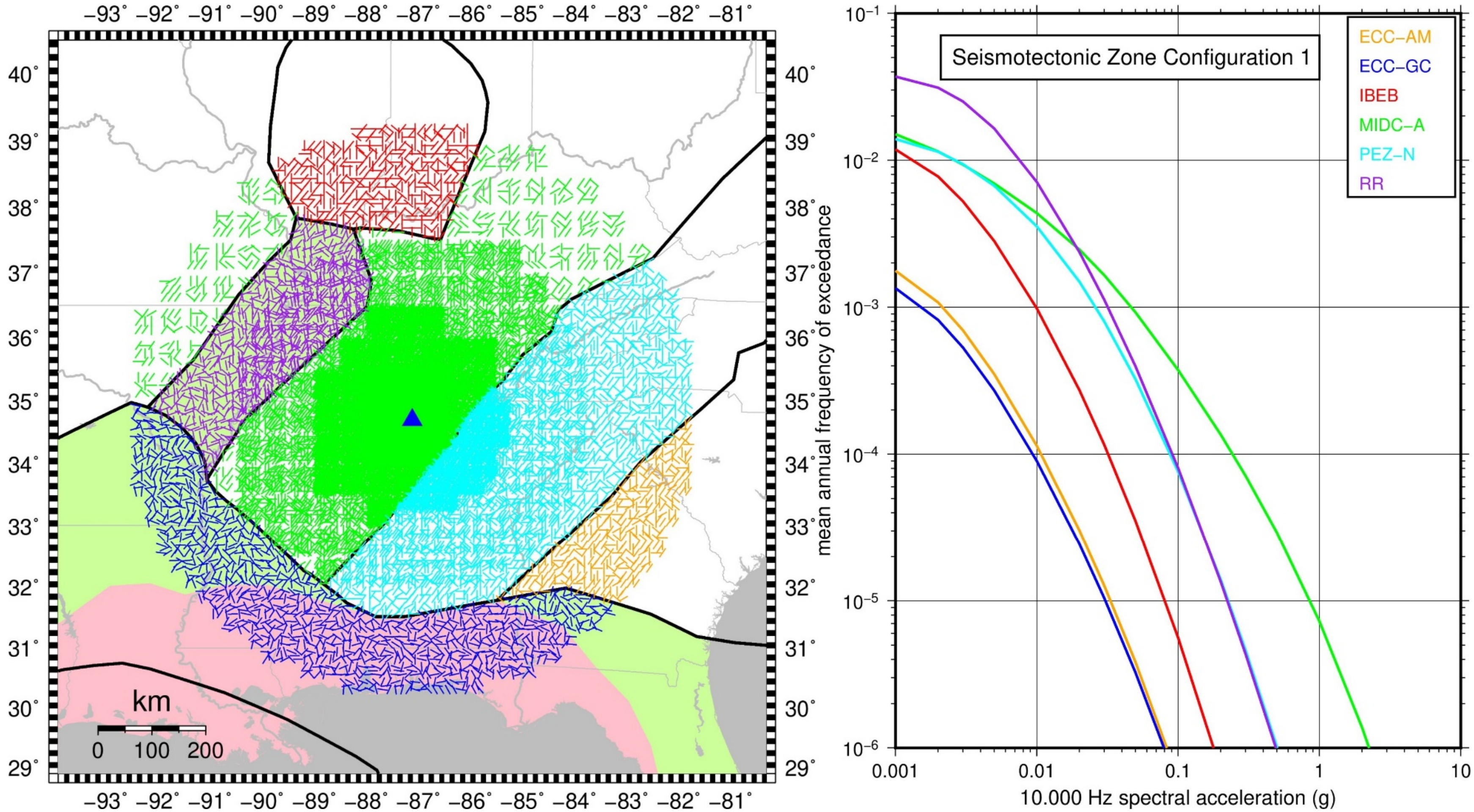

Figure 1 Distribution of virtual ruptures (left) for CEUS-SSC Seismotectonic Configuration 1 DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Browns Ferry

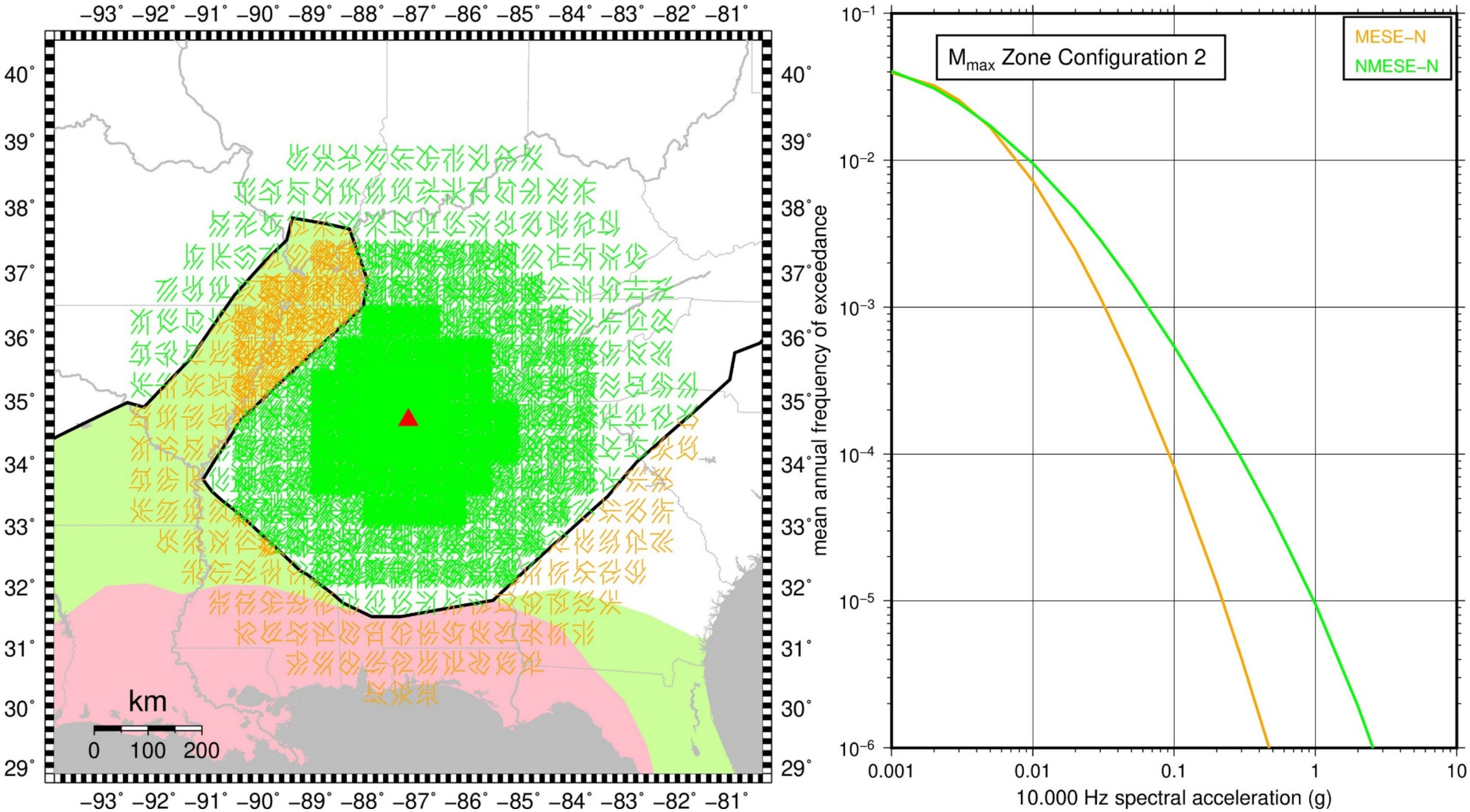

Figure 2 Distribution of virtual ruptures (left) for CEUS-SSC maximum-magnitude narrow-configuration DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Browns Ferry

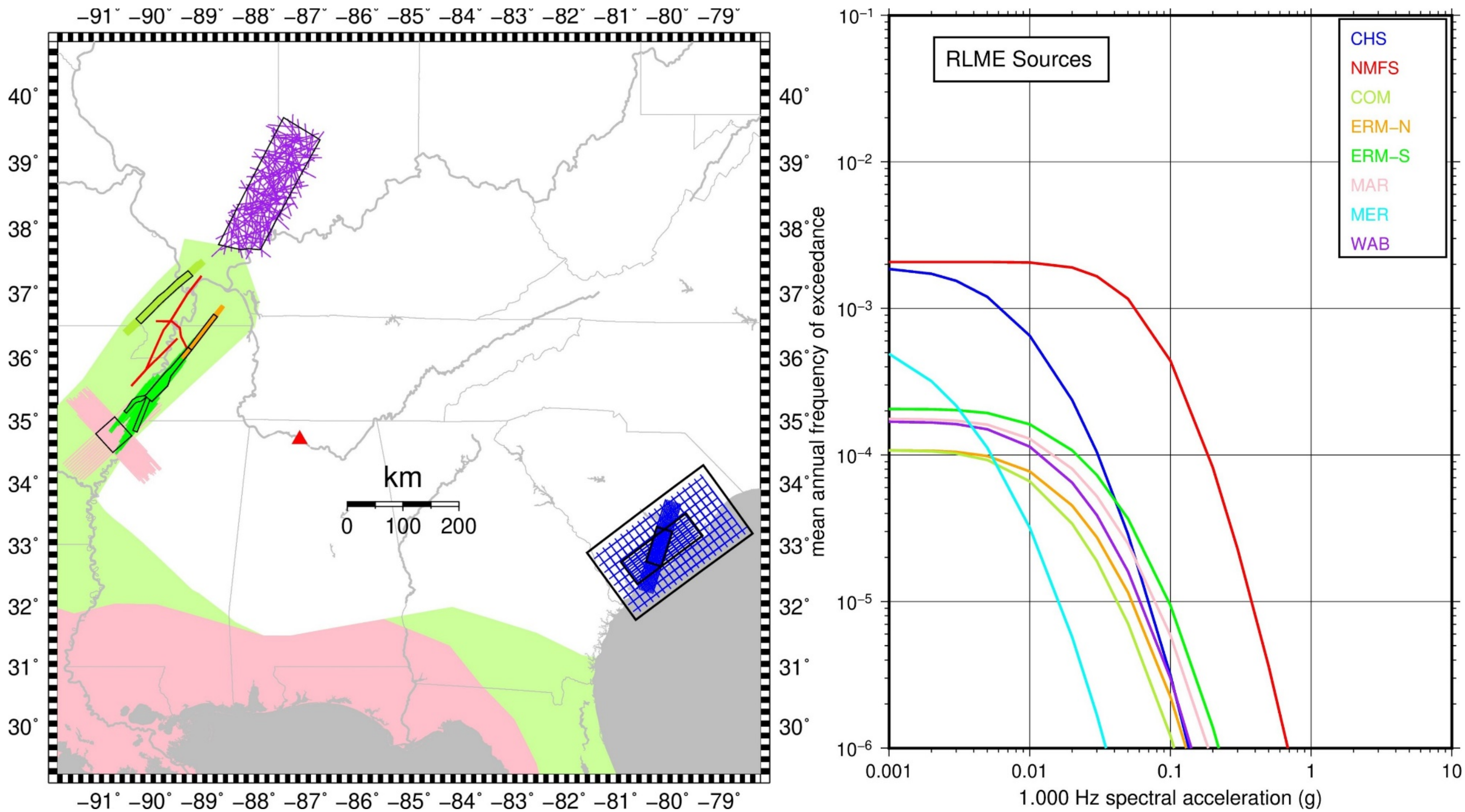

Figure 3 CEUS-SSC RLME sources (left), and associated mean 1 Hz reference rock hazard curves (right) for Browns Ferry

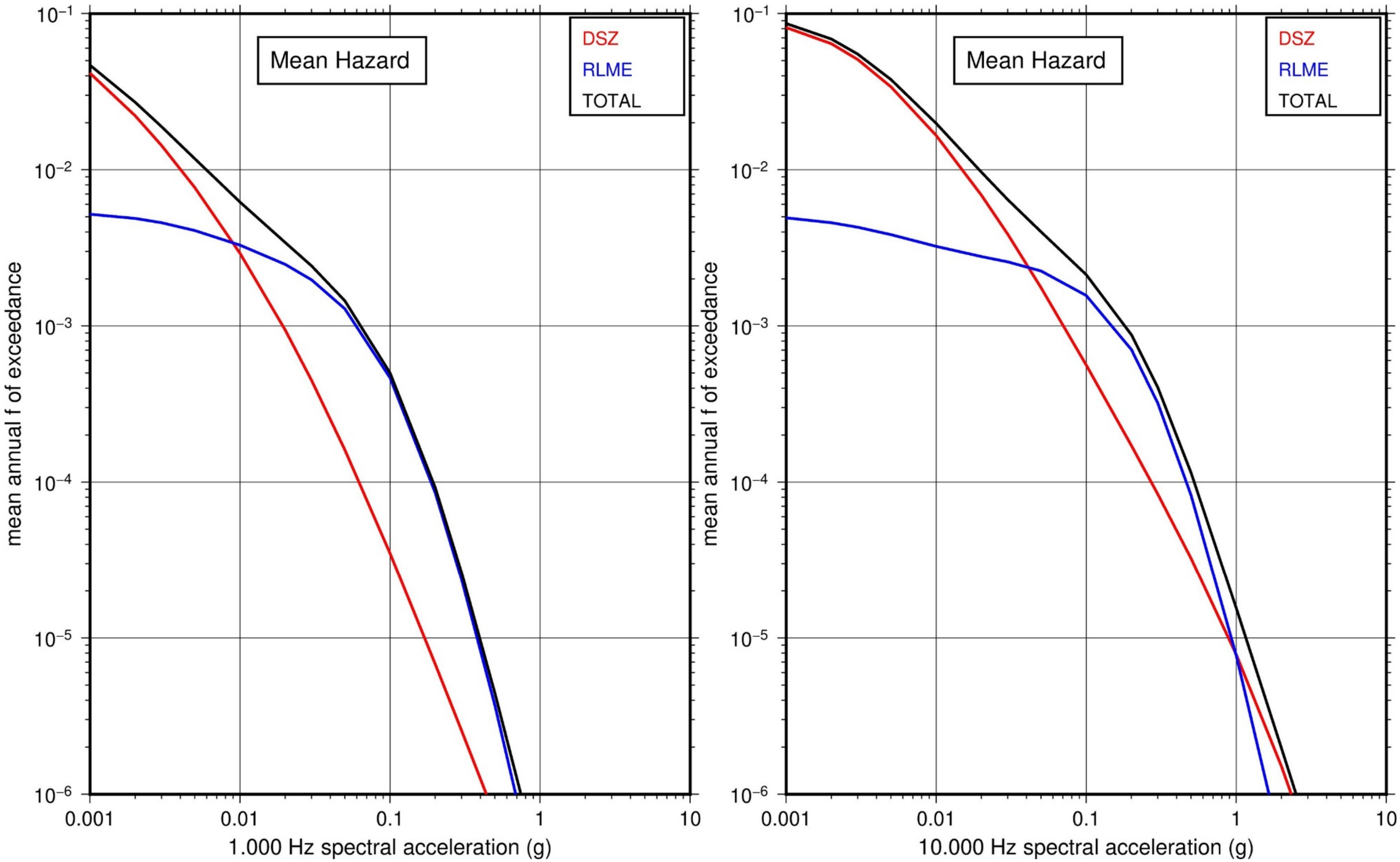

Figure 4 DSZ, RLME, and total mean reference rock hazard curves for 1 Hz (right) and 10 Hz (left) for Browns Ferry

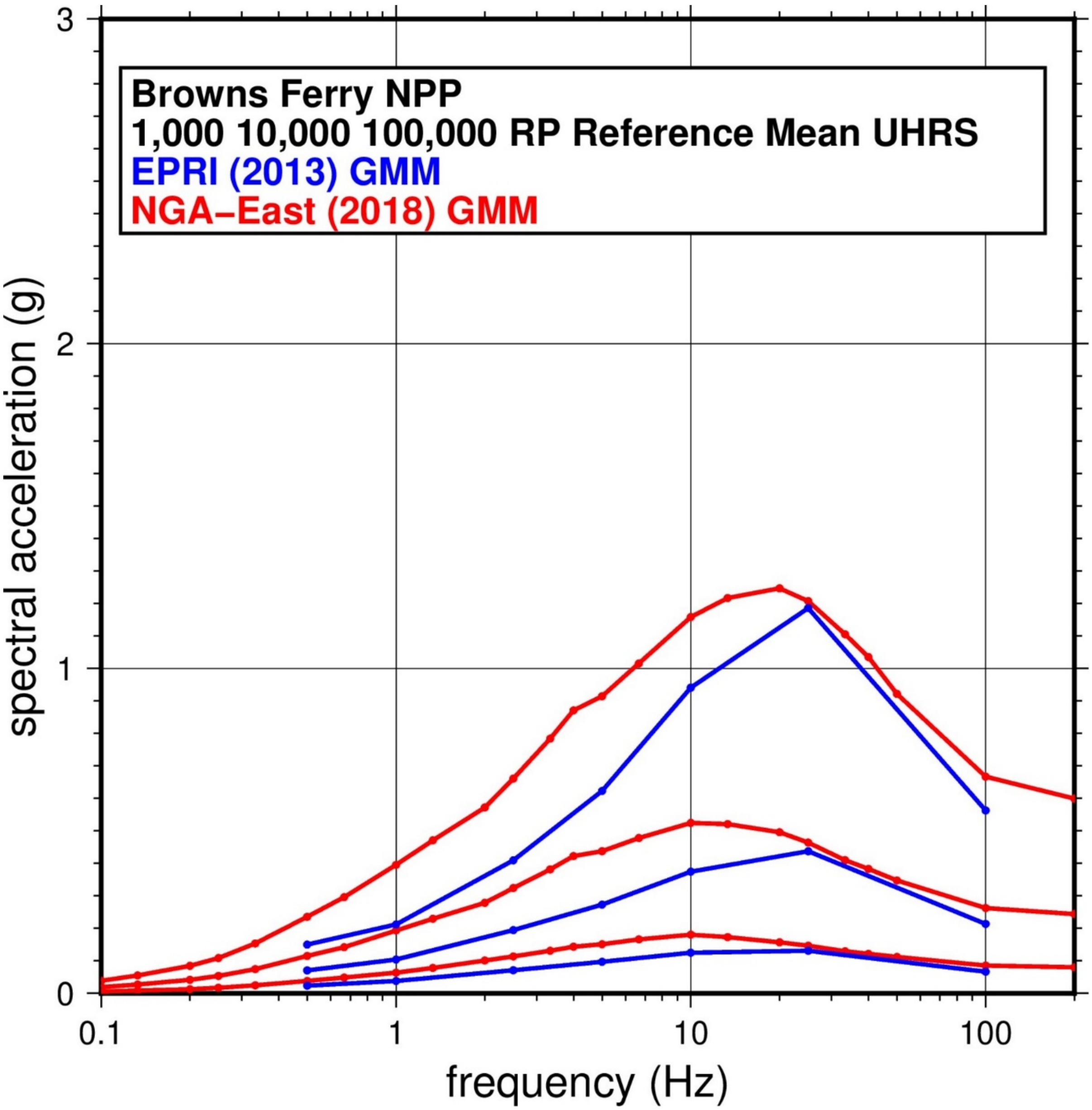

Figure 5 1,000-, 10,000-, and 100,000-year return period mean reference rock UHRS for CEUS-SSC and EPRI GMM (blue curves) and CEUS-SSC and NGA-East GMM (red curves)

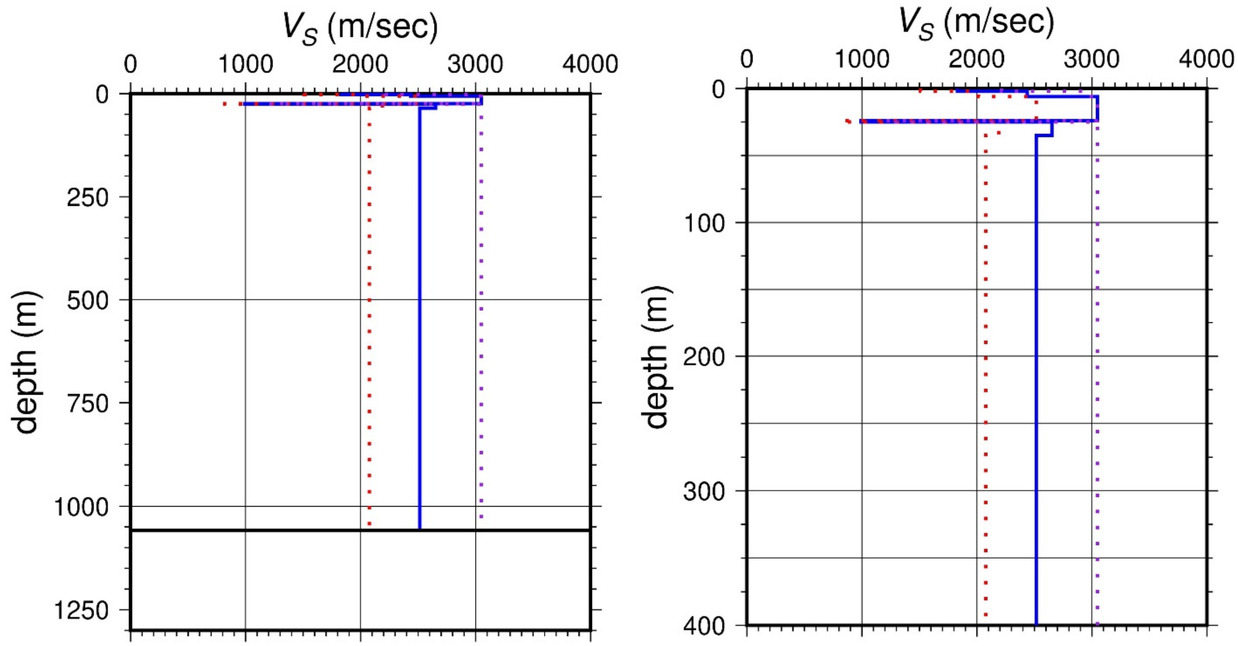

Figure 6 Complete (left) and upper 400 m (right) shear wave velocity (V_S) basecase profile for Browns Ferry; thick horizontal black line indicates reference rock horizon; best estimate basecase profile shown as solid blue line; lower and upper range basecase profiles shown as dotted red and purple lines, respectively

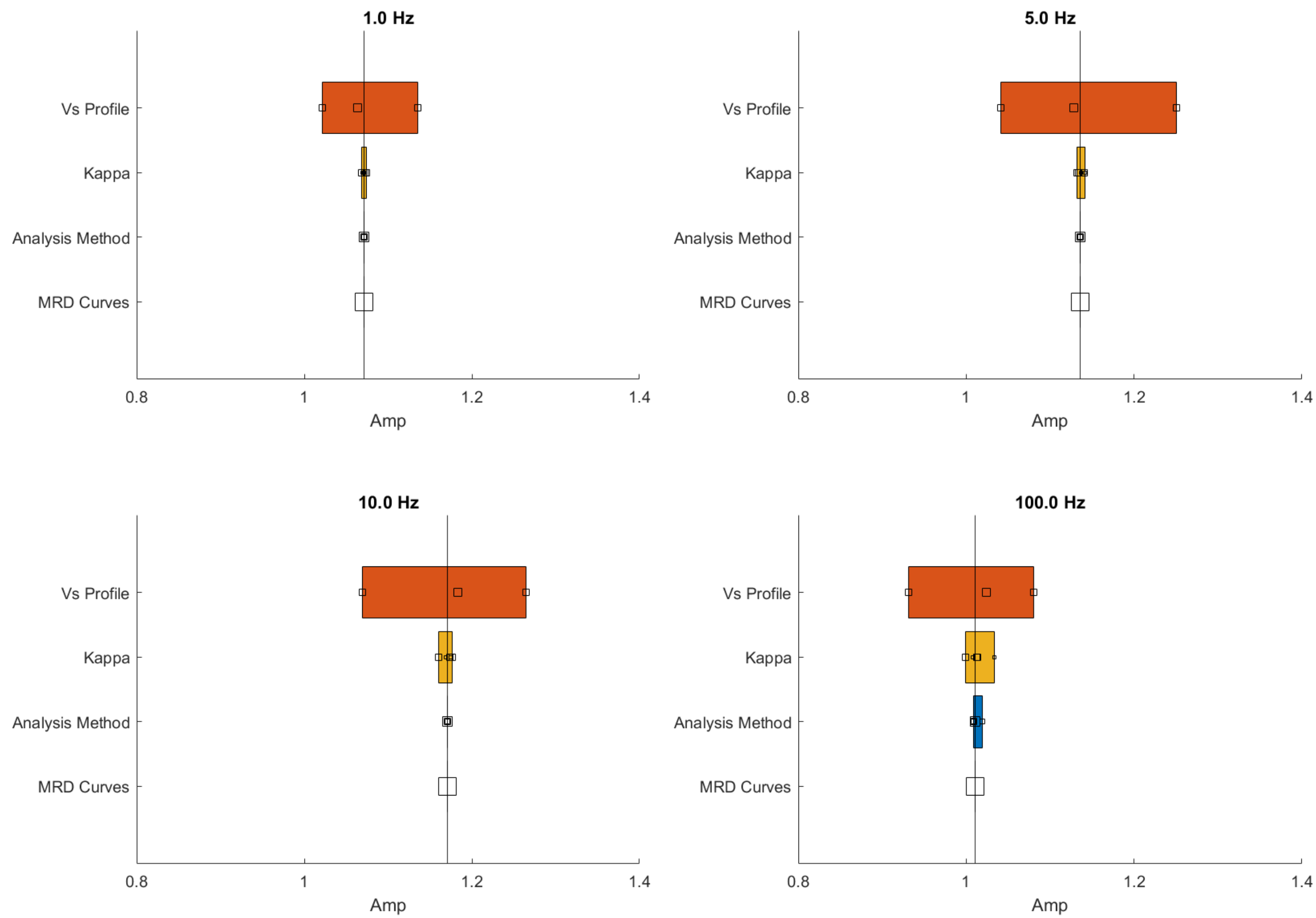

Figure 7 Tornado plots for site response logic tree nodes V_S profile, κ_0, MRD curves, and the analysis method for 1, 5, 10, and 100 Hz spectral frequencies for an input motion with a PGA of 0.63g.

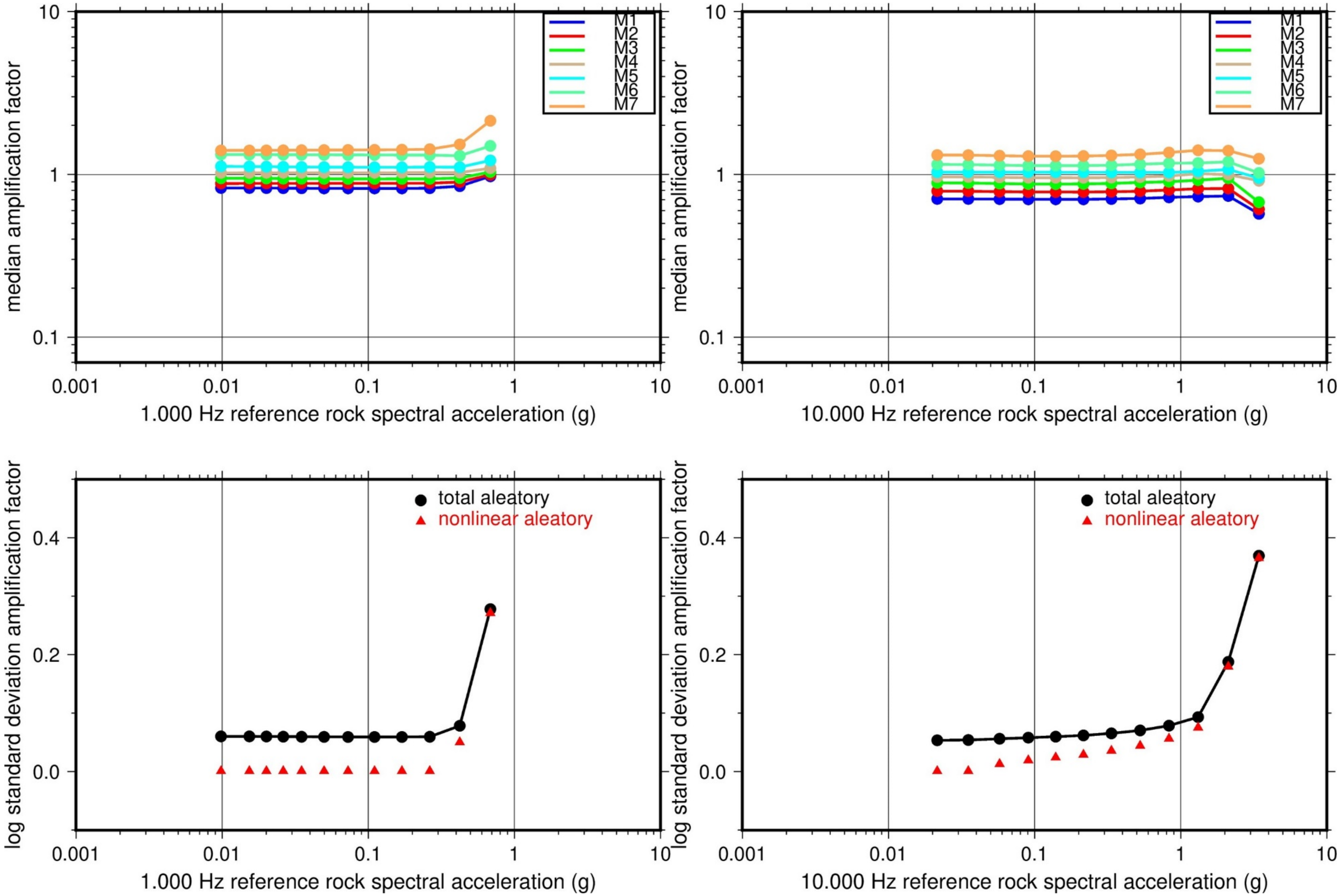

Figure 8 Seven median SAFs (above) and mean log standard deviations of SAF (below) as functions of input acceleration for 1 Hz (left) and 10 Hz (right)

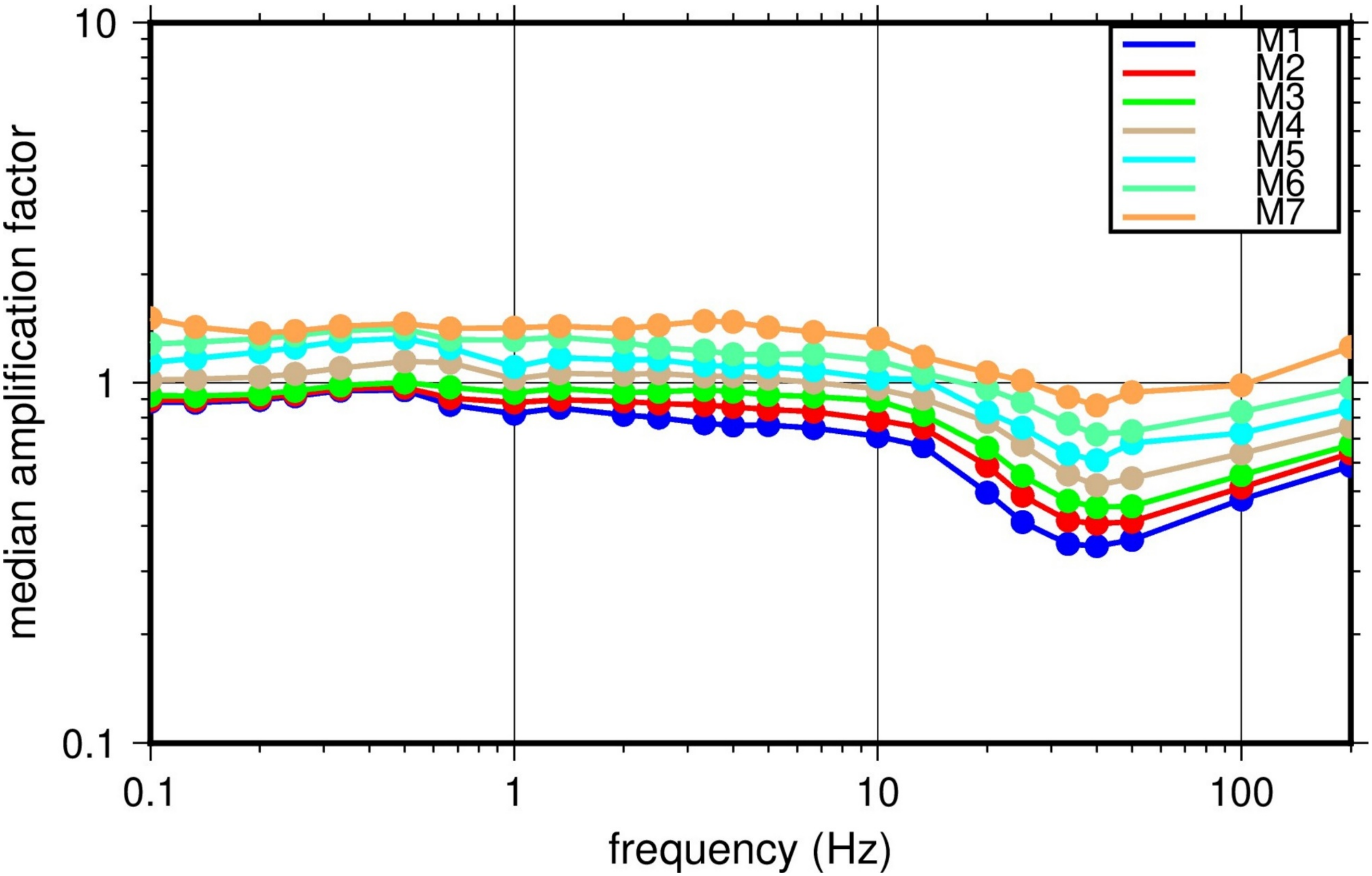

Figure 9 Seven median SAFs as functions of spectral frequency for spectral accelerations at the 10^{-4} AFE level

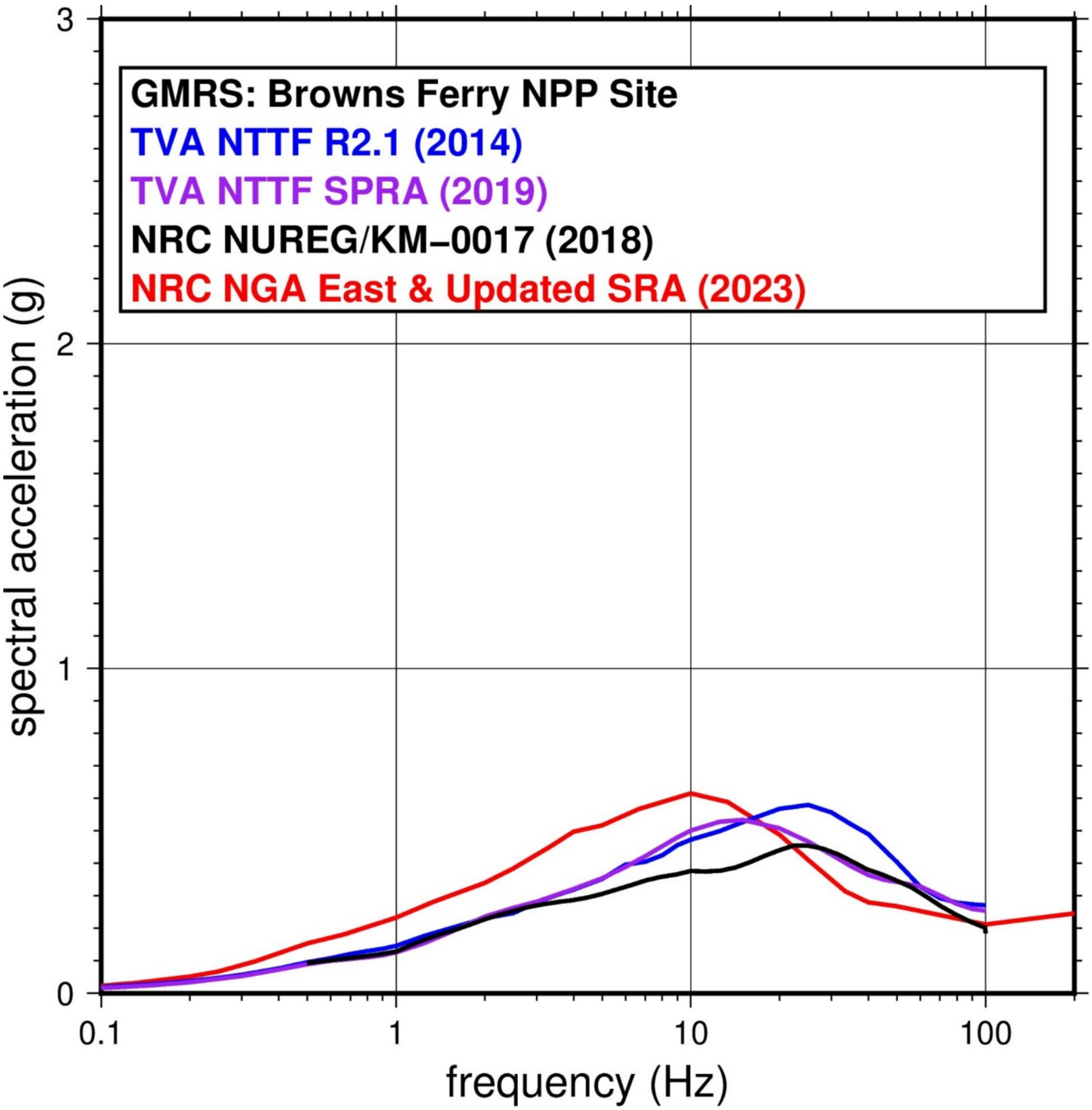

Figure 10 GMRS for the Browns Ferry site

Appendix A—Data Tables

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.00100	3.37628E-03	4.33932E-03	6.22055E-03	7.98285E-03	1.07882E-02	1.94903E-02	2.78929E-02	4.67384E-02
0.00126	2.94590E-03	3.79936E-03	5.40126E-03	6.86238E-03	9.17426E-03	1.62510E-02	2.30642E-02	3.89353E-02
0.00158	2.57766E-03	3.33578E-03	4.70365E-03	5.91774E-03	7.82808E-03	1.36014E-02	1.91469E-02	3.25582E-02
0.00200	2.24296E-03	2.91296E-03	4.07266E-03	5.07181E-03	6.63550E-03	1.12998E-02	1.57724E-02	2.70238E-02
0.00251	1.93660E-03	2.53241E-03	3.54514E-03	4.39089E-03	5.69152E-03	9.46577E-03	1.30251E-02	2.21014E-02
0.00316	1.65425E-03	2.19016E-03	3.07485E-03	3.79248E-03	4.87710E-03	7.91813E-03	1.07308E-02	1.79887E-02
0.00398	1.37113E-03	1.87259E-03	2.65093E-03	3.27089E-03	4.19476E-03	6.64493E-03	8.84585E-03	1.45340E-02
0.00501	1.13571E-03	1.60062E-03	2.28571E-03	2.82164E-03	3.60908E-03	5.57921E-03	7.29596E-03	1.17489E-02
0.00631	8.27335E-04	1.26827E-03	1.91464E-03	2.39369E-03	3.09387E-03	4.72206E-03	6.07047E-03	9.49608E-03
0.00794	6.03456E-04	1.00586E-03	1.60495E-03	2.03199E-03	2.65384E-03	3.99927E-03	5.05454E-03	7.68174E-03
0.01000	4.39620E-04	7.97024E-04	1.34443E-03	1.72384E-03	2.27503E-03	3.38492E-03	4.20564E-03	6.20893E-03
0.01260	2.55176E-04	5.18638E-04	1.00034E-03	1.35282E-03	1.87590E-03	2.84606E-03	3.52405E-03	5.08925E-03
0.01580	1.49799E-04	3.40512E-04	7.48896E-04	1.06700E-03	1.55300E-03	2.40162E-03	2.96379E-03	4.18874E-03
0.02000	8.60117E-05	2.19686E-04	5.53948E-04	8.33312E-04	1.27562E-03	2.01233E-03	2.47472E-03	3.41977E-03
0.02510	4.25795E-05	1.19712E-04	3.48947E-04	5.69097E-04	9.61917E-04	1.62699E-03	2.03320E-03	2.81754E-03
0.03160	2.03849E-05	6.27837E-05	2.10773E-04	3.72651E-04	6.99913E-04	1.28431E-03	1.64091E-03	2.29681E-03
0.03980	8.98330E-06	2.96797E-05	1.12550E-04	2.14879E-04	4.56272E-04	9.42745E-04	1.25674E-03	1.82119E-03
0.05010	3.96358E-06	1.40418E-05	6.01069E-05	1.23869E-04	2.97223E-04	6.91390E-04	9.61777E-04	1.44334E-03
0.06310	1.59903E-06	5.91574E-06	2.72956E-05	5.93092E-05	1.57908E-04	4.19055E-04	6.26225E-04	1.01287E-03
0.07940	6.47443E-07	2.50090E-06	1.24346E-05	2.84813E-05	8.41055E-05	2.54501E-04	4.08443E-04	7.11795E-04
0.10000	2.61227E-07	1.05373E-06	5.64728E-06	1.36382E-05	4.46869E-05	1.54264E-04	2.65956E-04	4.99527E-04
0.12600	9.66040E-08	4.06933E-07	2.29412E-06	5.70575E-06	1.98712E-05	7.53941E-05	1.39153E-04	2.84144E-04
0.15800	3.64706E-08	1.60286E-07	9.49542E-07	2.43067E-06	8.98618E-06	3.73996E-05	7.37936E-05	1.63533E-04
0.20000	1.32221E-08	6.07359E-08	3.78866E-07	9.99380E-07	3.93186E-06	1.80193E-05	3.81146E-05	9.19807E-05
0.25100	4.60277E-09	2.22919E-08	1.47157E-07	3.98352E-07	1.63671E-06	7.96006E-06	1.76713E-05	4.54381E-05
0.31600	1.55517E-09	7.95155E-09	5.57273E-08	1.55102E-07	6.66397E-07	3.43140E-06	7.98125E-06	2.18063E-05
0.39800	4.97738E-10	2.69216E-09	2.01991E-08	5.81119E-08	2.61759E-07	1.41182E-06	3.41244E-06	9.78559E-06
0.50100	1.59665E-10	9.13337E-10	7.33483E-09	2.18121E-08	1.03004E-07	5.81884E-07	1.46137E-06	4.39740E-06
0.63100	4.84036E-11	2.89311E-10	2.47567E-09	7.66134E-09	3.84491E-08	2.28471E-07	5.94212E-07	1.85426E-06

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.79400	1.47441E-11	9.20651E-11	8.39227E-10	2.70227E-09	1.44088E-08	9.00429E-08	2.42485E-07	7.84593E-07
1.00000	4.47041E-12	2.91669E-11	2.83295E-10	9.49273E-10	5.37913E-09	3.53585E-08	9.86087E-08	3.30876E-07
1.26000	1.31521E-12	8.97600E-12	9.14906E-11	3.17806E-10	1.91044E-09	1.33829E-08	3.89271E-08	1.35023E-07
1.58000	3.96894E-13	2.83076E-12	3.02486E-11	1.08843E-10	6.93249E-10	5.16855E-09	1.56665E-08	5.61348E-08
2.00000	1.13952E-13	8.50913E-13	9.55105E-12	3.56527E-11	2.41180E-10	1.91871E-09	6.07093E-09	2.25014E-08
2.51000	3.21156E-14	2.57592E-13	3.10038E-12	1.20012E-11	8.53164E-11	7.22808E-10	2.38750E-09	9.15815E-09
3.16000	8.68961E-15	7.52658E-14	9.80144E-13	3.94930E-12	2.95649E-11	2.67019E-10	9.21073E-10	3.66074E-09
3.98000	2.16577E-15	2.05670E-14	2.97902E-13	1.26380E-12	1.00107E-11	9.64505E-11	3.47198E-10	1.43317E-09
5.01000	5.40804E-16	5.62999E-15	9.07026E-14	4.05158E-13	3.39603E-12	3.49046E-11	1.31108E-10	5.62061E-10
6.31000	1.13797E-16	1.31395E-15	2.42441E-14	1.16385E-13	1.05836E-12	1.17998E-11	4.62436E-11	2.07351E-10
7.94000	2.40949E-17	3.08445E-16	6.51454E-15	3.35997E-14	3.31372E-13	4.00638E-12	1.63788E-11	7.67995E-11
10.00000	5.07103E-18	7.19988E-17	1.74157E-15	9.65324E-15	1.03285E-13	1.35457E-12	5.77776E-12	2.83356E-11

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.00100	6.13453E-02	7.69954E-02	8.15846E-02	8.56759E-02	8.65191E-02	8.77056E-02	8.78838E-02	8.64051E-02
0.00126	5.22300E-02	6.82559E-02	7.34785E-02	7.84447E-02	7.96021E-02	8.13127E-02	8.16953E-02	8.00425E-02
0.00158	4.46179E-02	6.06600E-02	6.63218E-02	7.19553E-02	7.33649E-02	7.55044E-02	7.60578E-02	7.42663E-02
0.00200	3.78665E-02	5.36456E-02	5.96076E-02	6.57663E-02	6.73874E-02	6.98953E-02	7.05991E-02	6.86926E-02
0.00251	3.11806E-02	4.52782E-02	5.09529E-02	5.70664E-02	5.87986E-02	6.15551E-02	6.24370E-02	6.06731E-02
0.00316	2.54940E-02	3.78289E-02	4.30719E-02	4.89272E-02	5.06873E-02	5.35522E-02	5.45562E-02	5.29750E-02
0.00398	2.05252E-02	3.07563E-02	3.52930E-02	4.05169E-02	4.21766E-02	4.49348E-02	4.59904E-02	4.47079E-02
0.00501	1.65318E-02	2.50120E-02	2.89237E-02	3.35547E-02	3.50964E-02	3.77039E-02	3.87689E-02	3.77314E-02
0.00631	1.31643E-02	1.97410E-02	2.28496E-02	2.65933E-02	2.78946E-02	3.01124E-02	3.11052E-02	3.04237E-02
0.00794	1.04924E-02	1.55956E-02	1.80680E-02	2.10957E-02	2.21910E-02	2.40711E-02	2.49784E-02	2.45524E-02
0.01000	8.35535E-03	1.23094E-02	1.42741E-02	1.67196E-02	1.76379E-02	1.92250E-02	2.00412E-02	1.97977E-02
0.01260	6.71254E-03	9.64191E-03	1.11174E-02	1.29596E-02	1.36822E-02	1.49117E-02	1.56213E-02	1.55842E-02
0.01580	5.41731E-03	7.59090E-03	8.70388E-03	1.00985E-02	1.06698E-02	1.16273E-02	1.22393E-02	1.23286E-02

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.02000	4.33321E-03	5.91705E-03	6.74533E-03	7.78783E-03	8.23502E-03	8.97298E-03	9.49270E-03	9.65853E-03
0.02510	3.53874E-03	4.72337E-03	5.35261E-03	6.13526E-03	6.48765E-03	7.04337E-03	7.48298E-03	7.68897E-03
0.03160	2.87201E-03	3.76309E-03	4.24754E-03	4.84050E-03	5.12108E-03	5.53890E-03	5.90907E-03	6.12670E-03
0.03980	2.30285E-03	3.00878E-03	3.40684E-03	3.88068E-03	4.11452E-03	4.43245E-03	4.74593E-03	4.94894E-03
0.05010	1.84591E-03	2.40566E-03	2.73308E-03	3.11245E-03	3.30743E-03	3.54891E-03	3.81389E-03	3.99973E-03
0.06310	1.34322E-03	1.80705E-03	2.11007E-03	2.45988E-03	2.64568E-03	2.83788E-03	3.07561E-03	3.24002E-03
0.07940	9.78665E-04	1.35895E-03	1.63076E-03	1.94596E-03	2.11823E-03	2.27134E-03	2.48238E-03	2.62682E-03
0.10000	7.12175E-04	1.02083E-03	1.25906E-03	1.53801E-03	1.69446E-03	1.81632E-03	2.00190E-03	2.12794E-03
0.12600	4.23494E-04	6.39606E-04	8.27630E-04	1.06593E-03	1.20837E-03	1.29798E-03	1.45896E-03	1.58311E-03
0.15800	2.54562E-04	4.04658E-04	5.48793E-04	7.44400E-04	8.67802E-04	9.34063E-04	1.07027E-03	1.18504E-03
0.20000	1.49813E-04	2.51187E-04	3.57736E-04	5.12154E-04	6.14698E-04	6.63044E-04	7.75089E-04	8.76439E-04
0.25100	7.67206E-05	1.34683E-04	2.00162E-04	3.03304E-04	3.77087E-04	4.07589E-04	4.86239E-04	5.67184E-04
0.31600	3.81160E-05	6.98965E-05	1.08096E-04	1.72897E-04	2.22611E-04	2.41663E-04	2.94453E-04	3.54666E-04
0.39800	1.75937E-05	3.33634E-05	5.30727E-05	8.85437E-05	1.17768E-04	1.29395E-04	1.61336E-04	2.01054E-04
0.50100	8.13148E-06	1.59436E-05	2.60828E-05	4.53745E-05	6.23299E-05	6.93160E-05	8.84432E-05	1.14033E-04
0.63100	3.51596E-06	7.07998E-06	1.17539E-05	2.08122E-05	2.90495E-05	3.29987E-05	4.34408E-05	5.85926E-05
0.79400	1.52537E-06	3.15418E-06	5.31370E-06	9.57586E-06	1.35802E-05	1.57561E-05	2.13976E-05	3.01864E-05
1.00000	6.59618E-07	1.40080E-06	2.39479E-06	4.39264E-06	6.32980E-06	7.50159E-06	1.05108E-05	1.55117E-05
1.26000	2.76568E-07	6.04994E-07	1.04904E-06	1.94468E-06	2.82894E-06	3.44480E-06	5.02247E-06	7.79050E-06
1.58000	1.18073E-07	2.65887E-07	4.67472E-07	8.75626E-07	1.28564E-06	1.60766E-06	2.43701E-06	3.96899E-06
2.00000	4.86550E-08	1.12927E-07	2.01431E-07	3.81401E-07	5.65424E-07	7.26879E-07	1.14746E-06	1.96616E-06
2.51000	2.03372E-08	4.85277E-08	8.80266E-08	1.68850E-07	2.53047E-07	3.33685E-07	5.49876E-07	9.91208E-07
3.16000	8.34751E-09	2.04573E-08	3.77325E-08	7.33144E-08	1.11069E-07	1.50078E-07	2.58117E-07	4.90012E-07
3.98000	3.35003E-09	8.39243E-09	1.57208E-08	3.09113E-08	4.73156E-08	6.51968E-08	1.16726E-07	2.33696E-07
5.01000	1.34670E-09	3.44840E-09	6.56004E-09	1.30527E-08	2.01859E-08	2.83606E-08	5.28456E-08	1.11558E-07
6.31000	5.08858E-10	1.32695E-09	2.56244E-09	5.15281E-09	8.02911E-09	1.14008E-08	2.18514E-08	4.82576E-08
7.94000	1.93025E-10	5.12566E-10	1.00469E-09	2.04175E-09	3.20543E-09	4.59974E-09	9.06738E-09	2.09452E-08
10.00000	7.29444E-11	1.97259E-10	3.92488E-10	8.06110E-10	1.27512E-09	1.84926E-09	3.74972E-09	9.06132E-09

