Exelon Generation

RS-14-067 10 CFR 50.54(f)

March 31, 2014

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
11555 Rockville Pike,
Rockville, MD 20852

Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

Subject: Exelon Generation Company, LLC, Seismic Hazard and Screening Report (Central and Eastern United States (CEUS) Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident

References:

1. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012
2. NEI Letter, Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations, dated April 9, 2013
3. NRC Letter, Electric Power Research Institute Final Draft Report XXXXXX, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations, dated May 7, 2013
4. Exelon Generation Company, LLC letter to the NRC, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Seismic Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident – 1.5 Year Response for CEUS Sites, dated September 12, 2013
5. EPRI Report 1025287, Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic
6. NRC Letter, Endorsement of Electric Power Research Institute Final Draft Report 1025287, "Seismic Evaluation Guidance," dated February 15, 2013
7. EPRI Technical Report 3002000704, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," dated May 2013

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

In Reference 2, the Nuclear Energy Institute (NEI) requested NRC agreement to delay submittal of the final CEUS Seismic Hazard Evaluation and Screening Reports so that an update to the Electric Power Research Institute (EPRI) ground motion attenuation model could be completed and used to develop that information. NEI proposed that descriptions of subsurface materials and properties and base case velocity profiles be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted by March 31, 2014. NRC agreed with that proposed path forward in Reference 3. In Reference 4, Exelon Generation Company, LLC (EGC) provided the description of subsurface materials and properties and base case velocity profiles for Dresden Nuclear Power Station, Units 2 and 3.

Reference 5 contains industry guidance and detailed information to be included in the Seismic Hazard Evaluation and Screening Report submittals. NRC endorsed this industry guidance in Reference 6.

The enclosed Seismic Hazard Evaluation and Screening Report for Dresden Nuclear Power Station, Units 2 and 3, provides the information described in Section 4 of Reference 5 in accordance with the schedule identified in Reference 2. As described in Enclosure 1, Dresden Nuclear Power Station, Units 2 and 3, do not meet the requirements of SPID Sections 3.2 and 7 (Reference 5) and therefore screen in and a Risk Evaluation and Spent Fuel Pool evaluation will be performed as determined by NRC prioritization following submittal of all nuclear power plant Seismic Hazard Re-evaluations per Reference 1. Additionally, Dresden Nuclear Power Station, Units 2 and 3, will prepare an Expedited Seismic Evaluation Process (ESEP) Report in accordance with Reference 7, by December 31, 2014.

A list of regulatory commitments contained in this letter is provided in Enclosure 2. If you have any questions regarding this report, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31st day of March 2014.

Respectfully submitted,

Glen T. Kaegi

Glen T. Kaegi
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosures:

1. Dresden Nuclear Power Station, Units 2 and 3, Seismic Hazard and Screening Report
2. Summary of Regulatory Commitments

cc: Director, Office of Nuclear Reactor Regulation
Regional Administrator - NRC Region III
NRC Senior Resident Inspector – Dresden Nuclear Power Station
NRC Project Manager, NRR – Dresden Nuclear Power Station
Ms. Jessica A. Kratchman, NRR/JLD/PMB, NRC
Mr. Eric E. Bowman, NRR/DPR/PGCB, NRC or Ms. Eileen M. McKenna, NRO/DSRA/BPTS, NRC
Illinois Emergency Management Agency - Division of Nuclear Safety

Enclosure 1

Dresden Nuclear Power Station, Units 2 and 3

Seismic Hazard and Screening Report

(57 pages)

SEISMIC HAZARD AND SCREENING REPORT

IN RESPONSE TO THE 50.54(f) INFORMATION REQUEST REGARDING FUKUSHIMA NEAR-TERM TASK FORCE RECOMMENDATION 2.1: SEISMIC

for the

Dresden Generating Station, Units 2 and 3
6500 North Dresden Road Morris, Illinois 60450-9765
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. STN 50-237 and STN 50-249
Correspondence No.: RS-14-067

Exelon.

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Prepared by:
Sargent & Lundy LLC
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Report Number: SL-012190, Revision 1

	Printed Name	Signature	Date
Preparer:	Ryan Foley	Ryan Foley	03/25/2014
Reviewer:	Ronald Boehm	R Boehm	3-25-2014
Approver:	Javad Moslemian	Javad Moslemian	3/25/14
Lead Responsible Engineer:	EYAD ALI	[signature]	03/25/14
Risk Management (Section 5.4):	LAWRENCE LEE	Lawrence Lee	3/25/2014
Branch Manager:	David H. Wolfson	David H. Wolfson	3/25/2014
Senior Manager Design Engineering:	Mark Budelier	Mark Budelier	3/25/14
Corporate Acceptance:	Jeffrey S. Clark	Jeffrey S. Clark	3/26/14

Exelon.

Sargent & Lundy LLC

Seismic Hazard and Screening Report – Dresden Units 2 and 3

Report No.: SL-012190
Revision 0 – Initial Issue

S&L Project No.: 11332-184
Nuclear Non-Safety Related

Sections: Cover page, Executive Summary, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, and Appendix A		
Prepared by:	Ryan Foley	03/17/2014 Date
Reviewed by:	Ronald Boehm	3-17-2014 Date
Section: 4.2		
Prepared by:	Jay Johnson	3/17/14 Date
Reviewed by:	Brent Starks	3/17/14 Date
All Sections		
Approved by:	Javad Moslemian	3/17/14 Date

Exelon.

Sargent & Lundy LLC

Seismic Hazard and Screening Report – Dresden Units 2 and 3

Report No.: SL-012190
Revision 1 – Revised Pages (see below)

S&L Project No.: 11332-184
Nuclear Non-Safety Related

Pages: vi, 4-1, 5-1, 6-1		
Prepared by:	Ryan Foley (signed) Ryan Foley	03/25/2014 Date
Reviewed by:	R Boehm (signed) Ronald Boehm	3.25.2014 Date
Section: 4.2		
Prepared by:	(signed) for Jay Johnson Jay Johnson	3/25/2014 Date
Reviewed by:	B. S (signed) Brent Starks	3/25/2014 Date
All Revisions		
Approved by:	Javad Moslemian (signed) Javad Moslemian	3/25/14 Date

RECORD OF REVISIONS

Revision	Affected Pages	Description
0	All	Initial Issue
1	vi, 4-1, 5-1, 6-1	Replace pages vi, 4-1, 5-1, and 6-1. All other pages have been revised to reflect Revision 1 as the current revision.