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.00100	8.48441E-02	8.26374E-02	8.08640E-02	7.85621E-02	7.69961E-02	7.44970E-02	6.92319E-02	6.84024E-02
0.00126	7.82708E-02	7.56983E-02	7.36228E-02	7.09050E-02	6.90731E-02	6.62283E-02	6.02867E-02	5.94199E-02
0.00158	7.23277E-02	6.94683E-02	6.71608E-02	6.41306E-02	6.21052E-02	5.90213E-02	5.26484E-02	5.17682E-02
0.00200	6.66168E-02	6.35237E-02	6.10324E-02	5.77618E-02	5.55939E-02	5.23473E-02	4.57195E-02	4.48440E-02
0.00251	5.86793E-02	5.56128E-02	5.31111E-02	4.98032E-02	4.76442E-02	4.44707E-02	3.80728E-02	3.72492E-02
0.00316	5.11161E-02	4.81724E-02	4.57406E-02	4.25057E-02	4.04259E-02	3.74159E-02	3.14172E-02	3.06551E-02
0.00398	4.31071E-02	4.04759E-02	3.82545E-02	3.52671E-02	3.33793E-02	3.06799E-02	2.53364E-02	2.46458E-02
0.00501	3.63546E-02	3.40123E-02	3.19979E-02	2.92666E-02	2.75671E-02	2.51633E-02	2.04400E-02	1.98216E-02
0.00631	2.93930E-02	2.75306E-02	2.58628E-02	2.35529E-02	2.21314E-02	2.01307E-02	1.61836E-02	1.56308E-02
0.00794	2.37847E-02	2.23030E-02	2.09217E-02	1.89712E-02	1.77831E-02	1.61190E-02	1.28256E-02	1.23377E-02
0.01000	1.92306E-02	1.80532E-02	1.69107E-02	1.52679E-02	1.42770E-02	1.28956E-02	1.01551E-02	9.72945E-03
0.01260	1.52372E-02	1.43883E-02	1.35026E-02	1.21905E-02	1.13974E-02	1.02928E-02	8.08087E-03	7.71474E-03
0.01580	1.21316E-02	1.15216E-02	1.08319E-02	9.77895E-03	9.14117E-03	8.25388E-03	6.46086E-03	6.14677E-03
0.02000	9.56783E-03	9.14119E-03	8.61010E-03	7.77292E-03	7.26467E-03	6.55839E-03	5.11779E-03	4.85143E-03
0.02510	7.66284E-03	7.35801E-03	6.94521E-03	6.27598E-03	5.86696E-03	5.30002E-03	4.12448E-03	3.89939E-03
0.03160	6.13593E-03	5.91260E-03	5.58991E-03	5.05282E-03	4.72259E-03	4.26714E-03	3.30369E-03	3.11338E-03
0.03980	4.96021E-03	4.77070E-03	4.50937E-03	4.06786E-03	3.79568E-03	3.42508E-03	2.61695E-03	2.45403E-03
0.05010	4.01164E-03	3.85069E-03	3.63879E-03	3.27555E-03	3.05114E-03	2.74944E-03	2.07269E-03	1.93395E-03
0.06310	3.22464E-03	3.04842E-03	2.86149E-03	2.54083E-03	2.34662E-03	2.09809E-03	1.51571E-03	1.39607E-03
0.07940	2.59430E-03	2.41555E-03	2.25240E-03	1.97292E-03	1.80667E-03	1.60277E-03	1.10979E-03	1.00910E-03
0.10000	2.08541E-03	1.91233E-03	1.77131E-03	1.53043E-03	1.38954E-03	1.22311E-03	8.11591E-04	7.28476E-04
0.12600	1.52895E-03	1.37248E-03	1.25179E-03	1.04802E-03	9.39188E-04	8.11487E-04	5.05286E-04	4.45391E-04
0.15800	1.12822E-03	9.91838E-04	8.91048E-04	7.23331E-04	6.39979E-04	5.42998E-04	3.17695E-04	2.75109E-04
0.20000	8.22062E-04	7.07148E-04	6.25362E-04	4.91599E-04	4.29193E-04	3.57323E-04	1.95932E-04	1.66559E-04
0.25100	5.29301E-04	4.53647E-04	3.95653E-04	3.02952E-04	2.61804E-04	2.13159E-04	1.11642E-04	9.30323E-05
0.31600	3.31214E-04	2.83890E-04	2.44721E-04	1.83502E-04	1.57208E-04	1.25425E-04	6.30729E-05	5.14998E-05
0.39800	1.91717E-04	1.66479E-04	1.43006E-04	1.07097E-04	9.14854E-05	7.20873E-05	3.55074E-05	2.83922E-05
0.50100	1.11046E-04	9.77167E-05	8.36621E-05	6.25894E-05	5.33135E-05	4.14926E-05	2.00194E-05	1.56777E-05
0.63100	5.96334E-05	5.49442E-05	4.79975E-05	3.67692E-05	3.13679E-05	2.42267E-05	1.14387E-05	8.80069E-06

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.79400	3.21039E-05	3.09652E-05	2.75977E-05	2.16466E-05	1.84950E-05	1.41759E-05	6.55044E-06	4.95169E-06
1.00000	1.72417E-05	1.74124E-05	1.58340E-05	1.27175E-05	1.08826E-05	8.27757E-06	3.74303E-06	2.77983E-06
1.26000	9.07804E-06	9.74389E-06	9.01439E-06	7.30173E-06	6.21481E-06	4.67004E-06	2.03549E-06	1.48578E-06
1.58000	4.84384E-06	5.51877E-06	5.19231E-06	4.24085E-06	3.59067E-06	2.66624E-06	1.12100E-06	8.04524E-07
2.00000	2.51794E-06	3.05272E-06	2.92298E-06	2.40808E-06	2.02776E-06	1.48716E-06	6.02245E-07	4.24665E-07
2.51000	1.31649E-06	1.66403E-06	1.60413E-06	1.31484E-06	1.09576E-06	7.91288E-07	3.04997E-07	2.10501E-07
3.16000	6.74487E-07	8.87108E-07	8.60131E-07	7.00317E-07	5.77001E-07	4.09864E-07	1.49975E-07	1.01246E-07
3.98000	3.31997E-07	4.50473E-07	4.37662E-07	3.52117E-07	2.85918E-07	1.99241E-07	6.87492E-08	4.53406E-08
5.01000	1.63551E-07	2.28906E-07	2.22843E-07	1.77160E-07	1.41776E-07	9.69238E-08	3.15435E-08	2.03248E-08
6.31000	7.26922E-08	1.04203E-07	1.01397E-07	7.93907E-08	6.25201E-08	4.19075E-08	1.29208E-08	8.16277E-09
7.94000	3.24139E-08	4.75852E-08	4.62824E-08	3.56918E-08	2.76604E-08	1.81806E-08	5.31149E-09	3.29027E-09
10.00000	1.44082E-08	2.16640E-08	2.10612E-08	1.59961E-08	1.21989E-08	7.86167E-09	2.17591E-09	1.32157E-09

Table A-4 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.100 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.000390	0.8614	0.8727	0.8945	1.0016	1.1870	1.2699	1.2994	0.025387	0.000000
0.000605	0.8611	0.8726	0.8946	1.0017	1.1867	1.2700	1.2998	0.025379	0.000000
0.000769	0.8593	0.8719	0.8952	1.0019	1.1847	1.2704	1.3016	0.025293	0.000000
0.001020	0.8576	0.8712	0.8956	1.0020	1.1826	1.2707	1.3033	0.025142	0.000000
0.001393	0.8560	0.8706	0.8960	1.0019	1.1808	1.2709	1.3046	0.024961	0.000000
0.001942	0.8550	0.8702	0.8961	1.0019	1.1796	1.2709	1.3055	0.024816	0.000000
0.002624	0.8542	0.8699	0.8963	1.0018	1.1785	1.2710	1.3063	0.024676	0.000000
0.003530	0.8535	0.8696	0.8964	1.0019	1.1775	1.2711	1.3072	0.024550	0.000000
0.004766	0.8531	0.8695	0.8965	1.0022	1.1764	1.2714	1.3087	0.024449	0.000000
0.006987	0.8531	0.8697	0.8970	1.0031	1.1741	1.2729	1.3129	0.024437	0.000000
0.011085	0.8574	0.8733	0.8997	1.0066	1.1610	1.2751	1.3578	0.025921	0.004130
0.017944	0.8828	0.8940	0.9206	1.0168	1.1412	1.2815	1.4975	0.040598	0.031518

Table A-5 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.133 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.000696	0.8720	0.8821	0.9028	1.0100	1.2000	1.2828	1.3101	0.033331	0.000000
0.001077	0.8717	0.8820	0.9029	1.0100	1.1997	1.2829	1.3104	0.033311	0.000000
0.001353	0.8700	0.8813	0.9032	1.0100	1.1978	1.2831	1.3118	0.033164	0.000000
0.001765	0.8684	0.8806	0.9035	1.0099	1.1959	1.2832	1.3130	0.032970	0.000000
0.002384	0.8670	0.8800	0.9036	1.0097	1.1942	1.2832	1.3139	0.032764	0.000000
0.003324	0.8661	0.8796	0.9037	1.0096	1.1931	1.2832	1.3145	0.032610	0.000000
0.004537	0.8654	0.8792	0.9038	1.0095	1.1922	1.2832	1.3151	0.032466	0.000000
0.006228	0.8649	0.8790	0.9039	1.0095	1.1913	1.2832	1.3158	0.032339	0.000000
0.008611	0.8645	0.8789	0.9040	1.0097	1.1904	1.2835	1.3171	0.032239	0.000000
0.012816	0.8646	0.8791	0.9044	1.0106	1.1885	1.2849	1.3209	0.032232	0.000000
0.020416	0.8688	0.8828	0.9074	1.0142	1.1768	1.2903	1.3587	0.033645	0.009633
0.033049	0.8914	0.9024	0.9276	1.0294	1.1629	1.3003	1.4853	0.047716	0.035180

Table A-6 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.200 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.001481	0.8982	0.9066	0.9254	1.0345	1.2333	1.3165	1.3424	0.054449	0.000000
0.002290	0.8979	0.9065	0.9255	1.0344	1.2330	1.3165	1.3426	0.054425	0.000000
0.002853	0.8966	0.9059	0.9257	1.0338	1.2314	1.3166	1.3435	0.054276	0.000000
0.003642	0.8953	0.9053	0.9258	1.0333	1.2299	1.3166	1.3443	0.054116	0.000000
0.004833	0.8942	0.9048	0.9259	1.0331	1.2286	1.3165	1.3448	0.053966	0.000000
0.006749	0.8935	0.9044	0.9259	1.0329	1.2277	1.3164	1.3452	0.053864	0.000000
0.009386	0.8930	0.9042	0.9259	1.0328	1.2270	1.3164	1.3456	0.053775	0.000000
0.013315	0.8926	0.9040	0.9260	1.0328	1.2264	1.3165	1.3461	0.053699	0.000000
0.019080	0.8924	0.9040	0.9262	1.0331	1.2259	1.3168	1.3472	0.053643	0.000000
0.028886	0.8927	0.9043	0.9267	1.0341	1.2247	1.3182	1.3506	0.053683	0.000000
0.046193	0.8973	0.9086	0.9306	1.0381	1.2153	1.3286	1.3793	0.055106	0.012100
0.074776	0.9192	0.9289	0.9521	1.0627	1.2114	1.3462	1.4921	0.069301	0.043731

Table A-7 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.250 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.002139	0.9201	0.9278	0.9460	1.0574	1.2624	1.3459	1.3728	0.072612	0.000000
0.003308	0.9199	0.9277	0.9461	1.0573	1.2621	1.3459	1.3730	0.072591	0.000000
0.004120	0.9187	0.9272	0.9462	1.0567	1.2607	1.3459	1.3737	0.072480	0.000000
0.005226	0.9175	0.9267	0.9464	1.0561	1.2594	1.3459	1.3744	0.072389	0.000000
0.006882	0.9167	0.9263	0.9465	1.0556	1.2583	1.3459	1.3749	0.072326	0.000000
0.009622	0.9161	0.9260	0.9465	1.0555	1.2577	1.3459	1.3752	0.072295	0.000000
0.013517	0.9157	0.9258	0.9466	1.0555	1.2571	1.3459	1.3757	0.072275	0.000000
0.019493	0.9154	0.9257	0.9467	1.0556	1.2567	1.3460	1.3762	0.072263	0.000000
0.028424	0.9153	0.9258	0.9470	1.0559	1.2564	1.3465	1.3773	0.072261	0.000000
0.043315	0.9157	0.9263	0.9477	1.0570	1.2556	1.3480	1.3805	0.072349	0.002853
0.069342	0.9206	0.9310	0.9521	1.0617	1.2485	1.3588	1.4070	0.073829	0.014983
0.112250	0.9447	0.9538	0.9762	1.0922	1.2500	1.3847	1.5159	0.088738	0.051461

Table A-8 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.003240	0.9538	0.9615	0.9804	1.0983	1.3103	1.3931	1.4239	0.098658	0.000000
0.005017	0.9536	0.9614	0.9804	1.0982	1.3100	1.3931	1.4240	0.098636	0.000000
0.006274	0.9524	0.9609	0.9805	1.0976	1.3087	1.3930	1.4246	0.098546	0.000000
0.007935	0.9514	0.9604	0.9806	1.0971	1.3075	1.3930	1.4252	0.098525	0.000000
0.010397	0.9506	0.9601	0.9808	1.0968	1.3067	1.3930	1.4257	0.098566	0.000000
0.014566	0.9502	0.9600	0.9809	1.0968	1.3062	1.3931	1.4262	0.098622	0.003494
0.020691	0.9499	0.9599	0.9811	1.0969	1.3059	1.3933	1.4267	0.098693	0.005120
0.030362	0.9497	0.9599	0.9814	1.0971	1.3057	1.3936	1.4274	0.098764	0.006343
0.045105	0.9498	0.9601	0.9818	1.0977	1.3056	1.3942	1.4286	0.098832	0.007326
0.069155	0.9505	0.9609	0.9827	1.0990	1.3053	1.3960	1.4320	0.098990	0.009216
0.110790	0.9561	0.9663	0.9880	1.1046	1.3006	1.4079	1.4576	0.100650	0.020404
0.179350	0.9859	0.9951	1.0178	1.1440	1.3105	1.4448	1.5720	0.118000	0.064884

Table A-9 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.500 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.005273	0.9594	0.9710	1.0013	1.1445	1.3381	1.4083	1.4505	0.101210	0.000000
0.008184	0.9591	0.9708	1.0013	1.1444	1.3377	1.4082	1.4506	0.101160	0.000000
0.010361	0.9572	0.9701	1.0010	1.1441	1.3357	1.4078	1.4511	0.100870	0.000000
0.013172	0.9554	0.9694	1.0009	1.1439	1.3339	1.4074	1.4517	0.100670	0.000000
0.017280	0.9539	0.9695	1.0008	1.1437	1.3326	1.4074	1.4525	0.100550	0.000000
0.024317	0.9531	0.9692	1.0009	1.1438	1.3318	1.4074	1.4530	0.100510	0.000000
0.034951	0.9526	0.9690	1.0011	1.1439	1.3313	1.4075	1.4536	0.100500	0.000000
0.052198	0.9523	0.9690	1.0014	1.1443	1.3309	1.4078	1.4545	0.100510	0.000000
0.079010	0.9524	0.9692	1.0019	1.1450	1.3307	1.4086	1.4561	0.100530	0.000000
0.121850	0.9533	0.9703	1.0033	1.1467	1.3304	1.4111	1.4606	0.100680	0.000000
0.195340	0.9606	0.9772	1.0096	1.1532	1.3267	1.4216	1.4968	0.103050	0.020875
0.316200	1.0083	1.0223	1.0527	1.2025	1.3446	1.4737	1.6600	0.132530	0.085911

Table A-10 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.667 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.007013	0.8820	0.9098	0.9692	1.1337	1.2644	1.3229	1.3982	0.075369	0.000000
0.010911	0.8814	0.9096	0.9692	1.1337	1.2639	1.3227	1.3985	0.075308	0.000000
0.013981	0.8783	0.9086	0.9694	1.1338	1.2606	1.3216	1.4003	0.074974	0.000000
0.017930	0.8752	0.9077	0.9697	1.1339	1.2574	1.3205	1.4023	0.074687	0.000000
0.023653	0.8726	0.9069	0.9700	1.1341	1.2547	1.3195	1.4040	0.074476	0.000000
0.033432	0.8708	0.9064	0.9703	1.1344	1.2530	1.3188	1.4053	0.074356	0.000000
0.048367	0.8695	0.9061	0.9706	1.1347	1.2516	1.3183	1.4067	0.074271	0.000000
0.072852	0.8686	0.9059	0.9711	1.1352	1.2505	1.3180	1.4085	0.074212	0.000000
0.111230	0.8682	0.9062	0.9717	1.1361	1.2497	1.3181	1.4115	0.074179	0.000000
0.172060	0.8692	0.9076	0.9729	1.1381	1.2487	1.3190	1.4202	0.074275	0.000000
0.275910	0.8814	0.9176	0.9792	1.1431	1.2417	1.3229	1.4873	0.078432	0.021874
0.446630	0.9749	0.9972	1.0386	1.1720	1.2578	1.4203	1.7259	0.138980	0.116800

Table A-11 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.009838	0.8249	0.8795	0.9470	1.0221	1.1200	1.3250	1.4025	0.060412	0.000000
0.015366	0.8247	0.8796	0.9467	1.0222	1.1195	1.3248	1.4029	0.060368	0.000000
0.020104	0.8236	0.8798	0.9446	1.0225	1.1162	1.3232	1.4051	0.060102	0.000000
0.026218	0.8224	0.8801	0.9425	1.0228	1.1128	1.3214	1.4074	0.059841	0.000000
0.035015	0.8214	0.8803	0.9406	1.0230	1.1097	1.3197	1.4094	0.059620	0.000000
0.049887	0.8207	0.8805	0.9394	1.0232	1.1078	1.3185	1.4111	0.059480	0.000000
0.072771	0.8203	0.8807	0.9384	1.0233	1.1061	1.3175	1.4129	0.059374	0.000000
0.110510	0.8202	0.8810	0.9378	1.0237	1.1051	1.3166	1.4152	0.059296	0.000000
0.170030	0.8207	0.8816	0.9378	1.0241	1.1054	1.3157	1.4188	0.059294	0.000000
0.263830	0.8235	0.8831	0.9389	1.0245	1.1101	1.3130	1.4290	0.059679	0.000000
0.423240	0.8475	0.8982	0.9502	1.0255	1.1074	1.3018	1.5283	0.078578	0.050250
0.685130	0.9737	0.9954	1.0352	1.0922	1.2181	1.4965	2.1345	0.278040	0.271398

Table A-12 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.012067	0.8629	0.9015	0.9583	1.0661	1.1922	1.3396	1.4232	0.086414	0.000000
0.018910	0.8625	0.9012	0.9585	1.0660	1.1916	1.3395	1.4235	0.086323	0.000000
0.025173	0.8600	0.8999	0.9593	1.0652	1.1881	1.3390	1.4249	0.085792	0.000000
0.033309	0.8574	0.8985	0.9603	1.0643	1.1843	1.3384	1.4264	0.085284	0.000000
0.044978	0.8550	0.8972	0.9612	1.0634	1.1810	1.3378	1.4278	0.084860	0.000000
0.064514	0.8536	0.8965	0.9620	1.0629	1.1787	1.3375	1.4290	0.084596	0.000000
0.094649	0.8525	0.8960	0.9628	1.0625	1.1769	1.3375	1.4304	0.084395	0.000000
0.144320	0.8519	0.8958	0.9637	1.0625	1.1756	1.3378	1.4322	0.084262	0.000000
0.222780	0.8524	0.8964	0.9649	1.0629	1.1750	1.3390	1.4357	0.084256	0.000000
0.346290	0.8560	0.8993	0.9676	1.0643	1.1747	1.3430	1.4458	0.084916	0.000000
0.555660	0.8819	0.9198	0.9802	1.0691	1.1729	1.3422	1.5518	0.116690	0.079920
0.899480	0.9661	0.9911	1.0365	1.1630	1.3806	1.6898	2.4657	0.309490	0.297581

Table A-13 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.015262	0.8175	0.8862	0.9515	1.0577	1.1520	1.3154	1.4080	0.067227	0.000000
0.024044	0.8173	0.8862	0.9511	1.0575	1.1522	1.3147	1.4079	0.067162	0.000000
0.032921	0.8162	0.8862	0.9482	1.0563	1.1536	1.3104	1.4070	0.066765	0.000000
0.044610	0.8151	0.8862	0.9454	1.0552	1.1549	1.3059	1.4064	0.066364	0.000000
0.061344	0.8141	0.8862	0.9429	1.0542	1.1561	1.3018	1.4058	0.066015	0.000000
0.088954	0.8135	0.8862	0.9414	1.0538	1.1558	1.2995	1.4065	0.065797	0.000000
0.131610	0.8134	0.8864	0.9404	1.0536	1.1553	1.2980	1.4082	0.065655	0.000000
0.201590	0.8137	0.8868	0.9402	1.0537	1.1561	1.2967	1.4107	0.065590	0.000000
0.312160	0.8156	0.8881	0.9411	1.0541	1.1594	1.2958	1.4158	0.065793	0.000000
0.486300	0.8223	0.8921	0.9451	1.0551	1.1658	1.2959	1.4348	0.067540	0.011762
0.780610	0.8795	0.9308	0.9769	1.0596	1.1504	1.2959	1.6490	0.127760	0.109084
1.263600	0.9589	0.9939	1.0581	1.1905	1.4074	1.5267	1.6529	0.278770	0.270720

Table A-14 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.500 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.016960	0.8072	0.8790	0.9389	1.0698	1.1521	1.2656	1.4379	0.068985	0.000000
0.026809	0.8068	0.8788	0.9390	1.0696	1.1523	1.2650	1.4379	0.068917	0.000000
0.037361	0.8043	0.8776	0.9397	1.0681	1.1533	1.2614	1.4373	0.068494	0.000000
0.051385	0.8018	0.8763	0.9404	1.0664	1.1544	1.2576	1.4371	0.068058	0.000000
0.071463	0.7997	0.8753	0.9411	1.0646	1.1555	1.2543	1.4368	0.067680	0.000000
0.104330	0.7986	0.8747	0.9416	1.0634	1.1563	1.2522	1.4373	0.067443	0.000000
0.155130	0.7981	0.8746	0.9424	1.0626	1.1574	1.2509	1.4386	0.067287	0.000000
0.238150	0.7986	0.8750	0.9433	1.0626	1.1588	1.2503	1.4412	0.067246	0.000000
0.369320	0.8013	0.8769	0.9449	1.0634	1.1610	1.2517	1.4478	0.067516	0.000000
0.576060	0.8112	0.8833	0.9487	1.0656	1.1652	1.2566	1.4712	0.070097	0.015328
0.924930	0.8919	0.9406	0.9842	1.0727	1.1500	1.2866	1.7026	0.135460	0.116922
1.497200	0.9303	0.9725	1.0497	1.1982	1.3342	1.4543	1.4702	0.272980	0.264272

Table A-15 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=3.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.018964	0.7731	0.8745	0.9491	1.0437	1.1171	1.2413	1.4736	0.058931	0.000000
0.030121	0.7728	0.8739	0.9494	1.0436	1.1165	1.2407	1.4737	0.058869	0.000000
0.043060	0.7709	0.8706	0.9508	1.0429	1.1148	1.2368	1.4732	0.058490	0.000000
0.060496	0.7693	0.8675	0.9519	1.0419	1.1144	1.2324	1.4723	0.058126	0.000000
0.085502	0.7680	0.8650	0.9527	1.0411	1.1142	1.2288	1.4714	0.057834	0.000000
0.126010	0.7674	0.8639	0.9534	1.0406	1.1146	1.2266	1.4718	0.057702	0.000000
0.188700	0.7678	0.8637	0.9541	1.0404	1.1152	1.2257	1.4737	0.057716	0.000000
0.290590	0.7692	0.8651	0.9550	1.0408	1.1168	1.2262	1.4779	0.057967	0.000000
0.451540	0.7738	0.8696	0.9565	1.0419	1.1203	1.2298	1.4883	0.059047	0.007504
0.705610	0.7911	0.8840	0.9591	1.0420	1.1484	1.2337	1.5127	0.066779	0.032081
1.133400	0.8819	0.9564	0.9906	1.0653	1.1784	1.2737	1.7178	0.138650	0.125673
1.834600	0.8628	0.9250	1.0466	1.2281	1.2890	1.3293	1.4757	0.295180	0.289311

Table A-16 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=4.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.020053	0.7570	0.8592	0.9442	1.0476	1.1035	1.2065	1.4692	0.055300	0.000000
0.031962	0.7569	0.8588	0.9439	1.0475	1.1037	1.2056	1.4688	0.055241	0.000000
0.046521	0.7562	0.8562	0.9423	1.0466	1.1040	1.2012	1.4658	0.054882	0.000000
0.066342	0.7558	0.8541	0.9407	1.0453	1.1042	1.1975	1.4633	0.054574	0.000000
0.094827	0.7561	0.8526	0.9395	1.0437	1.1040	1.1974	1.4596	0.054374	0.000000
0.140680	0.7564	0.8522	0.9393	1.0428	1.1043	1.1974	1.4589	0.054366	0.000000
0.211690	0.7575	0.8527	0.9398	1.0424	1.1051	1.1981	1.4609	0.054621	0.000000
0.326740	0.7592	0.8545	0.9421	1.0429	1.1071	1.1993	1.4672	0.055303	0.005524
0.508480	0.7637	0.8597	0.9467	1.0447	1.1110	1.2020	1.4843	0.057597	0.017015
0.795670	0.7830	0.8766	0.9582	1.0454	1.1388	1.2108	1.5248	0.072149	0.046664
1.278400	0.8663	0.9494	0.9949	1.0736	1.2052	1.2874	1.6600	0.152390	0.142108
2.069400	0.8293	0.9144	0.9982	1.1683	1.2589	1.2917	1.4382	0.303400	0.298368

Table A-17 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=5.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.021114	0.7578	0.8411	0.9230	1.0307	1.1045	1.1969	1.4156	0.049798	0.000000
0.033808	0.7577	0.8410	0.9228	1.0304	1.1045	1.1969	1.4148	0.049744	0.000000
0.050419	0.7565	0.8402	0.9214	1.0281	1.1038	1.1966	1.4103	0.049428	0.000000
0.073358	0.7556	0.8396	0.9200	1.0260	1.1030	1.1962	1.4074	0.049244	0.000000
0.106450	0.7551	0.8390	0.9193	1.0242	1.1026	1.1961	1.4051	0.049235	0.000000
0.159330	0.7555	0.8390	0.9194	1.0236	1.1028	1.1960	1.4058	0.049507	0.000000
0.241300	0.7571	0.8399	0.9202	1.0238	1.1039	1.1968	1.4095	0.050284	0.008199
0.373650	0.7603	0.8417	0.9231	1.0255	1.1066	1.1981	1.4179	0.051917	0.015301
0.582760	0.7678	0.8466	0.9295	1.0294	1.1120	1.2012	1.4397	0.056807	0.027673
0.913690	0.7892	0.8628	0.9505	1.0380	1.1246	1.2060	1.5159	0.081651	0.064851
1.468600	0.8342	0.9219	0.9965	1.0800	1.2036	1.2948	1.5659	0.158250	0.150272
2.377300	0.8212	0.8660	0.9680	1.0426	1.1996	1.2928	1.3539	0.317770	0.313873

Table A-18 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=6.667 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.021916	0.7419	0.8280	0.9127	1.0021	1.0831	1.2001	1.3657	0.045520	0.000000
0.035331	0.7415	0.8277	0.9124	1.0023	1.0820	1.2001	1.3652	0.045531	0.000000
0.054590	0.7391	0.8262	0.9108	1.0005	1.0761	1.1999	1.3623	0.045543	0.000884
0.081787	0.7377	0.8252	0.9095	0.9984	1.0718	1.1993	1.3613	0.045818	0.005090
0.121310	0.7371	0.8246	0.9087	0.9970	1.0695	1.1992	1.3606	0.046373	0.008779
0.183910	0.7379	0.8248	0.9091	0.9968	1.0696	1.1993	1.3628	0.047424	0.013253
0.281190	0.7408	0.8265	0.9105	0.9977	1.0732	1.2003	1.3683	0.049567	0.019583
0.437670	0.7465	0.8298	0.9146	1.0011	1.0807	1.2026	1.3794	0.053532	0.028148
0.685100	0.7589	0.8383	0.9226	1.0082	1.0986	1.2053	1.4067	0.063941	0.044890
1.077400	0.7926	0.8618	0.9454	1.0263	1.1344	1.2124	1.4916	0.092245	0.080223
1.732900	0.7816	0.8787	1.0082	1.0674	1.2301	1.2460	1.4084	0.168250	0.161971
2.805200	0.7282	0.7964	0.8829	1.0058	1.1176	1.1623	1.1923	0.350520	0.347550

Table A-19 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=10.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.021591	0.7076	0.7892	0.8872	0.9649	1.0313	1.1515	1.3148	0.053719	0.000000
0.035192	0.7071	0.7881	0.8857	0.9640	1.0315	1.1495	1.3126	0.054201	0.000000
0.057653	0.7048	0.7832	0.8782	0.9590	1.0322	1.1397	1.3014	0.056308	0.013164
0.090694	0.7035	0.7802	0.8737	0.9554	1.0320	1.1335	1.2958	0.058123	0.019519
0.139540	0.7028	0.7787	0.8720	0.9534	1.0310	1.1310	1.2938	0.059908	0.024324
0.216130	0.7034	0.7792	0.8742	0.9537	1.0296	1.1331	1.2975	0.061972	0.029038
0.335820	0.7058	0.7821	0.8800	0.9562	1.0283	1.1393	1.3083	0.065467	0.035897
0.527800	0.7108	0.7883	0.8922	0.9628	1.0269	1.1528	1.3271	0.070436	0.044316
0.832030	0.7232	0.8027	0.9011	0.9771	1.0275	1.1713	1.3621	0.078689	0.056521
1.315900	0.7305	0.8166	0.9213	1.0100	1.0439	1.1738	1.4070	0.093273	0.075515
2.119000	0.7374	0.8201	0.9476	0.9971	1.0721	1.1959	1.3988	0.187850	0.179695
3.430200	0.5730	0.6110	0.6744	0.9141	0.9495	1.0202	1.2483	0.369360	0.365280

Table A-20 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=13.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.020246	0.6922	0.7609	0.8298	0.9132	1.0399	1.0830	1.2230	0.055651	0.000000
0.033281	0.6915	0.7588	0.8268	0.9124	1.0389	1.0803	1.2168	0.056766	0.000000
0.057142	0.6793	0.7523	0.8160	0.9083	1.0322	1.0671	1.1899	0.061748	0.019878
0.093608	0.6691	0.7497	0.8100	0.9052	1.0260	1.0590	1.1765	0.064882	0.028143
0.148540	0.6638	0.7479	0.8069	0.9029	1.0218	1.0549	1.1700	0.066995	0.032721
0.234290	0.6627	0.7472	0.8072	0.9018	1.0203	1.0549	1.1694	0.068157	0.035039
0.369100	0.6638	0.7480	0.8096	0.9021	1.0207	1.0577	1.1735	0.069349	0.037304
0.585410	0.6678	0.7501	0.8167	0.9039	1.0225	1.0663	1.1830	0.070242	0.038939
0.929030	0.6725	0.7543	0.8283	0.9096	1.0197	1.0804	1.2061	0.071635	0.041399
1.476900	0.6703	0.7478	0.8484	0.9222	0.9759	1.0972	1.2446	0.092199	0.071295
2.380800	0.6500	0.7281	0.7639	0.8568	0.9619	1.0697	1.1608	0.198610	0.189811
3.854000	0.4621	0.4839	0.5392	0.7600	0.7860	0.9942	1.2049	0.338330	0.333241

Table A-21 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=20.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.017198	0.6384	0.7111	0.7540	0.8668	0.9447	1.0138	1.1252	0.032445	0.000000
0.028572	0.6294	0.7030	0.7506	0.8589	0.9306	1.0076	1.1165	0.033602	0.000000
0.052416	0.5917	0.6678	0.7273	0.8229	0.8709	0.9719	1.0676	0.041498	0.016721
0.091524	0.5494	0.6338	0.7035	0.8025	0.8431	0.9660	1.0655	0.048061	0.029451
0.152800	0.5233	0.6135	0.6819	0.7907	0.8347	0.9631	1.0655	0.052129	0.035706
0.248440	0.5100	0.6027	0.6722	0.7850	0.8315	0.9618	1.0660	0.054399	0.038946
0.400750	0.4996	0.5933	0.6638	0.7808	0.8300	0.9619	1.0677	0.056579	0.041937
0.646150	0.4899	0.5818	0.6551	0.7772	0.8301	0.9633	1.0710	0.060704	0.047355
1.038000	0.4788	0.5617	0.6421	0.7534	0.8324	0.9667	1.0769	0.073934	0.063433
1.665300	0.4592	0.5231	0.6149	0.6989	0.8364	0.9424	1.0840	0.111420	0.104747
2.689800	0.4167	0.5001	0.5649	0.6811	0.7425	0.8411	1.0816	0.183370	0.179394
4.354200	0.3432	0.3697	0.4247	0.5509	0.5944	0.8145	0.9857	0.247940	0.245014

Table A-22 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=25.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.015309	0.6363	0.6902	0.7337	0.8414	0.9274	0.9857	1.1049	0.030835	0.000000
0.025505	0.6244	0.6807	0.7244	0.8265	0.9068	0.9750	1.0950	0.030889	0.000000
0.048104	0.5630	0.6259	0.6787	0.7620	0.8123	0.9173	1.0260	0.035531	0.009700
0.086996	0.4944	0.5665	0.6261	0.7220	0.7777	0.9037	1.0214	0.043894	0.027538
0.149780	0.4525	0.5293	0.5904	0.6985	0.7637	0.8954	1.0182	0.051211	0.038134
0.248220	0.4310	0.5089	0.5717	0.6860	0.7568	0.8908	1.0162	0.056319	0.044760
0.406510	0.4146	0.4909	0.5564	0.6754	0.7517	0.8872	1.0145	0.062302	0.052088
0.662730	0.4005	0.4732	0.5413	0.6637	0.7477	0.8794	1.0122	0.070108	0.061211
1.073400	0.3867	0.4521	0.5231	0.6328	0.7398	0.8500	1.0082	0.085334	0.078189
1.732700	0.3688	0.4211	0.4942	0.5993	0.6954	0.7922	0.9974	0.114750	0.109541
2.802400	0.3428	0.3976	0.4552	0.5502	0.6074	0.7236	0.9604	0.158460	0.154729
4.536400	0.3039	0.3325	0.3777	0.4580	0.5275	0.6740	0.8352	0.195770	0.192763

Table A-23 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=33.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.013154	0.6409	0.7070	0.7601	0.8614	0.9595	0.9981	1.1351	0.037017	0.000000
0.021865	0.6305	0.6946	0.7418	0.8386	0.9413	0.9813	1.1086	0.036530	0.000000
0.041667	0.5666	0.6102	0.6504	0.7331	0.8082	0.8803	0.9919	0.038185	0.002827
0.078125	0.4811	0.5337	0.5790	0.6533	0.7199	0.8196	0.9451	0.046767	0.027149
0.139870	0.4163	0.4732	0.5296	0.6038	0.6670	0.7954	0.9309	0.057289	0.042801
0.237930	0.3827	0.4408	0.4949	0.5779	0.6489	0.7827	0.9223	0.064804	0.052435
0.398130	0.3582	0.4161	0.4711	0.5576	0.6359	0.7719	0.9137	0.072232	0.061379
0.659680	0.3396	0.3967	0.4510	0.5384	0.6250	0.7470	0.9025	0.080151	0.070527
1.081700	0.3247	0.3777	0.4320	0.5175	0.6077	0.7123	0.8853	0.090256	0.081829
1.761800	0.3110	0.3565	0.4097	0.4897	0.5665	0.6595	0.8563	0.106380	0.099331
2.855000	0.2991	0.3358	0.3832	0.4496	0.5038	0.5781	0.8007	0.124620	0.118659
4.621600	0.2845	0.3049	0.3442	0.3932	0.4335	0.5293	0.6917	0.142400	0.137214

Table A-24 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=40.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.012119	0.6568	0.7299	0.8012	0.8883	0.9748	1.0469	1.1944	0.040905	0.000000
0.020050	0.6468	0.7159	0.7812	0.8766	0.9625	1.0196	1.1688	0.040774	0.000000
0.037684	0.5800	0.6285	0.6728	0.7560	0.8508	0.8981	1.0074	0.045002	0.000000
0.071393	0.4995	0.5400	0.5778	0.6530	0.7391	0.8042	0.9165	0.057593	0.034418
0.130500	0.4226	0.4732	0.5110	0.5829	0.6742	0.7566	0.8917	0.073172	0.056761
0.225600	0.3813	0.4342	0.4767	0.5464	0.6379	0.7352	0.8778	0.084695	0.070999
0.382860	0.3521	0.4064	0.4519	0.5193	0.6097	0.7191	0.8650	0.095590	0.083697
0.641470	0.3315	0.3855	0.4333	0.4964	0.5850	0.7046	0.8502	0.106970	0.096490
1.060800	0.3163	0.3695	0.4183	0.4748	0.5608	0.6810	0.8296	0.120450	0.111247
1.738900	0.3042	0.3558	0.3994	0.4508	0.5361	0.6398	0.7982	0.134230	0.126037
2.821700	0.2976	0.3438	0.3827	0.4227	0.4878	0.6105	0.7456	0.143560	0.135931
4.567700	0.2907	0.3202	0.3517	0.3899	0.4349	0.5155	0.6555	0.143760	0.136142

Table A-25 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=50.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.011237	0.6920	0.7742	0.8417	0.9302	1.0052	1.1138	1.2785	0.043026	0.000000
0.018464	0.6852	0.7592	0.8316	0.9160	1.0001	1.0930	1.2561	0.043165	0.000000
0.033540	0.6287	0.6814	0.7347	0.8178	0.9128	0.9693	1.1254	0.049998	0.000000
0.063036	0.5375	0.5884	0.6293	0.7044	0.8145	0.8655	1.0221	0.068138	0.040137
0.116930	0.4500	0.4922	0.5379	0.6197	0.7575	0.8066	0.9707	0.091493	0.073069
0.205470	0.4018	0.4448	0.4880	0.5735	0.7107	0.7678	0.9530	0.108790	0.093827
0.354360	0.3652	0.4105	0.4530	0.5420	0.6794	0.7324	0.9417	0.124900	0.112108
0.601820	0.3390	0.3862	0.4285	0.5149	0.6579	0.7082	0.9338	0.140010	0.128728
1.006000	0.3211	0.3695	0.4119	0.4985	0.6400	0.6880	0.9264	0.155380	0.145297
1.662500	0.3085	0.3577	0.3980	0.4791	0.6212	0.6635	0.8761	0.169960	0.160794
2.702600	0.3038	0.3531	0.3883	0.4655	0.5759	0.6384	0.8100	0.180160	0.171540
4.374800	0.3007	0.3441	0.3774	0.4473	0.5147	0.5939	0.7499	0.189750	0.181585

Table A-26 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=100.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.010157	0.7231	0.8080	0.8878	0.9840	1.0527	1.1720	1.3295	0.041097	0.000000
0.016487	0.7159	0.8023	0.8815	0.9773	1.0384	1.1644	1.3230	0.040379	0.000000
0.027389	0.6826	0.7576	0.8312	0.9237	1.0184	1.0750	1.2488	0.037481	0.000000
0.046471	0.6542	0.7093	0.7583	0.8393	0.9407	1.0101	1.1698	0.038260	0.004106
0.080508	0.6001	0.6455	0.6816	0.7517	0.8543	0.9392	1.0411	0.042443	0.018827
0.138650	0.5361	0.5826	0.6181	0.6953	0.7939	0.8895	1.0172	0.048125	0.029480
0.239320	0.4820	0.5191	0.5622	0.6441	0.7345	0.8392	0.9907	0.054974	0.039688
0.411280	0.4377	0.4818	0.5174	0.6000	0.6841	0.7918	0.9581	0.063308	0.050606
0.698630	0.4043	0.4481	0.4855	0.5677	0.6452	0.7567	0.9394	0.070128	0.058915
1.172500	0.3820	0.4258	0.4636	0.5424	0.6172	0.7374	0.9324	0.083852	0.074727
1.912900	0.3814	0.4256	0.4629	0.5369	0.6102	0.7447	0.9463	0.098263	0.090602
3.096600	0.3854	0.4196	0.4669	0.5368	0.5769	0.7018	0.9883	0.144670	0.139580

Table A-27 Site Adjustment Factor Medians and Logarithmic Standard Deviation for PGA									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.010020	0.7297	0.8137	0.8949	0.9895	1.0650	1.1825	1.3337	0.041389	0.000000
0.016224	0.7231	0.8089	0.8901	0.9841	1.0534	1.1748	1.3299	0.040681	0.000000
0.026327	0.6911	0.7751	0.8575	0.9433	1.0309	1.1121	1.2732	0.037802	0.000000
0.042833	0.6772	0.7447	0.8041	0.8906	0.9976	1.0468	1.2354	0.039998	0.004960
0.069979	0.6577	0.7128	0.7567	0.8359	0.9421	1.0145	1.1698	0.045122	0.021465
0.114440	0.6424	0.6905	0.7260	0.8003	0.8976	0.9779	1.1668	0.053007	0.035136
0.187600	0.6046	0.6542	0.6883	0.7697	0.8674	0.9684	1.2158	0.067153	0.054169
0.307920	0.5737	0.6231	0.6587	0.7425	0.8353	0.9672	1.2953	0.085206	0.075398
0.504880	0.5495	0.5890	0.6360	0.7204	0.8121	0.9797	1.3684	0.116000	0.108999
0.826150	0.5322	0.5728	0.6216	0.7038	0.7975	0.9991	1.5000	0.154070	0.148870
1.340700	0.5321	0.5829	0.6276	0.7029	0.8069	1.0457	1.5336	0.197200	0.193165
2.170300	0.5427	0.5786	0.6401	0.7091	0.8294	0.9888	1.6809	0.244240	0.240994

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	F0.100Hz	F0.133Hz	F0.200Hz	F0.250Hz	F0.333Hz	F0.500Hz	F0.667Hz	F1.000Hz
0.00100	3.42190E-03	4.39933E-03	6.31161E-03	8.10738E-03	1.09676E-02	2.04298E-02	2.84296E-02	4.76056E-02
0.00130	3.08554E-03	3.97723E-03	5.67226E-03	7.45453E-03	1.00333E-02	1.85121E-02	2.56558E-02	4.15683E-02
0.00160	2.69903E-03	3.49095E-03	4.93882E-03	6.44344E-03	8.58309E-03	1.55514E-02	2.13883E-02	3.47833E-02
0.00200	2.35061E-03	3.05272E-03	4.28963E-03	5.36967E-03	7.30999E-03	1.29791E-02	1.73858E-02	2.88940E-02
0.00250	2.03418E-03	2.65878E-03	3.72539E-03	4.77948E-03	6.23704E-03	1.08318E-02	1.46088E-02	2.38033E-02
0.00320	1.73966E-03	2.30194E-03	3.23130E-03	4.12214E-03	5.33518E-03	9.05329E-03	1.20456E-02	1.94355E-02
0.00400	1.46455E-03	1.97969E-03	2.79475E-03	3.55867E-03	4.58041E-03	7.58443E-03	9.93307E-03	1.57699E-02
0.00500	1.19652E-03	1.67534E-03	2.40043E-03	3.06008E-03	3.93442E-03	6.36495E-03	8.19913E-03	1.27571E-02
0.00630	9.29777E-04	1.37645E-03	2.03805E-03	2.58535E-03	3.37979E-03	5.35863E-03	6.78703E-03	1.03122E-02
0.00790	6.90140E-04	1.10217E-03	1.71386E-03	2.20503E-03	2.90038E-03	4.52748E-03	5.63573E-03	8.33772E-03
0.01000	4.89043E-04	8.51659E-04	1.41152E-03	1.81856E-03	2.47239E-03	3.82516E-03	4.69508E-03	6.75481E-03
0.01260	3.17538E-04	6.15543E-04	1.11426E-03	1.47742E-03	2.08634E-03	3.22846E-03	3.92085E-03	5.50358E-03
0.01580	1.90810E-04	4.14779E-04	8.44628E-04	1.23630E-03	1.73812E-03	2.71878E-03	3.28135E-03	4.50709E-03
0.02000	1.05973E-04	2.64061E-04	6.16237E-04	9.02901E-04	1.41610E-03	2.27986E-03	2.63841E-03	3.69689E-03

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.02510	5.81105E-05	1.57441E-04	4.22872E-04	7.03980E-04	1.12179E-03	1.88788E-03	2.25951E-03	3.03111E-03
0.03160	2.99118E-05	8.58534E-05	2.66630E-04	4.47082E-04	8.44627E-04	1.52189E-03	1.76563E-03	2.47056E-03
0.03980	1.49746E-05	4.35646E-05	1.54915E-04	2.80477E-04	5.98274E-04	1.18321E-03	1.39084E-03	1.98809E-03
0.05010	7.06932E-06	2.12426E-05	8.40405E-05	1.66931E-04	3.97322E-04	8.77958E-04	1.05144E-03	1.55651E-03
0.06310	3.16522E-06	1.01582E-05	4.26453E-05	9.14538E-05	2.44616E-04	6.13129E-04	7.46555E-04	1.16297E-03
0.07940	1.37764E-06	4.73115E-06	2.09846E-05	4.71327E-05	1.41580E-04	3.95736E-04	5.00064E-04	8.32299E-04
0.10000	6.06024E-07	2.10721E-06	9.76855E-06	2.33364E-05	7.54700E-05	2.38712E-04	3.19204E-04	5.71476E-04
0.12600	2.65357E-07	9.01201E-07	4.49726E-06	1.11902E-05	3.98145E-05	1.37806E-04	1.90878E-04	3.67298E-04
0.15800	1.14298E-07	3.83880E-07	2.05007E-06	5.11695E-06	1.93355E-05	7.20745E-05	1.05160E-04	2.18523E-04
0.20000	4.71525E-08	1.59531E-07	8.75396E-07	2.23852E-06	8.52731E-06	3.55721E-05	5.46819E-05	1.23124E-04
0.25100	2.00810E-08	6.82445E-08	3.76862E-07	1.00296E-06	3.99302E-06	1.75370E-05	2.87292E-05	6.63204E-05
0.31600	8.31336E-09	2.78602E-08	1.57679E-07	4.33220E-07	1.83882E-06	8.07323E-06	1.43719E-05	3.29172E-05
0.39800	3.38273E-09	1.12889E-08	6.52070E-08	1.81894E-07	8.13219E-07	3.80947E-06	6.90757E-06	1.51997E-05
0.50100	1.38904E-09	4.50907E-09	2.66231E-08	7.58516E-08	3.54035E-07	1.77971E-06	3.30631E-06	6.84902E-06
0.63100	5.60832E-10	1.77544E-09	1.06797E-08	3.12351E-08	1.52491E-07	8.08893E-07	1.58584E-06	3.34616E-06
0.79400	2.24235E-10	6.96427E-10	4.22617E-09	1.27145E-08	6.53791E-08	3.67813E-07	7.58197E-07	1.87440E-06
1.00000	8.87511E-11	2.68874E-10	1.64389E-09	5.08155E-09	2.76336E-08	1.66586E-07	3.67757E-07	1.03484E-06
1.26000	3.47362E-11	1.02891E-10	6.34332E-10	2.01203E-09	1.15826E-08	7.50210E-08	1.78435E-07	5.96693E-07
1.58000	1.37483E-11	4.00495E-11	2.47788E-10	8.07174E-10	4.92602E-09	3.44566E-08	8.85789E-08	3.52025E-07
2.00000	5.20130E-12	1.48426E-11	9.23620E-11	3.09805E-10	2.01209E-09	1.53504E-08	4.30833E-08	2.05458E-07
2.51000	2.02221E-12	5.67603E-12	3.56800E-11	1.22746E-10	8.44964E-10	7.04619E-09	2.16369E-08	1.24565E-07
3.16000	7.71402E-13	2.14711E-12	1.36022E-11	4.79396E-11	3.49730E-10	3.20668E-09	1.08365E-08	7.56386E-08
3.98000	2.93494E-13	8.09001E-13	5.15413E-12	1.86421E-11	1.44295E-10	1.46120E-09	5.45391E-09	4.63127E-08
5.01000	1.11688E-13	3.03862E-13	1.95394E-12	7.26093E-12	5.95810E-11	6.68452E-10	2.76517E-09	2.86693E-08
6.31000	4.22040E-14	1.13851E-13	7.40182E-13	2.82276E-12	2.45193E-11	3.05677E-10	1.40625E-09	1.78660E-08
7.94000	1.59674E-14	4.28720E-14	2.80200E-13	1.09736E-12	1.00958E-11	1.40302E-10	7.19957E-10	1.12360E-08
10.00000	6.00858E-15	1.59180E-14	1.04927E-13	4.22483E-13	4.12230E-12	6.41360E-11	3.68658E-10	7.10357E-09