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Executive Summary

PURPOSE

Following the accident at the Fukushima Daiichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the Nuclear Regulatory Commission (NRC) issued a 50.54(f) letter (Reference 1) requesting information in response to NRC Near-Term Task Force (NTTF) recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. The 50.54(f) letter (Reference 1) requests that licensees and holders of construction permits under Title 10 Code of Federal Regulations Part 50 (Reference 2) reevaluate the seismic hazards at their sites against present-day NRC requirements. This report provides the information requested in items (1) through (7) of the "Requested Information" section and Attachment 1 of the 50.54(f) letter (Reference 1) pertaining to NTTF Recommendation 2.1 for Dresden Generating Station, Units 2 and 3, in accordance with the documented intention of Exelon Generating Company transmitted to the NRC via letter dated April 29, 2013 (Reference 23).

SCOPE

In response to the 50.54(f) letter (Reference 1) and following the Screening, Prioritization, and Implementation Details (SPID) industry guidance document (Reference 3), a seismic hazard reevaluation for Dresden station was performed to develop a Ground Motion Response Spectrum (GMRS) for comparison with the Safe Shutdown Earthquake (SSE). The new GMRS represents a beyond-design-basis seismic demand developed by more modern techniques than were used for plant licensing. Consistent with NRC letter dated February 20, 2014, (Reference 32) the seismic hazard reevaluations performed in response to the 50.54(f) letter (Reference 1) are distinct from the current design or licensing bases of operating plants. Therefore, the results generally do not call into question the operability or functionality of SSCs and are not expected to be reportable pursuant to 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and 10 CFR 50.73, "Licensee event report system."

Section 2 provides a summary of the regional and local geology, seismicity, other major inputs to the seismic hazard reevaluation, and detailed seismic hazard results including definition of the GMRS. Seismic hazard analysis for Dresden station, including the site response evaluation and GMRS development (Sections 2.2, 2.3, and 2.4 of this report) was performed by the Electric Power Research Institute (EPRI) (Reference 15). A more in-depth discussion of the calculation methods used in the seismic hazard reevaluation can be found in References 3, 7, 8, 17, and 18. Section 3 describes the characteristics of the appropriate plant-level SSE. Section 4 provides a comparison of the GMRS to the SSE. Sections 5 and 6 discuss interim actions and conclusions, respectively.

CONCLUSIONS

The GMRS exceeds the SSE for a portion of the frequency range from 1 Hz to 10 Hz. Therefore, Dresden station screens in for a risk evaluation and a spent fuel pool integrity evaluation in response to NTTF 2.1: Seismic. Due to the GMRS exceeding the SSE in the frequency range above 10 Hz, high frequency exceedances can be addressed for Dresden station in the risk evaluation process. Dresden station will perform the Expedited Seismic Evaluation Process (ESEP) as an interim action prior to completion of the risk evaluation per the ESEP guidance (Reference 4). These actions will be performed in accordance with the schedule for central and eastern United States (CEUS) nuclear plants provided via letter from the industry to the NRC dated April 9, 2013 (Reference 6), as agreed to by the NRC in the May 7, 2013 letter to the industry (Reference 29).

1 Introduction

Following the accident at the Fukushima Daiichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the NRC Commission established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations and to determine if the agency should make additional improvements to its regulatory system. The NTTF developed a set of recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. Subsequently, the NRC issued a 50.54(f) letter that requests information to assure that these recommendations are addressed by all U.S. nuclear power plants (Reference 1). The 50.54(f) letter requests that licensees and holders of construction permits under 10 CFR Part 50 (Reference 2) reevaluate the seismic hazards at their sites against present-day NRC requirements. Depending on the comparison between the reevaluated seismic hazard and the current design basis, the result is either no further risk evaluation or the performance of a seismic risk assessment. Risk assessment approaches acceptable to the staff include a seismic probabilistic risk assessment (SPRA), or a seismic margin assessment (SMA). Based upon the risk assessment results, the NRC staff will determine whether additional regulatory actions are necessary.

This report provides the information requested in items (1) through (7) of the "Requested Information" section and Attachment 1 of the 50.54(f) letter (Reference 1) pertaining to NTTF Recommendation 2.1 for the Dresden Generating Station, Units 2 and 3, (Dresden station), located in Grundy County, Illinois. In providing this information, Exelon followed the guidance provided in the *Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 3). The Augmented Approach, *Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 4), has been developed as the process for evaluating critical plant equipment as an interim action to demonstrate additional plant safety margin, prior to performing the complete plant seismic risk evaluations. The SPID (Reference 3) and Augmented Approach (Reference 4) have been endorsed by the NRC in letters to NEI per Reference 30 and Reference 29 respectively.

The original geology and seismology investigations for Dresden station are documented in Volume III, Section 4 of the Dresden Unit 2 Plant Design and Analysis Report (PDAR) (Reference 19). The Safe Shutdown Earthquake (SSE) ground motion was developed based on the seismology, geology, and other pertinent data of the site and is used for the design of seismic Category I systems, structures and components. (Reference 10)

In response to the 50.54(f) letter (Reference 1) and following the SPID guidance (Reference 3), a seismic hazard reevaluation for Dresden station was performed. For screening purposes, a Ground Motion Response Spectrum (GMRS) was developed.

2

Seismic Hazard Reevaluation

The Dresden station site is located 15 miles southwest of Joliet, Illinois, in the northeast quarter of the Morris 15-minute quadrangle, Goose Lake Township, Grundy County, adjacent to where the Des Plaines and Kankakee Rivers converge to form the Illinois River. The site is within the Central Stable Region of the North American Continent. The Dresden site has a thin (less than 10 feet) layer of soil, mostly glacial drift, and overlaying bedrock. (Reference 10)

The Dresden site area is placed in Zone 1 (zone of minor damage) on the seismic probability map of the 1958 Uniform Building Code. The August 1958 Seismic Regionalization map by Richter gives general predictions of probable maximum earthquake intensity and, recognizing that lines between the areas of differing intensity are approximations only, shows the Dresden region as Modified Mercalli Intensity (MMI) VII to VIII. (Reference 10)

At the time of licensing, only a few earthquakes of significant intensity in Northern Illinois had been reported since 1800, and none had been accompanied by clear-cut surface faulting. A seismological study of the region was performed and reported that historically there may have been a maximum MMI VII earthquake reported in the Dresden area. The recommended design earthquake for safe shutdown was a strong motion earthquake having a 0.2g ground acceleration. (Reference 10)

2.1 REGIONAL AND LOCAL GEOLOGY

The site is located just west of the area where the Des Plaines and Kankakee Rivers flow together to form the Illinois River. The terrain is slightly hilly with a maximum relief at the site of about 25 feet. Regional relief is on the order of 200 feet. The site area is within the Central Lowland Physiographic Provence. (Reference 10)

A thin (less than 10-foot) mantle of soil, mostly glacial drift, overlies bedrock at the site. The upper unit of bedrock is the Spoon formation of the Pennsylvanian age (300 million years before present [MYBP]). The Spoon is sandstone that varies in thickness beneath the site from 0 to 45 feet. A thin soil horizon is present below the Spoon overlying rocks of the Upper Ordovician (450 to 430 MYBP) Marquoketa formation. The Marquoketa consists of a 20- to 45-foot thick upper limestone member, the Fort Atkinson limestone, and a 70-foot thick lower shale member, the Scales shale. Below the Marquoketa formation are approximately 1000 feet of limestone, dolomites, and sandstones ranging in age from Middle Ordovician (450 MYBP) to Cambrian (570 MYBP). These rocks lie on the Precambrian crystalline basement. (Reference 10)

The Dresden site lies within the Central Stable Region of the North American Continent. This region extends from the Rocky Mountains to the Appalachian Plateaus and is relatively undeformed tectonically. It is characterized by a pattern of large basins, domes, and arches which formed throughout the Paleozoic Era (570 to 225 MYBP). The site is located on the northeast flank of one of these structures, the Illinois Basin. The north-northwest striking LaSalle anticlinal belt, a major structural element within the Illinois Basin, lies a few miles west of the site. The LaSalle anticline is a band of en echelon folds which formed during the Mississippian and Pennsylvanian periods (345 to 280 MYBP). (Reference 10)

The northwest trending Kankakee Arch forms the northeastern boundary of the Illinois Basin and intersects the Wisconsin Arch to the North. (Reference 10)

2.2 Probabilistic Seismic Hazard Analysis

2.2.1 Probabilistic Seismic Hazard Analysis Results

In accordance with the 50.54(f) letter (Reference 1) and following the SPID guidance (Reference 3), a probabilistic seismic hazard analysis (PSHA) was completed using the recently developed Central and Eastern United States Seismic Source Characterization (CEUS-SSC) for Nuclear Facilities (Reference 7) together with the updated EPRI Ground-Motion Model for CEUS (Reference 8). For the PSHA, a lower bound moment magnitude cutoff of 5.0 was used, as specified in the 50.54(f) letter.

For the PSHA, the CEUS-SSC (Reference 7) background seismic sources out to a distance of 400 miles around Dresden were included. This distance exceeds the 200 mile recommendation contained in NRC Regulatory Guide 1.208 (Reference 18) and was chosen for completeness. Background sources included in this site analysis are the following:

1. Illinois Basin Extended Basement (IBEB)
2. Mesozoic and younger extended prior – narrow (MESE-N)
3. Mesozoic and younger extended prior – wide (MESE-W)
4. Midcontinent-Craton alternative A (MIDC_A)
5. Midcontinent-Craton alternative B (MIDC_B)
6. Midcontinent-Craton alternative C (MIDC_C)
7. Midcontinent-Craton alternative D (MIDC_D)
8. Non-Mesozoic and younger extended prior – narrow (NMESE-N)
9. Non-Mesozoic and younger extended prior – wide (NMESE-W)
10. Paleozoic Extended Crust narrow (PEZ_N)
11. Paleozoic Extended Crust wide (PEZ_W)
12. Reelfoot Rift (RR)
13. Reelfoot Rift including the Rough Creek Graben (RR-RCG)
14. Study region (STUDY_R)

For sources of large magnitude earthquakes, designated Repeated Large Magnitude Earthquake (RLME) sources in CEUS-SSC (Reference 7), the following sources lie within 621 miles (1000 km) of the site and were included in the analysis:

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

For each of the above background and RLME sources, the mid-continent version of the updated CEUS EPRI GMM (Reference 8) was used.

2.2.2 Base Rock Seismic Hazard Curves

Consistent with the SPID (Reference 3), base rock seismic hazard curves are not provided as the site amplification approach, referred to as Method 3, has been used. Seismic hazard curves are shown in Section 2.3.7 at the SSE control point elevation.

2.3 SITE RESPONSE EVALUATION

Following the guidance contained in Seismic Enclosure 1 of the 50.54(f) Request for Information (Reference 1) and in the SPID (Reference 3), for nuclear power plant sites that are not founded on hard rock (hard rock is defined as having a shear wave velocity of at least 9285 ft/sec), a site response analysis was performed for Dresden station.

2.3.1 Description of Subsurface Material

The Dresden station is located near Joliet, Illinois. The site consists of a few feet of glacial drift soils overlying at least 1,000 feet of sedimentary rock below which lies Precambrian Basement. Table 2.3.1-1 shows the stratigraphic column and unit elevations with the SSE defined at elevation 515 feet, at the top of the Pottsville Formation. Depth to Precambrian basement is unspecified (Reference 14) and, based on unit elevations listed on Table 2.3.1-1, assumed[1] to exceed a depth of 1,000 feet.

A thin (less than 10 feet) mantle of soil, mostly glacial drift, overlies the bedrock at this site. In the vicinity of the power black the soil depth is approximately 3 to 4 feet thick. The upper bedrock is the Spoon Formation of the Pennsylvanian age, or Pennsylvanian Pottsville sandstone, which varies in thickness up to 50 feet (Reference 10 and Reference 19). The Pottsville sandstone is composed predominantly of cemented sub-angular fine to medium grains of quartz containing varying amounts of mica (Reference 19). The ISFSI geotechnical investigation report indicates the Spoon Formation is composed of two layers: Layer 1 is light gray slightly weathered sandstone to 11 feet depth; Layer 2 is light gray sandstone to 42 feet depth (Reference 16).

[1] Assumptions discussed in Section 2 are provided by EPRI engineers (Reference 15) in accordance with implementation of the SPID (Reference 3) methodology.

The Pottsville sandstone, where present, is immediately underlain by the Divine limestone member of the Ordovician Maquoketa formation, featuring a 20 to 45 feet thick upper limestone member, the Fort Atkinson limestone, composed of light brown to light gray fine to coarse-grained crystalline rock containing occasional stylolites, solution channels, joints, cavities, and thin layers of clay (Reference 10 and Reference 19). In areas where the Pottsville sandstone is not present, the Divine limestone is the uppermost rock (Reference 19). The ISFSI geotechnical investigation found that the surface of the limestone ranges to a depth of 42 feet (Reference 16).