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.00100	6.23584E-02	7.79668E-02	8.24856E-02	8.61033E-02	8.69270E-02	8.80814E-02	8.79588E-02	8.53470E-02
0.00130	5.52742E-02	7.11168E-02	7.61104E-02	7.94416E-02	8.05475E-02	8.21744E-02	8.22849E-02	7.87813E-02
0.00160	4.72268E-02	6.31754E-02	6.86590E-02	7.27029E-02	7.40699E-02	7.61407E-02	7.64739E-02	7.36463E-02
0.00200	3.99996E-02	5.55557E-02	6.12890E-02	6.58518E-02	6.74210E-02	6.98526E-02	7.03382E-02	6.61380E-02
0.00250	3.33996E-02	4.78538E-02	5.35311E-02	5.80968E-02	5.97896E-02	6.24743E-02	6.31135E-02	5.88381E-02
0.00320	2.74457E-02	4.02387E-02	4.55449E-02	4.98194E-02	5.15416E-02	5.43358E-02	5.51253E-02	5.09938E-02
0.00400	2.22834E-02	3.31858E-02	3.79253E-02	4.18053E-02	4.34648E-02	4.62115E-02	4.71009E-02	4.32627E-02
0.00500	1.79521E-02	2.69650E-02	3.10384E-02	3.44086E-02	3.59334E-02	3.84983E-02	3.94257E-02	3.60187E-02
0.00630	1.43759E-02	2.15964E-02	2.49628E-02	2.77627E-02	2.90968E-02	3.13655E-02	3.22727E-02	2.94288E-02
0.00790	1.14694E-02	1.71215E-02	1.98269E-02	2.20434E-02	2.31693E-02	2.50977E-02	2.59543E-02	2.37472E-02
0.01000	9.14763E-03	1.35037E-02	1.56376E-02	1.74150E-02	1.83504E-02	1.99575E-02	2.07401E-02	1.90137E-02
0.01260	7.32323E-03	1.06261E-02	1.22757E-02	1.36336E-02	1.43893E-02	1.56795E-02	1.63760E-02	1.50894E-02
0.01580	5.88255E-03	8.34224E-03	9.59187E-03	1.05964E-02	1.11933E-02	1.21975E-02	1.28053E-02	1.19720E-02
0.02000	4.73695E-03	6.55172E-03	7.32936E-03	8.23362E-03	8.70329E-03	9.47760E-03	1.00006E-02	9.40152E-03
0.02510	3.83106E-03	5.17492E-03	5.88297E-03	6.43538E-03	6.80552E-03	7.39462E-03	7.84026E-03	7.46046E-03
0.03160	3.10445E-03	4.11531E-03	4.66000E-03	5.08298E-03	5.37863E-03	5.82311E-03	6.20098E-03	5.96649E-03
0.03980	2.50581E-03	3.28555E-03	3.71812E-03	4.04748E-03	4.28998E-03	4.62665E-03	4.94215E-03	4.81162E-03
0.05010	1.98567E-03	2.60304E-03	2.95499E-03	3.23573E-03	3.44252E-03	3.70020E-03	3.94398E-03	3.89418E-03
0.06310	1.51748E-03	2.01747E-03	2.25206E-03	2.57305E-03	2.75954E-03	2.96072E-03	3.12227E-03	3.15178E-03
0.07940	1.12097E-03	1.52997E-03	1.73621E-03	2.03154E-03	2.20467E-03	2.36433E-03	2.50509E-03	2.54149E-03
0.10000	7.97668E-04	1.12502E-03	1.31210E-03	1.57440E-03	1.73286E-03	1.85840E-03	1.97531E-03	2.00596E-03
0.12600	5.31814E-04	7.79027E-04	9.24757E-04	1.15662E-03	1.29937E-03	1.39490E-03	1.49321E-03	1.52818E-03
0.15800	3.29464E-04	5.05383E-04	6.17705E-04	8.07166E-04	9.31877E-04	1.00233E-03	1.09506E-03	1.14000E-03
0.20000	1.93714E-04	3.12479E-04	3.98347E-04	5.48400E-04	6.51371E-04	7.02050E-04	7.76214E-04	8.10818E-04
0.25100	1.08512E-04	1.83437E-04	2.39981E-04	3.47977E-04	4.26008E-04	4.60026E-04	5.13987E-04	5.45026E-04
0.31600	5.65754E-05	9.98817E-05	1.32378E-04	2.02153E-04	2.55789E-04	2.76609E-04	3.15195E-04	3.40788E-04
0.39800	2.79500E-05	5.07928E-05	6.86081E-05	1.10061E-04	1.43726E-04	1.55865E-04	1.81986E-04	2.01392E-04
0.50100	1.31760E-05	2.46244E-05	3.41194E-05	5.66567E-05	7.60749E-05	8.28329E-05	1.00019E-04	1.13889E-04
0.63100	6.02423E-06	1.14759E-05	1.71092E-05	2.79645E-05	3.80945E-05	4.19519E-05	5.26867E-05	6.18770E-05
0.79400	3.08176E-06	5.11130E-06	8.17210E-06	1.35131E-05	1.83266E-05	2.05266E-05	2.68421E-05	3.27197E-05

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	F1.333Hz	F2.000Hz	F2.500Hz	F3.333Hz	F4.000Hz	F5.000Hz	F6.667Hz	F10.000Hz
1.00000	1.71858E-06	2.55054E-06	3.92573E-06	6.59882E-06	8.92848E-06	1.01009E-05	1.35230E-05	1.73000E-05
1.26000	9.82745E-07	1.38367E-06	2.06911E-06	3.36670E-06	4.62314E-06	5.12658E-06	6.86194E-06	8.96340E-06
1.58000	5.91772E-07	7.62398E-07	1.07835E-06	1.73523E-06	2.35609E-06	2.64354E-06	3.56402E-06	4.49637E-06
2.00000	3.54465E-07	4.18010E-07	5.64475E-07	8.62976E-07	1.14561E-06	1.25743E-06	1.69515E-06	2.15875E-06
2.51000	2.17590E-07	2.37897E-07	3.04253E-07	4.59951E-07	5.85298E-07	6.20413E-07	8.06688E-07	1.03088E-06
3.16000	1.35053E-07	1.35845E-07	1.67341E-07	2.45940E-07	3.01105E-07	3.12119E-07	3.92901E-07	4.81628E-07
3.98000	8.45872E-08	7.85678E-08	9.32513E-08	1.34798E-07	1.58392E-07	1.59932E-07	1.96947E-07	2.32636E-07
5.01000	5.34341E-08	4.59091E-08	5.25513E-08	7.49107E-08	8.46834E-08	8.35851E-08	1.01884E-07	1.16306E-07
6.31000	3.40609E-08	2.69547E-08	2.97765E-08	4.20923E-08	4.58228E-08	4.41909E-08	5.34057E-08	5.91499E-08
7.94000	2.19320E-08	1.59375E-08	1.70175E-08	2.39298E-08	2.50557E-08	2.35798E-08	2.82997E-08	3.04089E-08
10.00000	1.41913E-08	9.44505E-09	9.74741E-09	1.36471E-08	1.37202E-08	1.25762E-08	1.49903E-08	1.55883E-08

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	F13.333Hz	F20.000Hz	F25.000Hz	F33.333Hz	F40.000Hz	F50.000Hz	F100.000Hz	PGA
0.00100	8.29197E-02	7.93057E-02	7.73949E-02	7.63346E-02	7.57043E-02	7.49860E-02	6.97711E-02	6.89444E-02
0.00130	7.69205E-02	7.27766E-02	7.06082E-02	6.94902E-02	6.76334E-02	6.57066E-02	6.16262E-02	6.07700E-02
0.00160	7.07796E-02	6.61692E-02	6.38129E-02	6.25310E-02	6.04995E-02	5.84086E-02	5.36904E-02	5.28181E-02
0.00200	6.38233E-02	5.92774E-02	5.68302E-02	5.51130E-02	5.33537E-02	5.12092E-02	4.63573E-02	4.54938E-02
0.00250	5.64320E-02	5.12668E-02	4.95105E-02	4.77342E-02	4.60203E-02	4.38672E-02	3.91657E-02	3.83404E-02
0.00320	4.87313E-02	4.30148E-02	4.07426E-02	4.04499E-02	3.88657E-02	3.68027E-02	3.19363E-02	3.15879E-02
0.00400	4.12928E-02	3.60777E-02	3.40277E-02	3.37048E-02	3.22867E-02	3.03928E-02	2.51244E-02	2.50443E-02
0.00500	3.43413E-02	2.97295E-02	2.79587E-02	2.55253E-02	2.49897E-02	2.41767E-02	2.01836E-02	1.95753E-02
0.00630	2.80635E-02	2.41909E-02	2.27081E-02	2.06332E-02	2.01413E-02	1.94826E-02	1.60708E-02	1.55247E-02
0.00790	2.26682E-02	1.95432E-02	1.79354E-02	1.65914E-02	1.61702E-02	1.56064E-02	1.27412E-02	1.22594E-02
0.01000	1.82187E-02	1.57057E-02	1.42283E-02	1.33087E-02	1.29564E-02	1.24827E-02	1.01046E-02	9.68454E-03
0.01260	1.45239E-02	1.25577E-02	1.13328E-02	1.03997E-02	9.95561E-03	9.97943E-03	8.03801E-03	7.67560E-03
0.01580	1.15258E-02	1.00223E-02	9.01666E-03	8.14142E-03	7.89075E-03	7.96117E-03	6.24393E-03	6.09244E-03
0.02000	9.15684E-03	7.94801E-03	7.23024E-03	6.53110E-03	6.32703E-03	5.76533E-03	4.98365E-03	4.72514E-03
0.02510	7.30886E-03	6.38364E-03	5.82216E-03	4.89476E-03	4.57216E-03	4.59588E-03	3.98710E-03	3.76810E-03

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	F13.333Hz	F20.000Hz	F25.000Hz	F33.333Hz	F40.000Hz	F50.000Hz	F100.000Hz	PGA
0.03160	5.87092E-03	5.08208E-03	4.37534E-03	3.82915E-03	3.57759E-03	3.35695E-03	2.91871E-03	2.99991E-03
0.03980	4.72916E-03	4.00325E-03	3.47071E-03	2.80359E-03	2.68033E-03	2.54355E-03	2.22628E-03	2.22677E-03
0.05010	3.80210E-03	3.15772E-03	2.63714E-03	2.12306E-03	1.91049E-03	1.86629E-03	1.57858E-03	1.58920E-03
0.06310	3.04315E-03	2.45702E-03	1.98306E-03	1.53512E-03	1.32784E-03	1.29770E-03	1.07282E-03	1.14662E-03
0.07940	2.41786E-03	1.88143E-03	1.46596E-03	1.06196E-03	8.97154E-04	8.70204E-04	7.19942E-04	7.81848E-04
0.10000	1.87496E-03	1.38725E-03	1.04984E-03	7.03907E-04	5.82766E-04	5.58047E-04	4.45747E-04	4.94641E-04
0.12600	1.39817E-03	9.83919E-04	7.25766E-04	4.50793E-04	3.65430E-04	3.42524E-04	2.56384E-04	2.96428E-04
0.15800	1.02066E-03	6.91095E-04	4.86942E-04	2.82824E-04	2.22653E-04	2.06797E-04	1.44686E-04	1.75503E-04
0.20000	7.10016E-04	4.50173E-04	3.06383E-04	1.66388E-04	1.27904E-04	1.17485E-04	7.68671E-05	9.83185E-05
0.25100	4.68179E-04	2.83591E-04	1.86849E-04	9.74813E-05	7.35189E-05	6.66800E-05	4.07358E-05	5.51837E-05
0.31600	2.89572E-04	1.70341E-04	1.09811E-04	5.60261E-05	4.17164E-05	3.74152E-05	2.13709E-05	3.06167E-05
0.39800	1.71636E-04	9.90749E-05	6.31897E-05	3.17774E-05	2.36365E-05	2.10733E-05	1.13552E-05	1.70520E-05
0.50100	9.81318E-05	5.64670E-05	3.57120E-05	1.79675E-05	1.33658E-05	1.19279E-05	6.12438E-06	9.53725E-06
0.63100	5.43005E-05	3.12759E-05	1.98742E-05	1.00307E-05	7.46379E-06	6.72511E-06	3.32872E-06	5.39648E-06
0.79400	2.92833E-05	1.72315E-05	1.09578E-05	5.48055E-06	4.10923E-06	3.76266E-06	1.82001E-06	3.10140E-06
1.00000	1.55231E-05	9.34171E-06	5.86530E-06	2.88279E-06	2.18372E-06	2.05574E-06	9.87603E-07	1.79323E-06
1.26000	7.92661E-06	4.96848E-06	3.00973E-06	1.42881E-06	1.10929E-06	1.08067E-06	5.25658E-07	1.02681E-06
1.58000	3.95304E-06	2.54796E-06	1.48002E-06	6.66879E-07	5.40551E-07	5.48606E-07	2.72574E-07	5.78864E-07
2.00000	1.84757E-06	1.17075E-06	6.68803E-07	2.83033E-07	2.31382E-07	2.53601E-07	1.31462E-07	3.09595E-07
2.51000	8.66933E-07	5.26188E-07	2.98247E-07	1.14251E-07	8.93884E-08	1.12493E-07	6.33218E-08	1.66335E-07
3.16000	4.05167E-07	2.30387E-07	1.24214E-07	3.92850E-08	2.82950E-08	4.55395E-08	2.91360E-08	8.75072E-08
3.98000	1.94795E-07	9.94711E-08	4.76871E-08	1.12851E-08	6.30968E-09	1.61782E-08	1.28181E-08	4.52826E-08
5.01000	9.60952E-08	4.23083E-08	1.67109E-08	2.62246E-09	1.03971E-09	4.67645E-09	5.27672E-09	2.29623E-08
6.31000	4.76674E-08	1.74086E-08	5.06260E-09	3.44027E-10	9.79905E-11	1.02501E-09	1.96612E-09	1.13393E-08
7.94000	2.36406E-08	6.77551E-09	1.18871E-09	1.59383E-11	1.40800E-12	1.52912E-10	6.77587E-10	5.45499E-09
10.00000	1.15450E-08	2.35740E-09	1.81641E-10	1.69080E-13	1.54595E-15	1.14372E-11	2.26764E-10	2.53126E-09

ENCLOSURE 2

SEQUOYAH SEISMIC HAZARDS REPORT

Sequoyah Seismic Hazard Report

Overview

This report provides the NRC staff's updated seismic hazard curves and response spectra for the Sequoyah Nuclear Plant (Sequoyah) site that are based on the implementation of (1) a new seismic ground motion model for the central and eastern United States (CEUS) and (2) recent advances in site response analysis. The NRC staff's updated hazard curves and site amplification factors are included in an appendix to this report.

Background

In response to the March 11, 2011, Great East Japan Earthquake and tsunami, which triggered an accident at the Fukushima Dai-ichi nuclear power plant, the U.S. Nuclear Regulatory Commission (NRC) established the Near-Term Task Force (NTTF) to conduct a systematic and methodical review of NRC processes and regulations and determine whether the agency should make additional improvements to its regulatory system. In SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (NRC, 2011), the NRC staff recommended a set of actions to clarify and strengthen the regulatory framework for protection against natural hazards. In particular, NTTF Recommendation 2.1 (NTTF R2.1) instructed the NRC staff to issue requests for information to all power reactor licensees pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) ("50.54(f) letter"). Enclosure 1 to the 50.54(f) letter requested that addressees reevaluate the seismic hazards at their sites, using present day NRC requirements and guidance to perform a probabilistic seismic hazard analysis (PSHA) and develop a site-specific ground motion response spectrum (GMRS). To comply with the 50.54(f) request, the Nuclear Energy Institute submitted Electric Power Research Institute (EPRI) Report 1025287, "Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima NTTF Recommendation 2.1 Seismic," dated November 27, 2012 (EPRI, 2012). Recipients of the 50.54(f) letter committed to following the SPID to develop seismic hazard and screening reports (SHSRs). By December 2017, the NRC staff had finished assessing the SHSRs for all operating U.S. nuclear power plants.

Under the process for the ongoing assessment of natural hazards information (POANHI), described in SECY-16-0144, "Proposed Resolution of Remaining Tier 2 and 3 Recommendations Resulting from the Fukushima Dai-ichi Accident," dated December 26, 2016 (NRC, 2016), the NRC staff continuously seeks out and integrates new natural hazards information for operating plants in the United States. The Office of Nuclear Reactor Regulation's Office Instruction LIC-208, "Process for the Ongoing Assessment of Natural Hazards Information," issued November 2019 (NRC, 2019), provides guidance to the staff on how to collect, integrate, and evaluate new information for consideration in its regulatory decision-making. This report presents the NRC staff's latest understanding of seismic hazards at the Sequoyah site following the POANHI framework.

The Sequoyah site is located on the western shore of Chickamauga Reservoir along the Tennessee River within the Ridge and Valley physiographic province and is founded on over 3,600 meters of competent sedimentary rock (limestone, shale, sandstone and dolomite) of Paleozoic age.

Motivation

After evaluating the SHSR submittals, the NRC staff captured in NUREG/KM-0017, "Seismic Hazards Evaluations for U.S. Nuclear Power Plants: Near-Term Task Force Recommendation 2.1 Results," issued December 2021 (Munson et al., 2021), the information used to develop the GMRS at each of the U.S. nuclear power plants. This includes a compilation and synthesis of (1) information provided by licensees in their SHSRs, (2) information collected by the NRC staff during its reviews of the SHSRs, and (3) information subsequently collected by the NRC staff from the scientific and engineering literature pertaining to several of the nuclear power plant sites. In addition, NUREG/KM-0017 includes updated approaches and relationships, relative to those recommended by the SPID, that the NRC staff used to perform its analyses.

After the development of NUREG/KM-0017, a new Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 ground motion model (GMM) for Eastern North America called NGA-East was published by Goulet et al. (2018). In addition, the NRC staff also participated in a SSHAC Level 2 study, documented in Research Information Letter (RIL) 2021--15, "Documentation Report for SSHAC Level 2: Site Response," issued November 2021 (Rodriguez-Marek et al., 2021). This SSHAC Level 2 study implemented the SSHAC approach to performing site response analyses (SRAs). The SSHAC process, described most recently in NUREG-2213, "Updated Implementation Guidelines for SSHAC Hazard Studies," issued October 2018 (Ake et al., 2018), provides a structured and logical framework for the systematic evaluation of alternative data, models, and methods. This seismic hazard report for the Sequoyah site incorporates the NGA-East GMM in place of the EPRI (2013) GMM and lessons learned from the SSHAC Level 2 SRA study (RIL 2021-15) into a PSHA to develop updated seismic hazard curves and a GMRS for the site.

Methods

Reference Rock Hazard

For the reference rock PSHA, the NRC staff used the distributed seismicity zones (DSZs) from the SSHAC Level 3 Central and Eastern United States Seismic Source Characterization for Nuclear Facilities (CEUS-SSC) model in NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, issued January 2012 (NRC, 2012). Specifically, the NRC staff selected the DSZs that are located within 500 kilometers of the site. For this reevaluation, the NRC staff used the SSHAC Level 2 update to the CEUS-SSC seismicity catalog and recurrence parameters (Gatlin, 2015), which primarily impact the DSZs that encompass Monticello Reservoir and Lake Keowee in South Carolina as well as the 1886 Charleston earthquake sequence. In addition, the NRC staff selected the RLME sources that are within 1,000 kilometers of the site. To develop the reference rock seismic hazard curves for the site, the NRC staff used the NGA-East GMM (2018) to compute the median and logarithmic

standard deviation of the spectral accelerations. Because the NGA-East GMM implements the rupture distance parameter, the NRC staff developed virtual rupture planes for each of the distributed source zones surrounding the site. For each virtual rupture, the NRC staff used the CEUS-SSC hazard input document (NRC, 2012) to specify the size of the rupture plane and the orientation of the rupture plane in terms of the strike and dip angles, dip direction, and rupture type (e.g., reverse and strike slip). In contrast, to develop the hazard curves for NUREG/KM-0017, the NRC staff used point source approximations for the CEUS-SSC and EPRI GMM (EPRI, 2013) combination.

Figure 1 shows the distribution of the virtual ruptures for one of the four alternative CEUS-SSC seismotectonic DSZ configurations along with the resulting 10-Hertz (Hz) mean hazard curves developed using the NGA-East GMM. In particular, Figure 1 shows the distribution of the surface projection of the updip segments of the virtual rupture planes for each of the five seismotectonic DSZs within 500 kilometers of the site. As expected, the Paleozoic Extended Crust—Narrow Geometry (PEZ-N) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} annual frequency of exceedance (AFE) level. Similarly, Figure 2 shows the distribution of the virtual ruptures for one of the three alternative CEUS-SSC maximum-magnitude DSZ configurations along with the resulting 10 Hz mean hazard curves developed using the NGA-East GMM. The Non-Mesozoic-and-Younger Extension—Narrow Configuration (NMESE-N) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 3 shows the RLME sources within 1,000 kilometers of the site, and their contribution to the 1 Hz reference rock mean hazard, from using the NGA-East GMM. The New Madrid Fault System RLME source is the largest contributor to the 1 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 4 shows the contribution from all of the DSZs relative to the RLMEs, as well as the total mean hazard for the 1 and 10 Hz mean reference rock hazard curves, from using the NGA-East GMM. For the 1 Hz mean reference rock hazard curves, the RLME sources provide the largest contribution at the 10^{-4} AFE level. In contrast, for the 10 Hz mean reference rock hazard curves at the 10^{-4} AFE level, the DSZs provide the largest contribution. Finally, Figure 5 shows the mean 1,000-, 10,000-, and 100,000-year return period mean reference rock uniform hazard response spectra (UHRS) for the Sequoyah site from using the EPRI GMM (blue) and the NGA-East GMM (red). For this reevaluation, the NRC staff used the NGA-East single station standard deviation and for the comparison shown in Figure 5, the NRC staff used the EPRI GMM ergodic standard deviation. As shown in Figure 5, the spectral accelerations from using the NGA-East GMM are moderately higher than those from using the EPRI GMM, up to the spectral frequency of about 5 Hz.

Site Response Analysis

SRAs, which are used to develop site adjustment (or amplification) factors ($SAFs$), depend on several factors, including the site strata (material type, stiffness, and thickness) and their response to dynamic loading. Because this information is site specific, the ability to accurately model the site response depends on the quantity and quality of site-specific geologic and geotechnical data available, and on the interpretation and use of these data to develop input models for assessing amplification (or deamplification) of ground motions. The resulting $SAFs$

are assessed for a wide range of input ground motions as part of understanding the changes in the soil and rock response as input ground motions increase.

The NRC staff followed the site response approach described in RIL 2021-15, which uses a logic tree for systematically identifying and propagating epistemic uncertainties in the SRA. As described in RIL 2021-15, to produce a truly probabilistic estimate of the seismic hazard at the control point elevation, it is necessary to estimate both the epistemic uncertainties and the aleatory variability of the soil and or rock dynamic response, and to propagate these through the SRA and the calculation of the site hazard curves.

Site Exploration. As described in the NTTF R2.1 SHSR submitted by the Tennessee Valley Authority (TVA; Shea, 2014) and summarized in section 2.3.12 of NUREG/KM-0017, the field investigations for Sequoyah consisted of downhole and crosshole geophysical measurements of the uppermost soil and rock strata to a depth of 31 meters in addition to more recent Spectral Analysis of Surface Waves (SASW) testing to estimate shear wave velocities (V_S) at the Watts Bar nuclear plant site, which is situated over the same Valley and Ridge rock formations as Sequoyah.

Basecase Profiles. TVA stated in its NTTF R2.1 SHSR (Shea, 2014) that the uppermost 12 meters beneath the plant site are residual clays and silts overlying interbedded limestone and shale bedrock of the Conasauga Group. The primary structures of the Sequoyah plant are founded on the Conasauga Group, which is of Middle Cambrian age. TVA selected the deepest structure foundation, which is at a depth of 19.5 meters, as the control point for its basecase profile. For its SHSR, TVA developed a basecase profile that extends to a depth of 1,628 meters below the control point elevation. The major controlling geologic feature of the Sequoyah site is the Kingston Thrust fault. Movement along this fault during the Late Paleozoic Era resulted in the Cambrian age Conasauga Group resting upon the younger Ordovician age Knox Group dolomites, which would normally overlie the Conasauga sedimentary strata. The majority of TVA's best-estimate basecase profiles consist of sedimentary strata from the Conasauga (shale and limestone) and the Knox Groups, for which TVA estimated a V_S of about 1,830 meters/second (m/s) to 2,134 m/s. In between the Conasauga and Knox Group strat is 46 meters of limestone from the Pond Springs Formation, which has an estimated V_S of 2,896 m/s. In summary, the sequence of sedimentary strata and thrust faults underlying the site is as follows: (1) Conasauga Group (Cambrian), (2) Kingston Fault, (3) Pond Springs Formation (Ordovician), (4) Knox Group (Ordovician-Cambrian), (5) Conasauga Group, (6) Rome Formation (Cambrian), (7) Chattanooga Fault, (8) Knox Group, (9) Conasauga Group, (10) Rome Formation, (11) Sequatchie Valley Fault, (12) Rome Formation, and (13) basement rock. TVA terminated its basecase profile at the top of the first instance of the Rome Formation above the Chattanooga Fault based on the estimated V_S of 3,049 m/s, which exceeds the NGA-East GMM reference rock V_S of 3,000 m/s.

Based on (1) the stratigraphy of the Valley and Ridge physiographic province in the vicinity of the Sequoyah site, (2) the estimated lower V_S (i.e., V_S< 3,000 m/s) for the sedimentary rock layers below the Chattanooga Thrust fault, and (3) consistent with the NRC staff's effort to capture a wider range of uncertainty (RIL 2021-15), the NRC staff developed two best-estimate basecase profiles for the Sequoyah SRA. The first best-estimate basecase profile developed by the NRC staff extends to a depth of 1,905 meters below the control point elevation, which is similar to the best-estimate basecase profile developed by TVA. However, the second best-estimate basecase profile developed by the NRC staff extends to a depth of 3,399 meters below the control point elevation. This second best-estimate basecase profile captures the possibility that the sedimentary strata beneath the Sequoyah site consists of multiple layers beneath the Chattanooga Thrust fault that have V_S less than the reference rock V_S of 3,000 m/s. The estimated V_S for these deeper rock layers beneath the Chattanooga Thrust fault are provided in Table 2.3.1-2 of TVA's SHSR and are based on geologic investigations performed by consultants to TVA (Shea, 2014).

To capture the uncertainty in its best-estimate basecase profiles, the NRC staff developed lower and upper profiles by multiplying its two best-estimate basecase profiles by scale factors of 0.82 and 1.21, respectively, which corresponds to an epistemic logarithmic standard deviation of 0.15. The weights for the lower, best-estimate, and upper basecase profiles are 0.3, 0.4, and 0.3, respectively. Figure 6 shows the six lower, best-estimate, and upper basecase profiles used by the NRC staff. The lower epistemic value used by the NRC staff to determine the lower and upper basecase profiles is due to the staff's conclusion that the lithology of the sedimentary strata beneath Sequoyah site likely has a low range in V_S.

Site Kappa. To estimate the site kappa (κ_0), which captures the overall attenuation (i.e., intrinsic and scattering attenuation) of the geologic profile, the NRC staff used the four Q_{ef}-V_S models from Campbell (2009), where Q_{ef} is the effective quality factor of shear waves, which captures both the frequency-independent component of intrinsic attenuation and small-scale scattering. For each of the four Q_{ef}-V_S models, the NRC staff estimated a Q_{ef} for each layer in the basecase profiles, then used the estimated Q_{ef}, V_S, and layer thickness to determine a κ_0 for each layer. Summing these κ_0 values for each layer and adding the reference value of 6 milliseconds (msec) provides an estimate of the total κ_0. The NRC staff used a weight of 0.25 for each of the four Q_{ef}-V_S models. Assuming a lognormal distribution for κ_0 with a logarithmic standard deviation of 0.2 from Xu et al. (2020), the NRC staff developed a nine-point discrete distribution. This results in 45 κ_0 values and associated weights for each of the basecase profiles, which the NRC staff then resampled using the approach from Miller and Rice (1983) to reduce the distribution to five representative values and associated weights. These five κ_0 values and weights, which are listed in Table 1, range from 10 msec to 51 msec for the six basecase profiles.

Nonlinear Dynamic Properties. For the equivalent linear (EQL) SRA, nonlinearity is incorporated using strain-compatible site properties (i.e., shear modulus and damping ratio) for each layer. The strain-compatible properties model both the shear modulus reduction and the increased damping that are expected as the intensity of shaking increases. To model the nonlinear response within the upper 152 meters of weathered rock layers, the NRC staff used the EPRI rock modulus reduction and damping (MRD) curves (EPRI, 1993), which are identified in Table 2. The NRC staff used a weight of 0.5 for the MRD curves and a weight of 0.5 to capture the possibility that the weathered rock behaves linearly under seismic loading. The NRC staff used MRD curves as well as a linear alternative to better capture the epistemic uncertainty in the response of the weathered rock to higher dynamic loading.

Table 2 provides the layer depths, lithologies, V_S, unit weights, and dynamic properties for the NRC staff's basecase profiles. It is important to note that the NRC staff has adjusted the critical damping ratio values in the lower layers of the profiles, which are treated as having a linear response, so that each profile as a whole has the appropriate κ_0 value. Figure 7, which shows tornado plots for the reference rock peak ground acceleration (PGA) value of 0.63g, shows the site response logic tree nodes that contribute to the variance of the SAF. Each tornado plot in Figure 7 is associated with one of the four oscillator frequencies of 1, 5, 10, and 100 Hz. For the frequencies of 5, 10, and 100 Hz, the epistemic uncertainty in the basecase V_S and the uncertainty in κ_0 contribute similar amounts to the variance in the SAF. For 1 Hz, the epistemic uncertainty in the basecase V_S contributes the most to the variance in the SAF.

Input Motions. Input motions used for the SRA were generated as outcrop motions at the reference rock horizon, located at the bottom of the basecase profiles. The NRC staff used random vibration theory to generate the input motions after first developing an input Fourier amplitude spectrum (FAS) using seismological source theory (i.e., single-corner frequency Brune source spectrum). To develop the FAS, the NRC staff used the source and regional attenuation parameters recommended in the SPID for Eastern North American rock sites and then used random vibration theory to develop corresponding 5 percent damped acceleration response spectra. The NRC staff developed 12 input FAS assuming a magnitude ($\boldsymbol{M}$) of 6.5 and 12 different source-to-site distances, as recommended in the SPID.

Analysis Methodology. To develop $SAFs$ for the Sequoyah site, the NRC staff used traditional EQL analysis and the recently developed kappa-corrected EQL analysis, which adjusts the high-frequency control point (i.e., top of profile) FAS from the EQL SRA to be consistent with the target κ_0 value. In particular, the NRC staff used the kappa-corrected EQL analysis methodology (Xu and Rathje, 2021) with the modification in which the EQL control point FAS remains unmodified below a specified transition frequency, and then a slope equal to the target κ_0 value is imposed at frequencies above the transition frequency (RIL 2021-15). To capture the uncertainty in the transition frequency value, the NRC staff selected three frequencies for which the FAS amplitude equals 5 percent, 11 percent, and 17 percent of its peak value, with weights of 0.2, 0.6, and 0.2, respectively.

To capture the spatial variability in site properties across the site, the NRC staff generated randomized V_S profiles around each of the basecase profiles using the Toro (1995) model, which quantifies the aleatory variability through a depth-dependent standard deviation of the natural log of the velocities. The logarithmic standard deviation values used by the NRC staff for the Sequoyah site were based on site-specific data and are shown in Table 2. In addition to randomizing the V_S profiles, the NRC staff also randomized the MRD curves following the logit function approach used in the SPID and described in RIL 2021-15.

For each terminal branch of the site response logic tree, the NRC staff developed 60 randomized profiles and then determined the SAF by dividing the computed control point response spectrum by the outcrop response spectrum for the reference condition. Next, the NRC staff computed a median and logarithmic standard deviation for the SAF, using the 60 $SAFs$ from the randomized profiles, for each terminal branch of the logic tree. To facilitate implementing the SAF medians and logarithmic standard deviations into the PSHA seismic hazard integral, the NRC staff reduced the median SAFs from the over 200 logic tree terminal branches to seven discrete fractiles and weights using the resampling procedure outlined by Miller and Rice (1983). As recommended by Rodriguez-Marek et al. (2021), to ensure that estimates of the SRA capture enough epistemic uncertainty in the median SAF, the NRC staff implemented a minimum logarithmic standard deviation value of 0.15, which causes the seven median SAF fractiles to spread apart if necessary.

Finally, because the SAF logarithmic standard deviation for each spectral frequency does not vary significantly across the terminal branches of the logic tree, the NRC staff used a single mean value for each frequency. In addition, to avoid double-counting the aleatory variability already captured by the GMM, the NRC staff adjusted the SAF logarithmic standard deviation to include only the portion of the standard deviation associated with the nonlinear site response.

Figure 8 shows the seven median SAF values (top) and the average logarithmic standard deviation (bottom) as a function of input reference rock spectral acceleration for the 1 and 10 Hz spectral frequencies. As shown in Figure 8, the median $SAFs$ range from about 0.5 to 1.5 and remain constant with higher input spectral accelerations. The lower half of Figure 8 shows both the total and the nonlinear values of the SAF logarithmic standard deviation, the latter of which are implemented into the PSHA hazard integral. Figure 9 shows the seven median SAF values versus frequency at the 10^{-4} AFE spectral acceleration value for each of the 23 NGA-East GMM spectral frequencies as well for PGA, which is plotted at 200 Hz. Overall, the Sequoyah site produces a flat SAF from about 0.1 Hz to 3 Hz and then falls off over the higher frequencies out to about 30 Hz.

Control Point Hazard and Ground Motion Response Spectra

The NRC staff calculated the mean control point hazard for the Sequoyah site using Convolution Approach 3 from NUREG/CR-6728, “Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines,” issued October 2001 (McGuire et al., 2001), which convolves the predetermined mean reference condition hazard with the $SAFs$. For each NGA-East GMM spectral frequency, the NRC staff convolved the mean reference condition hazard curve with the seven $SAFs$ to determine the final mean control point hazard. Using the mean control point hazard curves, the NRC staff then determined the 10^{-4} and 10^{-5} UHRS in order to calculate the final GMRS for the site, which are provided in Table 3. Figure 10 shows this final GMRS (red curve) compared to the GMRS (black curve) developed for NUREG/KM-0017, the GMRS (blue curve) in TVA’s SHSR (Shea, 2014) and the GMRS (purple curve) in TVA’s seismic probabilistic risk assessment (SPRA; Polickoski, 2019). The years in the legend for Figure 10 show when the GMRS were developed either by TVA or the NRC staff. As shown in Figure 10, the final GMRS from this study is higher than the previous GMRS for the low frequencies between 0.5 to about 3 Hz and then is lower than the previous GMRS above 5 Hz. The higher spectral accelerations for the lower frequencies are due to the NGA-East GMM, which predicts higher median ground motions for the lower spectral frequencies relative to the EPRI GMM (see Figure 5). Based on a sensitivity analysis, the NRC staff found that the lower spectral accelerations in the mid-to-upper frequencies for the updated GMRS developed by this study and the previous GMRS are due to the higher κ_0 values estimated for the Sequoyah site (see Table 1), compared to the lower κ_0 values estimated for the previous studies.

Data Tables

Appendix A provides the data tables for the Sequoyah site. Tables A-1, A-2, and A-3 give the reference rock mean hazard curves for 23 spectral frequencies ranging from 0.1 to 100 Hz and for PGA. Tables A-4 through A-27 give the SAF medians and logarithmic standard deviations for the 23 spectral frequencies and for PGA. Tables A-28, A-29, and A-30 give the control point hazard mean hazard curves for the 23 spectral frequencies and for PGA.

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Table 1 Site Kappa (κ_0) Values for Each Basecase Profile

Shallow Profile Kappa Distribution					
Lower Case		Base Case		Upper Case	
κ_0 (sec)	Weight	κ_0 (sec)	Weight	κ_0 (sec)	Weight
0.018	0.101	0.014	0.101	0.010	0.101
0.022	0.244	0.016	0.244	0.012	0.244
0.026	0.309	0.022	0.309	0.017	0.309
0.029	0.244	0.025	0.244	0.020	0.244
0.033	0.101	0.028	0.101	0.023	0.101

Deep Profile Kappa Distribution					
Lower Case		Base Case		Upper Case	
κ_0 (sec)	Weight	κ_0 (sec)	Weight	κ_0 (sec)	Weight
0.027	0.101	0.019	0.101	0.014	0.101
0.032	0.244	0.023	0.244	0.017	0.244
0.040	0.309	0.032	0.309	0.025	0.309
0.046	0.244	0.037	0.244	0.031	0.244
0.051	0.101	0.043	0.101	0.036	0.101

Table 2 Layer Depths, Shear Wave Velocities (V_S), Unit Weights, and Dynamic Properties for Sequoyah

		Vs (m/s)			*Vs*	Unit	Dynamic Properties	
Layer #	**Depth (m)**	**LR (0.2, 0.2)**	**BC (0.15, 0.15)**	**UR (0.15, 0.15)**	**Sigma (ln)**	**Weight (kN/m^3)**	**Alt. 1 (0.5)**	**Alt. 2 (0.5)**
1	15	1509	1829	2216	0.25	25	EPRI Rock	Linear
2	152	1509	1829	2216	0.15	25	EPRI Rock	Linear
3	305	1572	1905	2308	0.15	25	Linear	Linear
4	457	1635	1981	2401	0.15	25	Linear	Linear
5	503	2476	3000	3000	0.15	26	Linear	Linear
6	1463	1761	2134	2585	0.15	25	Linear	Linear
7	1905	1761	2134	2585	0.15	25	Linear	Linear
8	2310	2476	3000	3000	0.15	26	Linear	Linear
9	2957	1761	2134	2585	0.15	25	Linear	Linear
10	3399	1761	2134	2585	0.15	25	Linear	Linear

LR = lower range; BC = basecase; UR = upper range; ln = natural log; Alt. = Alternative
EPRI Rock = EPRI, 1993 rock
For LR, BC, UR and Alt.: Values in parentheses refer to weights for site response analysis logic tree branches.

Table 3 GMRS and UHRS for Sequoyah

Frequency (Hz)	UHRS 1E-4 (g)	GMRS (g)	UHRS 1E-5 (g)
0.100	0.016390	0.018300	0.035540
0.133	0.025333	0.027600	0.053476
0.200	0.042003	0.046000	0.089142
0.250	0.051117	0.055600	0.107562
0.333	0.068238	0.075100	0.145741
0.500	0.099567	0.111300	0.216652
0.667	0.131164	0.148200	0.289405
1.000	0.178521	0.206700	0.406014
1.333	0.215046	0.251600	0.495427
2.000	0.252181	0.305800	0.607802
2.500	0.274824	0.331300	0.657425
3.333	0.305642	0.392300	0.790777
4.000	0.303435	0.400600	0.813089
5.000	0.312309	0.426800	0.873782
6.667	0.345758	0.475700	0.975563
10.000	0.349964	0.504000	1.045615
13.333	0.339984	0.499400	1.041188
20.000	0.301417	0.446000	0.931440
25.000	0.259101	0.378700	0.788406
33.333	0.209269	0.297300	0.614525
40.000	0.181580	0.257400	0.531974
50.000	0.158560	0.223500	0.461288
100.000	0.148498	0.192700	0.389405
PGA	0.165325	0.228700	0.469602

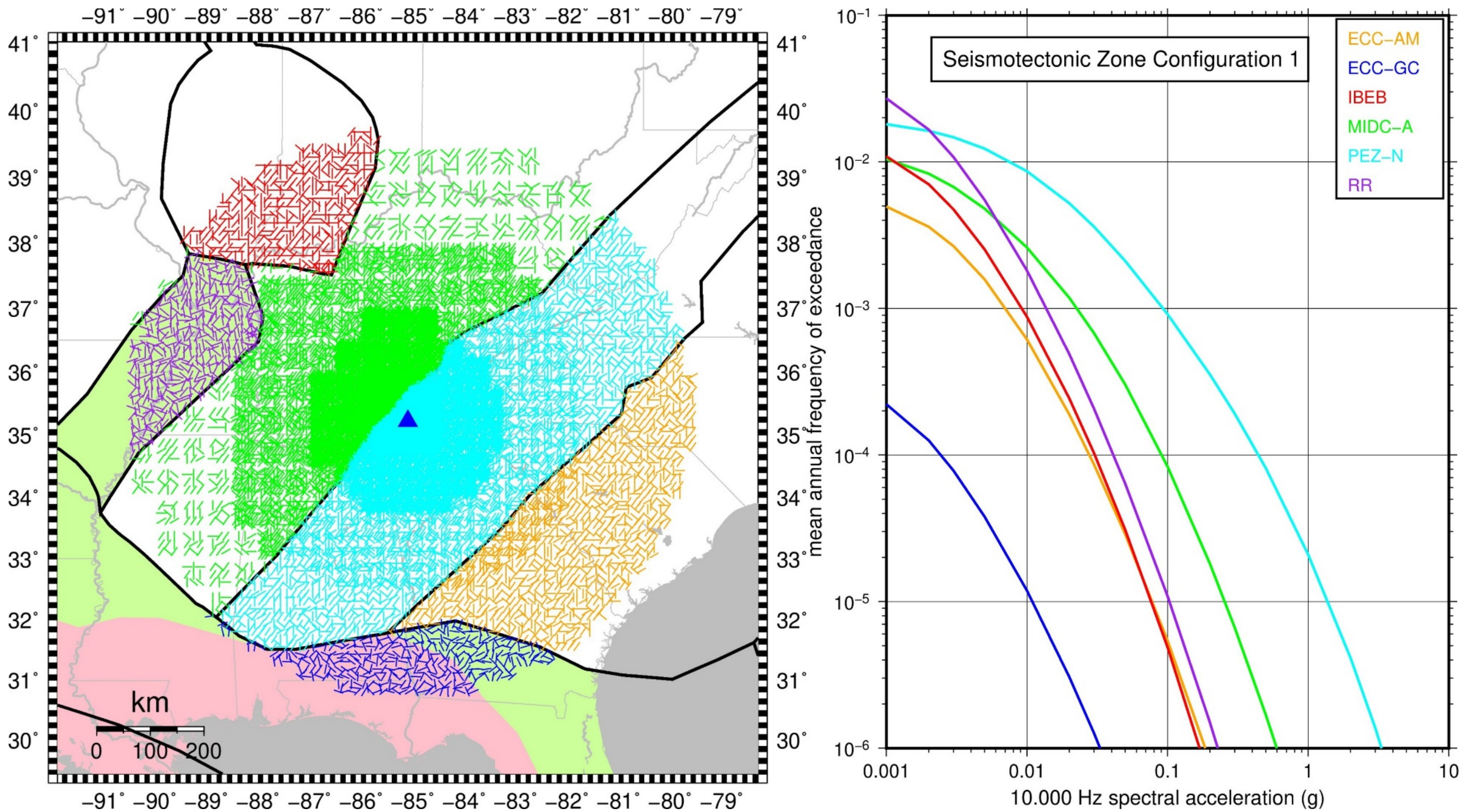

Figure 1 Distribution of virtual ruptures (left) for CEUS-SSC Seismotectonic Configuration 1 DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Sequoyah

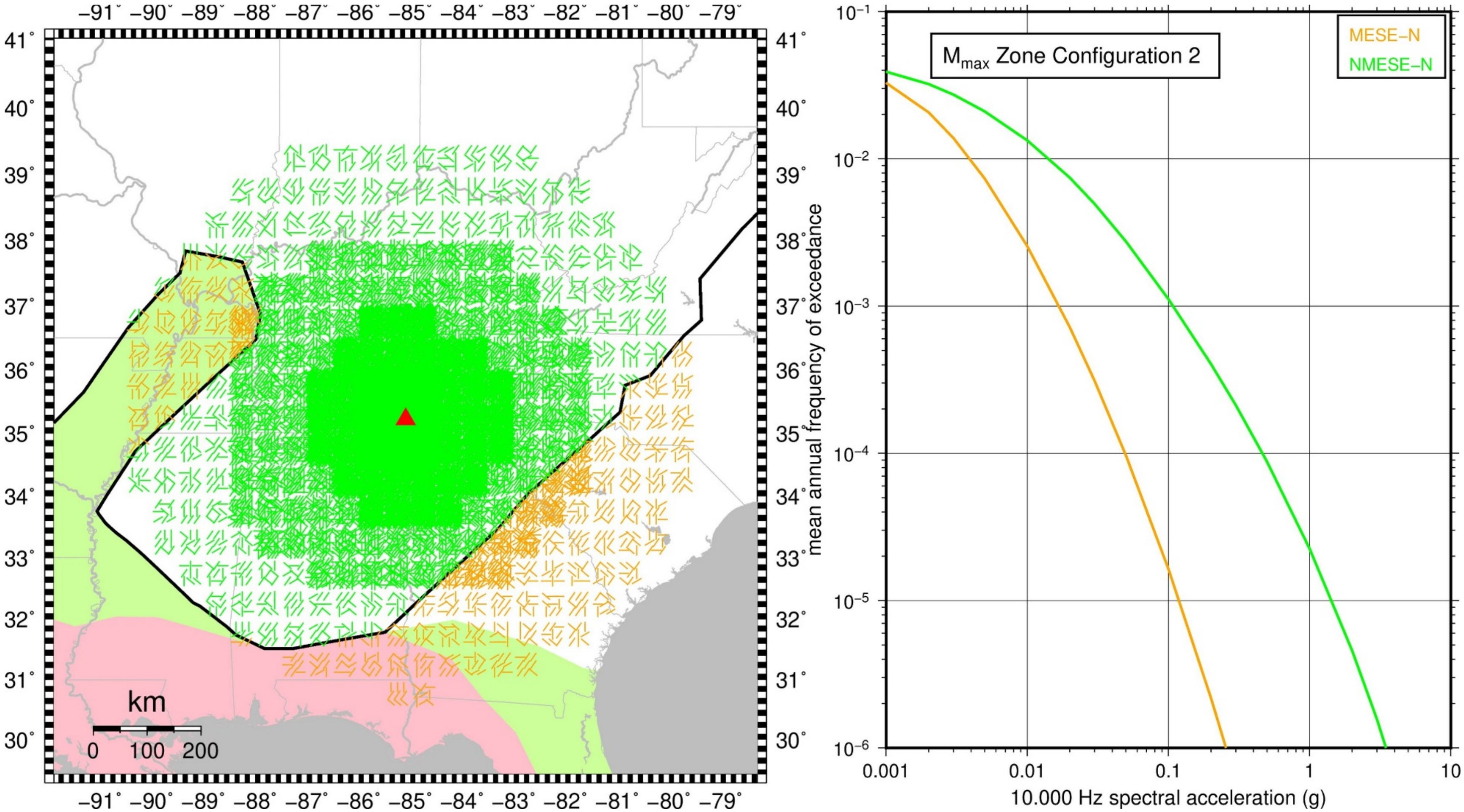

Figure 2 Distribution of virtual ruptures (left) for CEUS-SSC maximum-magnitude narrow-configuration DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Sequoyah

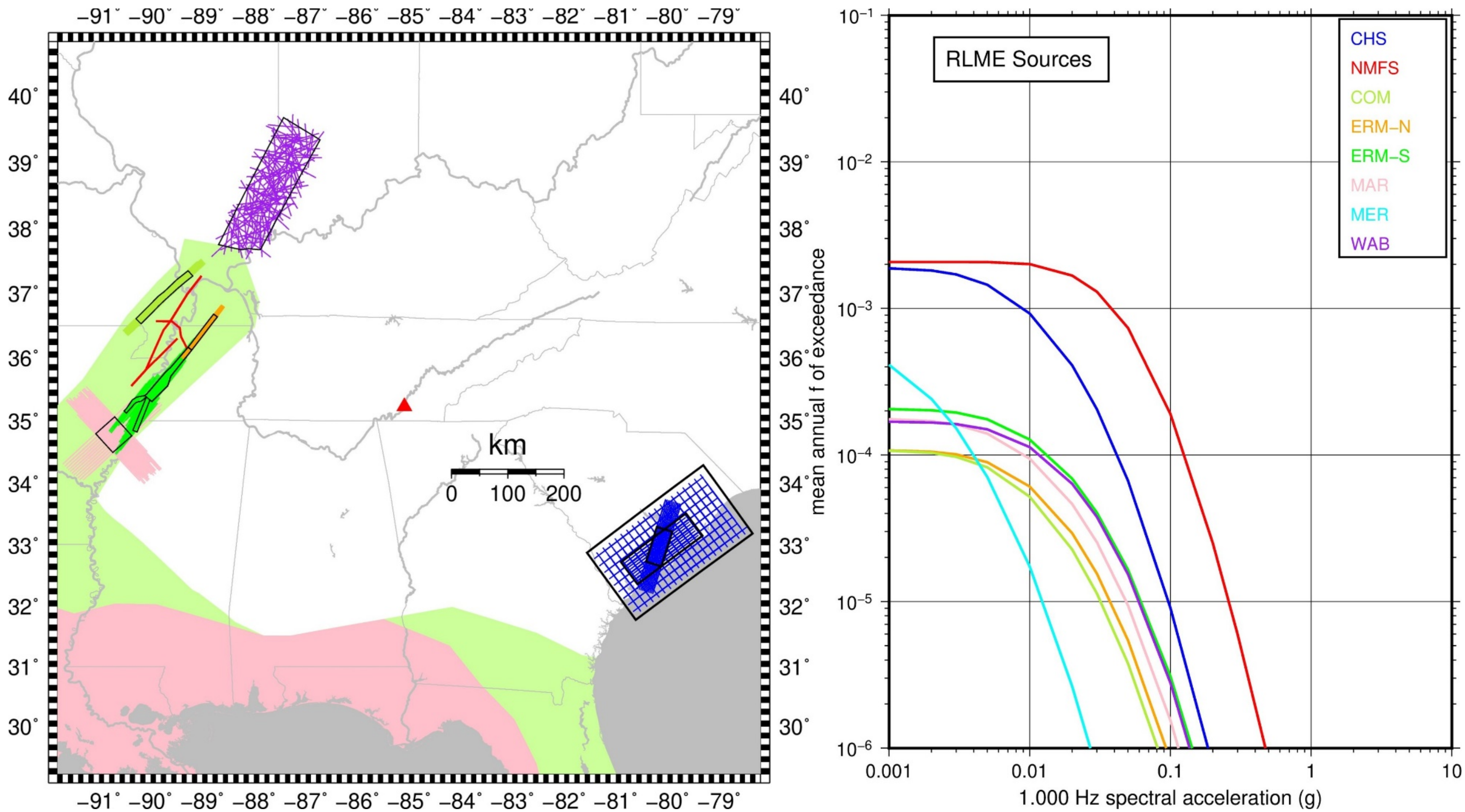

Figure 3 CEUS-SSC RLME sources (left), and associated mean 1 Hz reference rock hazard curves (right) for Sequoyah

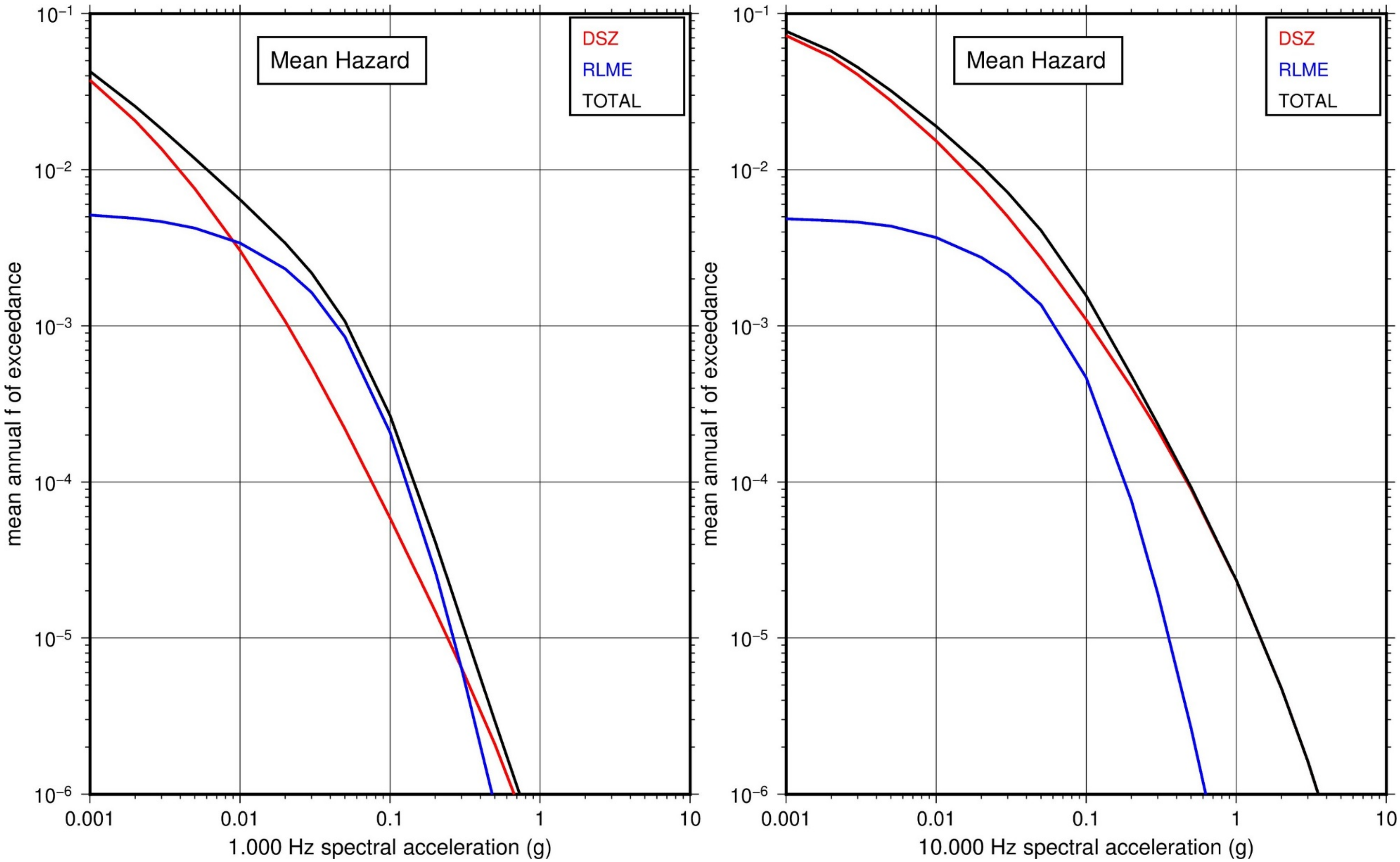

Figure 4 DSZ, RLME, and total mean reference rock hazard curves for 1 Hz (right) and 10 Hz (left) for Sequoyah

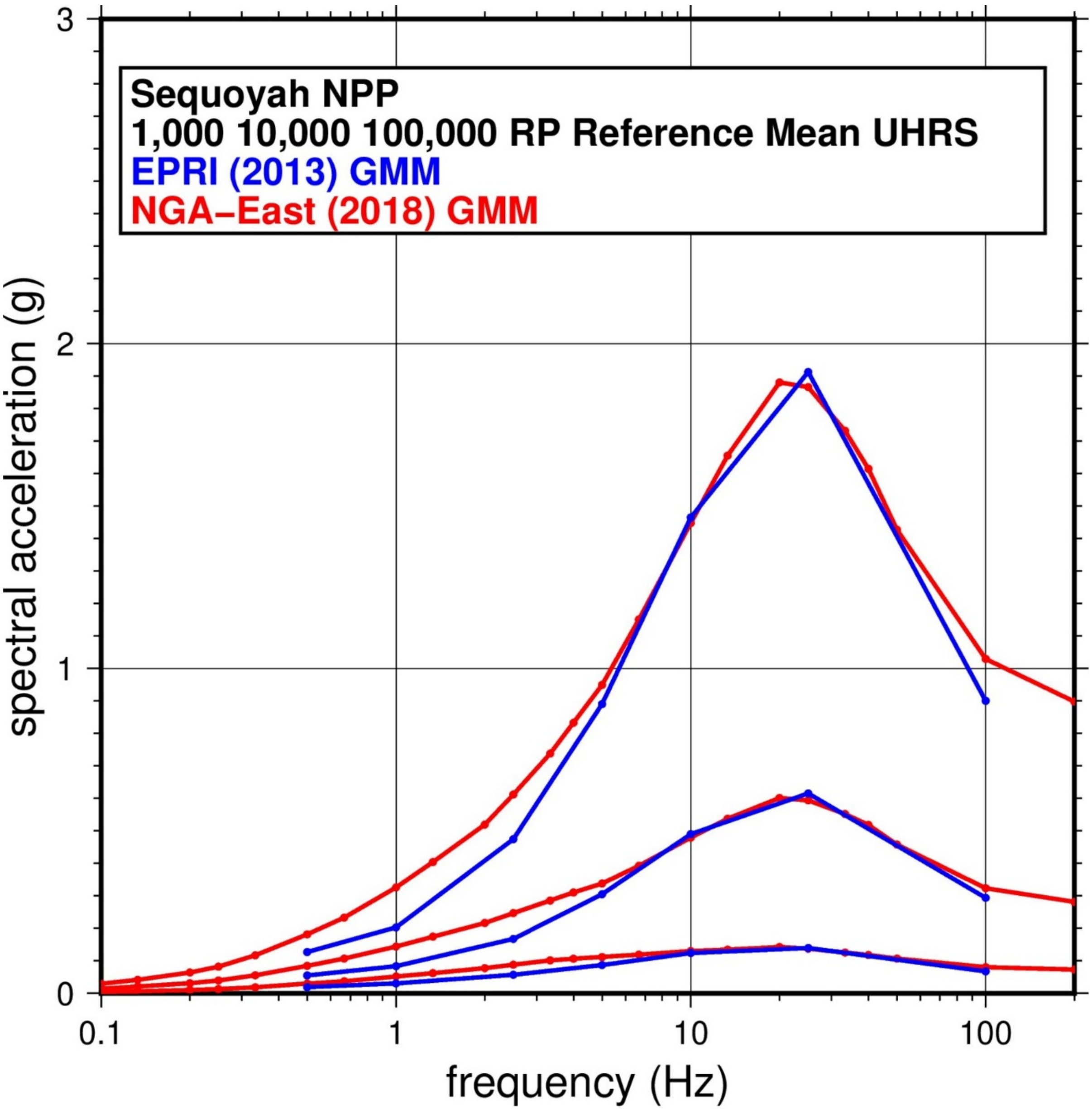

Figure 5 1,000-, 10,000-, and 100,000-year return period mean reference rock UHRS for CEUS-SSC and EPRI GMM (blue curves) and CEUS-SSC and NGA-East GMM (red curves)

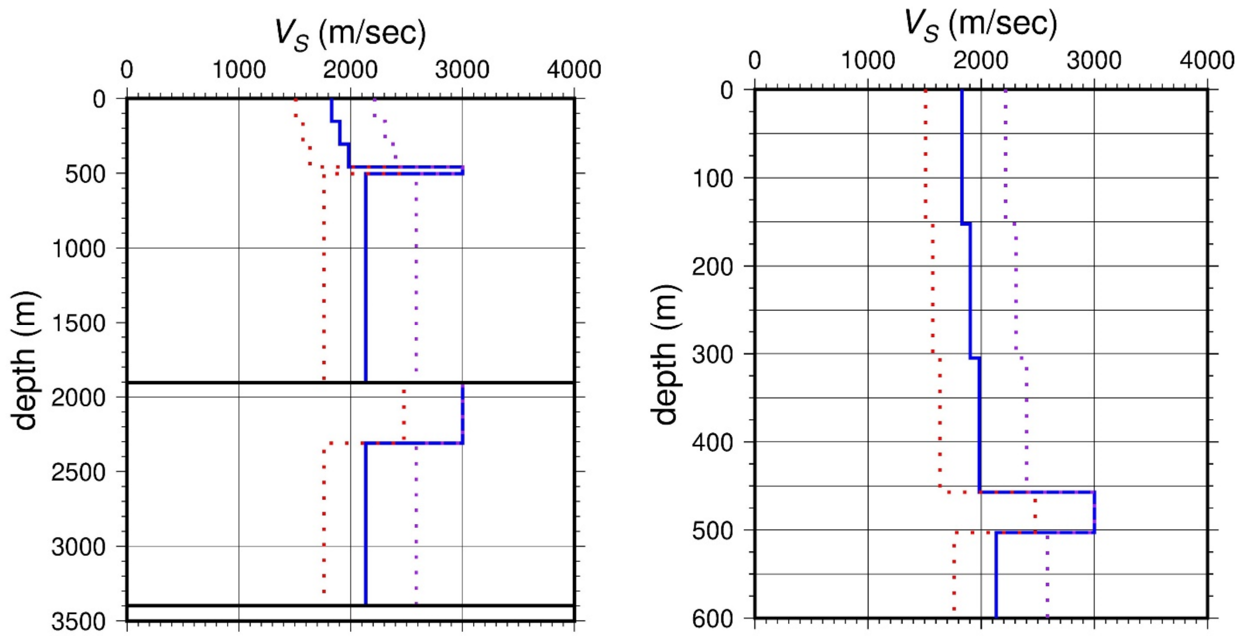

Figure 6 Complete (left) and upper 600 m (right) shear wave velocity (V_S) basecase profiles for Sequoyah; thick horizontal black lines indicate two reference rock horizons for shallow and deep profiles; best estimate basecase profile shown as solid blue line; lower and upper range basecase profiles shown as dotted red and purple lines, respectively

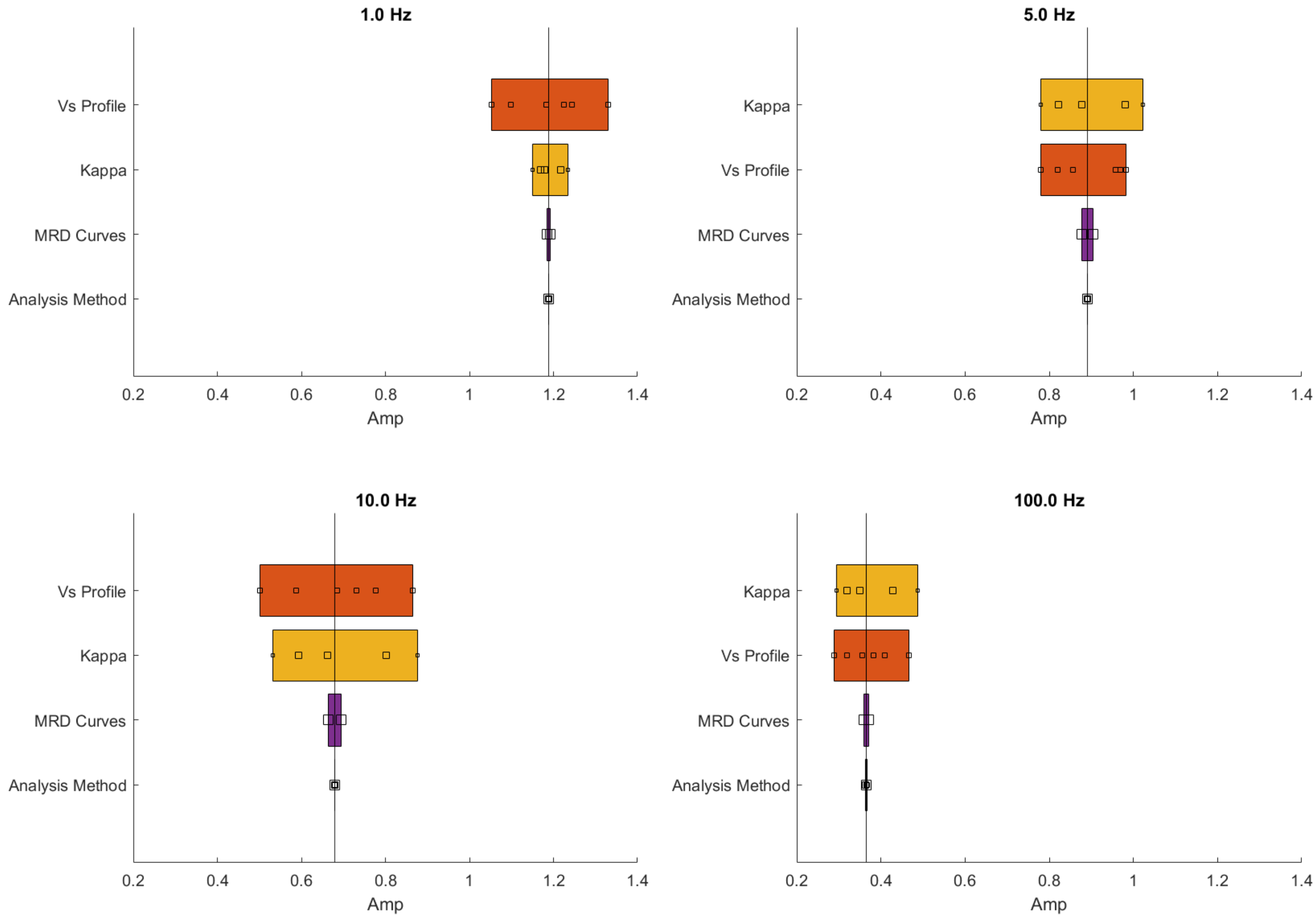

Figure 7 Tornado plots for site response logic tree nodes V_S profile, κ_0, MRD curves, and the analysis method for 1, 5, 10, and 100 Hz spectral frequencies for an input motion with a PGA of 0.63g.

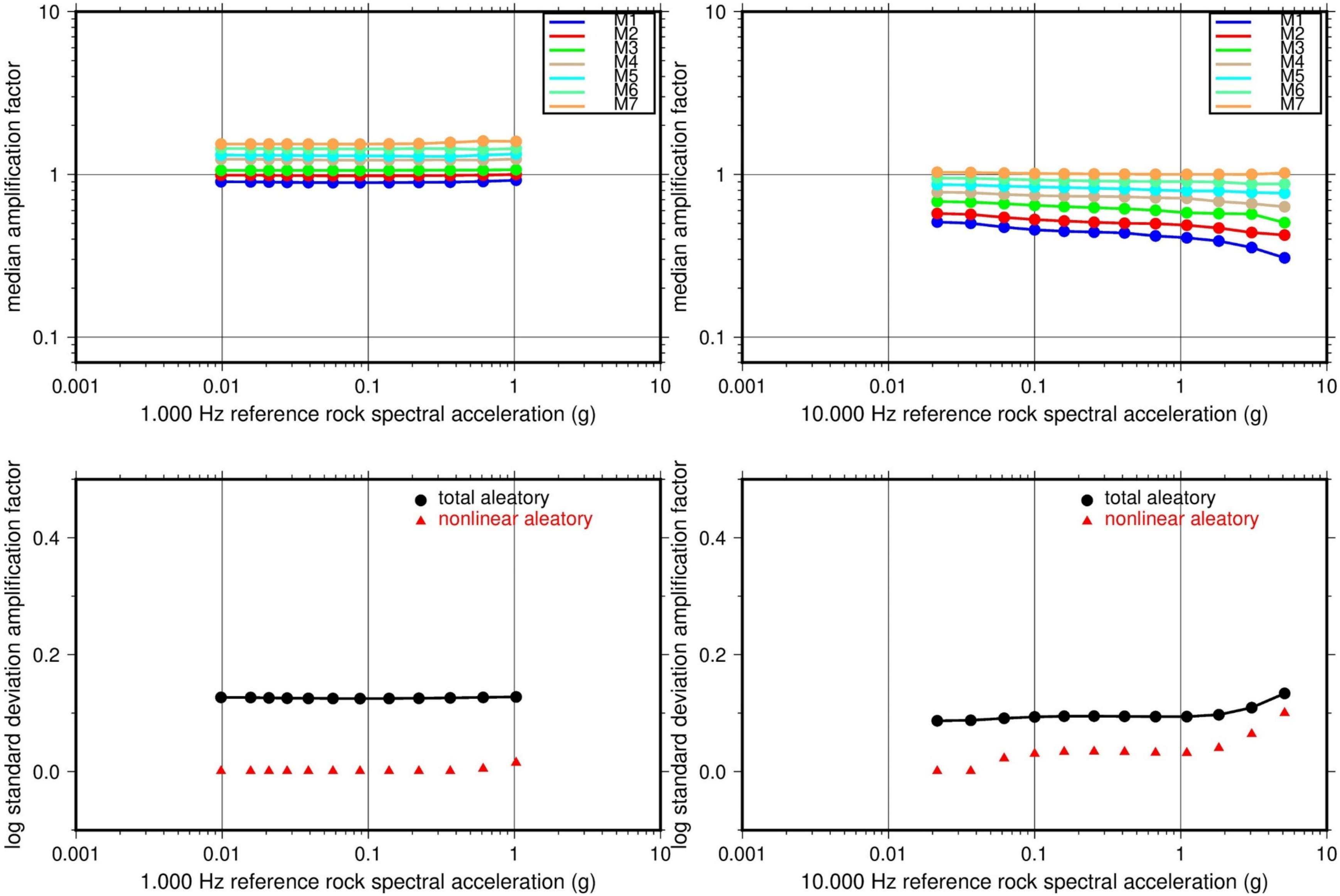

Figure 8 Seven median SAFs (above) and mean log standard deviations of SAF (below) as functions of input acceleration for 1 Hz (left) and 10 Hz (right)

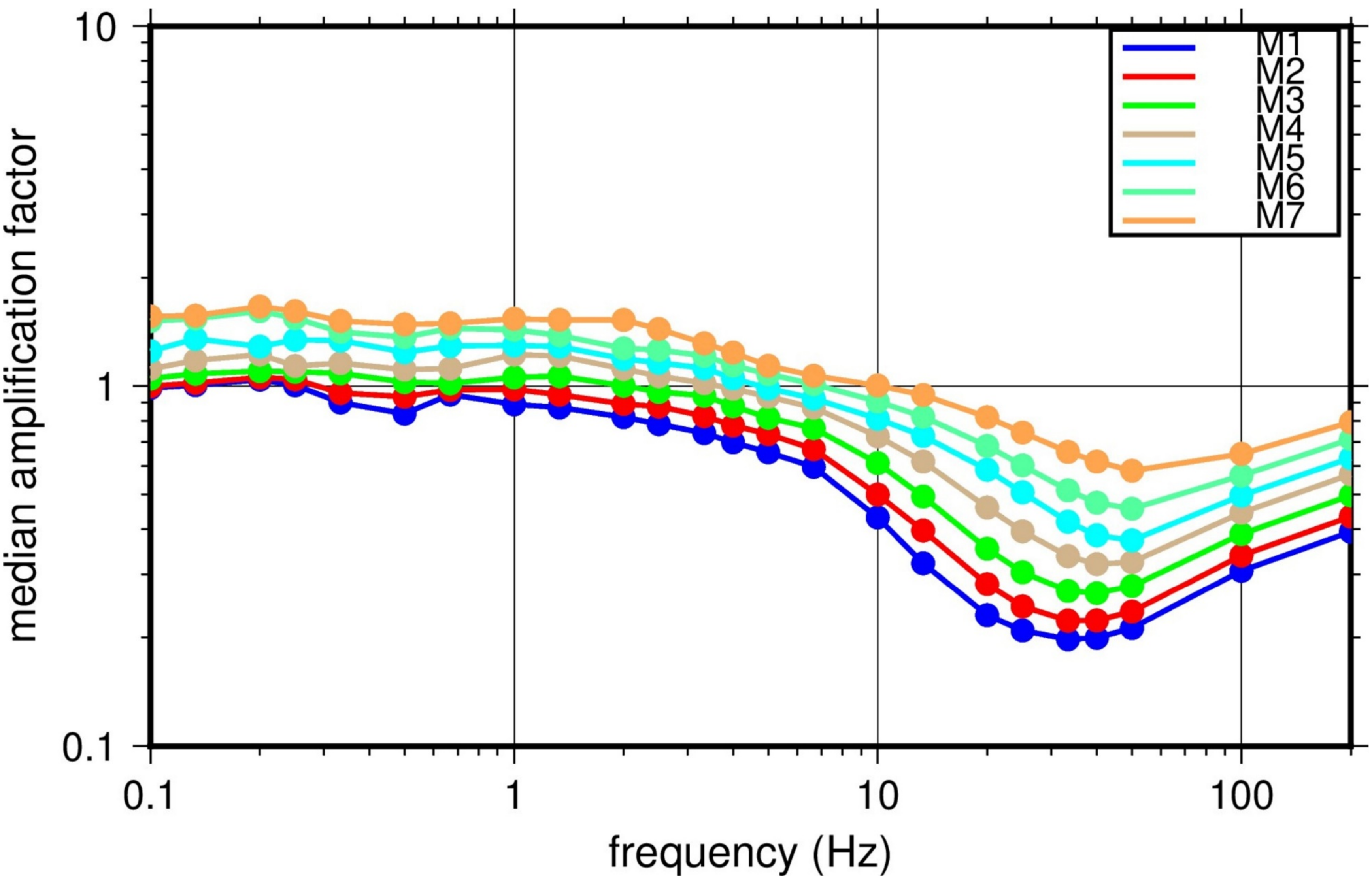

Figure 9 **Seven median SAFs as functions of spectral frequency for spectral accelerations at the 10^{-4} AFE level**

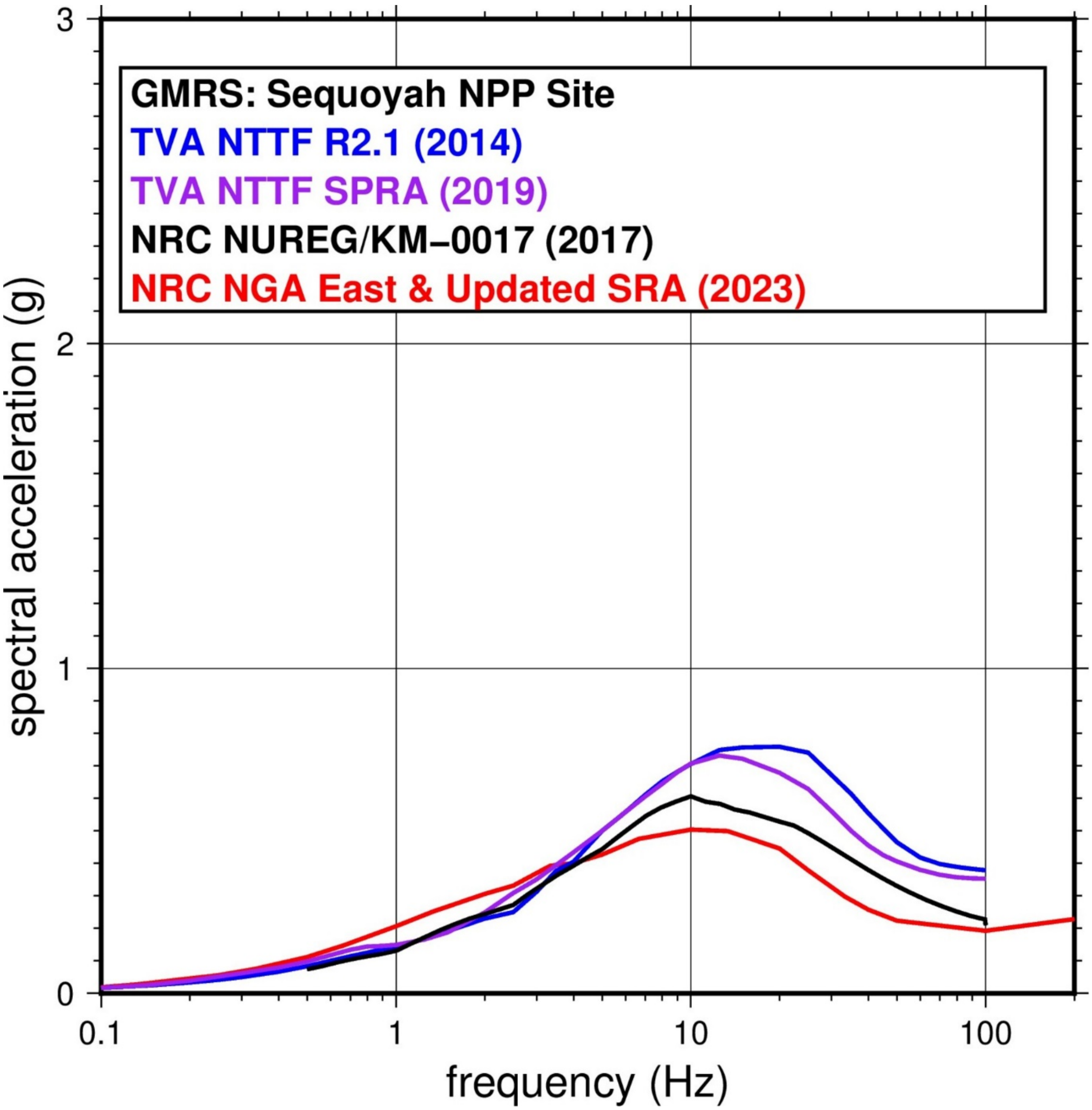

Figure 10 GMRS for the Sequoyah site

Appendix A—Data Tables

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.00Hz**
0.00100	3.34715E-03	4.38362E-03	6.27818E-03	7.98501E-03	1.06678E-02	1.87747E-02	2.63212E-02	4.26027E-02
0.00126	2.86560E-03	3.79077E-03	5.45115E-03	6.90176E-03	9.15058E-03	1.58046E-02	2.20085E-02	3.58843E-02
0.00158	2.46125E-03	3.28801E-03	4.74696E-03	5.98354E-03	7.87418E-03	1.33519E-02	1.84710E-02	3.03333E-02
0.00200	2.10063E-03	2.83510E-03	4.11004E-03	5.15679E-03	6.73364E-03	1.12011E-02	1.53895E-02	2.54625E-02
0.00251	1.74666E-03	2.40514E-03	3.52755E-03	4.44134E-03	5.79725E-03	9.48010E-03	1.28674E-02	2.11275E-02
0.00316	1.42703E-03	2.01915E-03	3.00681E-03	3.80327E-03	4.97197E-03	8.00683E-03	1.07326E-02	1.74552E-02
0.00398	1.10682E-03	1.64758E-03	2.52049E-03	3.21522E-03	4.23730E-03	6.76587E-03	8.95128E-03	1.43312E-02
0.00501	8.57796E-04	1.34369E-03	2.11263E-03	2.71818E-03	3.61173E-03	5.71907E-03	7.46861E-03	1.17715E-02
0.00631	5.67250E-04	9.75497E-04	1.66681E-03	2.20210E-03	2.99579E-03	4.78592E-03	6.20626E-03	9.62426E-03
0.00794	3.75736E-04	7.09102E-04	1.31632E-03	1.78550E-03	2.48674E-03	4.00788E-03	5.16109E-03	7.87501E-03
0.01000	2.48482E-04	5.14816E-04	1.03858E-03	1.44653E-03	2.06270E-03	3.35401E-03	4.28886E-03	6.43867E-03
0.01260	1.32322E-04	3.01886E-04	6.94523E-04	1.03190E-03	1.57749E-03	2.68679E-03	3.46376E-03	5.19824E-03
0.01580	7.13925E-05	1.78998E-04	4.68342E-04	7.41297E-04	1.21315E-03	2.16224E-03	2.80983E-03	4.21547E-03
0.02000	3.75431E-05	1.03852E-04	3.10688E-04	5.25261E-04	9.22822E-04	1.72445E-03	2.25961E-03	3.38885E-03
0.02510	1.76725E-05	5.24295E-05	1.75879E-04	3.18952E-04	6.21610E-04	1.27765E-03	1.72379E-03	2.64840E-03
0.03160	8.12246E-06	2.56869E-05	9.60052E-05	1.86350E-04	4.03246E-04	9.17184E-04	1.28137E-03	2.03024E-03
0.03980	3.55964E-06	1.17130E-05	4.74612E-05	9.75601E-05	2.34023E-04	5.98827E-04	8.82145E-04	1.47312E-03
0.05010	1.56271E-06	5.34907E-06	2.34842E-05	5.11023E-05	1.35811E-04	3.90784E-04	6.06991E-04	1.06839E-03
0.06310	6.65661E-07	2.33511E-06	1.05984E-05	2.37258E-05	6.75019E-05	2.14371E-04	3.55114E-04	6.72380E-04
0.07940	2.84517E-07	1.02276E-06	4.79832E-06	1.10492E-05	3.36443E-05	1.17880E-04	2.08201E-04	4.23941E-04
0.10000	1.21207E-07	4.46525E-07	2.16569E-06	5.13041E-06	1.67236E-05	6.46697E-05	1.21814E-04	2.66818E-04
0.12600	4.98496E-08	1.91543E-07	9.61128E-07	2.31067E-06	7.77807E-06	3.13182E-05	6.17989E-05	1.43461E-04
0.15800	2.08837E-08	8.36220E-08	4.33801E-07	1.05807E-06	3.67550E-06	1.53968E-05	3.17969E-05	7.81358E-05
0.20000	8.43809E-09	3.52703E-08	1.89425E-07	4.69019E-07	1.68354E-06	7.34924E-06	1.59144E-05	4.14948E-05
0.25100	3.37953E-09	1.48256E-08	8.45890E-08	2.15707E-07	8.07153E-07	3.57711E-06	7.96350E-06	2.13879E-05
0.31600	1.32727E-09	6.10509E-09	3.70608E-08	9.76675E-08	3.83257E-07	1.73279E-06	3.96716E-06	1.09499E-05
0.39800	5.08206E-10	2.43756E-09	1.57805E-08	4.34279E-08	1.82073E-07	8.53440E-07	2.00908E-06	5.64655E-06
0.50100	1.94958E-10	9.74997E-10	6.72997E-09	1.93380E-08	8.66107E-08	4.20997E-07	1.01911E-06	2.91662E-06
0.63100	7.11195E-11	3.71413E-10	2.71088E-09	8.10439E-09	3.89256E-08	2.03941E-07	5.15416E-07	1.51685E-06

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.00Hz**
0.79400	2.60487E-11	1.42032E-10	1.09594E-09	3.40831E-09	1.75504E-08	9.90803E-08	2.61383E-07	7.90932E-07
1.00000	9.50353E-12	5.41118E-11	4.41501E-10	1.42854E-09	7.88846E-09	4.80010E-08	1.32206E-07	4.11373E-07
1.26000	3.12736E-12	1.89751E-11	1.65475E-10	5.55122E-10	3.24143E-09	2.13023E-08	6.16153E-08	2.00506E-07
1.58000	1.05316E-12	6.80026E-12	6.32968E-11	2.19992E-10	1.35675E-09	9.61456E-09	2.91750E-08	9.91968E-08
2.00000	3.38967E-13	2.33528E-12	2.32638E-11	8.38903E-11	5.47697E-10	4.19824E-09	1.33917E-08	4.76609E-08
2.51000	1.00670E-13	7.54109E-13	8.21864E-12	3.08852E-11	2.12644E-10	1.74872E-09	5.82382E-09	2.16772E-08
3.16000	2.85713E-14	2.33629E-13	2.80416E-12	1.10187E-11	8.01940E-11	7.08252E-10	2.46351E-09	9.59778E-09
3.98000	7.33438E-15	6.61038E-14	8.90325E-13	3.69351E-12	2.85806E-11	2.71149E-10	9.84299E-10	4.01690E-09
5.01000	1.88597E-15	1.87324E-14	2.83088E-13	1.23988E-12	1.02010E-11	1.03955E-10	3.93797E-10	1.68325E-09
6.31000	4.03637E-16	4.45570E-15	7.71676E-14	3.62839E-13	3.23876E-12	3.59000E-11	1.41952E-10	6.37818E-10
7.94000	8.69208E-17	1.06593E-15	2.11449E-14	1.06704E-13	1.03301E-12	1.24506E-11	5.13786E-11	2.42622E-10
10.00000	1.86063E-17	2.53587E-16	5.76484E-15	3.12304E-14	3.28021E-13	4.30029E-12	1.85227E-11	9.19453E-11

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.00100	5.51481E-02	6.94351E-02	7.37809E-02	7.78401E-02	7.85026E-02	7.96631E-02	7.94890E-02	7.71684E-02
0.00126	4.72491E-02	6.13203E-02	6.59136E-02	7.03751E-02	7.11816E-02	7.26622E-02	7.24988E-02	6.99479E-02
0.00158	4.06116E-02	5.42938E-02	5.90231E-02	6.37593E-02	6.46747E-02	6.64032E-02	6.62498E-02	6.35325E-02
0.00200	3.46875E-02	4.78298E-02	5.26110E-02	5.75288E-02	5.85288E-02	6.04566E-02	6.03130E-02	5.74751E-02
0.00251	2.89752E-02	4.07064E-02	4.51640E-02	4.98524E-02	5.08917E-02	5.28797E-02	5.28402E-02	5.02781E-02
0.00316	2.40582E-02	3.43709E-02	3.84520E-02	4.28353E-02	4.38862E-02	4.58729E-02	4.59424E-02	4.36994E-02
0.00398	1.97282E-02	2.84523E-02	3.20437E-02	3.59830E-02	3.70191E-02	3.89207E-02	3.91502E-02	3.73766E-02
0.00501	1.61836E-02	2.35587E-02	2.67089E-02	3.02320E-02	3.12318E-02	3.30274E-02	3.33682E-02	3.19757E-02
0.00631	1.31205E-02	1.90447E-02	2.16731E-02	2.46849E-02	2.56242E-02	2.72599E-02	2.77622E-02	2.68639E-02
0.00794	1.06461E-02	1.54087E-02	1.76015E-02	2.01719E-02	2.10401E-02	2.25168E-02	2.31151E-02	2.25850E-02
0.01000	8.63136E-03	1.24566E-02	1.42832E-02	1.64711E-02	1.72628E-02	1.85852E-02	1.92321E-02	1.89748E-02
0.01260	6.92563E-03	9.89289E-03	1.13498E-02	1.31198E-02	1.38025E-02	1.49247E-02	1.55897E-02	1.55922E-02
0.01580	5.58244E-03	7.89449E-03	9.06203E-03	1.04999E-02	1.10871E-02	1.20398E-02	1.26924E-02	1.28650E-02

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.02000	4.45960E-03	6.24095E-03	7.16799E-03	8.32564E-03	8.82520E-03	9.62622E-03	1.02456E-02	1.05302E-02
0.02510	3.50509E-03	4.88794E-03	5.62651E-03	6.54443E-03	6.95538E-03	7.59435E-03	8.14330E-03	8.47327E-03
0.03160	2.71144E-03	3.78026E-03	4.36951E-03	5.09621E-03	5.43254E-03	5.93429E-03	6.40938E-03	6.74982E-03
0.03980	2.00799E-03	2.83100E-03	3.30724E-03	3.88501E-03	4.15876E-03	4.53598E-03	4.92948E-03	5.24602E-03
0.05010	1.48644E-03	2.11955E-03	2.50280E-03	2.96152E-03	3.18362E-03	3.46712E-03	3.79126E-03	4.07732E-03
0.06310	9.66825E-04	1.42048E-03	1.72031E-03	2.08069E-03	2.26041E-03	2.45684E-03	2.70952E-03	2.96029E-03
0.07940	6.29933E-04	9.53506E-04	1.18423E-03	1.46391E-03	1.60712E-03	1.74334E-03	1.93903E-03	2.15204E-03
0.10000	4.09748E-04	6.39054E-04	8.14021E-04	1.02855E-03	1.14113E-03	1.23540E-03	1.38583E-03	1.56252E-03
0.12600	2.27954E-04	3.69209E-04	4.83781E-04	6.30142E-04	7.12713E-04	7.82201E-04	9.02280E-04	1.05451E-03
0.15800	1.28371E-04	2.15751E-04	2.90639E-04	3.90003E-04	4.49511E-04	4.99978E-04	5.92710E-04	7.17505E-04
0.20000	7.05859E-05	1.23292E-04	1.70946E-04	2.36610E-04	2.78127E-04	3.13691E-04	3.82609E-04	4.80446E-04
0.25100	3.74139E-05	6.76900E-05	9.59176E-05	1.36492E-04	1.64083E-04	1.91355E-04	2.43864E-04	3.21088E-04
0.31600	1.96891E-05	3.68808E-05	5.33978E-05	7.81103E-05	9.60503E-05	1.15868E-04	1.54305E-04	2.12973E-04
0.39800	1.04073E-05	2.01204E-05	2.97119E-05	4.46008E-05	5.60812E-05	6.99654E-05	9.72144E-05	1.40211E-04
0.50100	5.50995E-06	1.09932E-05	1.65566E-05	2.55020E-05	3.27866E-05	4.22933E-05	6.12993E-05	9.23698E-05
0.63100	2.93685E-06	6.02690E-06	9.26897E-06	1.46087E-05	1.91306E-05	2.51299E-05	3.75257E-05	5.84840E-05
0.79400	1.56931E-06	3.31211E-06	5.20113E-06	8.38712E-06	1.11866E-05	1.49628E-05	2.30172E-05	3.70968E-05
1.00000	8.36520E-07	1.81595E-06	2.91197E-06	4.80483E-06	6.52770E-06	8.89119E-06	1.40913E-05	2.34892E-05
1.26000	4.18815E-07	9.35995E-07	1.53970E-06	2.60435E-06	3.59927E-06	4.94049E-06	8.02416E-06	1.37823E-05
1.58000	2.12719E-07	4.89124E-07	8.24960E-07	1.42970E-06	2.00926E-06	2.77894E-06	4.62302E-06	8.17683E-06
2.00000	1.05041E-07	2.48797E-07	4.30687E-07	7.65527E-07	1.09480E-06	1.52615E-06	2.60313E-06	4.74702E-06
2.51000	4.89518E-08	1.18779E-07	2.10589E-07	3.83730E-07	5.58342E-07	7.84063E-07	1.37528E-06	2.60022E-06
3.16000	2.22059E-08	5.51473E-08	1.00057E-07	1.86734E-07	2.76301E-07	3.90849E-07	7.05320E-07	1.38555E-06
3.98000	9.50823E-09	2.40658E-08	4.45096E-08	8.47098E-08	1.27139E-07	1.81093E-07	3.36300E-07	6.90309E-07
5.01000	4.07613E-09	1.05140E-08	1.98210E-08	3.84656E-08	5.85564E-08	8.39798E-08	1.60470E-07	3.44134E-07
6.31000	1.58159E-09	4.15298E-09	7.96499E-09	1.57001E-08	2.41464E-08	3.47857E-08	6.79103E-08	1.51523E-07
7.94000	6.16006E-10	1.64651E-09	3.21238E-09	6.43117E-09	9.99237E-09	1.44596E-08	2.88383E-08	6.69350E-08
10.00000	2.39046E-10	6.50437E-10	1.29103E-09	2.62523E-09	4.12091E-09	5.99001E-09	1.22055E-08	2.94746E-08

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.00100	7.48932E-02	7.20770E-02	6.98936E-02	6.72645E-02	6.56850E-02	6.32643E-02	5.87828E-02	5.80348E-02
0.00126	6.75297E-02	6.46321E-02	6.23796E-02	5.96663E-02	5.80700E-02	5.56465E-02	5.10842E-02	5.03612E-02
0.00158	6.10212E-02	5.80875E-02	5.58049E-02	5.30584E-02	5.14693E-02	4.90765E-02	4.45235E-02	4.38311E-02
0.00200	5.49081E-02	5.19744E-02	4.96926E-02	4.69525E-02	4.53906E-02	4.30567E-02	3.85842E-02	3.79281E-02
0.00251	4.79761E-02	4.53409E-02	4.32626E-02	4.07334E-02	3.92930E-02	3.71355E-02	3.29173E-02	3.22913E-02
0.00316	4.16830E-02	3.93561E-02	3.74903E-02	3.51842E-02	3.38678E-02	3.18908E-02	2.79555E-02	2.73567E-02
0.00398	3.57387E-02	3.37883E-02	3.21780E-02	3.01344E-02	2.89520E-02	2.71680E-02	2.35449E-02	2.29544E-02
0.00501	3.06496E-02	2.90159E-02	2.76261E-02	2.58166E-02	2.47567E-02	2.31512E-02	1.98360E-02	1.92661E-02
0.00631	2.58986E-02	2.46202E-02	2.34589E-02	2.18803E-02	2.09310E-02	1.94961E-02	1.64844E-02	1.59065E-02
0.00794	2.18989E-02	2.09042E-02	1.99334E-02	1.85564E-02	1.77083E-02	1.64294E-02	1.37093E-02	1.31428E-02
0.01000	1.85048E-02	1.77377E-02	1.69270E-02	1.57273E-02	1.49721E-02	1.38358E-02	1.13932E-02	1.08512E-02
0.01260	1.53166E-02	1.47814E-02	1.41109E-02	1.30633E-02	1.23926E-02	1.13966E-02	9.23110E-03	8.71388E-03
0.01580	1.27275E-02	1.23646E-02	1.18079E-02	1.08924E-02	1.02979E-02	9.42523E-03	7.51206E-03	7.02948E-03
0.02000	1.04950E-02	1.02664E-02	9.80785E-03	9.01385E-03	8.49163E-03	7.73359E-03	6.06098E-03	5.62025E-03
0.02510	8.49425E-03	8.37455E-03	7.99625E-03	7.30800E-03	6.85619E-03	6.21039E-03	4.76916E-03	4.37551E-03
0.03160	6.80165E-03	6.76050E-03	6.45010E-03	5.85800E-03	5.47188E-03	4.92865E-03	3.70172E-03	3.35703E-03
0.03980	5.30045E-03	5.31485E-03	5.06269E-03	4.55931E-03	4.23768E-03	3.79375E-03	2.77151E-03	2.47762E-03
0.05010	4.13070E-03	4.17860E-03	3.97400E-03	3.54885E-03	3.28220E-03	2.92047E-03	2.07534E-03	1.82886E-03
0.06310	3.01318E-03	3.09546E-03	2.93959E-03	2.60216E-03	2.39621E-03	2.11467E-03	1.45625E-03	1.26191E-03
0.07940	2.20077E-03	2.29583E-03	2.17706E-03	1.91038E-03	1.75158E-03	1.53318E-03	1.02329E-03	8.72014E-04
0.10000	1.60543E-03	1.70079E-03	1.61045E-03	1.40082E-03	1.27881E-03	1.11020E-03	7.18064E-04	6.01717E-04
0.12600	1.11026E-03	1.20170E-03	1.14111E-03	9.92736E-04	9.03834E-04	7.77401E-04	4.89275E-04	4.03704E-04
0.15800	7.73713E-04	8.55215E-04	8.14352E-04	7.08582E-04	6.43430E-04	5.48408E-04	3.36049E-04	2.73107E-04
0.20000	5.31149E-04	6.00084E-04	5.73069E-04	4.98721E-04	4.51624E-04	3.81295E-04	2.27232E-04	1.81780E-04
0.25100	3.65743E-04	4.21893E-04	4.05122E-04	3.53846E-04	3.19618E-04	2.67325E-04	1.54878E-04	1.22353E-04
0.31600	2.49842E-04	2.94175E-04	2.84007E-04	2.48822E-04	2.24078E-04	1.85540E-04	1.04352E-04	8.14273E-05
0.39800	1.68911E-04	2.02626E-04	1.96554E-04	1.72366E-04	1.54527E-04	1.26430E-04	6.87737E-05	5.30804E-05
0.50100	1.14259E-04	1.39635E-04	1.36091E-04	1.19451E-04	1.06606E-04	8.61866E-05	4.53464E-05	3.46185E-05
0.63100	7.38480E-05	9.16848E-05	8.95984E-05	7.83400E-05	6.94165E-05	5.53272E-05	2.80500E-05	2.11841E-05

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.79400	4.78130E-05	6.03018E-05	5.90874E-05	5.14646E-05	4.52781E-05	3.55801E-05	1.73843E-05	1.29887E-05
1.00000	3.09042E-05	3.95964E-05	3.89033E-05	3.37538E-05	2.94844E-05	2.28418E-05	1.07541E-05	7.94866E-06
1.26000	1.84237E-05	2.39338E-05	2.35235E-05	2.02319E-05	1.75044E-05	1.33570E-05	6.02151E-06	4.38207E-06
1.58000	1.11019E-05	1.46187E-05	1.43732E-05	1.22565E-05	1.05052E-05	7.89821E-06	3.41246E-06	2.44588E-06
2.00000	6.55051E-06	8.74786E-06	8.60424E-06	7.27186E-06	6.17225E-06	4.56941E-06	1.88875E-06	1.33248E-06
2.51000	3.64670E-06	4.93886E-06	4.85265E-06	4.05107E-06	3.39631E-06	2.47160E-06	9.68264E-07	6.68523E-07
3.16000	1.97724E-06	2.71788E-06	2.66717E-06	2.19747E-06	1.81800E-06	1.29933E-06	4.81312E-07	3.25006E-07
3.98000	1.00568E-06	1.40594E-06	1.37732E-06	1.11720E-06	9.09692E-07	6.37005E-07	2.21886E-07	1.46339E-07
5.01000	5.11813E-07	7.27681E-07	7.11633E-07	5.68314E-07	4.55469E-07	3.12501E-07	1.02379E-07	6.59541E-08
6.31000	2.30476E-07	3.33675E-07	3.25716E-07	2.55837E-07	2.01651E-07	1.35587E-07	4.20435E-08	2.65538E-08
7.94000	1.04118E-07	1.53483E-07	1.49548E-07	1.15537E-07	8.95686E-08	5.90250E-08	1.73274E-08	1.07298E-08
10.00000	4.68903E-08	7.03854E-08	6.84548E-08	5.20161E-08	3.96589E-08	2.56122E-08	7.11653E-09	4.32041E-09

Table A-4 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.100 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.000390	0.9884	0.9996	1.0504	1.1165	1.2524	1.5189	1.5635	0.061372	0.000000
0.000615	0.9883	0.9995	1.0503	1.1166	1.2523	1.5189	1.5634	0.061356	0.000000
0.000801	0.9881	0.9991	1.0499	1.1164	1.2516	1.5185	1.5631	0.061355	0.000000
0.001091	0.9879	0.9988	1.0496	1.1161	1.2507	1.5182	1.5629	0.061450	0.000000
0.001559	0.9877	0.9985	1.0495	1.1156	1.2501	1.5178	1.5626	0.061589	0.000000
0.002177	0.9876	0.9983	1.0494	1.1151	1.2499	1.5175	1.5624	0.061720	0.000000
0.003036	0.9875	0.9982	1.0493	1.1146	1.2497	1.5173	1.5623	0.061853	0.000000
0.004162	0.9875	0.9981	1.0493	1.1143	1.2495	1.5172	1.5621	0.061974	0.000000
0.005963	0.9876	0.9982	1.0494	1.1145	1.2496	1.5173	1.5624	0.062071	0.000000
0.009541	0.9878	0.9984	1.0495	1.1154	1.2500	1.5176	1.5629	0.062118	0.000000
0.016025	0.9883	0.9988	1.0498	1.1174	1.2512	1.5184	1.5639	0.062123	0.000752
0.026916	0.9892	0.9998	1.0504	1.1208	1.2532	1.5199	1.5657	0.062141	0.001674