The Maquoketa shale underlying the Divine limestone consists of dark gray dolomitic shale with layers of shale and argillaceous dolomite, ranging in thickness from approximately 65 to 70 feet. There is considerable variation in the dolomite content of the Maquoketa shale, resulting in a variation of the type and character of the rock. Where the dolomite content is high, the rock consists of argillaceous dolomite and is very sound. Where the dolomite content is low, the rock consists of fissile shale, which readily breaks and rapidly deteriorates in water (Reference 19).

Below the Maquoketa formation is approximately 1000 feet of limestone, dolomites, and sandstones ranging in age from Middle Ordovician to Cambrian. These rocks lie on Precambrian crystalline basement (Reference 10). Detailed information on the Cambrian and Precambrian rocks beneath the Dresden site is not available (Reference 14).

Table 2.3.1-1: Summary of geotechnical profile data for Dresden station (Reference 28)

Elevations of Layer Boundaries At Reactor Buildings (ft, MSL)	Range in Thickness Across Site (ft)	Soil/Rock Description and Age	Density (pcf)	Shear Wave Velocity (fps)	Compressional Wave Velocity (fps)	Poisson's Ratio
517[a] to 515	0-40	Glacial drift and topsoil	N/A	N/A	N/A	N/A
515[b] to 475	0-50	Pennsylvanian Pottsville Formation, sandstone	130-138	2600	2700-5000	0.20-0.25
475 to 455[c]	5-70	Ordovician Divine limestone member, limestone	155-173	8600	6600-15300	0.20
455 to 385	65-70	Ordovician Maquoketa shale member, dolomitic shale with layers of shale and argillaceous dolomite	134-171	3900-4700	3800-9800	0.22-0.28
385 to 155	230	Ordovician Galena Formation, dolomite	167	4700	8500	0.28
155 to 40	115	Ordovician Platteville Formation, dolomite and limestone	N/A	N/A	N/A	N/A
40 to 25	5-30	Ordovician Glenwood Formation, sandstone	N/A	N/A	N/A	N/A
25 to -140	165	Ordovician St. Peter Formation, sandstone	N/A	N/A	N/A	N/A
-140 to -220	70-90	Ordovician Shakopee Formation, dolomite	N/A	N/A	N/A	N/A
-220 to -270	45-55	Ordovician New Richmond Formation, sandstone and dolomite	N/A	N/A	N/A	N/A
-270 to -480	210	Ordovician Oneota Formation, dolomite	N/A	N/A	N/A	N/A
-480 to N/A	N/A	Cambrian dolomite and sandstone	N/A	N/A	N/A	N/A
N/A	N/A	Precambrian granite, quartz monzonite, rhyolite porphyry, felsite	N/A	N/A	N/A	N/A

[a] Surface of finish grade is nominally at El. 517 ft MSL in the vicinity of the main power block.
[b] The control point elevation for the SSE and IPEEE HCLPF is at the top of the bedrock, which is at El. 515 ft MSL.
[c] Bottom of the deepest foundation is at El. 473 ft MSL, at the surface of the Ordovician limestone.

2.3.2 Development of Base Case Profiles and Nonlinear Material Properties

Table 2.3.1-1 shows the recommended shear-wave velocities (Vs) and unit weights along with elevations and corresponding stratigraphy. From Table 2.3.1-1 the SSE control point is at elevation 515 feet at the top of the Pottsville Formation.

Shear-wave velocities listed on Table 2.3.1-1 were based on compressional-wave velocity measurements and assumed[1] Poisson ratios and extend into the Galena Formation dolomites, the deepest velocities specified. To develop the mean base-case profile, the listed shear-wave velocities and unit weights were used, which extended to a depth below the SSE of 360 feet. Below this elevation, in general, a gradient of 0.5 ft/s/ft (Reference 3) was used to extend the profile. To accommodate uncertainty in depth to hard rock (Precambrian basement) two depths were considered: 1,000 feet randomized ± 300 feet (Profile 1) and 5,000 feet randomized ± 1,500 feet (Profile 4). The depth randomization reflects ± 30% of the depth and was included to provide a realistic broadening of the fundamental resonance at deep sites rather than reflect actual random variations to basement shear-wave velocities across a footprint. Lower- and upper-range profiles, Profile 2 and Profile 3 respectively for shallow depths to Precambrian basement, and Profile 5 and Profile 6 respectively for deep depths to Precambrian basement were developed using two scale factors: 1.25 reflecting shear-wave velocity estimates over the top 360 feet and 1.57 below. The scale factors of 1.25 and 1.57 reflect $\sigma_{\mu ln}$ of about 0.2 and about 0.35 based on the SPID (Reference 3) 10^{th} and 90^{th} fractiles which implies a 1.28 scale factor on σ_{μ}. The upper-range deep profile P6 encountered hard rock shear-wave velocities (9,285 ft/s) at a depth below the SSE control point of about 2,200 feet.

The six base-case profiles are shown in Figure 2.3.2-1 and Figure 2.3.2-2 and listed in Table 2.3.2-1 and Table 2.3.2-2.

[1] Assumptions discussed in Section 2 are provided by EPRI engineers (Reference 15) in accordance with implementation of the SPID (Reference 3) methodology.

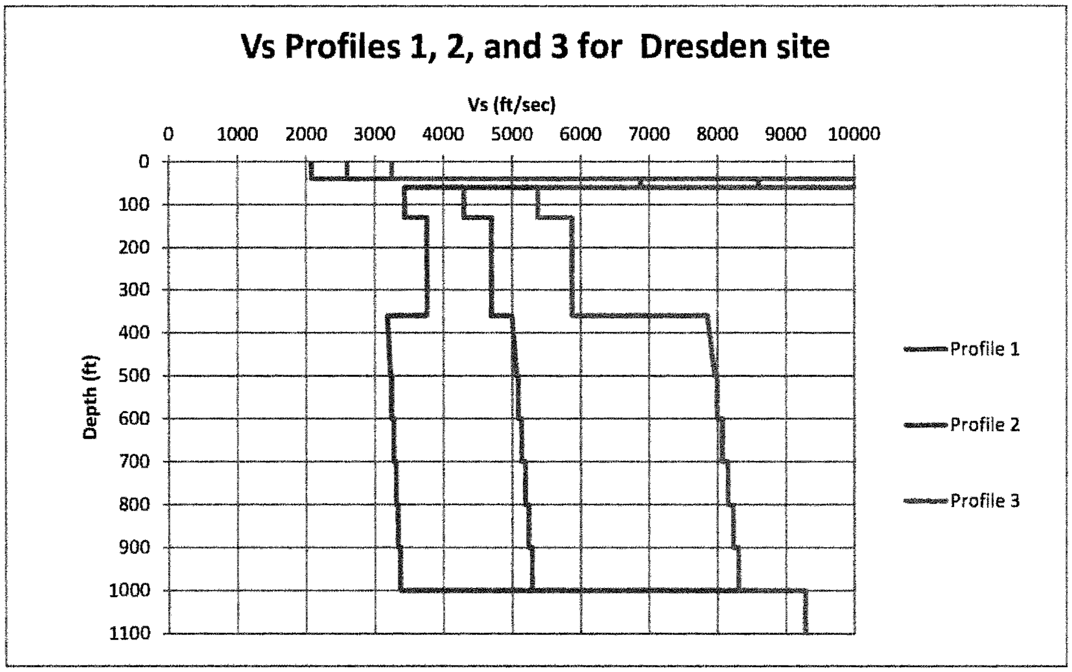


Figure 2.3.2-1: Shear wave velocity (Vs) for Profiles 1, 2, and 3 for Dresden site (Reference 28)

Table 2.3.2-1: Layer thicknesses, depths, and shear wave velocity (Vs) for Profiles 1, 2, and 3 for Dresden site (Reference 28)

Profile 1 (P1)			Profile 2 (P2)			Profile 3 (P3)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
	0	2600		0	2080		0	3250
5.0	5.0	2600	5.0	5.0	2080	5.0	5.0	3250
5.0	10.0	2600	5.0	10.0	2080	5.0	10.0	3250
5.0	15.0	2600	5.0	15.0	2080	5.0	15.0	3250
5.0	20.0	2600	5.0	20.0	2080	5.0	20.0	3250
5.0	25.0	2600	5.0	25.0	2080	5.0	25.0	3250
5.0	30.0	2600	5.0	30.0	2080	5.0	30.0	3250
5.0	35.0	2600	5.0	35.0	2080	5.0	35.0	3250
5.0	40.0	2600	5.0	40.0	2080	5.0	40.0	3250
10.0	50.0	8600	10.0	50.0	6880	10.0	50.0	10749
10.0	60.0	8600	10.0	60.0	6880	10.0	60.0	10749
10.0	70.0	4300	10.0	70.0	3440	10.0	70.0	5375
10.0	80.0	4300	10.0	80.0	3440	10.0	80.0	5375
10.0	90.0	4300	10.0	90.0	3440	10.0	90.0	5375
10.0	100.0	4300	10.0	100.0	3440	10.0	100.0	5375
10.0	110.0	4300	10.0	110.0	3440	10.0	110.0	5375
10.0	120.0	4300	10.0	120.0	3440	10.0	120.0	5375
10.0	130.0	4300	10.0	130.0	3440	10.0	130.0	5375
10.0	140.0	4700	10.0	140.0	3760	10.0	140.0	5875

Table 2.3.2-1: (Continued)

Profile 1 (P1)			Profile 2 (P2)			Profile 3 (P3)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
10.0	150.0	4700	10.0	150.0	3760	10.0	150.0	5875
10.0	160.0	4700	10.0	160.0	3760	10.0	160.0	5875
10.0	170.0	4700	10.0	170.0	3760	10.0	170.0	5875
10.0	180.0	4700	10.0	180.0	3760	10.0	180.0	5875
10.0	190.0	4700	10.0	190.0	3760	10.0	190.0	5875
10.0	200.0	4700	10.0	200.0	3760	10.0	200.0	5875
10.0	210.0	4700	10.0	210.0	3760	10.0	210.0	5875
10.0	220.0	4700	10.0	220.0	3760	10.0	220.0	5875
10.0	230.0	4700	10.0	230.0	3760	10.0	230.0	5875
10.0	240.0	4700	10.0	240.0	3760	10.0	240.0	5875
10.0	250.0	4700	10.0	250.0	3760	10.0	250.0	5875
10.0	260.0	4700	10.0	260.0	3760	10.0	260.0	5875
10.0	270.0	4700	10.0	270.0	3760	10.0	270.0	5875
10.0	280.0	4700	10.0	280.0	3760	10.0	280.0	5875
10.0	290.0	4700	10.0	290.0	3760	10.0	290.0	5875
10.0	300.0	4700	10.0	300.0	3760	10.0	300.0	5875
10.0	310.0	4700	10.0	310.0	3760	10.0	310.0	5875
10.0	320.0	4700	10.0	320.0	3760	10.0	320.0	5875
10.0	330.0	4700	10.0	330.0	3760	10.0	330.0	5875
10.0	340.0	4700	10.0	340.0	3760	10.0	340.0	5875
10.0	350.0	4700	10.0	350.0	3760	10.0	350.0	5875
10.0	360.0	4700	10.0	360.0	3760	10.0	360.0	5875
10.0	370.0	5002	10.0	370.0	3186	10.0	370.0	7854
10.0	380.0	5007	10.0	380.0	3190	10.0	380.0	7861
10.0	390.0	5012	10.0	390.0	3193	10.0	390.0	7869
10.0	400.0	5017	10.0	400.0	3196	10.0	400.0	7877
10.0	410.0	5022	10.0	410.0	3199	10.0	410.0	7885
10.0	420.0	5027	10.0	420.0	3202	10.0	420.0	7893
10.0	430.0	5032	10.0	430.0	3206	10.0	430.0	7901
10.0	440.0	5037	10.0	440.0	3209	10.0	440.0	7908
10.0	450.0	5042	10.0	450.0	3212	10.0	450.0	7916
10.0	460.0	5047	10.0	460.0	3215	10.0	460.0	7924
10.0	470.0	5052	10.0	470.0	3218	10.0	470.0	7932
10.0	480.0	5057	10.0	480.0	3221	10.0	480.0	7940
10.0	490.0	5062	10.0	490.0	3225	10.0	490.0	7948
10.0	500.0	5067	10.0	500.0	3228	10.0	500.0	7956
100.0	600.0	5092	100.0	600.0	3244	100.0	600.0	7995
100.0	700.0	5142	100.0	700.0	3276	100.0	700.0	8073
100.0	800.0	5192	100.0	800.0	3307	100.0	800.0	8152
100.0	900.0	5242	100.0	900.0	3339	100.0	900.0	8230
100.0	1000.0	5292	100.0	1000.0	3371	100.0	1000.0	8309
3280.8	4280.8	9285	3280.8	4280.8	9285	3280.8	4280.8	9285