Table A-5 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.133 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.000696	1.0067	1.0214	1.0823	1.1793	1.3559	1.5404	1.5690	0.073780	0.000000
0.001095	1.0066	1.0213	1.0822	1.1793	1.3558	1.5402	1.5690	0.073780	0.000000
0.001407	1.0061	1.0208	1.0819	1.1791	1.3551	1.5395	1.5689	0.073861	0.000000
0.001882	1.0057	1.0203	1.0817	1.1788	1.3543	1.5391	1.5688	0.074065	0.000000
0.002662	1.0054	1.0201	1.0817	1.1784	1.3536	1.5390	1.5689	0.074307	0.000000
0.003740	1.0053	1.0199	1.0817	1.1780	1.3530	1.5390	1.5689	0.074520	0.000000
0.005282	1.0052	1.0198	1.0817	1.1776	1.3524	1.5391	1.5690	0.074728	0.000000
0.007424	1.0052	1.0198	1.0818	1.1774	1.3523	1.5393	1.5691	0.074916	0.000000
0.010888	1.0054	1.0200	1.0820	1.1778	1.3526	1.5396	1.5693	0.075068	0.002251
0.017574	1.0059	1.0204	1.0824	1.1788	1.3537	1.5402	1.5695	0.075151	0.004188
0.029516	1.0065	1.0210	1.0827	1.1810	1.3563	1.5397	1.5705	0.075177	0.004631
0.049573	1.0073	1.0218	1.0832	1.1848	1.3621	1.5367	1.5745	0.075245	0.005628

Table A-6 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.200 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.001481	1.0412	1.0566	1.0999	1.2303	1.2904	1.6136	1.6641	0.097836	0.000000
0.002328	1.0412	1.0565	1.0999	1.2298	1.2903	1.6135	1.6641	0.097838	0.000000
0.002957	1.0409	1.0563	1.0997	1.2274	1.2897	1.6129	1.6641	0.097966	0.000000
0.003866	1.0408	1.0563	1.0997	1.2253	1.2892	1.6128	1.6640	0.098273	0.000000
0.005376	1.0409	1.0563	1.0998	1.2244	1.2888	1.6128	1.6641	0.098632	0.000000
0.007638	1.0409	1.0563	1.0998	1.2240	1.2885	1.6128	1.6643	0.098946	0.000000
0.011048	1.0410	1.0564	1.0999	1.2236	1.2884	1.6129	1.6645	0.099252	0.004049
0.016144	1.0411	1.0565	1.1000	1.2234	1.2883	1.6133	1.6644	0.099534	0.008512
0.024434	1.0413	1.0567	1.1002	1.2239	1.2881	1.6140	1.6640	0.099767	0.010904
0.039762	1.0416	1.0570	1.1004	1.2251	1.2879	1.6152	1.6630	0.099904	0.012093
0.066782	1.0422	1.0577	1.1008	1.2275	1.2880	1.6164	1.6638	0.099972	0.012643
0.112160	1.0432	1.0588	1.1016	1.2286	1.2941	1.6132	1.6729	0.100160	0.014052

Table A-7 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.250 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.002139	1.0066	1.0506	1.0955	1.1433	1.3450	1.5518	1.6219	0.102210	0.000000
0.003363	1.0064	1.0502	1.0955	1.1430	1.3451	1.5513	1.6214	0.102180	0.000000
0.004267	1.0055	1.0486	1.0953	1.1415	1.3450	1.5493	1.6191	0.102200	0.000000
0.005536	1.0049	1.0470	1.0952	1.1401	1.3450	1.5475	1.6172	0.102400	0.000000
0.007642	1.0044	1.0458	1.0957	1.1390	1.3450	1.5463	1.6160	0.102690	0.000000
0.010925	1.0043	1.0450	1.0957	1.1383	1.3449	1.5455	1.6151	0.102960	0.003709
0.016004	1.0042	1.0444	1.0958	1.1378	1.3448	1.5449	1.6147	0.103240	0.008455
0.023836	1.0044	1.0441	1.0960	1.1374	1.3448	1.5447	1.6147	0.103500	0.011191
0.036592	1.0049	1.0442	1.0963	1.1373	1.3452	1.5449	1.6151	0.103730	0.013149
0.059688	1.0060	1.0449	1.0970	1.1377	1.3463	1.5456	1.6161	0.103870	0.014212
0.100250	1.0083	1.0467	1.0982	1.1384	1.3485	1.5472	1.6191	0.103970	0.014925
0.168370	1.0110	1.0488	1.1009	1.1431	1.3525	1.5549	1.6153	0.104280	0.016950

Table A-8 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.003240	0.9075	0.9600	1.0907	1.1568	1.3452	1.4184	1.5225	0.110840	0.000000
0.005103	0.9070	0.9599	1.0905	1.1567	1.3445	1.4185	1.5223	0.110790	0.000000
0.006498	0.9055	0.9598	1.0897	1.1561	1.3460	1.4158	1.5195	0.110700	0.000000
0.008397	0.9034	0.9589	1.0888	1.1567	1.3441	1.4143	1.5188	0.110840	0.000000
0.011527	0.9020	0.9584	1.0877	1.1572	1.3427	1.4129	1.5184	0.111080	0.004889
0.016598	0.9011	0.9580	1.0869	1.1576	1.3419	1.4117	1.5182	0.111330	0.008917
0.024657	0.9004	0.9576	1.0861	1.1579	1.3413	1.4108	1.5180	0.111600	0.011819
0.037473	0.9003	0.9577	1.0856	1.1581	1.3410	1.4110	1.5172	0.111860	0.014064
0.058367	0.9003	0.9577	1.0853	1.1582	1.3387	1.4138	1.5165	0.112100	0.015860
0.095369	0.9017	0.9588	1.0853	1.1579	1.3391	1.4185	1.5126	0.112260	0.016954
0.160180	0.9052	0.9616	1.0858	1.1570	1.3409	1.4288	1.5041	0.112420	0.017983
0.269030	0.9108	0.9661	1.0868	1.1566	1.3423	1.4421	1.4995	0.112990	0.021257

Table A-9 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.500 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.005273	0.8431	0.9457	1.0256	1.1160	1.2577	1.3705	1.4918	0.108090	0.000000
0.008333	0.8430	0.9450	1.0258	1.1161	1.2567	1.3708	1.4913	0.108050	0.000000
0.010743	0.8421	0.9418	1.0270	1.1142	1.2530	1.3694	1.4920	0.107880	0.000000
0.013947	0.8405	0.9386	1.0275	1.1148	1.2492	1.3671	1.4918	0.107840	0.000000
0.019155	0.8391	0.9363	1.0275	1.1150	1.2466	1.3651	1.4914	0.107910	0.000000
0.027817	0.8377	0.9350	1.0277	1.1147	1.2451	1.3634	1.4911	0.108020	0.004458
0.041941	0.8370	0.9342	1.0271	1.1141	1.2439	1.3623	1.4906	0.108170	0.007232
0.065039	0.8374	0.9342	1.0262	1.1132	1.2424	1.3645	1.4879	0.108440	0.010526
0.102760	0.8392	0.9351	1.0255	1.1117	1.2422	1.3705	1.4810	0.108760	0.013427
0.168140	0.8428	0.9365	1.0246	1.1131	1.2444	1.3810	1.4658	0.109240	0.016880
0.282400	0.8511	0.9409	1.0253	1.1101	1.2456	1.3935	1.4659	0.110170	0.022113
0.474310	0.8637	0.9472	1.0253	1.1189	1.2517	1.3621	1.5549	0.113130	0.033911

Table A-10 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.667 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.007013	0.9532	0.9842	1.0270	1.1252	1.3123	1.4534	1.5012	0.117840	0.000000
0.011122	0.9534	0.9837	1.0266	1.1250	1.3112	1.4535	1.5007	0.117750	0.000000
0.014519	0.9518	0.9816	1.0241	1.1241	1.3066	1.4517	1.4988	0.117370	0.000000
0.019014	0.9502	0.9796	1.0218	1.1230	1.3024	1.4498	1.4970	0.117140	0.000000
0.026243	0.9490	0.9781	1.0199	1.1220	1.2992	1.4481	1.4958	0.117060	0.000000
0.038332	0.9482	0.9770	1.0187	1.1211	1.2972	1.4468	1.4950	0.117050	0.000000
0.058249	0.9473	0.9761	1.0184	1.1204	1.2956	1.4461	1.4945	0.117130	0.000000
0.091185	0.9471	0.9757	1.0184	1.1198	1.2940	1.4473	1.4934	0.117420	0.000000
0.145020	0.9480	0.9764	1.0191	1.1198	1.2919	1.4497	1.4962	0.117820	0.003406
0.237490	0.9498	0.9779	1.0226	1.1251	1.2889	1.4569	1.5039	0.118530	0.013394
0.398880	0.9518	0.9796	1.0276	1.1365	1.2858	1.4619	1.5243	0.119920	0.022602
0.669940	0.9586	0.9857	1.0317	1.1591	1.2936	1.4591	1.5603	0.123540	0.037312

Table A-11 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.009838	0.9007	0.9889	1.0591	1.2388	1.3151	1.4416	1.5368	0.126930	0.000000
0.015689	0.9005	0.9887	1.0592	1.2386	1.3138	1.4419	1.5374	0.126810	0.000000
0.020937	0.8975	0.9864	1.0592	1.2348	1.3105	1.4397	1.5369	0.126210	0.000000
0.027896	0.8945	0.9840	1.0590	1.2311	1.3071	1.4374	1.5361	0.125690	0.000000
0.038939	0.8920	0.9821	1.0589	1.2281	1.3044	1.4355	1.5352	0.125340	0.000000
0.057379	0.8901	0.9808	1.0586	1.2249	1.3028	1.4341	1.5345	0.125090	0.000000
0.087965	0.8889	0.9799	1.0581	1.2221	1.3014	1.4326	1.5351	0.124960	0.000000
0.138890	0.8896	0.9801	1.0583	1.2239	1.2978	1.4345	1.5380	0.125170	0.000000
0.222220	0.8928	0.9819	1.0600	1.2270	1.2923	1.4412	1.5460	0.125530	0.000000
0.364310	0.8965	0.9843	1.0613	1.2289	1.2882	1.4389	1.5708	0.126170	0.000000
0.611880	0.9049	0.9894	1.0639	1.2236	1.3124	1.4229	1.6030	0.127030	0.005144
1.027700	0.9208	0.9991	1.0692	1.2425	1.3351	1.4401	1.5956	0.127870	0.015511

Table A-12 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.012067	0.8881	0.9526	1.0748	1.2309	1.3059	1.3956	1.5384	0.120930	0.000000
0.019336	0.8874	0.9523	1.0746	1.2316	1.3047	1.3957	1.5369	0.120880	0.000000
0.026279	0.8833	0.9506	1.0730	1.2290	1.3009	1.3924	1.5340	0.120430	0.000000
0.035544	0.8792	0.9487	1.0719	1.2261	1.2970	1.3894	1.5311	0.119980	0.000000
0.050126	0.8763	0.9475	1.0696	1.2230	1.2939	1.3869	1.5286	0.119600	0.000000
0.074377	0.8744	0.9468	1.0674	1.2195	1.2920	1.3848	1.5272	0.119250	0.000000
0.114640	0.8726	0.9460	1.0655	1.2164	1.2906	1.3824	1.5264	0.118970	0.000000
0.181730	0.8720	0.9459	1.0659	1.2134	1.2882	1.3838	1.5286	0.119100	0.000000
0.291520	0.8742	0.9476	1.0667	1.2114	1.2860	1.3911	1.5322	0.119490	0.000000
0.478300	0.8758	0.9487	1.0671	1.2126	1.2876	1.3957	1.5278	0.119840	0.000000
0.803330	0.8836	0.9536	1.0679	1.2304	1.3094	1.3919	1.5195	0.119930	0.004395
1.349200	0.8891	0.9571	1.0700	1.2374	1.3307	1.3983	1.4915	0.119240	0.000000

Table A-13 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.015262	0.8347	0.9090	1.0070	1.1225	1.2158	1.2869	1.5495	0.118810	0.000000
0.024642	0.8349	0.9086	1.0069	1.1218	1.2151	1.2870	1.5496	0.118850	0.000000
0.034503	0.8320	0.9051	1.0059	1.1205	1.2103	1.2845	1.5445	0.118670	0.000000
0.047835	0.8287	0.9013	1.0048	1.1199	1.2035	1.2822	1.5400	0.118330	0.000000
0.068612	0.8258	0.8981	1.0038	1.1188	1.1984	1.2802	1.5351	0.117910	0.000000
0.102930	0.8231	0.8954	1.0030	1.1181	1.1953	1.2780	1.5298	0.117400	0.000000
0.159780	0.8203	0.8929	1.0023	1.1171	1.1933	1.2747	1.5251	0.116880	0.000000
0.254330	0.8196	0.8919	1.0021	1.1158	1.1899	1.2739	1.5268	0.116690	0.000000
0.409090	0.8207	0.8920	1.0017	1.1143	1.1882	1.2836	1.5171	0.116470	0.000000
0.671930	0.8254	0.8945	1.0014	1.1104	1.1993	1.2993	1.4948	0.115120	0.000000
1.128500	0.8247	0.8943	1.0011	1.1102	1.2034	1.2998	1.4860	0.112260	0.000000
1.895400	0.8126	0.8789	0.9990	1.1215	1.1677	1.2732	1.4994	0.110660	0.000000

Table A-14 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.500 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.016960	0.8007	0.8911	0.9808	1.0717	1.1759	1.2869	1.4666	0.120930	0.000000
0.027516	0.8000	0.8900	0.9818	1.0712	1.1752	1.2875	1.4640	0.120950	0.000000
0.039252	0.7964	0.8868	0.9789	1.0696	1.1745	1.2812	1.4567	0.120820	0.000000
0.055264	0.7926	0.8838	0.9758	1.0679	1.1720	1.2754	1.4506	0.120460	0.000000
0.080108	0.7892	0.8811	0.9733	1.0667	1.1680	1.2706	1.4471	0.119920	0.000000
0.120980	0.7874	0.8796	0.9707	1.0659	1.1644	1.2693	1.4431	0.119170	0.000000
0.188560	0.7861	0.8787	0.9668	1.0654	1.1616	1.2672	1.4397	0.118140	0.000000
0.300730	0.7833	0.8773	0.9615	1.0658	1.1616	1.2544	1.4427	0.116830	0.000000
0.484380	0.7807	0.8758	0.9597	1.0660	1.1552	1.2502	1.4468	0.115540	0.000000
0.796150	0.7794	0.8746	0.9573	1.0682	1.1488	1.2512	1.4435	0.112580	0.000000
1.337200	0.7763	0.8673	0.9607	1.0688	1.1328	1.2497	1.4463	0.110110	0.000000
2.245900	0.7305	0.8682	0.9514	1.0347	1.1114	1.2132	1.4343	0.112450	0.000000

Table A-15 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=3.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.018964	0.7652	0.8458	0.9460	1.0494	1.1439	1.2434	1.3445	0.104140	0.000000
0.030981	0.7643	0.8452	0.9457	1.0479	1.1433	1.2429	1.3424	0.104110	0.000000
0.045399	0.7603	0.8409	0.9444	1.0419	1.1398	1.2376	1.3360	0.104010	0.000000
0.065344	0.7568	0.8366	0.9430	1.0366	1.1359	1.2323	1.3303	0.103650	0.000000
0.096151	0.7541	0.8326	0.9419	1.0324	1.1323	1.2279	1.3256	0.103130	0.000000
0.146590	0.7515	0.8289	0.9415	1.0296	1.1271	1.2240	1.3241	0.102370	0.000000
0.229740	0.7465	0.8262	0.9409	1.0228	1.1246	1.2201	1.3166	0.101350	0.000000
0.367410	0.7340	0.8237	0.9412	1.0147	1.1205	1.2078	1.3130	0.099640	0.000000
0.592910	0.7255	0.8269	0.9283	1.0153	1.1120	1.2027	1.3085	0.097641	0.000000
0.975570	0.7340	0.8112	0.9128	1.0059	1.0948	1.1876	1.3116	0.095430	0.000000
1.638500	0.7059	0.8179	0.8974	0.9974	1.0794	1.1740	1.2952	0.094724	0.000000
2.752000	0.6754	0.7952	0.8761	0.9481	1.0381	1.1487	1.2468	0.102230	0.000000

Table A-16 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=4.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.020053	0.7117	0.7985	0.9012	0.9958	1.0771	1.1652	1.2784	0.093579	0.000000
0.032924	0.7113	0.7974	0.8998	0.9954	1.0764	1.1635	1.2764	0.093638	0.000000
0.049170	0.7092	0.7930	0.8944	0.9935	1.0726	1.1560	1.2698	0.093861	0.004640
0.071874	0.7069	0.7889	0.8895	0.9921	1.0671	1.1495	1.2651	0.093772	0.002198
0.106870	0.7043	0.7854	0.8857	0.9899	1.0628	1.1439	1.2600	0.093455	0.000000
0.164010	0.7010	0.7819	0.8829	0.9876	1.0590	1.1381	1.2545	0.092873	0.000000
0.258050	0.6988	0.7795	0.8806	0.9848	1.0531	1.1390	1.2477	0.092011	0.000000
0.413500	0.6974	0.7738	0.8775	0.9803	1.0471	1.1419	1.2278	0.090323	0.000000
0.668250	0.6925	0.7680	0.8579	0.9790	1.0369	1.1204	1.2197	0.088809	0.000000
1.100400	0.6784	0.7644	0.8443	0.9637	1.0329	1.0988	1.2068	0.087293	0.000000
1.848200	0.6552	0.7468	0.8496	0.9275	1.0190	1.0775	1.1867	0.087454	0.000000
3.104100	0.6230	0.7493	0.8193	0.9034	0.9942	1.0579	1.1503	0.095265	0.016943

Table A-17 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=5.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.021114	0.6744	0.7510	0.8338	0.9670	1.0035	1.1035	1.1693	0.091268	0.000000
0.034897	0.6727	0.7501	0.8325	0.9650	1.0019	1.1018	1.1671	0.091433	0.000000
0.053467	0.6668	0.7464	0.8282	0.9590	0.9961	1.0960	1.1586	0.091801	0.006774
0.079795	0.6624	0.7434	0.8245	0.9537	0.9925	1.0907	1.1515	0.091817	0.006988
0.120320	0.6597	0.7412	0.8217	0.9490	0.9900	1.0876	1.1466	0.091589	0.002648
0.186270	0.6579	0.7398	0.8193	0.9444	0.9882	1.0863	1.1421	0.091076	0.000000
0.294640	0.6562	0.7384	0.8172	0.9376	0.9865	1.0854	1.1395	0.090433	0.000000
0.473500	0.6525	0.7289	0.8162	0.9272	0.9859	1.0684	1.1401	0.089005	0.000000
0.766830	0.6447	0.7233	0.8178	0.9158	0.9822	1.0619	1.1325	0.087599	0.000000
1.264100	0.6428	0.7128	0.8146	0.8942	0.9768	1.0540	1.1223	0.086880	0.000000
2.123200	0.6253	0.7054	0.7960	0.8806	0.9606	1.0283	1.1090	0.088188	0.000000
3.566000	0.5694	0.6893	0.7607	0.8407	0.9516	1.0169	1.0914	0.101800	0.044516

Table A-18 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=6.667 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.021916	0.6313	0.7046	0.7878	0.9029	0.9443	1.0412	1.0975	0.085185	0.000000
0.036575	0.6282	0.7015	0.7858	0.8995	0.9421	1.0385	1.0956	0.085590	0.000000
0.058174	0.6161	0.6905	0.7781	0.8935	0.9356	1.0318	1.0917	0.086736	0.012633
0.089486	0.6077	0.6827	0.7724	0.8877	0.9303	1.0275	1.0883	0.087299	0.016049
0.137710	0.6025	0.6774	0.7687	0.8834	0.9280	1.0253	1.0843	0.087354	0.016346
0.215910	0.5993	0.6736	0.7663	0.8791	0.9265	1.0229	1.0795	0.086932	0.013915
0.344250	0.5968	0.6697	0.7644	0.8736	0.9246	1.0157	1.0713	0.086122	0.007312
0.555830	0.5949	0.6650	0.7634	0.8679	0.9232	1.0059	1.0628	0.085113	0.000000
0.903260	0.5867	0.6572	0.7620	0.8508	0.9210	0.9968	1.0598	0.083462	0.000000
1.491700	0.5626	0.6388	0.7426	0.8243	0.9205	0.9965	1.0601	0.084647	0.000000
2.505300	0.5179	0.6133	0.7105	0.7998	0.9027	0.9718	1.0644	0.091309	0.031206
4.207800	0.4514	0.5683	0.6756	0.7773	0.8994	0.9739	1.0667	0.112130	0.072178

Table A-19 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=10.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.021591	0.5098	0.5755	0.6814	0.7775	0.8659	0.9501	1.0299	0.087016	0.000000
0.036608	0.5013	0.5682	0.6758	0.7719	0.8615	0.9462	1.0272	0.087905	0.000000
0.061937	0.4740	0.5443	0.6607	0.7537	0.8470	0.9337	1.0184	0.091390	0.022831
0.100210	0.4569	0.5283	0.6455	0.7422	0.8377	0.9250	1.0124	0.093680	0.030742
0.159540	0.4473	0.5170	0.6346	0.7355	0.8310	0.9185	1.0086	0.094774	0.033930
0.255500	0.4419	0.5081	0.6253	0.7315	0.8241	0.9115	1.0061	0.094956	0.034435
0.413150	0.4374	0.5008	0.6153	0.7285	0.8154	0.9067	1.0041	0.094723	0.033787
0.673070	0.4190	0.4982	0.6017	0.7189	0.8021	0.9034	1.0026	0.094224	0.032362
1.101000	0.4078	0.4873	0.5813	0.7126	0.7922	0.9032	1.0014	0.094152	0.032151
1.824000	0.3897	0.4681	0.5748	0.6824	0.7916	0.8974	1.0009	0.097322	0.040505
3.063500	0.3553	0.4397	0.5713	0.6605	0.7741	0.8741	1.0014	0.109430	0.064374
5.145300	0.3074	0.4240	0.5051	0.6328	0.7668	0.8741	1.0186	0.133860	0.100437

Table A-20 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=13.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.020246	0.4614	0.5209	0.6211	0.7135	0.8159	0.8920	0.9920	0.092359	0.000000
0.034750	0.4468	0.5063	0.6071	0.7019	0.8076	0.8862	0.9870	0.094181	0.000000
0.061800	0.3996	0.4612	0.5626	0.6664	0.7735	0.8651	0.9707	0.101150	0.032211
0.104280	0.3601	0.4297	0.5356	0.6463	0.7512	0.8506	0.9597	0.106090	0.045402
0.170860	0.3421	0.4132	0.5266	0.6354	0.7379	0.8409	0.9515	0.108870	0.051565
0.278600	0.3322	0.4053	0.5133	0.6278	0.7303	0.8342	0.9471	0.110030	0.053971
0.456160	0.3250	0.3988	0.4995	0.6196	0.7282	0.8254	0.9460	0.110560	0.055043
0.749430	0.3156	0.3943	0.4813	0.6136	0.7241	0.8155	0.9451	0.110870	0.055663
1.233400	0.3052	0.3823	0.4731	0.6096	0.7068	0.8115	0.9445	0.112000	0.057881
2.049400	0.2923	0.3657	0.4689	0.5803	0.7061	0.8192	0.9456	0.116500	0.066170
3.442000	0.2687	0.3411	0.4555	0.5429	0.6770	0.8015	0.9517	0.127250	0.083659
5.781000	0.2379	0.3243	0.3958	0.5157	0.6627	0.8123	0.9613	0.146870	0.111252

Table A-21 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=20.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.017198	0.4658	0.5140	0.5854	0.6758	0.7515	0.8403	0.9438	0.085079	0.000000
0.029978	0.4402	0.4881	0.5633	0.6517	0.7363	0.8228	0.9310	0.087680	0.000000
0.057271	0.3540	0.4008	0.4817	0.5694	0.6673	0.7654	0.8886	0.099316	0.035212
0.103340	0.2993	0.3447	0.4249	0.5221	0.6204	0.7301	0.8628	0.109250	0.057548
0.177530	0.2693	0.3133	0.3991	0.4969	0.6047	0.7101	0.8468	0.115610	0.068861
0.298380	0.2472	0.2956	0.3787	0.4819	0.5966	0.6967	0.8324	0.118960	0.074348
0.499340	0.2346	0.2845	0.3605	0.4631	0.5909	0.6839	0.8215	0.120960	0.077508
0.833030	0.2238	0.2763	0.3417	0.4551	0.5773	0.6788	0.8182	0.121940	0.079029
1.386300	0.2135	0.2655	0.3329	0.4488	0.5583	0.6754	0.8155	0.122690	0.080181
2.315300	0.2040	0.2550	0.3303	0.4278	0.5570	0.6739	0.8147	0.125070	0.083778
3.888700	0.1953	0.2417	0.3245	0.4013	0.5273	0.6547	0.8147	0.131470	0.093062
6.531300	0.1773	0.2244	0.2792	0.3763	0.5135	0.6526	0.8147	0.141190	0.106352

Table A-22 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=25.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.015309	0.5012	0.5450	0.6046	0.6947	0.7497	0.8447	0.9407	0.077643	0.000000
0.026801	0.4700	0.5159	0.5757	0.6630	0.7248	0.8194	0.9209	0.079439	0.000000
0.052834	0.3609	0.4026	0.4757	0.5506	0.6382	0.7315	0.8518	0.088808	0.025836
0.099007	0.2895	0.3282	0.3964	0.4767	0.5637	0.6728	0.8088	0.098430	0.049690
0.175110	0.2502	0.2867	0.3531	0.4363	0.5360	0.6419	0.7839	0.105200	0.062030
0.300000	0.2288	0.2630	0.3318	0.4148	0.5222	0.6256	0.7644	0.108980	0.068244
0.509300	0.2139	0.2470	0.3101	0.3997	0.5104	0.6050	0.7450	0.111390	0.072031
0.858470	0.1984	0.2366	0.2903	0.3848	0.4982	0.5957	0.7399	0.112480	0.073705
1.439300	0.1878	0.2272	0.2786	0.3767	0.4716	0.5907	0.7365	0.113030	0.074542
2.412200	0.1795	0.2183	0.2744	0.3538	0.4691	0.5885	0.7350	0.114530	0.076797
4.051400	0.1737	0.2088	0.2694	0.3363	0.4495	0.5660	0.7350	0.119330	0.083787
6.804600	0.1596	0.1947	0.2413	0.3162	0.4389	0.5660	0.7350	0.127020	0.094418

Table A-23 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=33.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.013154	0.5644	0.6000	0.6581	0.7498	0.7923	0.8922	0.9741	0.073133	0.000000
0.022962	0.5333	0.5702	0.6256	0.7103	0.7593	0.8529	0.9371	0.073854	0.000000
0.045969	0.3975	0.4369	0.4923	0.5683	0.6337	0.7232	0.8256	0.078545	0.012115
0.089771	0.3021	0.3363	0.3971	0.4599	0.5326	0.6272	0.7453	0.084855	0.034320
0.164910	0.2489	0.2800	0.3348	0.3972	0.4678	0.5743	0.6994	0.090106	0.045788
0.290120	0.2200	0.2483	0.2998	0.3617	0.4400	0.5450	0.6711	0.093288	0.051770
0.502790	0.2001	0.2257	0.2733	0.3395	0.4225	0.5180	0.6581	0.095439	0.055552
0.860550	0.1865	0.2099	0.2526	0.3251	0.4104	0.4943	0.6486	0.096350	0.057103
1.458900	0.1753	0.2000	0.2373	0.3116	0.3885	0.4826	0.6406	0.096620	0.057558
2.457500	0.1655	0.1928	0.2317	0.2906	0.3803	0.4787	0.6343	0.097205	0.058534
4.127600	0.1604	0.1860	0.2254	0.2800	0.3651	0.4657	0.6319	0.100250	0.063463
6.932400	0.1487	0.1761	0.2113	0.2697	0.3621	0.4655	0.6319	0.106990	0.073650

Table A-24 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=40.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.012119	0.5939	0.6343	0.6924	0.7969	0.8338	0.9417	1.0240	0.072358	0.000000
0.021015	0.5687	0.6053	0.6643	0.7590	0.7986	0.9003	0.9817	0.072766	0.000000
0.041583	0.4341	0.4734	0.5245	0.6009	0.6550	0.7430	0.8338	0.075619	0.004951
0.082413	0.3236	0.3571	0.4094	0.4734	0.5431	0.6233	0.7250	0.079920	0.026334
0.154650	0.2599	0.2892	0.3422	0.3962	0.4589	0.5487	0.6667	0.083870	0.036612
0.276670	0.2253	0.2519	0.3001	0.3534	0.4132	0.5097	0.6378	0.086363	0.042010
0.486140	0.2014	0.2253	0.2687	0.3228	0.3871	0.4770	0.6188	0.088061	0.045398
0.840900	0.1854	0.2062	0.2452	0.3037	0.3704	0.4527	0.6051	0.088661	0.046552
1.436700	0.1733	0.1940	0.2265	0.2888	0.3518	0.4377	0.5943	0.088581	0.046399
2.428900	0.1643	0.1872	0.2197	0.2701	0.3413	0.4323	0.5862	0.088692	0.046611
4.079400	0.1590	0.1811	0.2149	0.2611	0.3292	0.4202	0.5789	0.090881	0.050652
6.851500	0.1478	0.1735	0.2044	0.2528	0.3260	0.4193	0.5760	0.097272	0.061385

Table A-25 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=50.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.011237	0.6242	0.6712	0.7336	0.8475	0.8839	0.9968	1.0732	0.072075	0.000000
0.019294	0.6041	0.6458	0.7057	0.8131	0.8525	0.9591	1.0371	0.072345	0.000000
0.036891	0.4861	0.5251	0.5764	0.6559	0.7013	0.7904	0.8716	0.074213	0.000000
0.072920	0.3623	0.3975	0.4461	0.5122	0.5696	0.6500	0.7393	0.077076	0.019559
0.139230	0.2853	0.3151	0.3620	0.4180	0.4802	0.5547	0.6554	0.079787	0.028422
0.253600	0.2424	0.2688	0.3171	0.3641	0.4178	0.4973	0.6119	0.081425	0.032740
0.452910	0.2128	0.2363	0.2783	0.3252	0.3737	0.4572	0.5825	0.082468	0.035254
0.793760	0.1929	0.2133	0.2503	0.2959	0.3471	0.4271	0.5615	0.082670	0.035724
1.369700	0.1786	0.1977	0.2289	0.2802	0.3290	0.4090	0.5461	0.082245	0.034729
2.326300	0.1701	0.1896	0.2191	0.2631	0.3172	0.3986	0.5364	0.082077	0.034329
3.907100	0.1640	0.1841	0.2148	0.2519	0.3113	0.3837	0.5330	0.083873	0.038426
6.562200	0.1526	0.1783	0.2062	0.2470	0.3074	0.3831	0.5277	0.090158	0.050698

Table A-26 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=100.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.010157	0.6752	0.7273	0.8008	0.9278	0.9674	1.0780	1.1587	0.071894	0.000000
0.017129	0.6599	0.7117	0.7813	0.9066	0.9449	1.0545	1.1314	0.072062	0.000000
0.029653	0.5875	0.6344	0.6974	0.7987	0.8398	0.9406	1.0175	0.073189	0.000000
0.052661	0.4984	0.5450	0.5999	0.6826	0.7293	0.8165	0.8946	0.074861	0.010919
0.095017	0.4147	0.4556	0.5103	0.5828	0.6356	0.7145	0.7965	0.076417	0.018831
0.170860	0.3564	0.3927	0.4452	0.5099	0.5647	0.6371	0.7176	0.077238	0.021926
0.307240	0.3100	0.3419	0.3916	0.4494	0.5023	0.5694	0.6527	0.077640	0.023303
0.547090	0.2760	0.3038	0.3520	0.4010	0.4429	0.5149	0.6057	0.077349	0.022314
0.960500	0.2511	0.2755	0.3165	0.3613	0.4053	0.4742	0.5725	0.076657	0.019783
1.646600	0.2371	0.2610	0.2975	0.3454	0.3881	0.4629	0.5571	0.076390	0.018721
2.765500	0.2294	0.2545	0.2918	0.3296	0.3866	0.4410	0.5558	0.078065	0.024682
4.644800	0.2138	0.2487	0.2818	0.3229	0.3819	0.4394	0.5544	0.084543	0.040775

Table A-27 Site Adjustment Factor Medians and Logarithmic Standard Deviation for PGA									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.010020	0.6832	0.7357	0.8107	0.9383	0.9792	1.0915	1.1710	0.071880	0.000000
0.016836	0.6692	0.7225	0.7934	0.9212	0.9602	1.0690	1.1489	0.072034	0.000000
0.028357	0.6112	0.6602	0.7269	0.8339	0.8748	0.9800	1.0558	0.073056	0.000000
0.047926	0.5475	0.5978	0.6572	0.7462	0.7957	0.8873	0.9639	0.074518	0.008649
0.081326	0.4844	0.5318	0.5940	0.6776	0.7342	0.8210	0.9028	0.075815	0.016425
0.138230	0.4404	0.4848	0.5478	0.6266	0.6879	0.7677	0.8517	0.076417	0.019011
0.235540	0.4038	0.4450	0.5078	0.5819	0.6496	0.7243	0.8069	0.076615	0.019792
0.401380	0.3754	0.4129	0.4777	0.5428	0.5980	0.6889	0.7709	0.076149	0.017904
0.682720	0.3524	0.3861	0.4433	0.5027	0.5598	0.6450	0.7428	0.075327	0.014001
1.154100	0.3374	0.3711	0.4222	0.4880	0.5446	0.6426	0.7296	0.074909	0.011543
1.938300	0.3268	0.3620	0.4146	0.4665	0.5437	0.6046	0.7296	0.076430	0.019064
3.255500	0.3046	0.3540	0.3997	0.4572	0.5387	0.6043	0.7296	0.082964	0.037482

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	F0.100Hz	F0.133Hz	F0.200Hz	F0.250Hz	F0.333Hz	F0.500Hz	F0.667Hz	F1.000Hz
0.00100	3.50468E-03	4.68004E-03	6.69169E-03	8.52664E-03	1.11370E-02	1.96932E-02	2.76548E-02	4.46802E-02
0.00130	3.11926E-03	4.31773E-03	6.18626E-03	7.86461E-03	1.02327E-02	1.78427E-02	2.50931E-02	4.06857E-02
0.00160	2.67866E-03	3.75241E-03	5.55453E-03	6.89123E-03	8.82501E-03	1.51935E-02	2.11347E-02	3.45003E-02
0.00200	2.28827E-03	3.24736E-03	4.83530E-03	5.96434E-03	7.57573E-03	1.23463E-02	1.76827E-02	2.90461E-02
0.00250	1.92946E-03	2.79177E-03	4.18380E-03	5.14678E-03	6.50123E-03	1.07887E-02	1.47738E-02	2.43211E-02
0.00320	1.59156E-03	2.37079E-03	3.59798E-03	4.42777E-03	5.57834E-03	8.98302E-03	1.23319E-02	2.02000E-02
0.00400	1.27484E-03	1.98065E-03	3.06468E-03	3.78477E-03	4.77819E-03	7.50668E-03	1.02920E-02	1.66725E-02
0.00500	9.86299E-04	1.62696E-03	2.58647E-03	3.21131E-03	4.07057E-03	6.35155E-03	8.58274E-03	1.37075E-02
0.00630	7.19169E-04	1.29027E-03	2.14099E-03	2.68688E-03	3.43784E-03	5.29625E-03	7.15106E-03	1.12414E-02
0.00790	4.88026E-04	9.65681E-04	1.72781E-03	2.20292E-03	2.87100E-03	4.45920E-03	5.94944E-03	9.20339E-03
0.01000	3.20202E-04	7.01490E-04	1.37555E-03	1.78690E-03	2.36942E-03	3.69406E-03	4.93588E-03	7.52090E-03
0.01260	1.97537E-04	4.87289E-04	1.04737E-03	1.40223E-03	1.91585E-03	3.03274E-03	4.06525E-03	6.12685E-03
0.01580	1.10258E-04	3.05399E-04	7.51609E-04	1.04013E-03	1.49805E-03	2.44691E-03	3.30951E-03	4.96653E-03
0.02000	5.87436E-05	1.79578E-04	5.17826E-04	7.47253E-04	1.13885E-03	1.95076E-03	2.66525E-03	4.00449E-03

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.02510	3.01613E-05	1.02466E-04	3.35994E-04	5.14549E-04	8.37675E-04	1.50843E-03	2.10955E-03	3.19372E-03
0.03160	1.44907E-05	5.43495E-05	2.05000E-04	3.28158E-04	5.76494E-04	1.10975E-03	1.61250E-03	2.49138E-03
0.03980	6.63413E-06	2.65863E-05	1.16179E-04	1.92722E-04	3.68509E-04	7.73436E-04	1.18108E-03	1.88845E-03
0.05010	2.94811E-06	1.25011E-05	6.12140E-05	1.05861E-04	2.21061E-04	5.10567E-04	8.25419E-04	1.38139E-03
0.06310	1.28731E-06	5.68823E-06	3.07401E-05	5.50511E-05	1.24321E-04	3.15552E-04	5.45486E-04	9.64602E-04
0.07940	5.54339E-07	2.53963E-06	1.46664E-05	2.70379E-05	6.56201E-05	1.80618E-04	3.36941E-04	6.34776E-04
0.10000	2.36944E-07	1.11402E-06	6.79852E-06	1.27429E-05	3.26091E-05	9.88716E-05	1.96403E-04	3.97480E-04
0.12600	1.00527E-07	4.85350E-07	3.05296E-06	5.88988E-06	1.60464E-05	5.25337E-05	1.11685E-04	2.41676E-04
0.15800	4.27759E-08	2.14023E-07	1.39547E-06	2.73195E-06	7.69086E-06	2.69700E-05	5.99229E-05	1.37758E-04
0.20000	1.74141E-08	9.11540E-08	6.06802E-07	1.22721E-06	3.59416E-06	1.27713E-05	3.04815E-05	7.42278E-05
0.25100	7.15895E-09	3.90132E-08	2.74284E-07	5.53464E-07	1.68097E-06	6.37947E-06	1.54085E-05	3.95613E-05
0.31600	2.85104E-09	1.68212E-08	1.22172E-07	2.54942E-07	7.89718E-07	3.06191E-06	7.64913E-06	2.06062E-05
0.39800	1.12356E-09	6.88843E-09	5.32213E-08	1.14452E-07	3.76520E-07	1.49430E-06	3.78849E-06	1.05925E-05
0.50100	4.34531E-10	2.80718E-09	2.32505E-08	5.15497E-08	1.78710E-07	7.35335E-07	1.89255E-06	5.44957E-06
0.63100	1.65510E-10	1.12315E-09	9.93164E-09	2.28724E-08	8.42005E-08	3.61321E-07	9.52719E-07	2.81690E-06
0.79400	6.14970E-11	4.41277E-10	4.16390E-09	9.91684E-09	3.88024E-08	1.76973E-07	4.82395E-07	1.56525E-06
1.00000	2.25220E-11	1.69821E-10	1.70681E-09	4.20527E-09	1.74390E-08	8.55847E-08	2.43826E-07	8.18071E-07
1.26000	8.10548E-12	6.41595E-11	6.81189E-10	1.74580E-09	7.74841E-09	4.07411E-08	1.21821E-07	4.21270E-07
1.58000	3.24209E-12	2.43023E-11	2.75709E-10	7.22175E-10	3.32518E-09	1.89583E-08	5.98836E-08	2.12149E-07
2.00000	9.21644E-13	8.44947E-12	1.01985E-10	2.80673E-10	1.37129E-09	8.25398E-09	2.77930E-08	1.04300E-07
2.51000	3.32312E-13	2.95461E-12	3.91777E-11	1.08480E-10	5.60508E-10	3.69577E-09	1.30824E-08	5.02870E-08
3.16000	9.06494E-14	1.03113E-12	1.44537E-11	4.20382E-11	2.20865E-10	1.54839E-09	5.90174E-09	2.34636E-08
3.98000	2.58856E-14	3.22273E-13	5.05831E-12	1.50765E-11	8.39324E-11	6.28290E-10	2.53403E-09	1.05137E-08
5.01000	6.92987E-15	9.79057E-14	1.72110E-12	5.29881E-12	3.07688E-11	2.46626E-10	1.05765E-09	4.53469E-09
6.31000	1.76025E-15	2.81895E-14	5.59389E-13	1.79282E-12	1.08592E-11	9.29971E-11	4.24682E-10	1.88309E-09
7.94000	4.22103E-16	7.73140E-15	1.73486E-13	5.79722E-13	3.68694E-12	3.37357E-11	1.63422E-10	7.51816E-10
10.00000	1.00720E-16	2.02896E-15	5.19607E-14	1.80343E-13	1.14795E-12	1.09217E-11	5.76918E-11	2.79996E-10

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	F1.333Hz	F2.000Hz	F2.500Hz	F3.333Hz	F4.000Hz	F5.000Hz	F6.667Hz	F10.000Hz
0.00100	5.75908E-02	7.19445E-02	7.46553E-02	7.82835E-02	7.74049E-02	7.76203E-02	7.60646E-02	7.01135E-02
0.00130	5.28837E-02	6.54815E-02	6.84787E-02	7.14271E-02	7.07304E-02	7.09466E-02	6.93246E-02	6.34250E-02
0.00160	4.55585E-02	5.79645E-02	6.12896E-02	6.45743E-02	6.40978E-02	6.45131E-02	6.31646E-02	5.69550E-02
0.00200	3.89820E-02	5.10525E-02	5.43912E-02	5.78895E-02	5.73584E-02	5.79065E-02	5.55692E-02	5.03313E-02
0.00250	3.30800E-02	4.42803E-02	4.74565E-02	5.08348E-02	5.02480E-02	5.08804E-02	4.93850E-02	4.37400E-02
0.00320	2.77014E-02	3.76535E-02	4.06075E-02	4.37046E-02	4.32123E-02	4.38856E-02	4.24145E-02	3.76021E-02
0.00400	2.29400E-02	3.15491E-02	3.42161E-02	3.70293E-02	3.66578E-02	3.73594E-02	3.54681E-02	3.10177E-02
0.00500	1.88567E-02	2.61395E-02	2.84800E-02	3.09806E-02	3.07130E-02	3.14083E-02	2.97298E-02	2.60862E-02
0.00630	1.54086E-02	2.14216E-02	2.34094E-02	2.55871E-02	2.53978E-02	2.61045E-02	2.47582E-02	2.19044E-02
0.00790	1.25318E-02	1.73757E-02	1.90692E-02	2.09139E-02	2.08586E-02	2.15135E-02	2.05241E-02	1.82768E-02
0.01000	1.01567E-02	1.40349E-02	1.54317E-02	1.70119E-02	1.70000E-02	1.76068E-02	1.68192E-02	1.51255E-02
0.01260	8.21106E-03	1.12657E-02	1.23976E-02	1.36964E-02	1.36994E-02	1.42495E-02	1.37256E-02	1.24305E-02
0.01580	6.61162E-03	8.98050E-03	9.89085E-03	1.09330E-02	1.09800E-02	1.14392E-02	1.10930E-02	1.01339E-02
0.02000	5.30235E-03	7.12928E-03	7.84591E-03	8.68663E-03	8.72234E-03	9.12242E-03	8.79431E-03	8.08632E-03
0.02510	4.21950E-03	5.61651E-03	6.18083E-03	6.84269E-03	6.89021E-03	7.18984E-03	6.94613E-03	6.41208E-03
0.03160	3.30536E-03	4.37261E-03	4.81389E-03	5.33328E-03	5.33070E-03	5.59038E-03	5.40761E-03	4.99933E-03
0.03980	2.53395E-03	3.34342E-03	3.66137E-03	4.09902E-03	4.05186E-03	4.16436E-03	4.13417E-03	3.80959E-03
0.05010	1.88608E-03	2.49914E-03	2.73837E-03	3.08993E-03	3.02451E-03	3.05828E-03	3.07570E-03	2.81047E-03
0.06310	1.34737E-03	1.79333E-03	1.98169E-03	2.25056E-03	2.18484E-03	2.18467E-03	2.21924E-03	2.01214E-03
0.07940	9.11775E-04	1.22366E-03	1.38261E-03	1.58595E-03	1.54907E-03	1.53134E-03	1.56650E-03	1.41661E-03
0.10000	5.89811E-04	8.15017E-04	9.35021E-04	1.09547E-03	1.06452E-03	1.03280E-03	1.07323E-03	9.68412E-04
0.12600	3.70169E-04	5.19330E-04	6.05367E-04	7.17272E-04	6.91635E-04	6.66547E-04	7.09743E-04	6.48505E-04
0.15800	2.17860E-04	3.09148E-04	3.70964E-04	4.44121E-04	4.40045E-04	4.22083E-04	4.61650E-04	4.34417E-04
0.20000	1.21400E-04	1.78652E-04	2.18690E-04	2.70464E-04	2.59232E-04	2.63089E-04	2.96824E-04	2.83740E-04
0.25100	6.68300E-05	1.01219E-04	1.27333E-04	1.60167E-04	1.55186E-04	1.60900E-04	1.89141E-04	1.87267E-04
0.31600	3.58713E-05	5.58593E-05	6.89326E-05	9.23390E-05	9.10290E-05	9.74753E-05	1.19785E-04	1.21802E-04
0.39800	1.89466E-05	3.04593E-05	3.56470E-05	5.28244E-05	5.32086E-05	5.88687E-05	7.54077E-05	7.79984E-05
0.50100	1.00029E-05	1.66013E-05	1.98584E-05	3.01931E-05	3.10815E-05	3.53795E-05	4.70142E-05	4.91423E-05
0.63100	5.29996E-06	9.06419E-06	1.10911E-05	1.72808E-05	1.81550E-05	2.11025E-05	2.89507E-05	3.04022E-05

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	F1.333Hz	F2.000Hz	F2.500Hz	F3.333Hz	F4.000Hz	F5.000Hz	F6.667Hz	F10.000Hz
0.79400	2.81887E-06	4.95983E-06	6.20982E-06	9.90190E-06	1.05827E-05	1.25182E-05	1.63560E-05	1.86118E-05
1.00000	1.50149E-06	2.70988E-06	3.46148E-06	5.64728E-06	6.10652E-06	7.28702E-06	9.47607E-06	1.11284E-05
1.26000	7.91807E-07	1.45567E-06	1.88976E-06	2.98930E-06	3.44272E-06	4.11528E-06	5.21678E-06	6.44007E-06
1.58000	4.07073E-07	7.60574E-07	1.01679E-06	1.45665E-06	1.89940E-06	2.28618E-06	2.94550E-06	3.70455E-06
2.00000	2.04216E-07	3.90612E-07	5.29396E-07	7.72511E-07	1.02942E-06	1.23534E-06	1.57440E-06	1.97976E-06
2.51000	1.00886E-07	1.95251E-07	2.70848E-07	3.97217E-07	5.34147E-07	6.36474E-07	7.19029E-07	1.03345E-06
3.16000	4.78715E-08	9.32343E-08	1.29571E-07	1.94874E-07	2.63605E-07	3.12458E-07	3.49725E-07	5.10770E-07
3.98000	2.17462E-08	4.25839E-08	5.99063E-08	9.13140E-08	1.24014E-07	1.46095E-07	1.63348E-07	2.37407E-07
5.01000	9.51050E-09	1.86548E-08	2.64766E-08	4.07901E-08	5.50095E-08	6.49514E-08	7.12154E-08	1.03447E-07
6.31000	3.98943E-09	7.81190E-09	1.11533E-08	1.72179E-08	2.11129E-08	2.67517E-08	2.79016E-08	3.70822E-08
7.94000	1.59293E-09	3.07292E-09	4.32172E-09	6.50085E-09	7.48182E-09	9.60044E-09	7.99592E-09	1.21330E-08
10.00000	5.66080E-10	1.02482E-09	1.35825E-09	1.83864E-09	2.28315E-09	1.61565E-09	9.12577E-10	1.16914E-09

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	F13.333Hz	F20.000Hz	F25.000Hz	F33.333Hz	F40.000Hz	F50.000Hz	F100.000Hz	PGA
0.00100	6.61727E-02	6.56958E-02	6.38096E-02	6.35598E-02	6.34828E-02	6.27577E-02	5.84919E-02	5.75330E-02
0.00130	5.95549E-02	5.66601E-02	5.70120E-02	5.60726E-02	5.49161E-02	5.54729E-02	5.13912E-02	5.06715E-02
0.00160	5.30632E-02	5.02159E-02	5.03234E-02	4.88217E-02	4.84778E-02	4.73755E-02	4.46577E-02	4.39402E-02
0.00200	4.65915E-02	4.36999E-02	4.41451E-02	4.27304E-02	4.12628E-02	4.01700E-02	3.69949E-02	3.63450E-02
0.00250	4.03550E-02	3.78321E-02	3.63963E-02	3.70205E-02	3.56689E-02	3.46274E-02	3.16089E-02	3.09888E-02
0.00320	3.44964E-02	3.16258E-02	3.10255E-02	3.15205E-02	3.06248E-02	2.87809E-02	2.67980E-02	2.61992E-02
0.00400	2.94525E-02	2.61153E-02	2.65040E-02	2.64285E-02	2.59705E-02	2.45015E-02	2.25957E-02	2.20111E-02
0.00500	2.49843E-02	2.20297E-02	2.18069E-02	2.20764E-02	2.20750E-02	2.07485E-02	1.83096E-02	1.83726E-02
0.00630	2.10926E-02	1.86395E-02	1.79211E-02	1.80134E-02	1.82086E-02	1.73653E-02	1.51956E-02	1.46266E-02
0.00790	1.76597E-02	1.56750E-02	1.49609E-02	1.51709E-02	1.53418E-02	1.45729E-02	1.26097E-02	1.20567E-02
0.01000	1.41046E-02	1.30981E-02	1.25065E-02	1.25058E-02	1.24057E-02	1.21382E-02	1.00276E-02	9.84045E-03
0.01260	1.16243E-02	1.06359E-02	1.03851E-02	9.99744E-03	9.95318E-03	9.73150E-03	8.12540E-03	7.63683E-03
0.01580	9.51197E-03	8.70559E-03	8.32154E-03	7.79993E-03	7.79110E-03	7.78730E-03	6.49087E-03	6.04184E-03

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.02000	7.49633E-03	6.99024E-03	6.50813E-03	6.06988E-03	5.71580E-03	5.40028E-03	5.02744E-03	4.75892E-03
0.02510	5.90975E-03	5.06133E-03	4.63496E-03	4.07915E-03	3.99031E-03	4.00331E-03	3.52793E-03	3.49960E-03
0.03160	4.51798E-03	3.73419E-03	3.36067E-03	2.84191E-03	2.65855E-03	2.51913E-03	2.34463E-03	2.38586E-03
0.03980	3.30622E-03	2.70546E-03	2.28126E-03	1.87771E-03	1.72392E-03	1.62462E-03	1.61425E-03	1.51924E-03
0.05010	2.40113E-03	1.91033E-03	1.57177E-03	1.27222E-03	1.13058E-03	1.01659E-03	9.77095E-04	1.01432E-03
0.06310	1.70619E-03	1.33196E-03	1.09612E-03	8.08870E-04	7.00516E-04	6.31937E-04	6.08806E-04	6.80620E-04
0.07940	1.19914E-03	9.27460E-04	7.58251E-04	5.24902E-04	4.59980E-04	4.02801E-04	3.84603E-04	4.39307E-04
0.10000	8.25836E-04	6.40463E-04	5.18655E-04	3.54252E-04	3.11179E-04	2.61449E-04	2.38661E-04	2.68173E-04
0.12600	5.62570E-04	4.41009E-04	3.52398E-04	2.42579E-04	2.06701E-04	1.64144E-04	1.42892E-04	1.71956E-04
0.15800	3.85197E-04	3.04297E-04	2.40559E-04	1.65141E-04	1.33528E-04	1.00769E-04	8.73943E-05	1.10435E-04
0.20000	2.56993E-04	2.04816E-04	1.59448E-04	1.08899E-04	8.18044E-05	6.05254E-05	5.34249E-05	6.59006E-05
0.25100	1.73078E-04	1.38389E-04	1.06127E-04	7.10237E-05	5.10423E-05	3.75520E-05	3.15109E-05	4.07659E-05
0.31600	1.14525E-04	9.19558E-05	6.89621E-05	4.48015E-05	3.14359E-05	2.32511E-05	1.75731E-05	2.51893E-05
0.39800	7.46701E-05	5.98387E-05	4.40646E-05	2.74387E-05	1.92313E-05	1.41334E-05	9.42775E-06	1.47589E-05
0.50100	4.78811E-05	3.82475E-05	2.75763E-05	1.62647E-05	1.15046E-05	8.23698E-06	5.16084E-06	8.58775E-06
0.63100	3.01315E-05	2.38663E-05	1.66756E-05	9.38093E-06	6.69172E-06	4.57933E-06	2.70956E-06	4.97868E-06
0.79400	1.86227E-05	1.44695E-05	9.84576E-06	5.34696E-06	3.76229E-06	2.41668E-06	1.43540E-06	2.78403E-06
1.00000	1.10345E-05	8.51982E-06	5.68950E-06	2.95107E-06	2.01756E-06	1.19605E-06	7.40497E-07	1.40838E-06
1.26000	6.40828E-06	4.89440E-06	3.18987E-06	1.57263E-06	1.03597E-06	5.68238E-07	3.59272E-07	7.47725E-07
1.58000	3.68596E-06	2.75044E-06	1.74216E-06	8.08118E-07	5.08779E-07	2.64538E-07	1.61348E-07	3.76559E-07
2.00000	1.98866E-06	1.44336E-06	8.81846E-07	3.80192E-07	2.30356E-07	1.10710E-07	6.55847E-08	1.75970E-07
2.51000	1.04849E-06	7.38914E-07	4.36904E-07	1.69622E-07	9.72666E-08	4.42770E-08	2.60987E-08	8.00151E-08
3.16000	5.22748E-07	3.56032E-07	1.96621E-07	7.30852E-08	3.87060E-08	1.56312E-08	9.61652E-09	2.87848E-08
3.98000	2.46123E-07	1.54669E-07	8.53204E-08	2.54829E-08	1.31436E-08	4.28451E-09	2.86132E-09	1.11688E-08
5.01000	1.04290E-07	6.35736E-08	2.99921E-08	6.84163E-09	2.78353E-09	1.31387E-09	4.70725E-10	3.28436E-09
6.31000	4.00777E-08	1.92717E-08	7.23603E-09	1.26329E-09	2.65297E-11	1.73345E-19	0.00000E+00	1.19895E-09
7.94000	1.16290E-08	3.20203E-09	7.10204E-10	6.92785E-14	7.76462E-22	0.00000E+00	0.00000E+00	0.00000E+00
10.00000	1.15271E-09	6.17845E-11	3.53998E-13	5.41701E-24	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00

ENCLOSURE 3

WATTS BAR SEISMIC HAZARDS REPORT

Watts Bar Seismic Hazard Report

Overview

This report provides the NRC staff's updated seismic hazard curves and response spectra for the Watts Bar Nuclear Plant (Watts Bar) site that are based on the implementation of (1) a new seismic ground motion model for the central and eastern United States (CEUS) and (2) recent advances in site response analysis. The NRC staff's updated hazard curves and site amplification factors are included in an appendix to this report.

Background

In response to the March 11, 2011, Great East Japan Earthquake and tsunami, which triggered an accident at the Fukushima Dai-ichi nuclear power plant, the U.S. Nuclear Regulatory Commission (NRC) established the Near-Term Task Force (NTTF) to conduct a systematic and methodical review of NRC processes and regulations and determine whether the agency should make additional improvements to its regulatory system. In SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (NRC, 2011), the NRC staff recommended a set of actions to clarify and strengthen the regulatory framework for protection against natural hazards. In particular, NTTF Recommendation 2.1 (NTTF R2.1) instructed the NRC staff to issue requests for information to all power reactor licensees pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) ("50.54(f) letter"). Enclosure 1 to the 50.54(f) letter requested that addressees reevaluate the seismic hazards at their sites, using present day NRC requirements and guidance to perform a probabilistic seismic hazard analysis (PSHA) and develop a site-specific ground motion response spectrum (GMRS). To comply with the 50.54(f) request, the Nuclear Energy Institute submitted Electric Power Research Institute (EPRI) Report 1025287, "Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima NTTF Recommendation 2.1 Seismic," dated November 27, 2012 (EPRI, 2012). Recipients of the 50.54(f) letter committed to following the SPID to develop seismic hazard and screening reports (SHSRs). By December 2017, the NRC staff had finished assessing the SHSRs for all operating U.S. nuclear power plants.

Under the process for the ongoing assessment of natural hazards information (POANHI), described in SECY-16-0144, "Proposed Resolution of Remaining Tier 2 and 3 Recommendations Resulting from the Fukushima Dai-ichi Accident," dated December 26, 2016 (NRC, 2016), the NRC staff continuously seeks out and integrates new natural hazards information for operating plants in the United States. The Office of Nuclear Reactor Regulation's Office Instruction LIC-208, "Process for the Ongoing Assessment of Natural Hazards Information," issued November 2019 (NRC, 2019), provides guidance to the staff on how to collect, integrate, and evaluate new information for consideration in its regulatory decision-making. This report presents the NRC staff's latest understanding of seismic hazards at the Watts Bar site following the POANHI framework.

The Watts Bar site is located 80 kilometers northeast of Chattanooga, TN, on the west side of the Tennessee River in the Valley and Ridge physiographic province and consists of about 3,350 meters of competent sedimentary rock (shale, limestone, dolomite, and sandstone) of Paleozoic age.

Motivation

After evaluating the SHSR submittals, the NRC staff captured in NUREG/KM-0017, "Seismic Hazards Evaluations for U.S. Nuclear Power Plants: Near-Term Task Force Recommendation 2.1 Results," issued December 2021 (Munson et al., 2021), the information used to develop the GMRS at each of the U.S. nuclear power plants. This includes a compilation and synthesis of (1) information provided by licensees in their SHSRs, (2) information collected by the NRC staff during its reviews of the SHSRs, and (3) information subsequently collected by the NRC staff from the scientific and engineering literature pertaining to several of the nuclear power plant sites. In addition, NUREG/KM-0017 includes updated approaches and relationships, relative to those recommended by the SPID, that the NRC staff used to perform its analyses.

After the development of NUREG/KM-0017, a new Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 ground motion model (GMM) for Eastern North America called NGA-East was published by Goulet et al. (2018). In addition, the NRC staff also participated in a SSHAC Level 2 study, documented in Research Information Letter (RIL) 2021--15, "Documentation Report for SSHAC Level 2: Site Response," issued November 2021 (Rodriguez-Marek et al., 2021). This SSHAC Level 2 study implemented the SSHAC approach to performing site response analyses (SRAs). The SSHAC process, described most recently in NUREG-2213, "Updated Implementation Guidelines for SSHAC Hazard Studies," issued October 2018 (Ake et al., 2018), provides a structured and logical framework for the systematic evaluation of alternative data, models, and methods. This seismic hazard report for the Watts Bar site incorporates the NGA-East GMM in place of the EPRI (2013) GMM and lessons learned from the SSHAC Level 2 SRA study (RIL 2021-15) into a PSHA to develop updated seismic hazard curves and a GMRS for the site.

Methods

Reference Rock Hazard

For the reference rock PSHA, the NRC staff used the distributed seismicity zones (DSZs) from the SSHAC Level 3 Central and Eastern United States Seismic Source Characterization for Nuclear Facilities (CEUS-SSC) model in NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, issued January 2012 (NRC, 2012). Specifically, the NRC staff selected the DSZs that are located within 500 kilometers of the site. For this reevaluation, the NRC staff used the SSHAC Level 2 update to the CEUS-SSC seismicity catalog and recurrence parameters (Gatlin, 2015), which primarily impact the DSZs that encompass Monticello Reservoir and Lake Keowee in South Carolina as well as the 1886 Charleston earthquake sequence. In addition, the NRC staff selected the RLME sources that are within 1,000 kilometers of the site. To develop the reference rock seismic hazard curves for the site, the NRC staff used the NGA-East GMM (2018) to compute the median and logarithmic

standard deviation of the spectral accelerations. Because the NGA-East GMM implements the rupture distance parameter, the NRC staff developed virtual rupture planes for each of the distributed source zones surrounding the site. For each virtual rupture, the NRC staff used the CEUS-SSC hazard input document (NRC, 2012) to specify the size of the rupture plane and the orientation of the rupture plane in terms of the strike and dip angles, dip direction, and rupture type (e.g., reverse and strike slip). In contrast, to develop the hazard curves for NUREG/KM-0017, the NRC staff used point source approximations for the CEUS-SSC and EPRI GMM (EPRI, 2013) combination.

Figure 1 shows the distribution of the virtual ruptures for one of the four alternative CEUS-SSC seismotectonic DSZ configurations along with the resulting 10-Hertz (Hz) mean hazard curves developed using the NGA-East GMM. In particular, Figure 1 shows the distribution of the surface projection of the updip segments of the virtual rupture planes for each of the five seismotectonic DSZs within 500 kilometers of the site. As expected, the Paleozoic Extended Crust—Narrow Geometry (PEZ-N) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} annual frequency of exceedance (AFE) level. Similarly, Figure 2 shows the distribution of the virtual ruptures for one of the three alternative CEUS-SSC maximum-magnitude DSZ configurations along with the resulting 10 Hz mean hazard curves developed using the NGA-East GMM. The Non-Mesozoic-and-Younger Extension—Narrow Configuration (NMESE-N) source zone, which surrounds the site, is the largest contributor to the 10 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 3 shows the RLME sources within 1,000 kilometers of the site, and their contribution to the 1 Hz reference rock mean hazard, from using the NGA-East GMM. The New Madrid Fault System RLME source is the largest contributor to the 1 Hz reference rock mean hazard curves at the 10^{-4} AFE level. Figure 4 shows the contribution from all of the DSZs relative to the RLMEs, as well as the total mean hazard for the 1 and 10 Hz mean reference rock hazard curves, from using the NGA-East GMM. For the 1 Hz mean reference rock hazard curves, the RLME sources provide the largest contribution at the 10^{-4} AFE level. In contrast, for the 10 Hz mean reference rock hazard curves at the 10^{-4} AFE level, the DSZs provide the largest contribution. Finally, Figure 5 shows the mean 1,000-, 10,000-, and 100,000-year return period mean reference rock uniform hazard response spectra (UHRS) for the Watts Bar site from using the EPRI GMM (blue) and the NGA-East GMM (red). For this reevaluation, the NRC staff used the NGA-East single station standard deviation and for the comparison shown in Figure 5, the NRC staff used the EPRI GMM ergodic standard deviation. As shown in Figure 5, the spectral accelerations from using the NGA-East GMM are moderately higher than those from using the EPRI GMM, up to the spectral frequency of about 5 Hz.

Site Response Analysis

SRAs, which are used to develop site adjustment (or amplification) factors ($SAFs$), depend on several factors, including the site strata (material type, stiffness, and thickness) and their response to dynamic loading. Because this information is site specific, the ability to accurately model the site response depends on the quantity and quality of site-specific geologic and geotechnical data available, and on the interpretation and use of these data to develop input models for assessing amplification (or deamplification) of ground motions. The resulting $SAFs$

are assessed for a wide range of input ground motions as part of understanding the changes in the soil and rock response as input ground motions increase.

The NRC staff followed the site response approach described in RIL 2021-15, which uses a logic tree for systematically identifying and propagating epistemic uncertainties in the SRA. As described in RIL 2021-15, to produce a truly probabilistic estimate of the seismic hazard at the control point elevation, it is necessary to estimate both the epistemic uncertainties and the aleatory variability of the soil and or rock dynamic response, and to propagate these through the SRA and the calculation of the site hazard curves.

Site Exploration. As described in the NTTF R2.1 SHSR submitted by the Tennessee Valley Authority (TVA; Shea, 2014) and summarized in section 2.3.18 of NUREG/KM-0017, the field investigations for Watts Bar consisted of continuous compressional wave velocities (V_P) measured in seven boreholes at the site in addition to more recent Spectral Analysis of Surface Waves (SASW) testing to estimate shear wave velocities (V_S) for the near-surface bedrock and deeper rock layers beneath the site.

Basecase Profiles. TVA stated in its NTTF R2.1 SHSR (Shea, 2014) that the uppermost 10 meters beneath the plant site are clay, silt, sand, and gravel layers that overlie interbedded weathered shale and limestone and that the primary Watts Bar structures are founded at a depth of 19 meters, which lies below the uppermost weathered rock and was selected as the control point by TVA. For its SHSR, TVA developed two basecase profiles. The first best-estimate basecase profile extends to a depth of about 180 meters below the control point elevation, and the second best-estimate basecase profile extends to a depth of 285 meters below the control point elevation. The major controlling geologic feature of the Watts Bar site is the Kingston Thrust fault. Movement along this fault during the Late Paleozoic Era resulted in the Cambrian age Conasauga Group and underlying Rome Formation at the plant site resting upon the younger Ordovician age Knox Group dolomites, which would normally overlie the Conasauga and Rome sedimentary strata. The majority of TVA's best-estimate basecase profiles consist of sedimentary strata from the Conasauga (shale and limestone) and the Rome Formation (sandstone), for which TVA estimated a V_S of about 1,830 meters/second (m/s) and 2,360 m/s, respectively. At a depth of about 300 meters within the Rome Formation, the licensee estimated that the V_S exceeded the NGA-East GMM reference rock V_S of 3,000 m/s. However as stated above, to capture the uncertainty in the depth to reference rock, TVA developed two best-estimate basecase profiles extending to depths of 180 and 285 meters, respectively.

Based on (1) the stratigraphy of the Valley and Ridge physiographic province in the vicinity of the Watts Bar site, (2) the estimated lower V_S (i.e., V_S< 3,000 m/s) for the sedimentary rock layers below the Kingston Thrust fault, and (3) consistent with the NRC staff's effort to capture a wider range of uncertainty (RIL 2021-15), the NRC staff developed two best-estimate basecase profiles for the Watts Bar SRA. The first best-estimate basecase profile developed by the NRC staff extends to a depth of 320 meters below the control point elevation, which is similar to the deeper best-estimate basecase profile developed by TVA. However, the second best-estimate basecase profile developed by the NRC staff extends to a depth of 2,880 meters below the control point elevation. This second best-estimate basecase profile captures the possibility that the sedimentary strata beneath the Watts Bar site consists of multiple layers beneath the Kingston Thrust fault that have V_S less than the reference rock V_S of 3,000 m/s. The estimated V_S for these deeper rock layers beneath the Kingston Thrust fault are provided in Table 2.3.1-2 of TVA's SHSR and are based on geologic investigations performed by consultants to TVA (Shea, 2014).

To capture the uncertainty in its best-estimate basecase profiles, the NRC staff developed lower and upper profiles by multiplying its two best-estimate basecase profiles by scale factors of 0.82 and 1.21, respectively, which corresponds to an epistemic logarithmic standard deviation of 0.15. The weights for the lower, best-estimate, and upper basecase profiles are 0.3, 0.4, and 0.3, respectively. Figure 6 shows the six lower, best-estimate, and upper basecase profiles used by the NRC staff. The lower epistemic value used by the NRC staff to determine the lower and upper basecase profiles is due to the staff's conclusion that the lithology of the sedimentary strata beneath Watts Bar site likely has a low range in V_S.

Site Kappa. To estimate the site kappa (κ_0), which captures the overall attenuation (i.e., intrinsic and scattering attenuation) of the geologic profile, the NRC staff used the four Q_{ef}-V_S models from Campbell (2009), where Q_{ef} is the effective quality factor of shear waves, which captures both the frequency-independent component of intrinsic attenuation and small-scale scattering. For each of the four Q_{ef}-V_S models, the NRC staff estimated a Q_{ef} for each layer in the basecase profiles, then used the estimated Q_{ef}, V_S, and layer thickness to determine a κ_0 for each layer. Summing these κ_0 values for each layer and adding the reference value of 6 milliseconds (msec) provides an estimate of the total κ_0. The NRC staff used a weight of 0.25 for each of the four Q_{ef}-V_S models. Assuming a lognormal distribution for κ_0 with a logarithmic standard deviation of 0.2 from Xu et al. (2020), the NRC staff developed a nine-point discrete distribution. This results in 45 κ_0 values and associated weights for each of the basecase profiles, which the NRC staff then resampled using the approach from Miller and Rice (1983) to reduce the distribution to five representative values and associated weights. These five κ_0 values and weights, which are listed in Table 1, range from 6 msec to 41 msec for the six basecase profiles.

Nonlinear Dynamic Properties. For the equivalent linear (EQL) SRA, nonlinearity is incorporated using strain-compatible site properties (i.e., shear modulus and damping ratio) for each layer. The strain-compatible properties model both the shear modulus reduction and the increased damping that are expected as the intensity of shaking increases. To model the nonlinear response within the upper 9 meters of weathered rock layers, the NRC staff used the EPRI rock and Stokoe weathered shale modulus reduction and damping (MRD) curves (EPRI, 1993 and Stokoe et al., 2003), which are identified in Table 2. The NRC staff used a weight of 0.33 for the two MRD curves and a weight of 0.33 to capture the possibility that the weathered rock behaves linearly under seismic loading. The NRC staff used multiple MRD curves to better capture the epistemic uncertainty in the nonlinear response of the weathered rock to higher dynamic loading.

Table 2 provides the layer depths, lithologies, V_S, unit weights, and dynamic properties for the NRC staff's basecase profiles. It is important to note that the NRC staff has adjusted the critical damping ratio values in the lower layers of the profiles, which are treated as having a linear response, so that each profile as a whole has the appropriate κ_0 value. Figure 7, which shows tornado plots for the reference rock peak ground acceleration (PGA) value of 0.63g, shows the site response logic tree nodes that contribute to the variance of the SAF. Each tornado plot in Figure 7 is associated with one of the four oscillator frequencies of 1, 5, 10, and 100 Hz. For the each of the four frequencies, the epistemic uncertainty in the basecase V_S contributes the most to the variance in the SAF and the uncertainty in κ_0 also contributes a moderate amount.

Input Motions. Input motions used for the SRA were generated as outcrop motions at the reference rock horizon, located at the bottom of the basecase profiles. The NRC staff used random vibration theory to generate the input motions after first developing an input Fourier amplitude spectrum (FAS) using seismological source theory (i.e., single-corner frequency Brune source spectrum). To develop the FAS, the NRC staff used the source and regional attenuation parameters recommended in the SPID for Eastern North American rock sites and then used random vibration theory to develop corresponding 5 percent damped acceleration response spectra. The NRC staff developed 12 input FAS assuming a magnitude ($\boldsymbol{M}$) of 6.5 and 12 different source-to-site distances, as recommended in the SPID.

Analysis Methodology. To develop $SAFs$ for the Watts Bar site, the NRC staff used traditional EQL analysis and the recently developed kappa-corrected EQL analysis, which adjusts the high-frequency control point (i.e., top of profile) FAS from the EQL SRA to be consistent with the target κ_0 value. In particular, the NRC staff used the kappa-corrected EQL analysis methodology (Xu and Rathje, 2021) with the modification in which the EQL control point FAS remains unmodified below a specified transition frequency, and then a slope equal to the target κ_0 value is imposed at frequencies above the transition frequency (RIL 2021-15). To capture the uncertainty in the transition frequency value, the NRC staff selected three frequencies for which the FAS amplitude equals 5 percent, 11 percent, and 17 percent of its peak value, with weights of 0.2, 0.6, and 0.2, respectively.

To capture the spatial variability in site properties across the site, the NRC staff generated randomized V_S profiles around each of the basecase profiles using the Toro (1995) model, which quantifies the aleatory variability through a depth-dependent standard deviation of the natural log of the velocities. The logarithmic standard deviation values used by the NRC staff for the Watts Bar site were based on site-specific data and are shown in Table 2. In addition to randomizing the V_S profiles, the NRC staff also randomized the MRD curves following the logit function approach used in the SPID and described in RIL 2021-15.

For each terminal branch of the site response logic tree, the NRC staff developed 60 randomized profiles and then determined the SAF by dividing the computed control point response spectrum by the outcrop response spectrum for the reference condition. Next, the NRC staff computed a median and logarithmic standard deviation for the SAF, using the 60 $SAFs$ from the randomized profiles, for each terminal branch of the logic tree. To facilitate implementing the SAF medians and logarithmic standard deviations into the PSHA seismic hazard integral, the NRC staff reduced the median SAFs from the over 200 logic tree terminal branches to seven discrete fractiles and weights using the resampling procedure outlined by Miller and Rice (1983). As recommended by Rodriguez-Marek et al. (2021), to ensure that estimates of the SRA capture enough epistemic uncertainty in the median SAF, the NRC staff implemented a minimum logarithmic standard deviation value of 0.15, which causes the seven median SAF fractiles to spread apart if necessary.

Finally, because the SAF logarithmic standard deviation for each spectral frequency does not vary significantly across the terminal branches of the logic tree, the NRC staff used a single mean value for each frequency. In addition, to avoid double-counting the aleatory variability already captured by the GMM, the NRC staff adjusted the SAF logarithmic standard deviation to include only the portion of the standard deviation associated with the nonlinear site response.

Figure 8 shows the seven median SAF values (top) and the average logarithmic standard deviation (bottom) as a function of input reference rock spectral acceleration for the 1 and 10 Hz spectral frequencies. As shown in Figure 8, the median $SAFs$ range from about 0.5 to 1.5 and remain constant with higher input spectral accelerations. The lower half of Figure 8 shows both the total and the nonlinear values of the SAF logarithmic standard deviation, the latter of which are implemented into the PSHA hazard integral. Figure 9 shows the seven median SAF values versus frequency at the 10^{-4} AFE spectral acceleration value for each of the 23 NGA-East GMM spectral frequencies as well for PGA, which is plotted at 200 Hz. Overall, the Watts Bar site produces a flat SAF from about 0.1 Hz to 10 Hz and then falls off over the higher frequencies out to about 50 Hz.

Control Point Hazard and Ground Motion Response Spectra

The NRC staff calculated the mean control point hazard for the Watts Bar site using Convolution Approach 3 from NUREG/CR-6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines," issued October 2001 (McGuire et al., 2001), which convolves the predetermined mean reference condition hazard with the $SAFs$. For each NGA-East GMM spectral frequency, the NRC staff convolved the mean reference condition hazard curve with the seven $SAFs$ to determine the final mean control point hazard. Using the mean control point hazard curves, the NRC staff then determined the 10^{-4} and 10^{-5} UHRS in order to calculate the final GMRS for the site, which are provided in Table 3. Figure 10 shows this final GMRS (red curve) compared to the GMRS (black curve) developed for NUREG/KM-0017, the GMRS (blue curve) in TVA's SHSR (Shea, 2014) and the GMRS (purple curve) in TVA's seismic probabilistic risk assessment (SPRA; Shea, 2017). The years in the legend for Figure 10 show when the GMRS were developed either by TVA or the NRC staff. As shown in Figure 10, the final GMRS from this study is higher than the previous GMRS for the low frequencies between 0.5 to about 5 Hz and then is similar to TVA's two GMRS above 5 Hz. The higher spectral accelerations for the lower frequencies are due to the NGA-East GMM, which predicts higher median ground motions for the lower spectral frequencies relative to the EPRI GMM (see Figure 5). Based on a sensitivity analysis, the NRC staff found that the lower spectral accelerations in the mid-to-upper frequencies between the updated GMRS developed by this study and the previous GMRS developed for NUREG/KM-0017 are due to the higher κ_0 values estimated for the Watts Bar site (see Table 1), compared to the lower κ_0 values estimated in the NUREG/KM-0017.

Data Tables

Appendix A provides the data tables for the Watts Bar site. Tables A-1, A-2, and A-3 give the reference rock mean hazard curves for 23 spectral frequencies ranging from 0.1 to 100 Hz and for PGA. Tables A-4 through A-27 give the SAF medians and logarithmic standard deviations for the 23 spectral frequencies and for PGA. Tables A-28, A-29, and A-30 give the control point hazard mean hazard curves for the 23 spectral frequencies and for PGA.

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Table 1 Site Kappa (κ_0) Values for Each Basecase Profile

Shallow Profile Kappa Distribution					
Lower Case		Base Case		Upper Case	
κ_0 (sec)	Weight	κ_0 (sec)	Weight	κ_0 (sec)	Weight
0.008	0.101	0.007	0.101	0.006	0.101
0.009	0.244	0.008	0.244	0.007	0.244
0.009	0.309	0.009	0.309	0.008	0.309
0.010	0.244	0.010	0.244	0.009	0.244
0.011	0.101	0.011	0.101	0.010	0.101

Deep Profile Kappa Distribution					
Lower Case		Base Case		Upper Case	
κ_0 (sec)	Weight	κ_0 (sec)	Weight	κ_0 (sec)	Weight
0.021	0.101	0.015	0.101	0.012	0.101
0.025	0.244	0.018	0.244	0.015	0.244
0.033	0.309	0.026	0.309	0.022	0.309
0.037	0.244	0.031	0.244	0.027	0.244
0.041	0.101	0.035	0.101	0.032	0.101

Table 2 Layer Depths, Shear Wave Velocities (V_S), Unit Weights, and Dynamic Properties for Watts Bar

		***Vs* (m/s)**			***Vs***	**Unit**	**Dynamic Properties**		
Layer #	**Depth (m)**	**LR (0.2, 0.2)**	**BC (0.15, 0.15)**	**UR (0.15, 0.15)**	**Sigma (ln)**	**Weight (kN/m^3)**	**Alt. 1 (0.33)**	**Alt. 2 (0.33)**	**Alt. 3 (0.33)**
1	6	1459	1768	2142	0.25	24	EPRI Rock	Stokoe WS	Linear
2	9	1459	1768	2142	0.15	24	EPRI Rock	Stokoe WS	Linear
3	15	1509	1829	2216	0.15	24	Linear	Linear	Linear
4	20	1509	1829	2216	0.15	24	Linear	Linear	Linear
5	30	1514	1834	2222	0.15	24	Linear	Linear	Linear
6	37	1520	1842	2231	0.15	24	Linear	Linear	Linear
7	46	1520	1842	2231	0.15	24	Linear	Linear	Linear
8	61	1526	1849	2241	0.15	24	Linear	Linear	Linear
9	76	1539	1864	2259	0.15	24	Linear	Linear	Linear
10	91	1539	1864	2259	0.15	24	Linear	Linear	Linear
11	137	1558	1887	2287	0.15	24	Linear	Linear	Linear
12	152	1583	1918	2324	0.15	24	Linear	Linear	Linear
13	198	1583	1918	2324	0.15	24	Linear	Linear	Linear
14	259	1950	2362	2862	0.15	25	Linear	Linear	Linear
15	320	1975	2393	2899	0.15	25	Linear	Linear	Linear
16	427	2476	3000	3000	0.15	26	Linear	Linear	Linear
17	716	2476	3000	3000	0.15	26	Linear	Linear	Linear
18	823	1761	2134	2585	0.15	25	Linear	Linear	Linear
19	884	1761	2134	2585	0.15	25	Linear	Linear	Linear
20	1052	1761	2134	2585	0.15	25	Linear	Linear	Linear
21	1295	2390	2896	3000	0.15	26	Linear	Linear	Linear
22	1356	1761	2134	2585	0.15	25	Linear	Linear	Linear
23	1935	1761	2134	2585	0.15	25	Linear	Linear	Linear
24	1966	1761	2134	2585	0.15	25	Linear	Linear	Linear

		Vs (m/s)			*Vs*	Unit	Dynamic Properties		
Layer	**Depth**	**LR**	**BC**	**UR**	**Sigma**	**Weight**	**Alt. 1**	**Alt. 2**	**Alt. 3**
#	**(m)**	**(0.2, 0.2)**	**(0.15, 0.15)**	**(0.15, 0.15)**	**(ln)**	**(kN/m^3)**	**(0.33)**	**(0.33)**	**(0.33)**
25	2195	2390	2896	3000	0.15	26	Linear	Linear	Linear
26	2347	1761	2134	2585	0.15	25	Linear	Linear	Linear
27	2576	1761	2134	2585	0.15	25	Linear	Linear	Linear
28	2758	1761	2134	2585	0.15	25	Linear	Linear	Linear
29	2880	2476	3000	3000	0.15	26	Linear	Linear	Linear

LR = lower range; BC = basecase; UR = upper range; ln = natural log; Alt. = Alternative
EPRI Rock = EPRI, 1993 rock; Stokoe WS = Stokoe et al., 2003 weathered shale
For LR, BC, UR, and Alt.: Values in parentheses refer to weights for site response analysis logic tree branches for shallow and deep profiles.

Table 3 GMRS and UHRS for Watts Bar

Frequency (Hz)	UHRS 1E-4 (g)	GMRS (g)	UHRS 1E-5 (g)
0.100	0.015365	0.017000	0.033090
0.133	0.022613	0.024800	0.048149
0.200	0.036191	0.039700	0.076924
0.250	0.043501	0.047600	0.092073
0.333	0.059141	0.065900	0.128239
0.500	0.093555	0.105200	0.205095
0.667	0.117690	0.134300	0.262827
1.000	0.167502	0.194400	0.382065
1.333	0.229911	0.274500	0.543388
2.000	0.298758	0.361000	0.716656
2.500	0.301090	0.379400	0.761231
3.333	0.347922	0.453900	0.918693
4.000	0.346330	0.465600	0.949292
5.000	0.376813	0.522500	1.073642
6.667	0.457456	0.657300	1.362810
10.000	0.492615	0.731000	1.527845
13.333	0.530493	0.801500	1.682674
20.000	0.547067	0.838700	1.767268
25.000	0.515797	0.797100	1.683022
33.333	0.441178	0.687000	1.453325
40.000	0.397880	0.614800	1.298116
50.000	0.334050	0.511900	1.078592
100.000	0.254608	0.369000	0.766594
PGA	0.256567	0.386700	0.811490

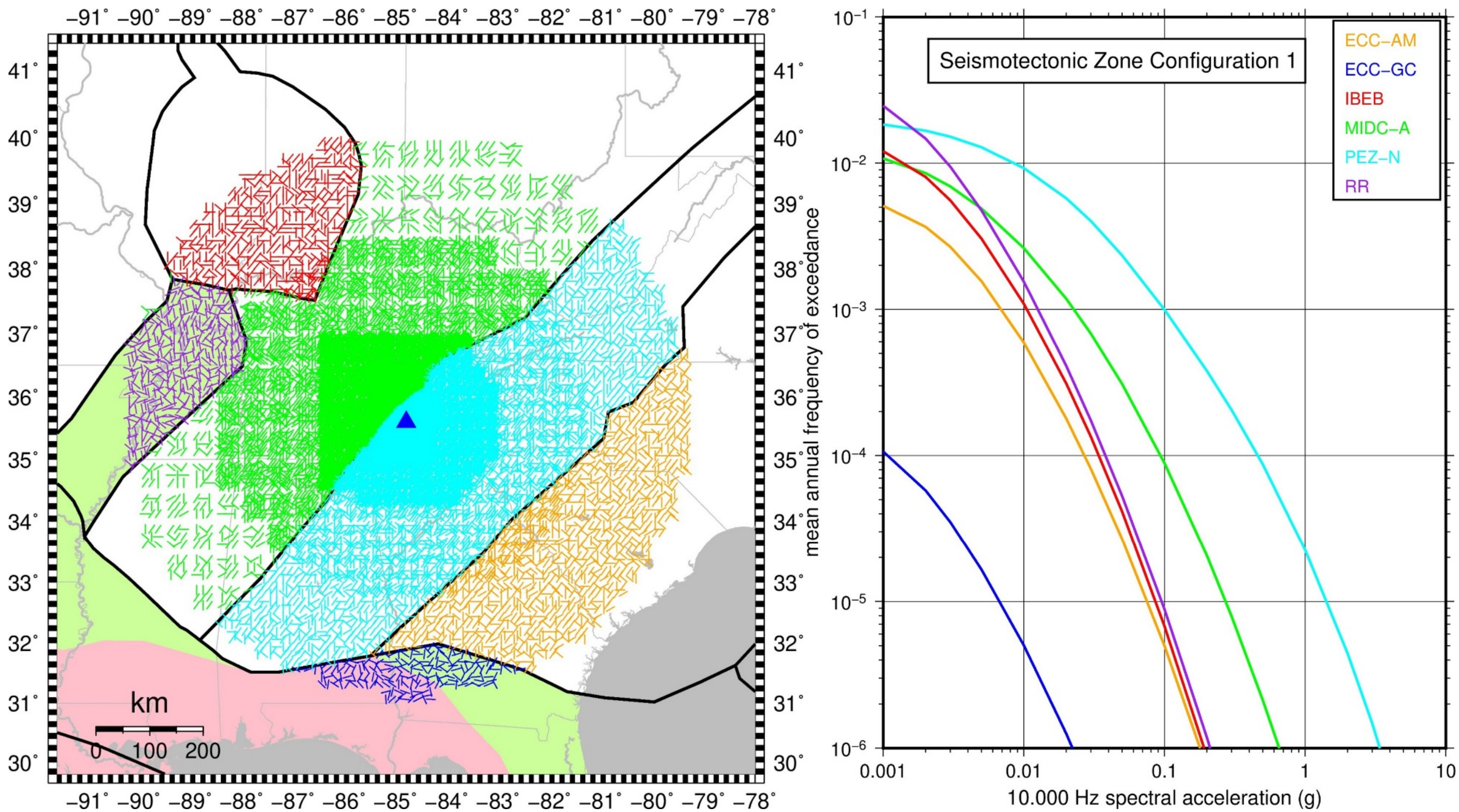

Figure 1 Distribution of virtual ruptures (left) for CEUS-SSC Seismotectonic Configuration 1 DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Watts Bar

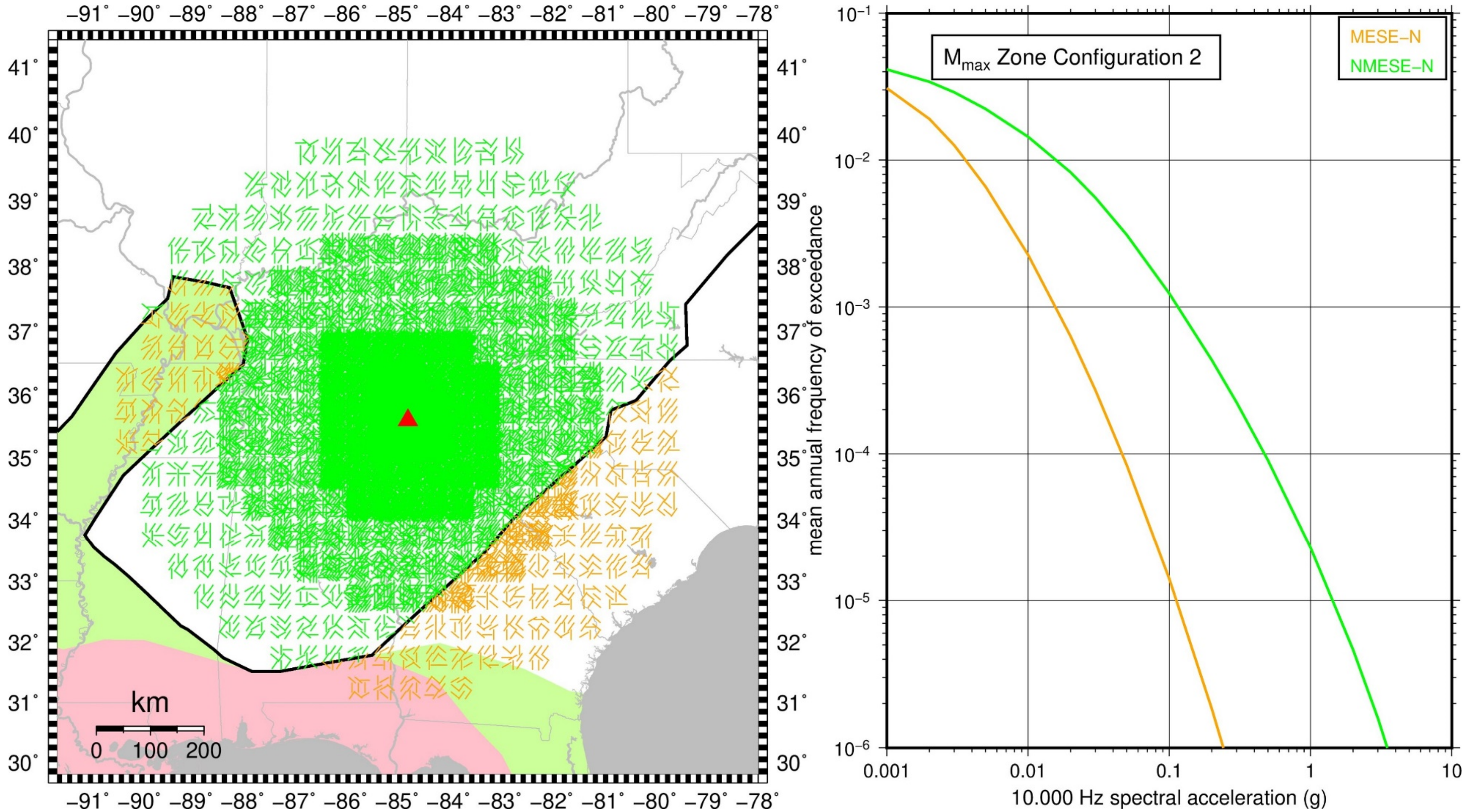

Figure 2 Distribution of virtual ruptures (left) for CEUS-SSC maximum-magnitude narrow-configuration DSZs, and associated mean 10 Hz reference rock hazard curves (right) for Watts Bar

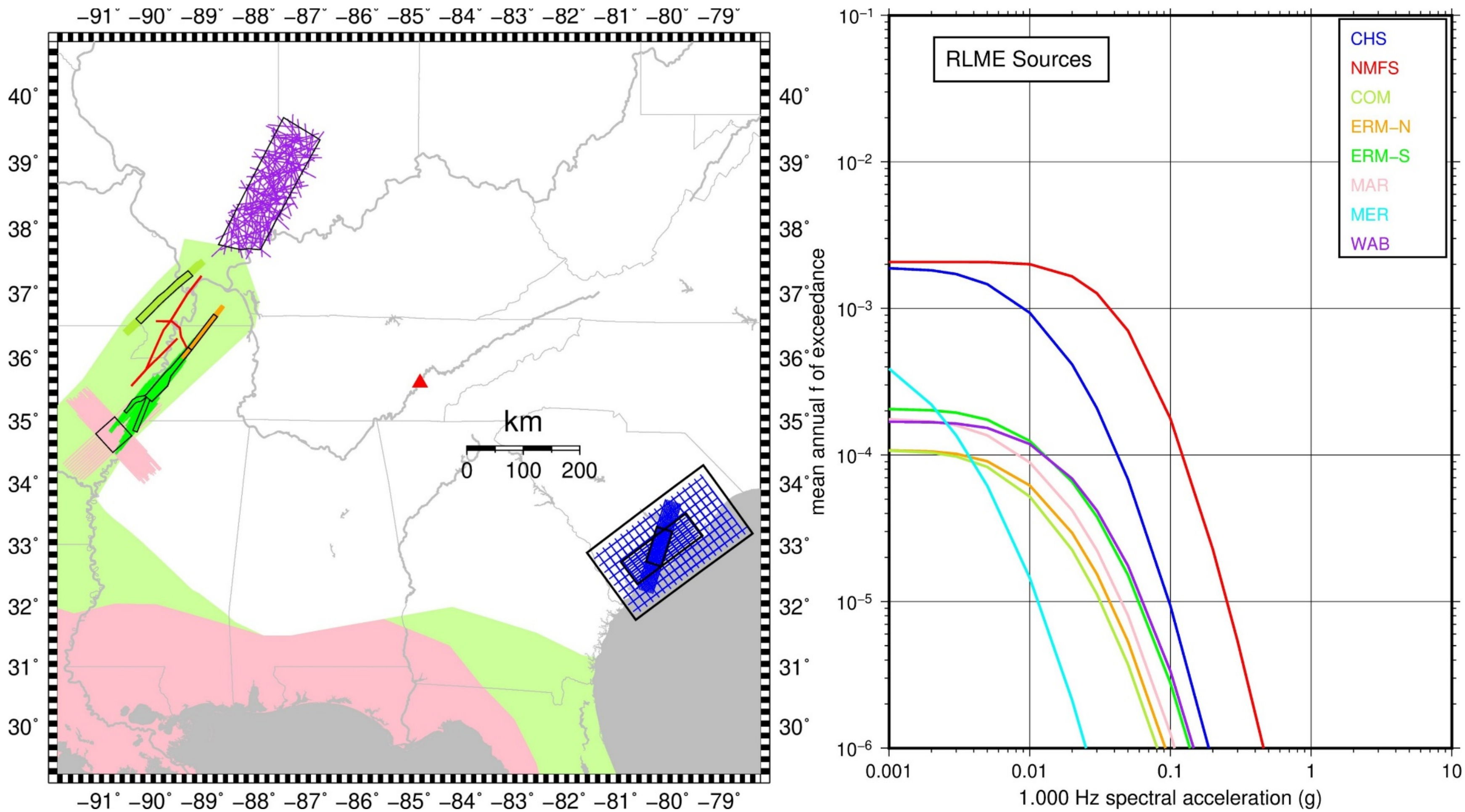

Figure 3 CEUS-SSC RLME sources (left), and associated mean 1 Hz reference rock hazard curves (right) for Watts Bar

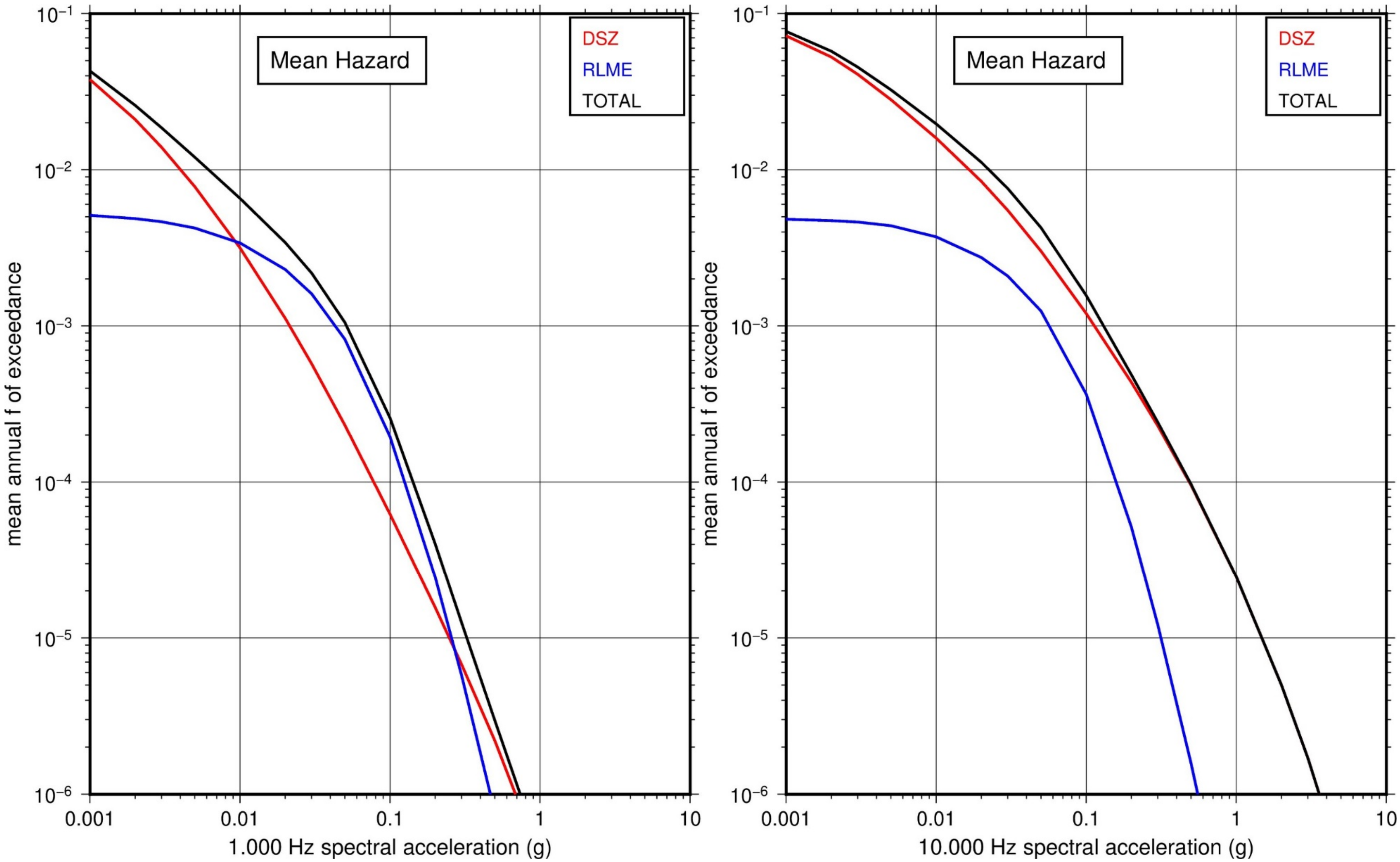

Figure 4 DSZ, RLME, and total mean reference rock hazard curves for 1 Hz (right) and 10 Hz (left) for Watts Bar