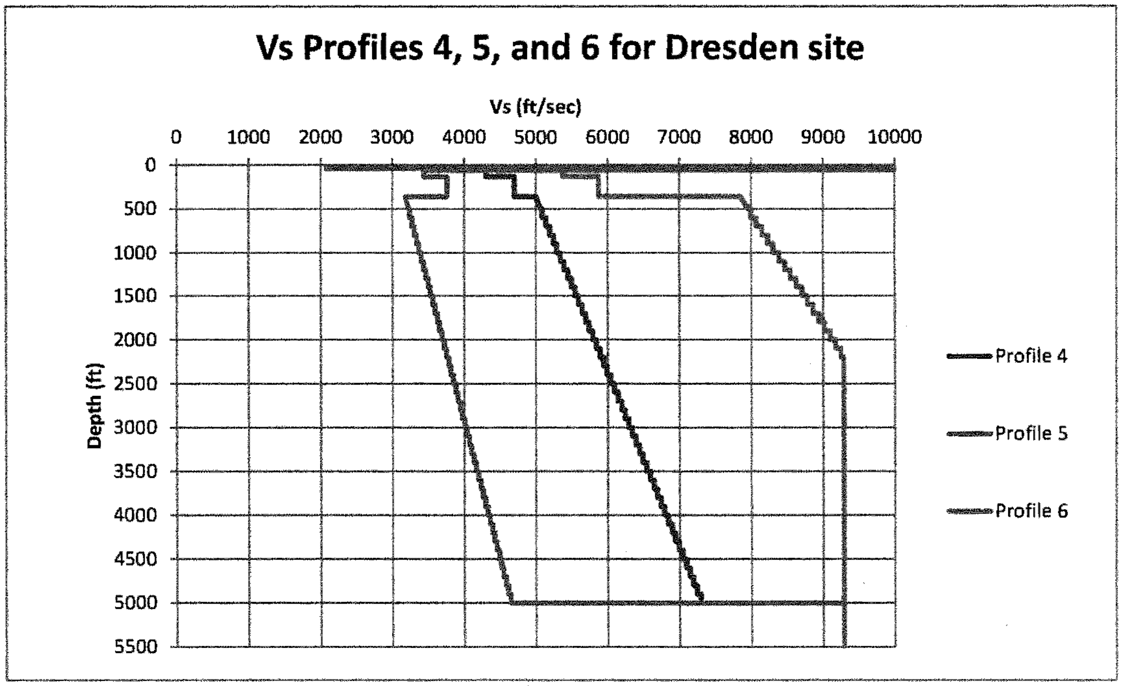


Figure 2.3.2-2: Shear wave velocity (Vs) for Profiles 4, 5, and 6 for Dresden site (Reference 28)

Table 2.3.2-2: Layer thicknesses, depths, and shear wave velocity (Vs) for Profiles 4, 5, and 6 for Dresden site (Reference 28)

Profile 4 (P4)			Profile 5 (P5)			Profile 6 (P6)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
	0	2600		0	2080		0	3250
5.0	5.0	2600	5.0	5.0	2080	5.0	5.0	3250
5.0	10.0	2600	5.0	10.0	2080	5.0	10.0	3250
5.0	15.0	2600	5.0	15.0	2080	5.0	15.0	3250
5.0	20.0	2600	5.0	20.0	2080	5.0	20.0	3250
5.0	25.0	2600	5.0	25.0	2080	5.0	25.0	3250
5.0	30.0	2600	5.0	30.0	2080	5.0	30.0	3250
5.0	35.0	2600	5.0	35.0	2080	5.0	35.0	3250
5.0	40.0	2600	5.0	40.0	2080	5.0	40.0	3250
10.0	50.0	8600	10.0	50.0	6880	10.0	50.0	10749
10.0	60.0	8600	10.0	60.0	6880	10.0	60.0	10749
10.0	70.0	4300	10.0	70.0	3440	10.0	70.0	5375
10.0	80.0	4300	10.0	80.0	3440	10.0	80.0	5375
10.0	90.0	4300	10.0	90.0	3440	10.0	90.0	5375
10.0	100.0	4300	10.0	100.0	3440	10.0	100.0	5375
10.0	110.0	4300	10.0	110.0	3440	10.0	110.0	5375

Table 2.3.2-2: (Continued)

Profile 4 (P4)			Profile 5 (P5)			Profile 6 (P6)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
10.0	120.0	4300	10.0	120.0	3440	10.0	120.0	5375
10.0	130.0	4300	10.0	130.0	3440	10.0	130.0	5375
10.0	140.0	4700	10.0	140.0	3760	10.0	140.0	5875
10.0	150.0	4700	10.0	150.0	3760	10.0	150.0	5875
10.0	160.0	4700	10.0	160.0	3760	10.0	160.0	5875
10.0	170.0	4700	10.0	170.0	3760	10.0	170.0	5875
10.0	180.0	4700	10.0	180.0	3760	10.0	180.0	5875
10.0	190.0	4700	10.0	190.0	3760	10.0	190.0	5875
10.0	200.0	4700	10.0	200.0	3760	10.0	200.0	5875
10.0	210.0	4700	10.0	210.0	3760	10.0	210.0	5875
10.0	220.0	4700	10.0	220.0	3760	10.0	220.0	5875
10.0	230.0	4700	10.0	230.0	3760	10.0	230.0	5875
10.0	240.0	4700	10.0	240.0	3760	10.0	240.0	5875
10.0	250.0	4700	10.0	250.0	3760	10.0	250.0	5875
10.0	260.0	4700	10.0	260.0	3760	10.0	260.0	5875
10.0	270.0	4700	10.0	270.0	3760	10.0	270.0	5875
10.0	280.0	4700	10.0	280.0	3760	10.0	280.0	5875
10.0	290.0	4700	10.0	290.0	3760	10.0	290.0	5875
10.0	300.0	4700	10.0	300.0	3760	10.0	300.0	5875
10.0	310.0	4700	10.0	310.0	3760	10.0	310.0	5875
10.0	320.0	4700	10.0	320.0	3760	10.0	320.0	5875
10.0	330.0	4700	10.0	330.0	3760	10.0	330.0	5875
10.0	340.0	4700	10.0	340.0	3760	10.0	340.0	5875
10.0	350.0	4700	10.0	350.0	3760	10.0	350.0	5875
10.0	360.0	4700	10.0	360.0	3760	10.0	360.0	5875
10.0	370.0	5002	10.0	370.0	3186	10.0	370.0	7854
10.0	380.0	5007	10.0	380.0	3190	10.0	380.0	7861
10.0	390.0	5012	10.0	390.0	3193	10.0	390.0	7869
10.0	400.0	5017	10.0	400.0	3196	10.0	400.0	7877
10.0	410.0	5022	10.0	410.0	3199	10.0	410.0	7885
10.0	420.0	5027	10.0	420.0	3202	10.0	420.0	7893
10.0	430.0	5032	10.0	430.0	3206	10.0	430.0	7901
10.0	440.0	5037	10.0	440.0	3209	10.0	440.0	7908
10.0	450.0	5042	10.0	450.0	3212	10.0	450.0	7916
10.0	460.0	5047	10.0	460.0	3215	10.0	460.0	7924
10.0	470.0	5052	10.0	470.0	3218	10.0	470.0	7932
10.0	480.0	5057	10.0	480.0	3221	10.0	480.0	7940
10.0	490.0	5062	10.0	490.0	3225	10.0	490.0	7948

Table 2.3.2-2: (Continued)

Profile 4 (P4)			Profile 5 (P5)			Profile 6 (P6)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
10.0	500.0	5067	10.0	500.0	3228	10.0	500.0	7956
100.0	600.0	5092	100.0	600.0	3244	100.0	600.0	7995
100.0	700.0	5142	100.0	700.0	3276	100.0	700.0	8073
100.0	800.0	5192	100.0	800.0	3307	100.0	800.0	8152
100.0	900.0	5242	100.0	900.0	3339	100.0	900.0	8230
100.0	1000.0	5292	100.0	1000.0	3371	100.0	1000.0	8309
100.0	1100.0	5342	100.0	1100.0	3403	100.0	1100.0	8387
100.0	1200.0	5392	100.0	1200.0	3435	100.0	1200.0	8466
100.0	1300.0	5442	100.0	1300.0	3467	100.0	1300.0	8544
100.0	1400.0	5492	100.0	1400.0	3499	100.0	1400.0	8623
100.0	1499.9	5542	100.0	1499.9	3530	100.0	1499.9	8701
100.0	1599.9	5592	100.0	1599.9	3562	100.0	1599.9	8780
100.0	1699.9	5642	100.0	1699.9	3594	100.0	1699.9	8858
100.0	1799.9	5692	100.0	1799.9	3626	100.0	1799.9	8937
100.0	1899.9	5742	100.0	1899.9	3658	100.0	1899.9	9015
100.0	1999.9	5792	100.0	1999.9	3690	100.0	1999.9	9094
100.0	2099.9	5842	100.0	2099.9	3721	100.0	2099.9	9172
100.0	2199.9	5892	100.0	2199.9	3753	100.0	2199.9	9251
100.0	2299.9	5942	100.0	2299.9	3785	100.0	2299.9	9285
100.0	2399.9	5992	100.0	2399.9	3817	100.0	2399.9	9285
100.0	2499.9	6042	100.0	2499.9	3849	100.0	2499.9	9285
100.0	2599.9	6092	100.0	2599.9	3881	100.0	2599.9	9285
100.0	2699.9	6142	100.0	2699.9	3913	100.0	2699.9	9285
100.0	2799.9	6192	100.0	2799.9	3944	100.0	2799.9	9285
100.0	2899.9	6242	100.0	2899.9	3976	100.0	2899.9	9285
100.0	2999.9	6292	100.0	2999.9	4008	100.0	2999.9	9285
100.0	3099.9	6342	100.0	3099.9	4040	100.0	3099.9	9285
100.0	3199.9	6392	100.0	3199.9	4072	100.0	3199.9	9285
100.0	3299.9	6442	100.0	3299.9	4104	100.0	3299.9	9285

Table 2.3.2-2: (Continued)

Profile 4 (P4)			Profile 5 (P5)			Profile 6 (P6)		
Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)	Thickness (ft)	Depth (ft)	Vs(ft/s)
100.0	3399.9	6492	100.0	3399.9	4136	100.0	3399.9	9285
100.0	3499.9	6542	100.0	3499.9	4167	100.0	3499.9	9285
100.0	3599.9	6592	100.0	3599.9	4199	100.0	3599.9	9285
100.0	3699.9	6642	100.0	3699.9	4231	100.0	3699.9	9285
100.0	3799.9	6692	100.0	3799.9	4263	100.0	3799.9	9285
100.0	3899.8	6742	100.0	3899.8	4295	100.0	3899.8	9285
100.0	3999.8	6792	100.0	3999.8	4327	100.0	3999.8	9285
100.0	4099.8	6842	100.0	4099.8	4358	100.0	4099.8	9285
100.0	4199.8	6892	100.0	4199.8	4390	100.0	4199.8	9285
100.0	4299.8	6942	100.0	4299.8	4422	100.0	4299.8	9285
100.0	4399.8	6992	100.0	4399.8	4454	100.0	4399.8	9285
100.0	4499.8	7042	100.0	4499.8	4486	100.0	4499.8	9285
100.0	4599.8	7092	100.0	4599.8	4518	100.0	4599.8	9285
100.0	4699.8	7142	100.0	4699.8	4550	100.0	4699.8	9285
100.0	4799.8	7192	100.0	4799.8	4581	100.0	4799.8	9285
100.0	4899.8	7242	100.0	4899.8	4613	100.0	4899.8	9285
100.0	4999.8	7292	100.0	4999.8	4645	100.0	4999.8	9285
3280.8	8280.6	9285	3280.8	8280.6	9285	3280.8	8280.6	9285

2.3.2.1 Shear Modulus and Damping Curves

Recent site-specific nonlinear dynamic material properties were not available for Dresden station for sedimentary rocks. The rock material over the upper 500 feet was assumed[1] to have behavior that could be modeled as either linear or non-linear. To represent this potential for either case in the upper 500 feet of sedimentary rock at the Dresden station site, two sets of shear modulus reduction and hysteretic damping curves were used. Consistent with the SPID (Reference 3), the EPRI rock curves (model M1) were considered to be appropriate to represent the upper range nonlinearity likely in the materials at this site; and, linear analyses (model M2) was assumed[1] to represent an equally plausible alternative rock response across loading level. For the linear analyses, the low strain damping from the EPRI rock curves were used as the constant damping values in the upper 500 feet.