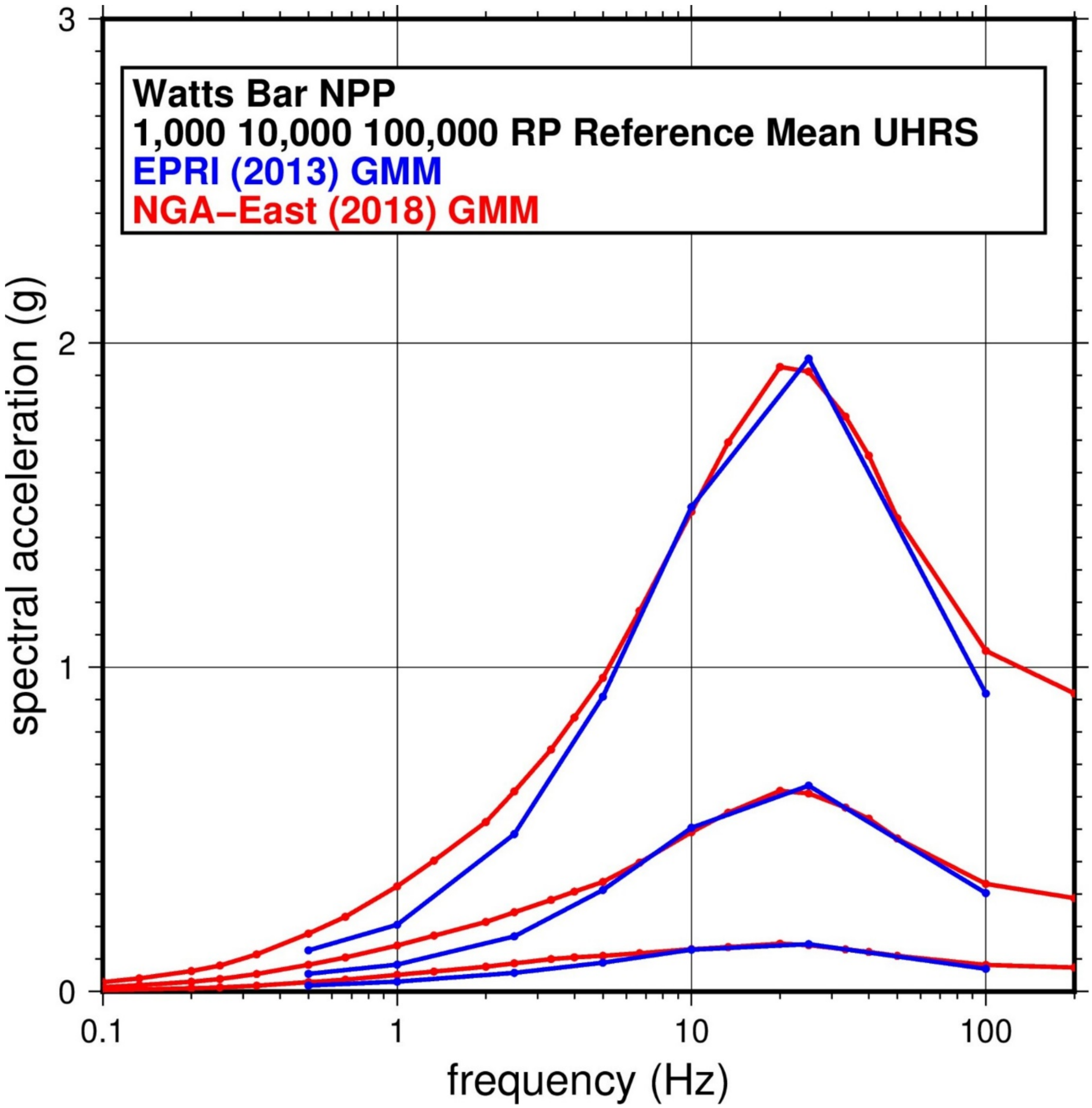

Figure 5 1,000-, 10,000-, and 100,000-year return period mean reference rock UHRS for CEUS-SSC and EPRI GMM (blue curves) and CEUS-SSC and NGA-East GMM (red curves)

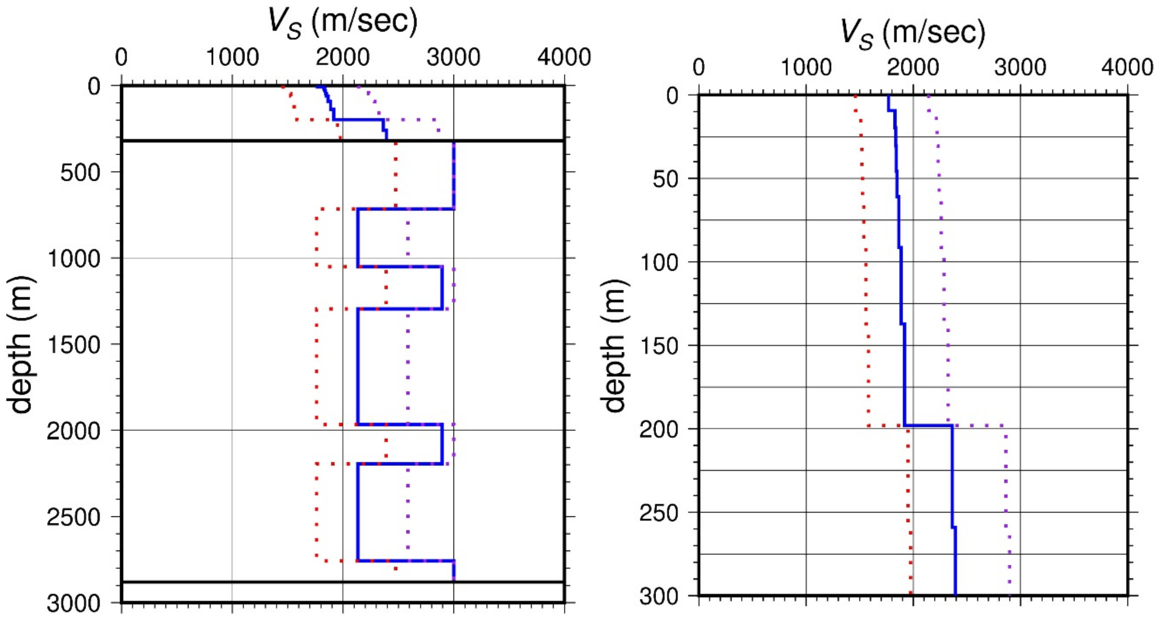

Figure 6 Complete (left) and upper 300 m (right) shear wave velocity (V_S) basecase profiles for Watts Bar; thick horizontal black lines indicate two reference rock horizons for shallow and deep profiles; best estimate basecase profile shown as solid blue line; lower and upper range basecase profiles shown as dotted red and purple lines, respectively

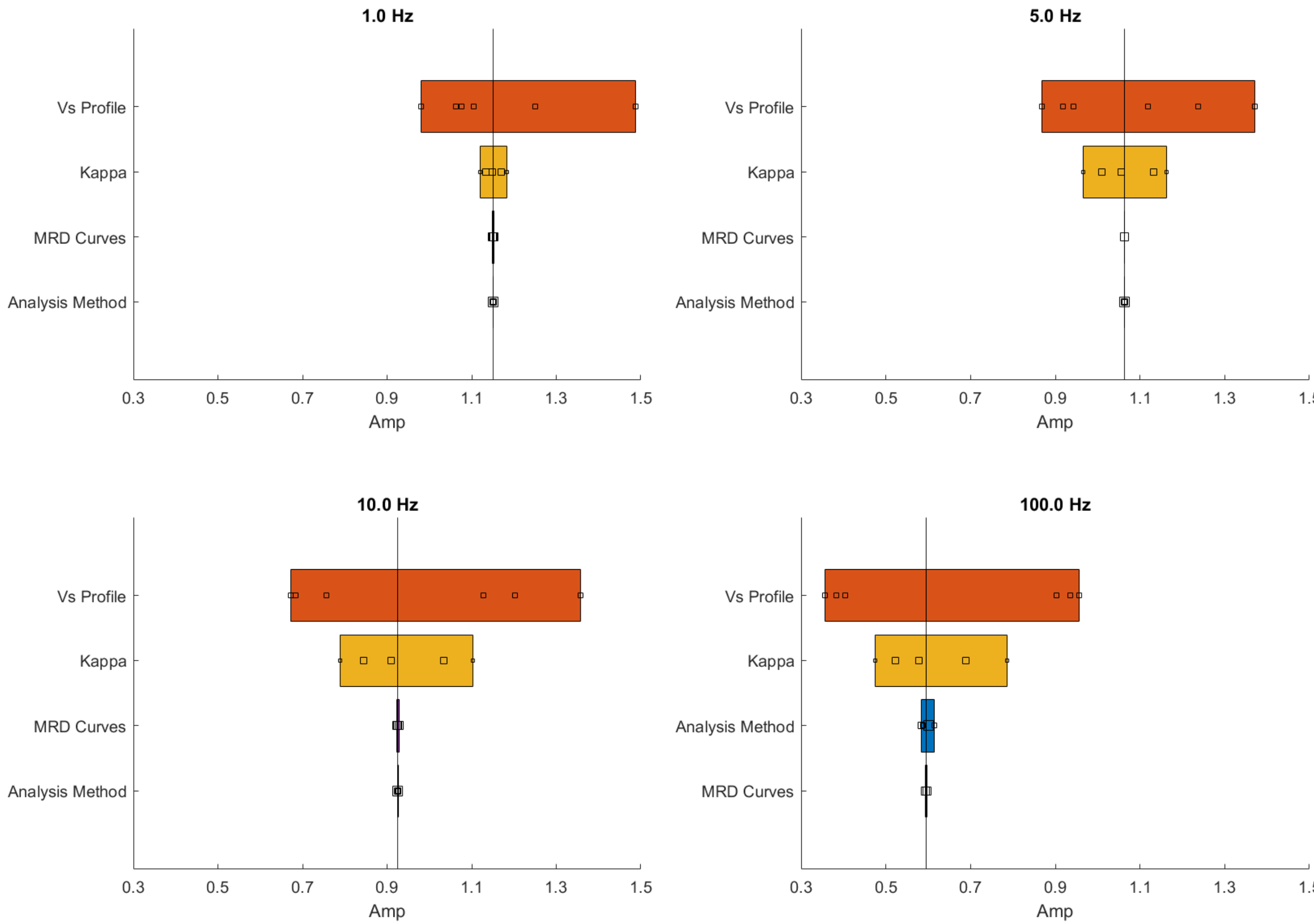

Figure 7 Tornado plots for site response logic tree nodes V_S profile, κ_0, MRD curves, and the analysis method for 1, 5, 10, and 100 Hz spectral frequencies for an input motion with a PGA of 0.63g.

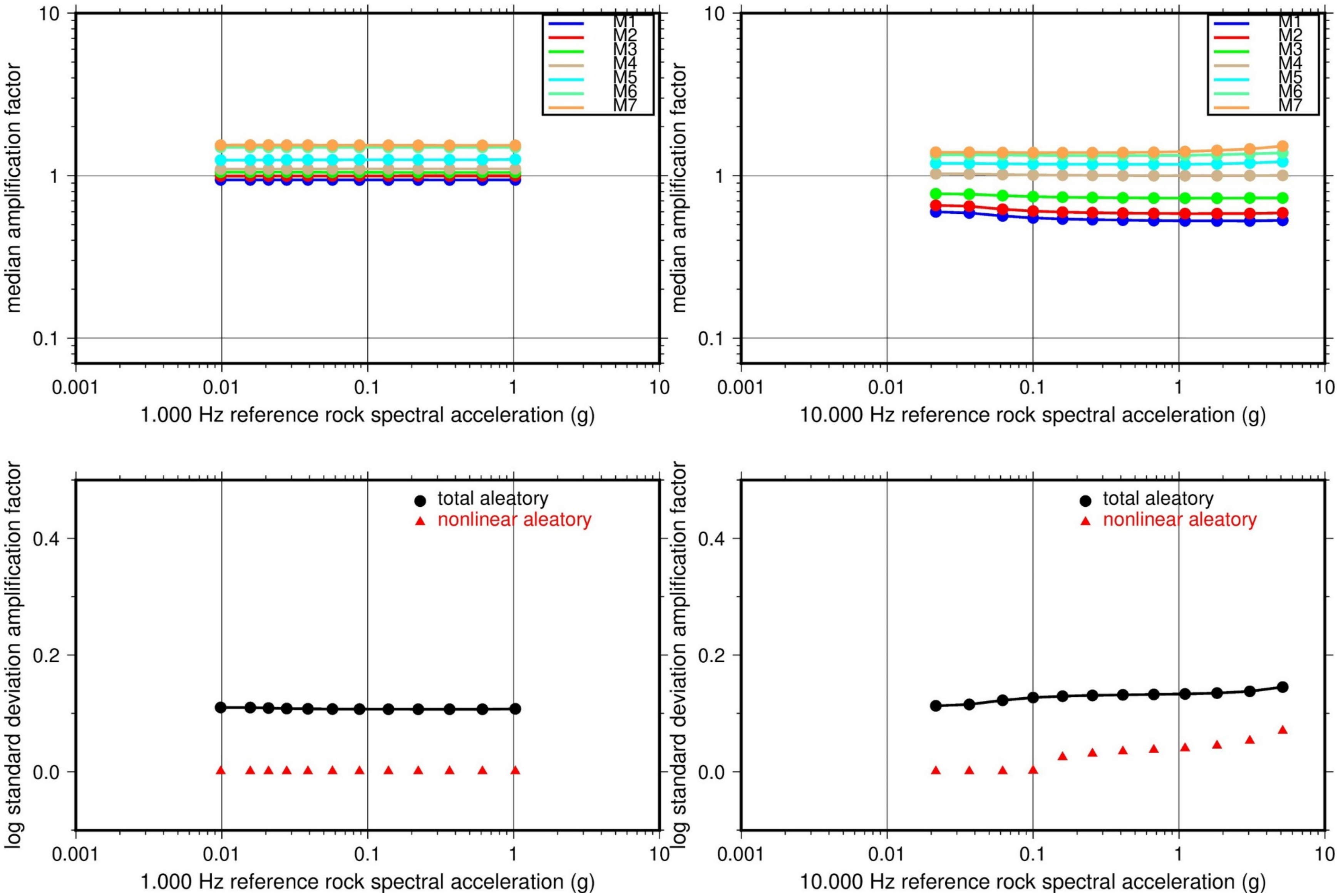

Figure 8 Seven median SAFs (above) and mean log standard deviations of SAF (below) as functions of input acceleration for 1 Hz (left) and 10 Hz (right)

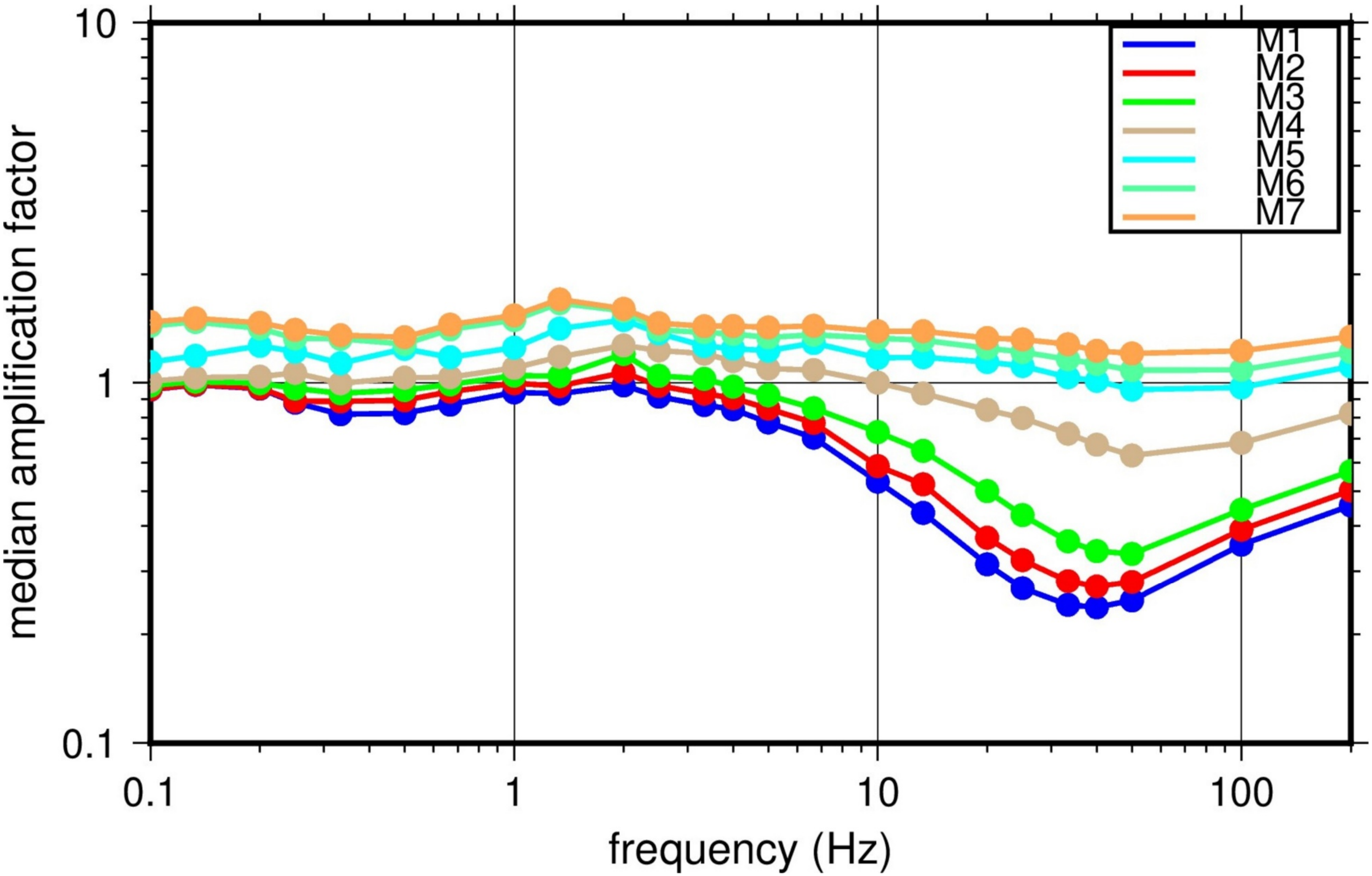

Figure 9 Seven median SAFs as functions of spectral frequency for spectral accelerations at the 10^{-4} AFE level

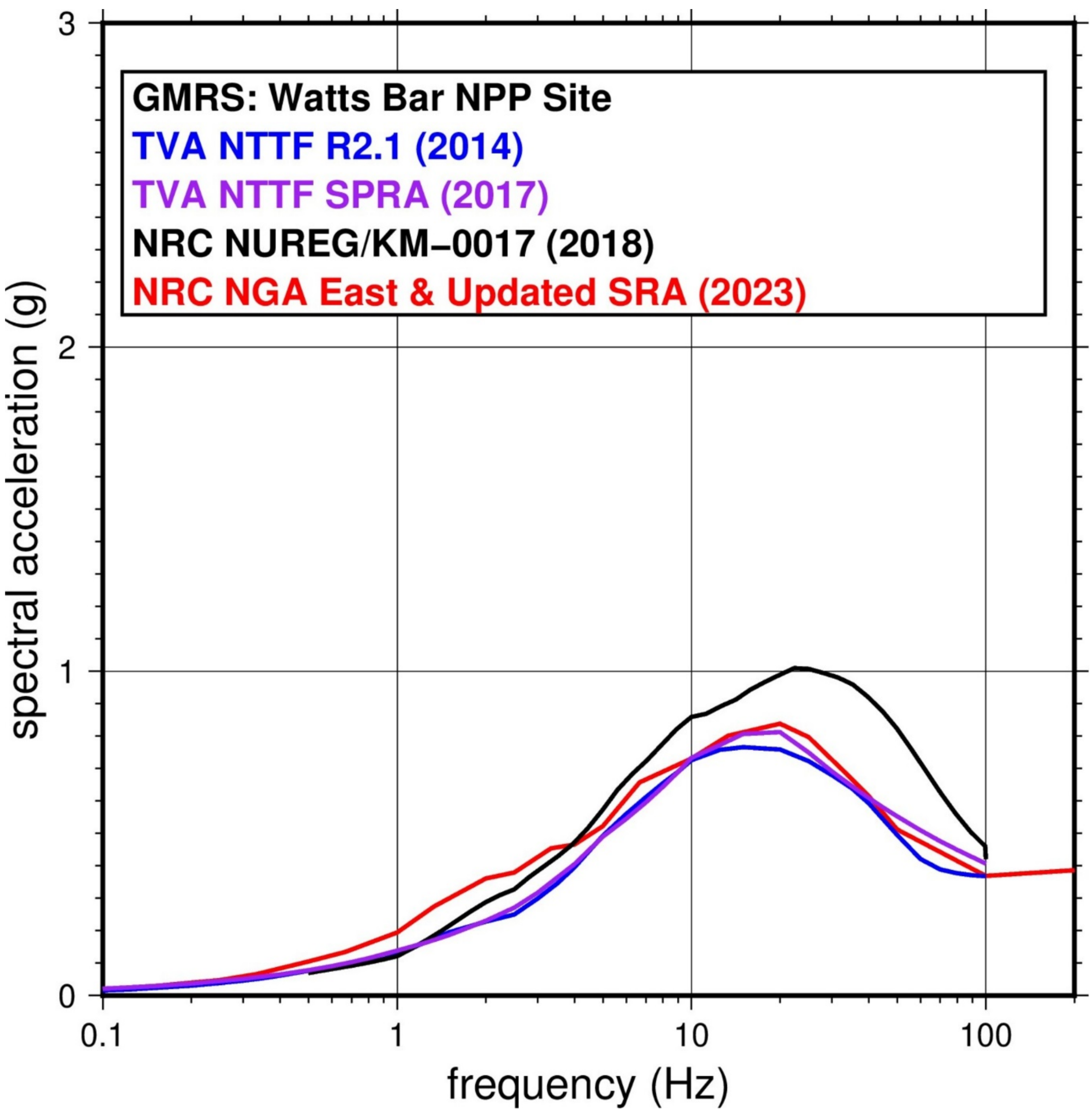

Figure 10 GMRS for the Watts Bar site

Appendix A—Data Tables

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.00100	3.34690E-03	4.39490E-03	6.31980E-03	8.05055E-03	1.07804E-02	1.90132E-02	2.66600E-02	4.29195E-02
0.00126	2.85754E-03	3.79303E-03	5.48093E-03	6.95371E-03	9.24276E-03	1.60043E-02	2.23091E-02	3.62386E-02
0.00158	2.44775E-03	3.28361E-03	4.76748E-03	6.02459E-03	7.94977E-03	1.35198E-02	1.87375E-02	3.07054E-02
0.00200	2.08328E-03	2.82562E-03	4.12293E-03	5.18859E-03	6.79495E-03	1.13412E-02	1.56239E-02	2.58384E-02
0.00251	1.72373E-03	2.38899E-03	3.53001E-03	4.46115E-03	5.84345E-03	9.59568E-03	1.30646E-02	2.14751E-02
0.00316	1.40035E-03	1.99770E-03	3.00053E-03	3.81252E-03	5.00455E-03	8.10090E-03	1.08970E-02	1.77685E-02
0.00398	1.07754E-03	1.62085E-03	2.50549E-03	3.21318E-03	4.25520E-03	6.83953E-03	9.08484E-03	1.45994E-02
0.00501	8.28496E-04	1.31437E-03	2.09188E-03	2.70811E-03	3.61856E-03	5.77635E-03	7.57706E-03	1.20006E-02
0.00631	5.41928E-04	9.44946E-04	1.63938E-03	2.18203E-03	2.98841E-03	4.82202E-03	6.28577E-03	9.80615E-03
0.00794	3.55083E-04	6.80253E-04	1.28601E-03	1.75966E-03	2.46988E-03	4.02826E-03	5.21845E-03	8.01942E-03
0.01000	2.32275E-04	4.89078E-04	1.00786E-03	1.41786E-03	2.03981E-03	3.36281E-03	4.32921E-03	6.55312E-03
0.01260	1.22837E-04	2.84240E-04	6.66964E-04	1.00168E-03	1.54826E-03	2.67912E-03	3.48009E-03	5.27484E-03
0.01580	6.58259E-05	1.67066E-04	4.45172E-04	7.12782E-04	1.18192E-03	2.14454E-03	2.81022E-03	4.26507E-03
0.02000	3.43718E-05	9.60490E-05	2.92181E-04	5.00081E-04	8.92183E-04	1.70081E-03	2.24921E-03	3.41828E-03
0.02510	1.61687E-05	4.82945E-05	1.64130E-04	3.00777E-04	5.95287E-04	1.24981E-03	1.70346E-03	2.65621E-03
0.03160	7.43874E-06	2.35983E-05	8.89900E-05	1.74201E-04	3.82690E-04	8.89633E-04	1.25667E-03	2.02366E-03
0.03980	3.28220E-06	1.07856E-05	4.38598E-05	9.06935E-05	2.20533E-04	5.75686E-04	8.57806E-04	1.45722E-03
0.05010	1.45092E-06	4.93752E-06	2.16385E-05	4.72463E-05	1.27092E-04	3.72373E-04	5.85270E-04	1.04887E-03
0.06310	6.32649E-07	2.18612E-06	9.83175E-06	2.20105E-05	6.31539E-05	2.03384E-04	3.40649E-04	6.55962E-04
0.07940	2.76773E-07	9.71079E-07	4.48131E-06	1.02853E-05	3.14699E-05	1.11354E-04	1.98700E-04	4.11007E-04
0.10000	1.20695E-07	4.29995E-07	2.03635E-06	4.79203E-06	1.56391E-05	6.08244E-05	1.15659E-04	2.57057E-04
0.12600	5.57607E-08	1.93008E-07	9.23696E-07	2.19488E-06	7.36188E-06	2.96316E-05	5.88975E-05	1.38326E-04
0.15800	2.61777E-08	8.80867E-08	4.25927E-07	1.02175E-06	3.52014E-06	1.46526E-05	3.04160E-05	7.53986E-05
0.20000	1.19092E-08	3.89119E-08	1.90179E-07	4.60755E-07	1.63233E-06	7.03658E-06	1.52818E-05	4.00745E-05
0.25100	7.28136E-09	1.91999E-08	8.89437E-08	2.18170E-07	7.98303E-07	3.47475E-06	7.73980E-06	2.08390E-05
0.31600	4.71746E-09	9.92871E-09	4.16731E-08	1.02511E-07	3.87294E-07	1.70903E-06	3.90531E-06	1.07726E-05
0.39800	3.81581E-09	6.23270E-09	2.03454E-08	4.85414E-08	1.88878E-07	8.56405E-07	2.00697E-06	5.62311E-06
0.50100	3.08657E-09	3.92131E-09	9.96335E-09	2.30382E-08	9.22471E-08	4.29799E-07	1.03301E-06	2.93992E-06
0.63100	2.36076E-09	2.79979E-09	5.67496E-09	1.15346E-08	4.35538E-08	2.11669E-07	5.28425E-07	1.54331E-06

Table A-1 Reference Rock Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.79400	1.80756E-09	2.00172E-09	3.23964E-09	5.79105E-09	2.06254E-08	1.04539E-07	2.71037E-07	8.12253E-07
1.00000	1.38255E-09	1.42927E-09	1.84537E-09	2.89967E-09	9.73903E-09	5.14880E-08	1.38658E-07	4.26426E-07
1.26000	7.40474E-10	7.59596E-10	9.34463E-10	1.37406E-09	4.25628E-09	2.31416E-08	6.50121E-08	2.08657E-07
1.58000	4.01762E-10	4.09025E-10	4.79928E-10	6.61298E-10	1.89238E-09	1.05752E-08	3.09653E-08	1.03625E-07
2.00000	2.12514E-10	2.14654E-10	2.39750E-10	3.08734E-10	8.13491E-10	4.67787E-09	1.43009E-08	4.99875E-08
2.51000	9.56766E-11	9.64363E-11	1.06070E-10	1.32814E-10	3.32782E-10	1.96489E-09	6.23730E-09	2.27656E-08
3.16000	4.18396E-11	4.20873E-11	4.56142E-11	5.55861E-11	1.32424E-10	8.02359E-10	2.64555E-09	1.00912E-08
3.98000	1.71717E-11	1.72466E-11	1.84698E-11	2.20004E-11	4.99242E-11	3.09407E-10	1.05902E-09	4.22531E-09
5.01000	7.05773E-12	7.07756E-12	7.48976E-12	8.72093E-12	1.88506E-11	1.19481E-10	4.24482E-10	1.77136E-09
6.31000	2.66923E-12	2.67274E-12	2.79744E-12	3.18438E-12	6.47302E-12	4.15665E-11	1.53194E-10	6.71119E-10
7.94000	1.01343E-12	1.01326E-12	1.04897E-12	1.16745E-12	2.23226E-12	1.45218E-11	5.55129E-11	2.55256E-10
10.00000	3.83325E-13	3.82687E-13	3.91839E-13	4.26336E-13	7.66623E-13	5.05266E-12	2.00369E-11	9.67208E-11

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.00100	5.53239E-02	6.94367E-02	7.37186E-02	7.77160E-02	7.83442E-02	7.94824E-02	7.92629E-02	7.68806E-02
0.00126	4.75201E-02	6.14229E-02	6.59415E-02	7.03241E-02	7.10943E-02	7.25423E-02	7.23350E-02	6.97460E-02
0.00158	4.09461E-02	5.44725E-02	5.91216E-02	6.37674E-02	6.46456E-02	6.63339E-02	6.61380E-02	6.34017E-02
0.00200	3.50638E-02	4.80680E-02	5.27669E-02	5.75872E-02	5.85498E-02	6.04316E-02	6.02472E-02	5.74063E-02
0.00251	2.93738E-02	4.10350E-02	4.54285E-02	5.00311E-02	5.10373E-02	5.29790E-02	5.29070E-02	5.03560E-02
0.00316	2.44563E-02	3.47617E-02	3.88008E-02	4.31165E-02	4.41408E-02	4.60847E-02	4.61299E-02	4.39070E-02
0.00398	2.00986E-02	2.88845E-02	3.24683E-02	3.63731E-02	3.73939E-02	3.92633E-02	3.94779E-02	3.77269E-02
0.00501	1.65234E-02	2.40066E-02	2.71747E-02	3.06896E-02	3.16838E-02	3.34571E-02	3.37915E-02	3.24243E-02
0.00631	1.34027E-02	1.94595E-02	2.21361E-02	2.51860E-02	2.61419E-02	2.77852E-02	2.83042E-02	2.74400E-02
0.00794	1.08805E-02	1.57869E-02	1.80465E-02	2.06858E-02	2.15860E-02	2.30920E-02	2.37248E-02	2.32374E-02
0.01000	8.82581E-03	1.27971E-02	1.47008E-02	1.69766E-02	1.78107E-02	1.91777E-02	1.98727E-02	1.96658E-02
0.01260	7.06748E-03	1.01585E-02	1.16876E-02	1.35510E-02	1.42835E-02	1.54678E-02	1.62025E-02	1.62764E-02
0.01580	5.68562E-03	8.10270E-03	9.33645E-03	1.08674E-02	1.15073E-02	1.25314E-02	1.32663E-02	1.35242E-02

Table A-2 Reference Rock Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.02000	4.53276E-03	6.40247E-03	7.38892E-03	8.63564E-03	9.18786E-03	1.00639E-02	1.07722E-02	1.11512E-02
0.02510	3.54542E-03	4.99416E-03	5.77865E-03	6.76834E-03	7.22311E-03	7.92556E-03	8.55538E-03	8.97985E-03
0.03160	2.72774E-03	3.84356E-03	4.46673E-03	5.24863E-03	5.61947E-03	6.17129E-03	6.71501E-03	7.14425E-03
0.03980	2.00526E-03	2.85660E-03	3.35406E-03	3.96790E-03	4.26431E-03	4.67274E-03	5.11462E-03	5.50632E-03
0.05010	1.47358E-03	2.12253E-03	2.51813E-03	2.99947E-03	3.23584E-03	3.53796E-03	3.89556E-03	4.24392E-03
0.06310	9.51627E-04	1.40994E-03	1.71278E-03	2.08050E-03	2.26513E-03	2.47011E-03	2.74409E-03	3.04277E-03
0.07940	6.15628E-04	9.38116E-04	1.16679E-03	1.44519E-03	1.58789E-03	1.72704E-03	1.93568E-03	2.18448E-03
0.10000	3.97589E-04	6.23196E-04	7.93665E-04	1.00246E-03	1.11159E-03	1.20583E-03	1.36358E-03	1.56627E-03
0.12600	2.21187E-04	3.59675E-04	4.70460E-04	6.11261E-04	6.90492E-04	7.62146E-04	8.89116E-04	1.06035E-03
0.15800	1.24559E-04	2.09967E-04	2.81919E-04	3.76570E-04	4.33178E-04	4.86327E-04	5.84916E-04	7.23687E-04
0.20000	6.84888E-05	1.19860E-04	1.65379E-04	2.27362E-04	2.66536E-04	3.04584E-04	3.78153E-04	4.86132E-04
0.25100	3.66011E-05	6.63676E-05	9.36296E-05	1.32483E-04	1.59003E-04	1.88242E-04	2.44166E-04	3.28131E-04
0.31600	1.94357E-05	3.64985E-05	5.26459E-05	7.66754E-05	9.42331E-05	1.15521E-04	1.56461E-04	2.19682E-04
0.39800	1.03915E-05	2.01460E-05	2.96758E-05	4.44407E-05	5.59097E-05	7.07390E-05	9.96574E-05	1.45605E-04
0.50100	5.56451E-06	1.11360E-05	1.67511E-05	2.57908E-05	3.32114E-05	4.33591E-05	6.35258E-05	9.65657E-05
0.63100	2.99055E-06	6.15202E-06	9.45512E-06	1.49050E-05	1.95504E-05	2.59265E-05	3.90475E-05	6.12713E-05
0.79400	1.61121E-06	3.40674E-06	5.34914E-06	8.63276E-06	1.15331E-05	1.55347E-05	2.40481E-05	3.89476E-05
1.00000	8.65984E-07	1.88218E-06	3.01952E-06	4.98936E-06	6.78954E-06	9.28952E-06	1.47825E-05	2.47138E-05
1.26000	4.34883E-07	9.72418E-07	1.60019E-06	2.71013E-06	3.75077E-06	5.16638E-06	8.41904E-06	1.44979E-05
1.58000	2.21536E-07	5.09332E-07	8.59274E-07	1.49086E-06	2.09774E-06	2.90850E-06	4.85124E-06	8.59970E-06
2.00000	1.09734E-07	2.59700E-07	4.49640E-07	8.00008E-07	1.14522E-06	1.59874E-06	2.73205E-06	4.99148E-06
2.51000	5.11791E-08	1.24039E-07	2.19917E-07	4.01045E-07	5.84013E-07	8.20960E-07	1.44218E-06	2.73131E-06
3.16000	2.32309E-08	5.76081E-08	1.04506E-07	1.95154E-07	2.88954E-07	4.09025E-07	7.38998E-07	1.45386E-06
3.98000	9.94760E-09	2.51365E-08	4.64766E-08	8.84927E-08	1.32894E-07	1.89386E-07	3.52049E-07	7.23518E-07
5.01000	4.26468E-09	1.09804E-08	2.06915E-08	4.01666E-08	6.11761E-08	8.77670E-08	1.67838E-07	3.60282E-07
6.31000	1.65409E-09	4.33546E-09	8.31067E-09	1.63845E-08	2.52106E-08	3.63298E-08	7.09775E-08	1.58495E-07
7.94000	6.43982E-10	1.71817E-09	3.35013E-09	6.70749E-09	1.04262E-08	1.50913E-08	3.01193E-08	6.99541E-08
10.00000	2.49802E-10	6.78470E-10	1.34571E-09	2.73638E-09	4.29707E-09	6.24749E-09	1.27386E-08	3.07772E-08

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.00100	7.45778E-02	7.17928E-02	6.96266E-02	6.70317E-02	6.54897E-02	6.31209E-02	5.87455E-02	5.80187E-02
0.00126	6.73211E-02	6.44723E-02	6.22494E-02	5.95813E-02	5.80240E-02	5.56554E-02	5.12046E-02	5.04966E-02
0.00158	6.08998E-02	5.80277E-02	5.57834E-02	5.30888E-02	5.15387E-02	4.92012E-02	4.47592E-02	4.40766E-02
0.00200	5.48619E-02	5.19991E-02	4.97616E-02	4.70773E-02	4.55533E-02	4.32732E-02	3.89069E-02	3.82560E-02
0.00251	4.80826E-02	4.55119E-02	4.34753E-02	4.09973E-02	3.95906E-02	3.74835E-02	3.33684E-02	3.27374E-02
0.00316	4.19217E-02	3.96527E-02	3.78249E-02	3.55648E-02	3.42782E-02	3.23473E-02	2.85061E-02	2.78910E-02
0.00398	3.61180E-02	3.42183E-02	3.26415E-02	3.06388E-02	2.94834E-02	2.77407E-02	2.41955E-02	2.35705E-02
0.00501	3.11258E-02	2.95369E-02	2.81766E-02	2.64030E-02	2.53667E-02	2.37971E-02	2.05426E-02	1.99246E-02
0.00631	2.65023E-02	2.52686E-02	2.41314E-02	2.25786E-02	2.16445E-02	2.02279E-02	1.72214E-02	1.65652E-02
0.00794	2.25801E-02	2.16306E-02	2.06797E-02	1.93203E-02	1.84802E-02	1.72052E-02	1.44473E-02	1.37824E-02
0.01000	1.92264E-02	1.85051E-02	1.77112E-02	1.65222E-02	1.57688E-02	1.46250E-02	1.21118E-02	1.14589E-02
0.01260	1.60416E-02	1.55653E-02	1.49030E-02	1.38446E-02	1.31591E-02	1.21304E-02	9.84368E-03	9.20951E-03
0.01580	1.34348E-02	1.31397E-02	1.25851E-02	1.16436E-02	1.10227E-02	1.01005E-02	8.03480E-03	7.43536E-03
0.02000	1.11690E-02	1.10142E-02	1.05532E-02	9.72227E-03	9.16539E-03	8.34648E-03	6.50319E-03	5.94981E-03
0.02510	9.05866E-03	9.02638E-03	8.64084E-03	7.90399E-03	7.41192E-03	6.70097E-03	5.09240E-03	4.60609E-03
0.03160	7.25532E-03	7.30988E-03	6.98971E-03	6.34378E-03	5.91634E-03	5.30939E-03	3.92941E-03	3.51191E-03
0.03980	5.61880E-03	5.73461E-03	5.47304E-03	4.91806E-03	4.55983E-03	4.06095E-03	2.91487E-03	2.57093E-03
0.05010	4.35153E-03	4.49897E-03	4.28566E-03	3.81307E-03	3.51472E-03	3.10644E-03	2.16271E-03	1.88248E-03
0.06310	3.14860E-03	3.31311E-03	3.15159E-03	2.78003E-03	2.55116E-03	2.23566E-03	1.51029E-03	1.29539E-03
0.07940	2.28115E-03	2.44280E-03	2.32046E-03	2.02942E-03	1.85414E-03	1.61109E-03	1.05620E-03	8.92735E-04
0.10000	1.65062E-03	1.79898E-03	1.70649E-03	1.47967E-03	1.34588E-03	1.15953E-03	7.37614E-04	6.14348E-04
0.12600	1.14347E-03	1.26850E-03	1.20651E-03	1.04688E-03	9.50178E-04	8.12184E-04	5.04465E-04	4.14264E-04
0.15800	7.98199E-04	9.00954E-04	8.59180E-04	7.46025E-04	6.75684E-04	5.73112E-04	3.47743E-04	2.81640E-04
0.20000	5.48919E-04	6.30868E-04	6.03265E-04	5.24192E-04	4.73726E-04	3.98592E-04	2.36031E-04	1.88427E-04
0.25100	3.79803E-04	4.43754E-04	4.26441E-04	3.71883E-04	3.35412E-04	2.79903E-04	1.61484E-04	1.27387E-04
0.31600	2.60611E-04	3.09555E-04	2.98939E-04	2.61504E-04	2.35271E-04	1.94572E-04	1.09181E-04	8.51194E-05
0.39800	1.76739E-04	2.13273E-04	2.06892E-04	1.81206E-04	1.62355E-04	1.32754E-04	7.21188E-05	5.56258E-05
0.50100	1.19922E-04	1.47009E-04	1.43252E-04	1.25617E-04	1.12083E-04	9.06119E-05	4.76585E-05	3.63684E-05
0.63100	7.75963E-05	9.65603E-05	9.43540E-05	8.24436E-05	7.30417E-05	5.82172E-05	2.95037E-05	2.22722E-05

Table A-3 Reference Rock Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**F13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.79400	5.02964E-05	6.35307E-05	6.22506E-05	5.41999E-05	4.76812E-05	3.74701E-05	1.82998E-05	1.36663E-05
1.00000	3.25462E-05	4.17312E-05	4.10038E-05	3.55739E-05	3.10743E-05	2.40754E-05	1.13294E-05	8.36978E-06
1.26000	1.93994E-05	2.52217E-05	2.47927E-05	2.13225E-05	1.84466E-05	1.40750E-05	6.34009E-06	4.61139E-06
1.58000	1.16881E-05	1.54038E-05	1.51482E-05	1.29169E-05	1.10696E-05	8.32079E-06	3.59102E-06	2.57232E-06
2.00000	6.89522E-06	9.21680E-06	9.06776E-06	7.66356E-06	6.50324E-06	4.81271E-06	1.98644E-06	1.40048E-06
2.51000	3.83488E-06	5.19931E-06	5.10989E-06	4.26563E-06	3.57523E-06	2.60073E-06	1.01734E-06	7.01956E-07
3.16000	2.07714E-06	2.85862E-06	2.80606E-06	2.31173E-06	1.91198E-06	1.36590E-06	5.05219E-07	3.40933E-07
3.98000	1.05525E-06	1.47709E-06	1.44745E-06	1.17403E-06	9.55723E-07	6.68980E-07	2.32709E-07	1.53379E-07
5.01000	5.36403E-07	7.63654E-07	7.47049E-07	5.96584E-07	4.78020E-07	3.27866E-07	1.07281E-07	6.90679E-08
6.31000	2.41322E-07	3.49842E-07	3.41622E-07	2.68338E-07	2.11465E-07	1.42147E-07	4.40237E-08	2.77847E-08
7.94000	1.08915E-07	1.60769E-07	1.56711E-07	1.21082E-07	9.38529E-08	6.18344E-08	1.81299E-08	1.12180E-08
10.00000	4.90044E-08	7.36579E-08	7.16700E-08	5.44667E-08	4.15225E-08	2.68111E-08	7.44058E-09	4.51326E-09

Table A-4 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.100 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.000390	0.9564	0.9586	0.9802	1.0089	1.1435	1.4370	1.4708	0.030582	0.000000
0.000615	0.9565	0.9588	0.9806	1.0087	1.1434	1.4372	1.4712	0.030592	0.000000
0.000801	0.9567	0.9591	0.9815	1.0098	1.1430	1.4382	1.4731	0.030660	0.000000
0.001091	0.9569	0.9594	0.9820	1.0103	1.1426	1.4387	1.4744	0.030763	0.000000
0.001559	0.9570	0.9597	0.9821	1.0103	1.1424	1.4390	1.4750	0.030871	0.000000
0.002177	0.9572	0.9599	0.9821	1.0102	1.1422	1.4390	1.4752	0.030962	0.000000
0.003036	0.9573	0.9601	0.9821	1.0100	1.1421	1.4389	1.4753	0.031049	0.000000
0.004162	0.9574	0.9602	0.9820	1.0097	1.1421	1.4389	1.4753	0.031124	0.000000
0.005963	0.9574	0.9604	0.9819	1.0095	1.1421	1.4388	1.4752	0.031186	0.000000
0.009541	0.9574	0.9603	0.9818	1.0101	1.1420	1.4389	1.4754	0.031473	0.000000
0.016025	0.9573	0.9603	0.9821	1.0102	1.1419	1.4391	1.4757	0.031621	0.002915
0.026916	0.9572	0.9601	0.9830	1.0104	1.1418	1.4396	1.4765	0.033289	0.010806

Table A-5 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.133 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.000696	0.9847	0.9867	1.0059	1.0329	1.1875	1.4727	1.5055	0.038407	0.000000
0.001095	0.9848	0.9868	1.0062	1.0331	1.1875	1.4730	1.5060	0.038431	0.000000
0.001407	0.9853	0.9875	1.0071	1.0336	1.1875	1.4743	1.5072	0.038574	0.000000
0.001882	0.9857	0.9880	1.0076	1.0340	1.1876	1.4750	1.5081	0.038768	0.000000
0.002662	0.9861	0.9884	1.0078	1.0339	1.1876	1.4753	1.5086	0.038958	0.000000
0.003740	0.9863	0.9887	1.0079	1.0337	1.1877	1.4754	1.5088	0.039112	0.000000
0.005282	0.9865	0.9889	1.0079	1.0335	1.1877	1.4754	1.5089	0.039255	0.000000
0.007424	0.9867	0.9891	1.0078	1.0334	1.1878	1.4753	1.5092	0.039376	0.000000
0.010888	0.9868	0.9892	1.0077	1.0335	1.1878	1.4753	1.5092	0.039474	0.001311
0.017574	0.9868	0.9893	1.0077	1.0335	1.1879	1.4754	1.5092	0.039723	0.004630
0.029516	0.9868	0.9893	1.0080	1.0337	1.1879	1.4757	1.5094	0.039841	0.005552
0.049573	0.9867	0.9892	1.0089	1.0339	1.1879	1.4763	1.5099	0.041185	0.011821

Table A-6 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.200 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.001481	0.9628	0.9658	0.9962	1.0412	1.2630	1.4168	1.4670	0.039521	0.000000
0.002328	0.9628	0.9659	0.9964	1.0415	1.2633	1.4169	1.4674	0.039528	0.000000
0.002957	0.9631	0.9664	0.9973	1.0413	1.2642	1.4170	1.4686	0.039599	0.000000
0.003866	0.9633	0.9667	0.9976	1.0416	1.2651	1.4170	1.4692	0.039733	0.000000
0.005376	0.9635	0.9671	0.9977	1.0413	1.2657	1.4167	1.4692	0.039882	0.000000
0.007638	0.9637	0.9673	0.9976	1.0409	1.2661	1.4164	1.4689	0.040011	0.000000
0.011048	0.9637	0.9674	0.9974	1.0408	1.2665	1.4161	1.4686	0.040134	0.001632
0.016144	0.9638	0.9675	0.9972	1.0410	1.2668	1.4159	1.4683	0.040242	0.003368
0.024434	0.9638	0.9676	0.9970	1.0411	1.2670	1.4157	1.4681	0.040332	0.004312
0.039762	0.9639	0.9677	0.9969	1.0409	1.2672	1.4156	1.4679	0.040576	0.006192
0.066782	0.9639	0.9677	0.9972	1.0409	1.2672	1.4158	1.4681	0.040694	0.006923
0.112160	0.9636	0.9674	0.9987	1.0408	1.2674	1.4164	1.4690	0.042075	0.012737

Table A-7 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.250 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.002139	0.8834	0.8905	0.9643	1.0616	1.2346	1.3245	1.3848	0.048633	0.000000
0.003363	0.8831	0.8903	0.9646	1.0625	1.2339	1.3248	1.3859	0.048623	0.000000
0.004267	0.8820	0.8897	0.9657	1.0657	1.2309	1.3255	1.3908	0.048626	0.000000
0.005536	0.8811	0.8893	0.9660	1.0673	1.2281	1.3256	1.3957	0.048708	0.000000
0.007642	0.8806	0.8892	0.9660	1.0677	1.2259	1.3252	1.3995	0.048828	0.000000
0.010925	0.8806	0.8893	0.9658	1.0674	1.2240	1.3261	1.4013	0.048942	0.001662
0.016004	0.8807	0.8896	0.9655	1.0667	1.2223	1.3269	1.4027	0.049058	0.003759
0.023836	0.8808	0.8898	0.9652	1.0660	1.2210	1.3275	1.4039	0.049163	0.004944
0.036592	0.8810	0.8900	0.9650	1.0655	1.2205	1.3278	1.4044	0.049252	0.005762
0.059688	0.8811	0.8902	0.9649	1.0650	1.2205	1.3278	1.4046	0.049463	0.007351
0.100250	0.8811	0.8903	0.9650	1.0652	1.2205	1.3280	1.4048	0.049562	0.007990
0.168370	0.8797	0.8888	0.9676	1.0663	1.2201	1.3282	1.4056	0.050747	0.013517

Table A-8 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.003240	0.8237	0.8888	0.9468	0.9857	1.1255	1.3331	1.3681	0.057275	0.000000
0.005103	0.8235	0.8891	0.9464	0.9865	1.1262	1.3331	1.3677	0.057230	0.000000
0.006498	0.8222	0.8896	0.9450	0.9895	1.1290	1.3324	1.3658	0.057090	0.000000
0.008397	0.8209	0.8890	0.9441	0.9912	1.1309	1.3309	1.3637	0.057042	0.000000
0.011527	0.8202	0.8882	0.9422	0.9928	1.1322	1.3291	1.3614	0.057067	0.001131
0.016598	0.8196	0.8873	0.9406	0.9942	1.1329	1.3276	1.3595	0.057121	0.002729
0.024657	0.8191	0.8863	0.9390	0.9957	1.1332	1.3260	1.3577	0.057190	0.003916
0.037473	0.8177	0.8880	0.9369	0.9963	1.1334	1.3254	1.3568	0.057260	0.004832
0.058367	0.8175	0.8871	0.9359	0.9972	1.1336	1.3244	1.3555	0.057327	0.005570
0.095369	0.8176	0.8868	0.9353	0.9974	1.1346	1.3237	1.3542	0.057505	0.007174
0.160180	0.8179	0.8873	0.9354	0.9974	1.1343	1.3242	1.3551	0.057591	0.007833
0.269030	0.8193	0.8851	0.9363	0.9978	1.1352	1.3221	1.3582	0.058665	0.013646

Table A-9 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.500 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.005273	0.8314	0.8961	0.9539	1.0277	1.2452	1.2795	1.3446	0.075583	0.000000
0.008333	0.8313	0.8964	0.9543	1.0281	1.2458	1.2800	1.3438	0.075499	0.000000
0.010743	0.8305	0.8974	0.9558	1.0298	1.2479	1.2822	1.3405	0.075198	0.000000
0.013947	0.8286	0.8973	0.9564	1.0312	1.2468	1.2837	1.3395	0.075018	0.000000
0.019155	0.8269	0.8964	0.9564	1.0323	1.2455	1.2829	1.3393	0.074962	0.000000
0.027817	0.8256	0.8957	0.9562	1.0329	1.2446	1.2821	1.3391	0.074971	0.000000
0.041941	0.8247	0.8952	0.9559	1.0333	1.2437	1.2817	1.3387	0.075012	0.000000
0.065039	0.8241	0.8948	0.9557	1.0336	1.2428	1.2819	1.3380	0.075067	0.000000
0.102760	0.8235	0.8945	0.9554	1.0338	1.2423	1.2816	1.3377	0.075127	0.000000
0.168140	0.8233	0.8943	0.9554	1.0338	1.2420	1.2815	1.3376	0.075263	0.000000
0.282400	0.8233	0.8943	0.9557	1.0337	1.2419	1.2818	1.3377	0.075331	0.002691
0.474310	0.8179	0.8891	0.9511	1.0761	1.2371	1.2782	1.3335	0.076193	0.011741

Table A-10 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=0.667 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.007013	0.8715	0.9430	0.9929	1.0292	1.1688	1.4079	1.4544	0.082832	0.000000
0.011122	0.8715	0.9433	0.9931	1.0298	1.1695	1.4083	1.4545	0.082710	0.000000
0.014519	0.8714	0.9446	0.9941	1.0310	1.1723	1.4093	1.4545	0.082230	0.000000
0.019014	0.8709	0.9453	0.9937	1.0329	1.1744	1.4095	1.4540	0.081855	0.000000
0.026243	0.8704	0.9457	0.9925	1.0343	1.1759	1.4088	1.4535	0.081634	0.000000
0.038332	0.8701	0.9458	0.9916	1.0353	1.1766	1.4085	1.4526	0.081523	0.000000
0.058249	0.8697	0.9459	0.9908	1.0361	1.1771	1.4082	1.4517	0.081462	0.000000
0.091185	0.8694	0.9458	0.9901	1.0367	1.1775	1.4079	1.4509	0.081437	0.000000
0.145020	0.8693	0.9457	0.9896	1.0370	1.1778	1.4078	1.4501	0.081440	0.000000
0.237490	0.8694	0.9458	0.9894	1.0372	1.1781	1.4081	1.4493	0.081535	0.000000
0.398880	0.8696	0.9460	0.9895	1.0374	1.1786	1.4086	1.4484	0.081614	0.000000
0.669940	0.8705	0.9465	0.9896	1.0372	1.1832	1.4078	1.4469	0.082447	0.000000

Table A-11 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.009838	0.9421	0.9959	1.0505	1.0950	1.2466	1.4966	1.5411	0.110280	0.000000
0.015689	0.9421	0.9959	1.0505	1.0955	1.2471	1.4967	1.5412	0.110090	0.000000
0.020937	0.9419	0.9954	1.0527	1.0975	1.2492	1.4974	1.5418	0.109260	0.000000
0.027896	0.9419	0.9957	1.0511	1.0991	1.2506	1.4969	1.5409	0.108540	0.000000
0.038939	0.9416	0.9964	1.0497	1.0994	1.2515	1.4963	1.5401	0.108040	0.000000
0.057379	0.9414	0.9967	1.0486	1.0993	1.2520	1.4956	1.5393	0.107730	0.000000
0.087965	0.9410	0.9969	1.0476	1.0997	1.2523	1.4951	1.5386	0.107500	0.000000
0.138890	0.9408	0.9970	1.0468	1.1000	1.2526	1.4947	1.5380	0.107340	0.000000
0.222220	0.9406	0.9971	1.0463	1.1003	1.2528	1.4945	1.5375	0.107260	0.000000
0.364310	0.9407	0.9972	1.0462	1.1004	1.2531	1.4946	1.5370	0.107270	0.000000
0.611880	0.9410	0.9974	1.0467	1.1006	1.2536	1.4952	1.5368	0.107350	0.000000
1.027700	0.9421	0.9981	1.0480	1.1013	1.2581	1.4956	1.5366	0.108050	0.000000

Table A-12 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=1.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.012067	0.9385	0.9828	1.0443	1.1775	1.4375	1.6667	1.7071	0.120160	0.000000
0.019336	0.9384	0.9829	1.0445	1.1778	1.4360	1.6667	1.7071	0.119890	0.000000
0.026279	0.9375	0.9829	1.0448	1.1790	1.4294	1.6664	1.7066	0.118770	0.000000
0.035544	0.9363	0.9823	1.0444	1.1797	1.4228	1.6656	1.7059	0.117790	0.000000
0.050126	0.9352	0.9816	1.0445	1.1801	1.4177	1.6649	1.7053	0.117090	0.000000
0.074377	0.9343	0.9809	1.0444	1.1803	1.4161	1.6644	1.7049	0.116650	0.000000
0.114640	0.9334	0.9802	1.0442	1.1805	1.4153	1.6639	1.7047	0.116320	0.000000
0.181730	0.9327	0.9796	1.0440	1.1805	1.4146	1.6636	1.7048	0.116080	0.000000
0.291520	0.9322	0.9792	1.0438	1.1806	1.4141	1.6634	1.7054	0.115940	0.000000
0.478300	0.9319	0.9790	1.0438	1.1806	1.4163	1.6634	1.7068	0.115910	0.000000
0.803330	0.9319	0.9790	1.0440	1.1806	1.4194	1.6643	1.7110	0.116010	0.000000
1.349200	0.9320	0.9791	1.0445	1.1870	1.4250	1.6678	1.7153	0.116740	0.008581

Table A-13 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.015262	0.9964	1.0810	1.2039	1.2808	1.5068	1.6012	1.6214	0.113980	0.000000
0.024642	0.9962	1.0807	1.2026	1.2793	1.5063	1.6000	1.6202	0.113890	0.000000
0.034503	0.9943	1.0790	1.1996	1.2724	1.5039	1.5957	1.6158	0.113400	0.000000
0.047835	0.9909	1.0761	1.2008	1.2688	1.5015	1.5921	1.6124	0.112820	0.000000
0.068612	0.9877	1.0733	1.2012	1.2697	1.4993	1.5892	1.6098	0.112330	0.000000
0.102930	0.9856	1.0714	1.2014	1.2703	1.4977	1.5872	1.6079	0.111990	0.000000
0.159780	0.9839	1.0699	1.2015	1.2707	1.4961	1.5858	1.6064	0.111700	0.000000
0.254330	0.9826	1.0688	1.2017	1.2710	1.4948	1.5847	1.6060	0.111480	0.000000
0.409090	0.9822	1.0684	1.2021	1.2692	1.4938	1.5840	1.6072	0.111340	0.000000
0.671930	0.9823	1.0687	1.2025	1.2685	1.4933	1.5846	1.6089	0.111320	0.000000
1.128500	0.9837	1.0703	1.2034	1.2685	1.4932	1.5868	1.6142	0.111380	0.000000
1.895400	0.9847	1.0726	1.2048	1.2692	1.4946	1.5871	1.6235	0.112050	0.002832

Table A-14 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=2.500 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.016960	0.9213	0.9880	1.0587	1.2460	1.3854	1.4137	1.4780	0.108350	0.000000
0.027516	0.9210	0.9877	1.0580	1.2452	1.3849	1.4131	1.4773	0.108370	0.000000
0.039252	0.9196	0.9863	1.0548	1.2416	1.3822	1.4105	1.4743	0.108250	0.000000
0.055264	0.9182	0.9848	1.0519	1.2379	1.3795	1.4081	1.4711	0.107920	0.000000
0.080108	0.9171	0.9834	1.0495	1.2347	1.3772	1.4062	1.4684	0.107550	0.000000
0.120980	0.9164	0.9824	1.0478	1.2324	1.3754	1.4050	1.4663	0.107260	0.000000
0.188560	0.9157	0.9815	1.0464	1.2304	1.3740	1.4039	1.4645	0.107000	0.000000
0.300730	0.9152	0.9808	1.0453	1.2288	1.3730	1.4030	1.4630	0.106780	0.000000
0.484380	0.9149	0.9803	1.0446	1.2277	1.3726	1.4022	1.4617	0.106620	0.000000
0.796150	0.9150	0.9802	1.0446	1.2274	1.3736	1.4015	1.4606	0.106630	0.000000
1.337200	0.9161	0.9810	1.0458	1.2279	1.3758	1.4038	1.4588	0.106690	0.000000
2.245900	0.9186	0.9829	1.0487	1.2289	1.3753	1.4128	1.4627	0.107320	0.000000

Table A-15 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=3.333 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.018964	0.8750	0.9429	1.0345	1.2134	1.2734	1.3980	1.4536	0.110320	0.000000
0.030981	0.8742	0.9423	1.0343	1.2131	1.2730	1.3970	1.4526	0.110480	0.000000
0.045399	0.8717	0.9401	1.0326	1.2116	1.2713	1.3929	1.4483	0.110830	0.000000
0.065344	0.8700	0.9377	1.0306	1.2099	1.2694	1.3891	1.4442	0.110800	0.000000
0.096151	0.8688	0.9358	1.0287	1.2084	1.2677	1.3861	1.4409	0.110600	0.000000
0.146590	0.8680	0.9344	1.0273	1.2072	1.2664	1.3841	1.4384	0.110400	0.000000
0.229740	0.8674	0.9333	1.0261	1.2062	1.2653	1.3825	1.4362	0.110200	0.000000
0.367410	0.8670	0.9324	1.0251	1.2053	1.2642	1.3815	1.4347	0.110020	0.000000
0.592910	0.8669	0.9320	1.0244	1.2047	1.2633	1.3814	1.4337	0.109910	0.000000
0.975570	0.8676	0.9323	1.0245	1.2046	1.2625	1.3833	1.4340	0.109930	0.000000
1.638500	0.8699	0.9340	1.0254	1.2048	1.2628	1.3884	1.4354	0.110130	0.000000
2.752000	0.8760	0.9377	1.0274	1.2067	1.2680	1.3941	1.4431	0.111030	0.009971

Table A-16 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=4.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.020053	0.8662	0.9240	0.9952	1.1568	1.2432	1.3723	1.4416	0.113880	0.000000
0.032924	0.8647	0.9230	0.9943	1.1564	1.2432	1.3719	1.4415	0.114210	0.000000
0.049170	0.8588	0.9187	0.9897	1.1548	1.2432	1.3701	1.4407	0.115120	0.000000
0.071874	0.8537	0.9147	0.9849	1.1533	1.2434	1.3685	1.4398	0.115460	0.000000
0.106870	0.8500	0.9116	0.9814	1.1519	1.2436	1.3674	1.4390	0.115480	0.000880
0.164010	0.8474	0.9093	0.9788	1.1510	1.2439	1.3666	1.4384	0.115400	0.000000
0.258050	0.8452	0.9074	0.9766	1.1503	1.2443	1.3663	1.4378	0.115280	0.000000
0.413500	0.8435	0.9059	0.9749	1.1498	1.2450	1.3666	1.4373	0.115170	0.000000
0.668250	0.8423	0.9047	0.9738	1.1496	1.2461	1.3678	1.4369	0.115100	0.000000
1.100400	0.8418	0.9042	0.9738	1.1498	1.2484	1.3716	1.4367	0.115190	0.000000
1.848200	0.8420	0.9043	0.9748	1.1509	1.2519	1.3806	1.4412	0.115530	0.003511
3.104100	0.8425	0.9046	0.9769	1.1547	1.2521	1.3979	1.4656	0.116850	0.017862

Table A-17 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=5.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.021114	0.7956	0.8662	0.9430	1.1005	1.2332	1.3425	1.4283	0.116190	0.000000
0.034897	0.7940	0.8648	0.9416	1.1000	1.2329	1.3419	1.4281	0.116730	0.000000
0.053467	0.7883	0.8595	0.9363	1.0985	1.2316	1.3400	1.4274	0.118370	0.000000
0.079795	0.7838	0.8553	0.9317	1.0974	1.2305	1.3385	1.4266	0.119180	0.000000
0.120320	0.7807	0.8522	0.9283	1.0967	1.2297	1.3374	1.4259	0.119460	0.005488
0.186270	0.7786	0.8499	0.9259	1.0962	1.2291	1.3366	1.4254	0.119520	0.006667
0.294640	0.7768	0.8479	0.9239	1.0958	1.2285	1.3362	1.4250	0.119510	0.006486
0.473500	0.7755	0.8464	0.9224	1.0955	1.2280	1.3363	1.4252	0.119480	0.005907
0.766830	0.7745	0.8454	0.9213	1.0953	1.2277	1.3375	1.4264	0.119490	0.006106
1.264100	0.7740	0.8453	0.9210	1.0952	1.2275	1.3409	1.4340	0.119760	0.010094
2.123200	0.7740	0.8463	0.9216	1.0953	1.2276	1.3459	1.4380	0.120420	0.016137
3.566000	0.7740	0.8481	0.9239	1.0954	1.2292	1.3709	1.4650	0.122720	0.028629

Table A-18 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=6.667 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.021916	0.7367	0.8022	0.8756	1.0914	1.2931	1.3705	1.4487	0.121600	0.000000
0.036575	0.7336	0.7998	0.8734	1.0904	1.2929	1.3693	1.4480	0.122550	0.000000
0.058174	0.7227	0.7934	0.8656	1.0868	1.2922	1.3655	1.4451	0.125480	0.000000
0.089486	0.7137	0.7855	0.8597	1.0839	1.2914	1.3628	1.4429	0.127070	0.000000
0.137710	0.7092	0.7803	0.8557	1.0817	1.2906	1.3606	1.4414	0.127770	0.011511
0.215910	0.7067	0.7769	0.8531	1.0802	1.2899	1.3590	1.4408	0.128070	0.014466
0.344250	0.7045	0.7744	0.8510	1.0856	1.2893	1.3589	1.4402	0.128240	0.015901
0.555830	0.7030	0.7726	0.8495	1.0849	1.2888	1.3597	1.4404	0.128350	0.016765
0.903260	0.7020	0.7717	0.8486	1.0844	1.2884	1.3616	1.4422	0.128520	0.018020
1.491700	0.7018	0.7720	0.8489	1.0841	1.2881	1.3667	1.4508	0.129090	0.021716
2.505300	0.7024	0.7742	0.8501	1.0845	1.2881	1.3800	1.4644	0.130250	0.027792
4.207800	0.7035	0.7728	0.8521	1.0854	1.2975	1.4007	1.4974	0.133990	0.041960

Table A-19 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=10.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.021591	0.5987	0.6565	0.7734	1.0270	1.1905	1.3430	1.3935	0.113230	0.000000
0.036608	0.5898	0.6484	0.7688	1.0244	1.1885	1.3416	1.3923	0.115440	0.000000
0.061937	0.5650	0.6215	0.7534	1.0155	1.1823	1.3367	1.3884	0.122720	0.000000
0.100210	0.5499	0.6048	0.7431	1.0097	1.1784	1.3334	1.3861	0.127260	0.002244
0.159540	0.5412	0.5964	0.7369	1.0059	1.1762	1.3313	1.3852	0.129710	0.025192
0.255500	0.5363	0.5916	0.7332	1.0034	1.1749	1.3299	1.3860	0.131040	0.031327
0.413150	0.5326	0.5881	0.7304	1.0015	1.1741	1.3292	1.3884	0.131980	0.035052
0.673070	0.5295	0.5856	0.7284	1.0000	1.1737	1.3304	1.3941	0.132730	0.037778
1.101000	0.5274	0.5840	0.7272	0.9991	1.1743	1.3340	1.4060	0.133550	0.040565
1.824000	0.5265	0.5836	0.7272	0.9993	1.1803	1.3436	1.4295	0.134980	0.045050
3.063500	0.5265	0.5846	0.7285	1.0007	1.1954	1.3632	1.4593	0.137940	0.053267
5.145300	0.5306	0.5898	0.7294	1.0041	1.2188	1.3791	1.5206	0.145410	0.070385

Table A-20 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=13.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.020246	0.5467	0.6219	0.7148	0.9727	1.1965	1.3405	1.4028	0.104400	0.000000
0.034750	0.5338	0.6099	0.7068	0.9680	1.1937	1.3272	1.4010	0.107510	0.000000
0.061800	0.4907	0.5720	0.6811	0.9531	1.1865	1.3206	1.3954	0.117990	0.000000
0.104280	0.4647	0.5489	0.6655	0.9442	1.1824	1.3169	1.3919	0.124660	0.011529
0.170860	0.4505	0.5364	0.6568	0.9392	1.1801	1.3147	1.3900	0.128390	0.032815
0.278600	0.4425	0.5293	0.6519	0.9365	1.1787	1.3133	1.3896	0.130480	0.040222
0.456160	0.4371	0.5242	0.6483	0.9349	1.1778	1.3128	1.3912	0.132060	0.045085
0.749430	0.4333	0.5207	0.6458	0.9343	1.1775	1.3139	1.3907	0.133420	0.048926
1.233400	0.4308	0.5183	0.6440	0.9349	1.1792	1.3175	1.3976	0.134900	0.052828
2.049400	0.4301	0.5173	0.6432	0.9376	1.1837	1.3214	1.4123	0.137180	0.058405
3.442000	0.4311	0.5174	0.6433	0.9446	1.1945	1.3396	1.4411	0.141320	0.067559
5.781000	0.4332	0.5200	0.6436	0.9614	1.2102	1.3656	1.5008	0.149230	0.082840

Table A-21 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=20.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.017198	0.5364	0.5882	0.6668	0.9415	1.1844	1.2985	1.3693	0.086386	0.000000
0.029978	0.5108	0.5636	0.6469	0.9295	1.1741	1.2959	1.3631	0.091008	0.000000
0.057271	0.4242	0.4800	0.5814	0.8879	1.1524	1.2711	1.3438	0.107380	0.000000
0.103340	0.3710	0.4276	0.5418	0.8618	1.1470	1.2619	1.3328	0.118570	0.012138
0.177530	0.3423	0.3995	0.5212	0.8508	1.1443	1.2541	1.3278	0.125100	0.041695
0.298380	0.3269	0.3847	0.5102	0.8453	1.1428	1.2501	1.3271	0.128840	0.051848
0.499340	0.3163	0.3744	0.5027	0.8419	1.1419	1.2480	1.3291	0.131710	0.058617
0.833030	0.3092	0.3675	0.4978	0.8404	1.1415	1.2486	1.3338	0.134020	0.063638
1.386300	0.3047	0.3629	0.4938	0.8410	1.1422	1.2540	1.3371	0.136140	0.067990
2.315300	0.3033	0.3622	0.4933	0.8446	1.1451	1.2613	1.3401	0.138310	0.072237
3.888700	0.3042	0.3631	0.4967	0.8509	1.1590	1.2754	1.3636	0.140360	0.076088
6.531300	0.3048	0.3631	0.5021	0.8633	1.1745	1.2781	1.3665	0.146920	0.087601

Table A-22 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=25.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.015309	0.5648	0.6124	0.6802	0.9530	1.1876	1.2897	1.3780	0.076572	0.000000
0.026801	0.5341	0.5826	0.6504	0.9369	1.1754	1.2771	1.3698	0.081602	0.000000
0.052834	0.4229	0.4764	0.5540	0.8760	1.1395	1.2509	1.3421	0.101200	0.000000
0.099007	0.3498	0.4038	0.4926	0.8340	1.1284	1.2291	1.3259	0.115370	0.000000
0.175110	0.3095	0.3635	0.4602	0.8137	1.1234	1.2234	1.3199	0.123650	0.044109
0.300000	0.2876	0.3417	0.4432	0.8050	1.1198	1.2208	1.3179	0.128310	0.055855
0.509300	0.2723	0.3255	0.4317	0.7996	1.1144	1.2191	1.3188	0.131690	0.063234
0.858470	0.2620	0.3151	0.4242	0.7969	1.1108	1.2163	1.3222	0.134080	0.068072
1.439300	0.2552	0.3083	0.4197	0.7966	1.1084	1.2143	1.3268	0.135860	0.071514
2.412200	0.2526	0.3058	0.4175	0.7983	1.1077	1.2218	1.3168	0.137320	0.074250
4.051400	0.2529	0.3059	0.4176	0.7996	1.1128	1.2268	1.3142	0.138360	0.076156
6.804600	0.2531	0.3062	0.4176	0.8053	1.0896	1.2140	1.3258	0.143800	0.085643

Table A-23 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=33.333 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.013154	0.6284	0.6782	0.7310	0.9647	1.1990	1.2926	1.3736	0.058009	0.000000
0.022962	0.5930	0.6394	0.6970	0.9433	1.1837	1.2757	1.3565	0.062168	0.000000
0.045969	0.4556	0.4993	0.5642	0.8539	1.1308	1.2269	1.3148	0.081702	0.000000
0.089771	0.3540	0.3973	0.4679	0.7903	1.0825	1.1975	1.2962	0.098871	0.000000
0.164910	0.2970	0.3387	0.4142	0.7543	1.0648	1.1845	1.2888	0.109420	0.042704
0.290120	0.2661	0.3068	0.3854	0.7374	1.0488	1.1723	1.2831	0.115270	0.056018
0.502790	0.2448	0.2846	0.3659	0.7240	1.0379	1.1645	1.2809	0.119260	0.063827
0.860550	0.2303	0.2697	0.3530	0.7163	1.0299	1.1608	1.2790	0.121630	0.068152
1.458900	0.2208	0.2598	0.3448	0.7097	1.0262	1.1574	1.2793	0.122950	0.070481
2.457500	0.2169	0.2555	0.3403	0.7076	1.0246	1.1506	1.2806	0.124060	0.072400
4.127600	0.2172	0.2557	0.3406	0.7076	1.0199	1.1284	1.2827	0.124660	0.073423
6.932400	0.2174	0.2565	0.3399	0.7076	1.0058	1.1126	1.2726	0.132990	0.086817

Table A-24 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=40.000 Hz									
SA (g)	SAF-M1	SAF-M2	SAF-M3	SAF-M4	SAF-M5	SAF-M6	SAF-M7	LNSTDEV	NL-LNSTDEV
0.012119	0.6725	0.7235	0.7745	0.9873	1.2150	1.3038	1.3848	0.049354	0.000000
0.021015	0.6378	0.6875	0.7382	0.9628	1.2003	1.2852	1.3686	0.052243	0.000000
0.041583	0.4912	0.5326	0.5921	0.8613	1.1325	1.2239	1.3136	0.068476	0.000000
0.082413	0.3743	0.4136	0.4771	0.7736	1.0713	1.1755	1.2796	0.085592	0.000000
0.154650	0.3048	0.3419	0.4079	0.7218	1.0345	1.1530	1.2503	0.097493	0.039236
0.276670	0.2669	0.3024	0.3699	0.6948	1.0241	1.1397	1.2427	0.104370	0.054108
0.486140	0.2409	0.2751	0.3439	0.6757	1.0142	1.1291	1.2279	0.108950	0.062487
0.840900	0.2234	0.2566	0.3265	0.6643	1.0029	1.1196	1.2234	0.111430	0.066717
1.436700	0.2119	0.2445	0.3153	0.6555	0.9837	1.1116	1.2212	0.112500	0.068490
2.428900	0.2071	0.2394	0.3108	0.6524	0.9718	1.0939	1.2202	0.113810	0.070621
4.079400	0.2074	0.2399	0.3114	0.6524	0.9529	1.0747	1.2190	0.114550	0.071807
6.851500	0.2077	0.2405	0.3131	0.6524	0.9472	1.0795	1.2112	0.126840	0.090127

Table A-25 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=50.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.011237	0.7195	0.7715	0.8255	1.0223	1.2281	1.3238	1.4009	0.045372	0.000000
0.019294	0.6885	0.7398	0.7911	0.9958	1.2163	1.3100	1.3894	0.047173	0.000000
0.036891	0.5449	0.5877	0.6431	0.8850	1.1448	1.2356	1.3263	0.058706	0.000000
0.072920	0.4147	0.4529	0.5092	0.7744	1.0679	1.1646	1.2702	0.073880	0.000000
0.139230	0.3308	0.3658	0.4222	0.7009	1.0077	1.1263	1.2307	0.086057	0.032150
0.253600	0.2832	0.3162	0.3719	0.6595	0.9792	1.0993	1.2206	0.093932	0.049508
0.452910	0.2501	0.2814	0.3368	0.6304	0.9585	1.0852	1.2071	0.099832	0.059952
0.793760	0.2281	0.2579	0.3130	0.6111	0.9399	1.0652	1.1993	0.103310	0.065580
1.369700	0.2139	0.2423	0.2975	0.5992	0.9258	1.0429	1.1923	0.104890	0.068042
2.326300	0.2078	0.2357	0.2910	0.5954	0.9117	1.0241	1.1911	0.107370	0.071806
3.907100	0.2081	0.2361	0.2914	0.5968	0.8988	1.0204	1.1697	0.107830	0.072492
6.562200	0.2086	0.2368	0.2920	0.5974	0.8819	1.0131	1.1592	0.128230	0.100353

Table A-26 Site Adjustment Factor Medians and Logarithmic Standard Deviation for F=100.000 Hz									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.010157	0.7909	0.8460	0.9065	1.0879	1.2529	1.3606	1.4306	0.042864	0.000000
0.017129	0.7700	0.8252	0.8832	1.0721	1.2459	1.3491	1.4242	0.043899	0.000000
0.029653	0.6709	0.7238	0.7778	0.9891	1.2122	1.3092	1.3872	0.050342	0.000000
0.052661	0.5656	0.6103	0.6690	0.8980	1.1549	1.2552	1.3453	0.060786	0.000000
0.095017	0.4761	0.5190	0.5760	0.8142	1.0914	1.1994	1.3099	0.071396	0.000000
0.170860	0.4121	0.4518	0.5075	0.7469	1.0326	1.1449	1.2708	0.079217	0.032866
0.307240	0.3607	0.3970	0.4505	0.6878	0.9774	1.0924	1.2312	0.085351	0.045713
0.547090	0.3220	0.3564	0.4076	0.6425	0.9322	1.0493	1.2038	0.091223	0.055915
0.960500	0.2955	0.3280	0.3774	0.6116	0.8994	1.0231	1.1827	0.098081	0.066519
1.646600	0.2842	0.3160	0.3642	0.6008	0.8877	1.0274	1.1762	0.114250	0.088645
2.765500	0.2848	0.3161	0.3642	0.6057	0.8901	1.0266	1.1940	0.131800	0.110345
4.644800	0.2861	0.3168	0.3643	0.6285	0.8952	1.0512	1.2607	0.195390	0.181610

Table A-27 Site Adjustment Factor Medians and Logarithmic Standard Deviation for PGA									
SA (g)	**SAF-M1**	**SAF-M2**	**SAF-M3**	**SAF-M4**	**SAF-M5**	**SAF-M6**	**SAF-M7**	**LNSTDEV**	**NL-LNSTDEV**
0.010020	0.8011	0.8566	0.9181	1.0979	1.2577	1.3688	1.4324	0.042479	0.000000
0.016836	0.7828	0.8386	0.8977	1.0851	1.2524	1.3612	1.4278	0.043343	0.000000
0.028357	0.7008	0.7560	0.8112	1.0242	1.2311	1.3264	1.4046	0.048267	0.000000
0.047926	0.6201	0.6685	0.7323	0.9610	1.2026	1.2952	1.3788	0.056595	0.000000
0.081326	0.5556	0.6040	0.6684	0.9088	1.1687	1.2668	1.3552	0.067798	0.000000
0.138230	0.5087	0.5566	0.6220	0.8693	1.1468	1.2479	1.3481	0.079280	0.032589
0.235540	0.4690	0.5152	0.5815	0.8326	1.1210	1.2236	1.3427	0.091464	0.056057
0.401380	0.4374	0.4827	0.5487	0.8024	1.0929	1.2085	1.3469	0.105940	0.077460
0.682720	0.4140	0.4586	0.5239	0.7804	1.0780	1.1972	1.3480	0.125610	0.102736
1.154100	0.4038	0.4477	0.5123	0.7723	1.0729	1.2030	1.3855	0.159090	0.141726
1.938300	0.4046	0.4480	0.5124	0.7782	1.0774	1.2224	1.5255	0.203260	0.189977
3.255500	0.4062	0.4487	0.5124	0.8194	1.0931	1.2702	1.8325	0.308070	0.299473

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.00100	3.40128E-03	4.58102E-03	6.41304E-03	8.17246E-03	1.06095E-02	1.93477E-02	2.71436E-02	4.49855E-02
0.00130	3.02075E-03	4.10278E-03	5.92227E-03	7.31746E-03	9.43995E-03	1.70147E-02	2.37742E-02	3.96885E-02
0.00160	2.58787E-03	3.55204E-03	5.16200E-03	6.33920E-03	8.11827E-03	1.43794E-02	1.99791E-02	3.36450E-02
0.00200	2.19859E-03	3.06156E-03	4.33602E-03	5.47097E-03	6.96219E-03	1.21123E-02	1.67153E-02	2.83835E-02
0.00250	1.83978E-03	2.61366E-03	3.84890E-03	4.70645E-03	5.97300E-03	1.02127E-02	1.39663E-02	2.37674E-02
0.00320	1.50154E-03	2.19904E-03	3.28476E-03	4.02545E-03	5.10944E-03	8.62148E-03	1.16578E-02	1.97357E-02
0.00400	1.18939E-03	1.81736E-03	2.77636E-03	3.41715E-03	4.35784E-03	7.28114E-03	9.72500E-03	1.62896E-02
0.00500	9.03423E-04	1.46831E-03	2.30780E-03	2.86550E-03	3.68198E-03	6.13740E-03	8.10338E-03	1.33930E-02
0.00630	6.44254E-04	1.13364E-03	1.87808E-03	2.35901E-03	3.07331E-03	5.15174E-03	6.73981E-03	1.09809E-02
0.00790	4.33454E-04	8.29600E-04	1.49733E-03	1.91273E-03	2.54884E-03	4.30816E-03	5.59666E-03	8.98224E-03
0.01000	2.78058E-04	5.90374E-04	1.15188E-03	1.51427E-03	2.06370E-03	3.57240E-03	4.62246E-03	7.33477E-03
0.01260	1.67345E-04	3.93702E-04	8.54768E-04	1.14498E-03	1.61979E-03	2.91278E-03	3.77512E-03	5.95752E-03
0.01580	9.30071E-05	2.38000E-04	5.99781E-04	8.26956E-04	1.24705E-03	2.33782E-03	3.05072E-03	4.81111E-03

Table A-28 Control Point Total Mean Hazard Curves for F=0.100 to 1.000 Hz								
SA(g)	**F0.100Hz**	**F0.133Hz**	**F0.200Hz**	**F0.250Hz**	**F0.333Hz**	**F0.500Hz**	**F0.667Hz**	**F1.000Hz**
0.02000	4.88818E-05	1.37442E-04	3.77934E-04	5.74168E-04	9.24293E-04	1.84202E-03	2.43193E-03	3.86530E-03
0.02510	2.47700E-05	7.59682E-05	2.48025E-04	3.76366E-04	6.51925E-04	1.40293E-03	1.88892E-03	3.05768E-03
0.03160	1.18671E-05	3.89214E-05	1.44538E-04	2.27725E-04	4.30914E-04	1.01602E-03	1.41031E-03	2.35860E-03
0.03980	5.42538E-06	1.88078E-05	7.72521E-05	1.27801E-04	2.65902E-04	6.96387E-04	1.00736E-03	1.76183E-03
0.05010	2.42253E-06	8.73744E-06	3.93997E-05	6.77248E-05	1.54969E-04	4.50980E-04	6.85026E-04	1.26961E-03
0.06310	1.06621E-06	3.96466E-06	1.89613E-05	3.39931E-05	8.42762E-05	2.72639E-04	4.37126E-04	8.68028E-04
0.07940	4.67162E-07	1.77151E-06	8.94333E-06	1.63256E-05	4.37220E-05	1.54547E-04	2.62801E-04	5.56300E-04
0.10000	2.04593E-07	7.85421E-07	4.03175E-06	7.60810E-06	2.16950E-05	8.37974E-05	1.51457E-04	3.46092E-04
0.12600	9.09310E-08	3.49139E-07	1.82485E-06	3.53228E-06	1.06106E-05	4.40456E-05	8.40388E-05	2.06390E-04
0.15800	4.14582E-08	1.56619E-07	8.49296E-07	1.63187E-06	5.09859E-06	2.21528E-05	4.43070E-05	1.17105E-04
0.20000	1.95519E-08	7.07058E-08	3.66041E-07	7.50514E-07	2.41467E-06	1.08264E-05	2.26000E-05	6.19108E-05
0.25100	9.99926E-09	3.24823E-08	1.75334E-07	3.47038E-07	1.15256E-06	5.28598E-06	1.14617E-05	3.30685E-05
0.31600	6.01148E-09	1.59311E-08	7.93066E-08	1.61742E-07	5.54386E-07	2.59095E-06	5.79301E-06	1.71519E-05
0.39800	4.28002E-09	8.66453E-09	3.73549E-08	7.63982E-08	2.70379E-07	1.28374E-06	2.94447E-06	8.90359E-06
0.50100	3.32377E-09	5.27558E-09	1.81100E-08	3.62825E-08	1.31466E-07	6.39759E-07	1.50647E-06	4.64038E-06
0.63100	2.61370E-09	3.47866E-09	9.17044E-09	1.75263E-08	6.34541E-08	3.18988E-07	7.73588E-07	2.42835E-06
0.79400	2.01589E-09	2.43369E-09	4.97396E-09	8.67372E-09	3.02978E-08	1.57983E-07	3.96623E-07	1.27452E-06
1.00000	1.48082E-09	1.70744E-09	2.80953E-09	4.33567E-09	1.42415E-08	7.74651E-08	2.01964E-07	6.68489E-07
1.26000	9.72529E-10	1.09883E-09	1.55125E-09	2.13825E-09	6.56266E-09	3.71235E-08	1.00545E-07	3.44434E-07
1.58000	5.61947E-10	6.26413E-10	8.31293E-10	1.03911E-09	2.95021E-09	1.71705E-08	4.83984E-08	1.86669E-07
2.00000	2.97915E-10	3.31180E-10	4.07665E-10	4.87107E-10	1.28467E-09	7.71320E-09	2.26598E-08	8.42521E-08
2.51000	1.50037E-10	1.68407E-10	2.05340E-10	2.26187E-10	5.49438E-10	3.38881E-09	1.03592E-08	4.22518E-08
3.16000	6.97051E-11	7.88196E-11	9.35343E-11	9.84568E-11	2.25884E-10	1.43108E-09	4.54400E-09	1.84605E-08
3.98000	3.01626E-11	3.43079E-11	4.01134E-11	4.09971E-11	8.93354E-11	5.80693E-10	1.91205E-09	8.12192E-09
5.01000	1.25442E-11	1.43811E-11	1.66166E-11	1.65052E-11	3.41706E-11	2.27183E-10	7.75178E-10	3.43874E-09
6.31000	5.00327E-12	5.79906E-12	6.58447E-12	6.38600E-12	1.25530E-11	8.53451E-11	3.01198E-10	1.39965E-09
7.94000	1.90512E-12	2.23421E-12	2.52103E-12	2.37915E-12	4.45091E-12	3.06377E-11	1.11357E-10	5.36586E-10
10.00000	6.03115E-13	7.62018E-13	8.38782E-13	7.45878E-13	1.26863E-12	9.26968E-12	3.43814E-11	1.83473E-10

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	F1.333Hz	F2.000Hz	F2.500Hz	F3.333Hz	F4.000Hz	F5.000Hz	F6.667Hz	F10.000Hz
0.00100	5.77371E-02	7.30075E-02	7.61236E-02	8.00019E-02	8.02340E-02	8.02538E-02	7.96729E-02	7.63879E-02
0.00130	5.30852E-02	6.99194E-02	7.14620E-02	7.55640E-02	7.42606E-02	7.47798E-02	7.56095E-02	6.99251E-02
0.00160	4.73291E-02	6.36844E-02	6.41158E-02	6.85429E-02	6.72871E-02	6.83375E-02	6.90752E-02	6.42160E-02
0.00200	4.06944E-02	5.64110E-02	5.71997E-02	6.18436E-02	6.05293E-02	6.19413E-02	6.25831E-02	5.61066E-02
0.00250	3.46451E-02	4.95673E-02	5.04280E-02	5.50997E-02	5.35200E-02	5.51896E-02	5.60364E-02	4.97303E-02
0.00320	2.91965E-02	4.29133E-02	4.35939E-02	4.80846E-02	4.64179E-02	4.82335E-02	4.93138E-02	4.34488E-02
0.00400	2.43359E-02	3.65104E-02	3.70455E-02	4.12150E-02	3.96881E-02	4.15271E-02	4.27094E-02	3.75368E-02
0.00500	2.00994E-02	3.06326E-02	3.10965E-02	3.48805E-02	3.35529E-02	3.53330E-02	3.65850E-02	3.21713E-02
0.00630	1.64833E-02	2.54135E-02	2.57936E-02	2.91587E-02	2.80265E-02	2.97007E-02	3.10318E-02	2.74246E-02
0.00790	1.34409E-02	2.08512E-02	2.11569E-02	2.40979E-02	2.32081E-02	2.47537E-02	2.61261E-02	2.31815E-02
0.01000	1.09176E-02	1.69575E-02	1.72128E-02	1.97468E-02	1.90733E-02	2.04735E-02	2.17943E-02	1.95050E-02
0.01260	8.82504E-03	1.37044E-02	1.39189E-02	1.60683E-02	1.55181E-02	1.66281E-02	1.80667E-02	1.63198E-02
0.01580	7.10901E-03	1.09989E-02	1.11450E-02	1.29282E-02	1.25059E-02	1.35828E-02	1.48338E-02	1.34961E-02
0.02000	5.69739E-03	8.76280E-03	8.85914E-03	1.03162E-02	1.00006E-02	1.08124E-02	1.20478E-02	1.10686E-02
0.02510	4.52480E-03	6.93625E-03	6.99680E-03	8.17591E-03	7.92032E-03	8.63447E-03	9.69651E-03	8.96496E-03
0.03160	3.54476E-03	5.43864E-03	5.45959E-03	6.39991E-03	6.18637E-03	6.71611E-03	7.67770E-03	7.13541E-03
0.03980	2.71849E-03	4.20011E-03	4.19595E-03	4.93823E-03	4.76065E-03	5.15985E-03	5.95614E-03	5.41726E-03
0.05010	2.02967E-03	3.17966E-03	3.15841E-03	3.74097E-03	3.58873E-03	3.87858E-03	4.40607E-03	4.13152E-03
0.06310	1.45525E-03	2.33995E-03	2.30568E-03	2.75870E-03	2.62076E-03	2.82734E-03	3.26799E-03	3.08360E-03
0.07940	9.98089E-04	1.65235E-03	1.61486E-03	1.96222E-03	1.85941E-03	1.99902E-03	2.35273E-03	2.22403E-03
0.10000	6.58538E-04	1.11811E-03	1.09251E-03	1.35389E-03	1.28528E-03	1.37970E-03	1.64277E-03	1.57932E-03
0.12600	4.12881E-04	7.23332E-04	7.18639E-04	9.09304E-04	8.54731E-04	9.23574E-04	1.13078E-03	1.08129E-03
0.15800	2.49015E-04	4.59684E-04	4.46589E-04	5.78990E-04	5.44112E-04	5.95837E-04	7.59418E-04	7.33107E-04
0.20000	1.43865E-04	2.54552E-04	2.65006E-04	3.38955E-04	3.36985E-04	3.75954E-04	4.90990E-04	4.93906E-04
0.25100	7.95320E-05	1.41944E-04	1.55360E-04	2.13007E-04	2.05419E-04	2.34885E-04	3.20252E-04	3.32407E-04
0.31600	4.34451E-05	8.93301E-05	8.89559E-05	1.25479E-04	1.23007E-04	1.45089E-04	2.05641E-04	2.22094E-04
0.39800	2.33650E-05	4.56204E-05	5.01713E-05	7.28216E-05	7.30389E-05	8.90766E-05	1.31551E-04	1.47395E-04
0.50100	1.24688E-05	2.50641E-05	2.82634E-05	4.21912E-05	4.33103E-05	5.44541E-05	8.36031E-05	9.69763E-05
0.63100	6.66238E-06	1.37325E-05	1.59467E-05	2.44517E-05	2.56327E-05	3.30490E-05	5.26679E-05	6.29860E-05

Table A-29 Control Point Total Mean Hazard Curves for F=1.333 to 10.000 Hz								
SA(g)	**F1.333Hz**	**F2.000Hz**	**F2.500Hz**	**F3.333Hz**	**F4.000Hz**	**F5.000Hz**	**F6.667Hz**	**F10.000Hz**
0.79400	3.57272E-06	7.74622E-06	9.00482E-06	1.41583E-05	1.51271E-05	1.98639E-05	3.27608E-05	4.00918E-05
1.00000	1.91649E-06	4.32239E-06	5.07767E-06	8.16972E-06	8.86410E-06	1.18073E-05	1.99644E-05	2.50984E-05
1.26000	1.02027E-06	2.27737E-06	2.83237E-06	4.65185E-06	5.09897E-06	6.87786E-06	1.20057E-05	1.54558E-05
1.58000	5.34641E-07	1.37274E-06	1.53966E-06	2.59776E-06	2.86395E-06	3.90774E-06	7.07733E-06	9.26610E-06
2.00000	2.74019E-07	6.29837E-07	8.16832E-07	1.22304E-06	1.57445E-06	2.15613E-06	3.93244E-06	5.33841E-06
2.51000	1.36288E-07	3.24931E-07	4.25825E-07	7.53976E-07	8.41444E-07	1.17038E-06	2.21785E-06	3.06764E-06
3.16000	6.62868E-08	1.86452E-07	2.12429E-07	3.81872E-07	4.29211E-07	6.01689E-07	1.17650E-06	1.67519E-06
3.98000	3.09947E-08	8.43869E-08	1.00875E-07	1.81270E-07	2.08433E-07	2.95554E-07	5.95974E-07	8.76703E-07
5.01000	1.38826E-08	3.92771E-08	4.58962E-08	8.49189E-08	9.65958E-08	1.38786E-07	2.88362E-07	4.38839E-07
6.31000	5.98281E-09	1.74100E-08	1.99241E-08	3.56592E-08	4.23709E-08	6.15765E-08	1.31683E-07	2.06347E-07
7.94000	2.45738E-09	7.46543E-09	8.19424E-09	1.54248E-08	1.77244E-08	2.55080E-08	5.57735E-08	8.94758E-08
10.00000	9.37359E-10	2.94850E-09	2.97624E-09	5.06043E-09	5.87820E-09	8.70085E-09	2.04274E-08	3.47367E-08

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.00100	7.10572E-02	6.99301E-02	6.91261E-02	6.78597E-02	6.63195E-02	6.40615E-02	6.10774E-02	6.03448E-02
0.00130	6.53822E-02	6.36163E-02	6.34626E-02	6.31497E-02	6.19475E-02	5.95847E-02	5.65734E-02	5.58528E-02
0.00160	5.87609E-02	5.63180E-02	5.67348E-02	5.62831E-02	5.50692E-02	5.27272E-02	4.83102E-02	4.76174E-02
0.00200	5.23085E-02	4.96683E-02	4.92497E-02	4.86089E-02	4.83383E-02	4.63664E-02	4.20094E-02	4.13415E-02
0.00250	4.61182E-02	4.37032E-02	4.33652E-02	4.19797E-02	4.24255E-02	4.05323E-02	3.63301E-02	3.56861E-02
0.00320	4.02175E-02	3.80966E-02	3.70880E-02	3.64912E-02	3.60608E-02	3.48831E-02	3.11760E-02	3.05471E-02
0.00400	3.47581E-02	3.29646E-02	3.14580E-02	3.09434E-02	3.03645E-02	2.91095E-02	2.65859E-02	2.59642E-02
0.00500	2.98522E-02	2.79253E-02	2.70951E-02	2.64480E-02	2.60941E-02	2.49429E-02	2.25614E-02	2.19344E-02
0.00630	2.55259E-02	2.39469E-02	2.32681E-02	2.19177E-02	2.23539E-02	2.09144E-02	1.90462E-02	1.84127E-02
0.00790	2.17028E-02	2.04459E-02	1.95466E-02	1.87030E-02	1.85422E-02	1.77719E-02	1.57696E-02	1.53749E-02
0.01000	1.80084E-02	1.73823E-02	1.66310E-02	1.57640E-02	1.51362E-02	1.50313E-02	1.27626E-02	1.24805E-02
0.01260	1.51231E-02	1.46970E-02	1.40697E-02	1.33108E-02	1.27447E-02	1.26211E-02	1.05325E-02	9.91454E-03
0.01580	1.25775E-02	1.23205E-02	1.17970E-02	1.09004E-02	1.05320E-02	1.00670E-02	8.59821E-03	8.33988E-03

Table A-30 Control Point Total Mean Hazard Curves for F=13.333 to 100.000 Hz and PGA								
SA(g)	**13.333Hz**	**F20.000Hz**	**F25.000Hz**	**F33.333Hz**	**F40.000Hz**	**F50.000Hz**	**F100.000Hz**	**PGA**
0.02000	1.03404E-02	1.01428E-02	9.39582E-03	8.68652E-03	8.40198E-03	7.70329E-03	6.77004E-03	6.22087E-03
0.02510	8.38952E-03	7.86315E-03	7.52122E-03	6.86090E-03	6.42717E-03	5.92823E-03	5.10618E-03	4.77291E-03
0.03160	6.62214E-03	6.26361E-03	5.98296E-03	5.42015E-03	5.05356E-03	4.56193E-03	3.61353E-03	3.54403E-03
0.03980	5.15897E-03	4.93003E-03	4.70527E-03	3.82537E-03	3.54978E-03	3.20839E-03	2.70721E-03	2.46247E-03
0.05010	3.93066E-03	3.81290E-03	3.46082E-03	2.90703E-03	2.67978E-03	2.37186E-03	1.89759E-03	1.73496E-03
0.06310	2.92986E-03	2.86735E-03	2.45406E-03	2.15117E-03	1.82911E-03	1.60938E-03	1.29989E-03	1.22833E-03
0.07940	2.13488E-03	2.11088E-03	1.80157E-03	1.45177E-03	1.30792E-03	1.13792E-03	8.61636E-04	8.35029E-04
0.10000	1.52090E-03	1.50544E-03	1.30891E-03	1.04225E-03	9.32946E-04	7.96023E-04	5.50417E-04	5.63090E-04
0.12600	1.07480E-03	1.06094E-03	9.22990E-04	7.41129E-04	6.53548E-04	5.33143E-04	3.69550E-04	3.63372E-04
0.15800	7.50651E-04	7.50167E-04	6.58225E-04	5.20259E-04	4.49016E-04	3.59428E-04	2.47774E-04	2.42854E-04
0.20000	5.14806E-04	5.14943E-04	4.58480E-04	3.59977E-04	3.08848E-04	2.41420E-04	1.59578E-04	1.57419E-04
0.25100	3.56211E-04	3.61874E-04	3.23413E-04	2.51694E-04	2.14188E-04	1.63837E-04	1.02857E-04	1.04209E-04
0.31600	2.43039E-04	2.49781E-04	2.24103E-04	1.73982E-04	1.47183E-04	1.10329E-04	6.52842E-05	6.75956E-05
0.39800	1.64947E-04	1.71477E-04	1.54364E-04	1.19167E-04	9.99494E-05	7.33467E-05	4.10582E-05	4.35504E-05
0.50100	1.10808E-04	1.16657E-04	1.05201E-04	8.05334E-05	6.68748E-05	4.81519E-05	2.54555E-05	2.76681E-05
0.63100	7.32513E-05	7.78805E-05	7.03839E-05	5.35910E-05	4.39458E-05	3.08687E-05	1.54423E-05	1.72222E-05
0.79400	4.75763E-05	5.11574E-05	4.62472E-05	3.47470E-05	2.80805E-05	1.92849E-05	9.21033E-06	1.04674E-05
1.00000	3.02500E-05	3.30427E-05	2.98261E-05	2.21251E-05	1.75814E-05	1.18469E-05	5.37181E-06	6.26289E-06
1.26000	1.89183E-05	2.07982E-05	1.87334E-05	1.37525E-05	1.07047E-05	7.02183E-06	3.05238E-06	3.66764E-06
1.58000	1.15582E-05	1.28653E-05	1.15312E-05	8.27903E-06	6.28417E-06	4.03199E-06	1.69420E-06	2.10228E-06
2.00000	6.71750E-06	7.54933E-06	6.74903E-06	4.79374E-06	3.56678E-06	2.23540E-06	9.02009E-07	1.14264E-06
2.51000	3.93179E-06	4.46775E-06	3.96816E-06	2.74418E-06	1.98194E-06	1.20485E-06	4.68875E-07	6.21247E-07
3.16000	2.17605E-06	2.48963E-06	2.19421E-06	1.48210E-06	1.03734E-06	6.12936E-07	2.29793E-07	3.23029E-07
3.98000	1.15541E-06	1.33126E-06	1.16630E-06	7.66785E-07	5.20017E-07	2.97803E-07	1.07662E-07	1.60954E-07
5.01000	5.86461E-07	6.82197E-07	5.91746E-07	3.79087E-07	2.47414E-07	1.37336E-07	4.82281E-08	7.73508E-08
6.31000	2.79504E-07	3.29716E-07	2.85088E-07	1.76028E-07	1.08266E-07	5.64927E-08	2.01073E-08	3.56782E-08
7.94000	1.24307E-07	1.48089E-07	1.23596E-07	7.03309E-08	4.13281E-08	2.14538E-08	7.63335E-09	1.57522E-08
10.00000	4.74768E-08	5.47964E-08	4.51991E-08	2.50513E-08	1.18605E-08	4.77327E-09	2.30383E-09	6.48458E-09

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2 AND 3; SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2; WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2 – STAFF ASSESSMENT OF UPDATED SEISMIC HAZARDS AT TVA SITES FOLLOWING THE NRC PROCESS FOR THE ONGOING ASSESSMENT OF NATURAL HAZARDS INFORMATION DATED JULY 31, 2023

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JRankin, NRR
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EMiller, NRR

ADAMS Accession No.: ML23192A447 **NRR-106**

OFFICE	NRR/DORL/LPLII-2/PM	NRR/DORL/LPLII-2/LA	NRR/DEX/EXHB/BC	NRR/DEX/D
NAME	KGreen	RButler	BHayes	EBenner
DATE	07/07/2023	07/14/2023	06/12/2023	07/17/2023
OFFICE	NRR/DRA/APLC/BC	OGC-NLO	NRR/DORL/LPLII-2/BC	NRR/DORL/LPLII-2/PM
NAME	SVasavada	DRoth	DWrona	KGreen
DATE	07/20/2023	07/27/2023	07/28/2023	07/31/2023

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