[1] Assumptions discussed in Section 2 are provided by EPRI engineers (Reference 15) in accordance with implementation of the SPID (Reference 3) methodology.

2.3.2.2 Kappa

Base-case kappa estimates were determined using Section B-5.1.3.1 of the SPID (Reference 3) for a firm CEUS rock site. Kappa for a firm rock site with at least 3,000 feet of sedimentary rock may be estimated from the average S-wave velocity over the upper 100 feet (V_{s100}) of the subsurface profile while for a site with less than 3,000 feet of firm rock, kappa may be estimated with a Q_s of 40 below 500 feet combined with the low strain damping from the EPRI rock curves and an additional kappa of 0.006s for the underlying hard rock. For the Dresden station site, both conditions, greater as well as less than 3,000 feet of firm rock, were considered within the uncertainty of available inferences in shear-wave velocity. For the shallow depth to hard rock (1,000 feet), profiles P1, P2, and P3, the kappa estimates were 0.016s, 0.019s, and 0.007s respectively and resulted in a range considered inadequate to reflect epistemic uncertainty in kappa for the site. To accommodate a larger expression of epistemic uncertainty in kappa, a scale factor of 1.68 (Reference 3) about the kappa estimate of profile P1 was used for profiles P2 and P3 resulting in estimates of 0.027s and 0.009s respectively (Table 2.3.2-3).

For the deep profile (P4, P5 and P6), 5,000 feet to hard rock site conditions, the corresponding average shear-wave velocities (equivalent travel time averaging procedure) over the top 100 feet were 3,702 ft/s (P4), 2,962 ft/s (P5), and 4,628 ft/s (P6). The corresponding kappa estimates were 0.021s, 0.027s, and 0.016s respectively. As with the shallow Precambrian depth profiles, the range in kappa was considered insufficient and the same scale factor of 1.68 about the mean base-case profile P4 kappa estimate was used resulting in revised estimates of 0.035s and 0.012s for profiles P5 and P6 respectively (Table 2.3.2-3).

Table 2.3.2-3: Kappa values and weights used for site response analyses (Reference 15)

Velocity Profile	Kappa(s)
P1	0.016
P2	0.019, 0.027*
P3	0.007, 0.009*
P4	0.021
P5	0.027, 0.035*
P6	0.016, 0.012*
Velocity Profile	Weights
P1	0.2
P2	0.15
P3	0.15
P4	0.20
P5	0.15
P6	0.15

*Denotes revised Kappa based on 1.68 scale factor

2.3.3 Randomization of Base Case Profiles

To account for the aleatory variability in dynamic material properties that is expected to occur across a site at the scale of a typical nuclear facility, variability in the assumed[1] shear-wave velocity profiles has been incorporated in the site response calculations. For the Dresden station site, random shear wave velocity profiles were developed from the base case profiles shown in Figure 2.3.2-1 and Figure 2.3.2-2. Consistent with the discussion in Appendix B of the SPID (Reference 3), the velocity randomization procedure made use of random field models which describe the statistical correlation between layering and shear wave velocity. The default randomization parameters developed in Toro (Reference 17) for USGS "A" site conditions were used for this site. Thirty random velocity profiles were generated for each base case profile. These random velocity profiles were generated using a natural log standard deviation of 0.25 over the upper 50 feet and 0.15 below that depth. As specified in the SPID (Reference 3), correlation of shear wave velocity between layers was modeled using the footprint correlation model. In the correlation model, a limit of +/- 2 standard deviations about the median value in each layer was assumed[1] for the limits on random velocity fluctuations.

2.3.4 Input Spectra

Consistent with the guidance in Appendix B of the SPID (Reference 3), input Fourier amplitude spectra were defined for a single representative earthquake magnitude (**M** 6.5) using two different assumptions regarding the shape of the seismic source spectrum (single-corner and double-corner). A range of 11 different input amplitudes (peak ground accelerations (PGA) ranging from 0.01g to 1.50g) were used in the site response analyses. The characteristics of the seismic source and upper crustal attenuation properties assumed[1] for the analysis of the Dresden station were the same as those identified in Tables B-4, B-5, B-6 and B-7 of the SPID (Reference 3) as appropriate for typical CEUS sites.

2.3.5 Methodology

To perform the site response analyses for the Dresden station, a random vibration theory (RVT) approach was employed. This process utilizes a simple, efficient approach for computing site-specific amplification functions and is consistent with existing NRC guidance and the SPID (Reference 3). The guidance contained in Appendix B of the SPID (Reference 3) on incorporating epistemic uncertainty in shear-wave velocities, kappa, non-linear dynamic properties and source spectra for plants with limited at-site information was followed for the Dresden station.

[1] Assumptions discussed in Section 2 are provided by EPRI engineers (Reference 15) in accordance with implementation of the SPID (Reference 3) methodology.

2.3.6 Amplification Functions

The results of the site response analysis consist of amplification factors (5% critical damped pseudo absolute response spectra) which describe the amplification (or de-amplification) of hard reference rock motion as a function of frequency and input reference rock amplitude. The amplification factors are represented in terms of a median amplification value and an associated standard deviation (sigma) for each oscillator frequency and input rock amplitude. Consistent with the SPID (Reference 3) a minimum median amplification value of 0.5 was employed in the present analysis. Figure 2.3.6-1 illustrates the median and +/- 1 standard deviation in the predicted amplification factors developed for the eleven loading levels parameterized by the median reference (hard rock) peak acceleration (0.01g to 1.50g) for profile P1 and the SPID (Reference 3) rock G/G_{max} and hysteretic damping curves. The variability in the amplification factors results from variability in shear-wave velocity, depth to hard rock, and modulus reduction and hysteretic damping curves. To illustrate the effects of nonlinearity at the Dresden station firm rock site, Figure 2.3.6-2 shows the corresponding amplification factors developed with linear site response analyses (model M2). Between the linear and nonlinear (equivalent-linear) analyses, Figure 2.3.6-1 and Figure 2.3.6-2 respectively show only a minor difference for frequencies below about 20 Hz and the 0.5g loading level and below. Above about the 0.5g loading level, the differences increase significantly but only above about 20 Hz. Tabulated values of amplification factors are provided in Tables A-2b1 and A-2b2 in Appendix A.

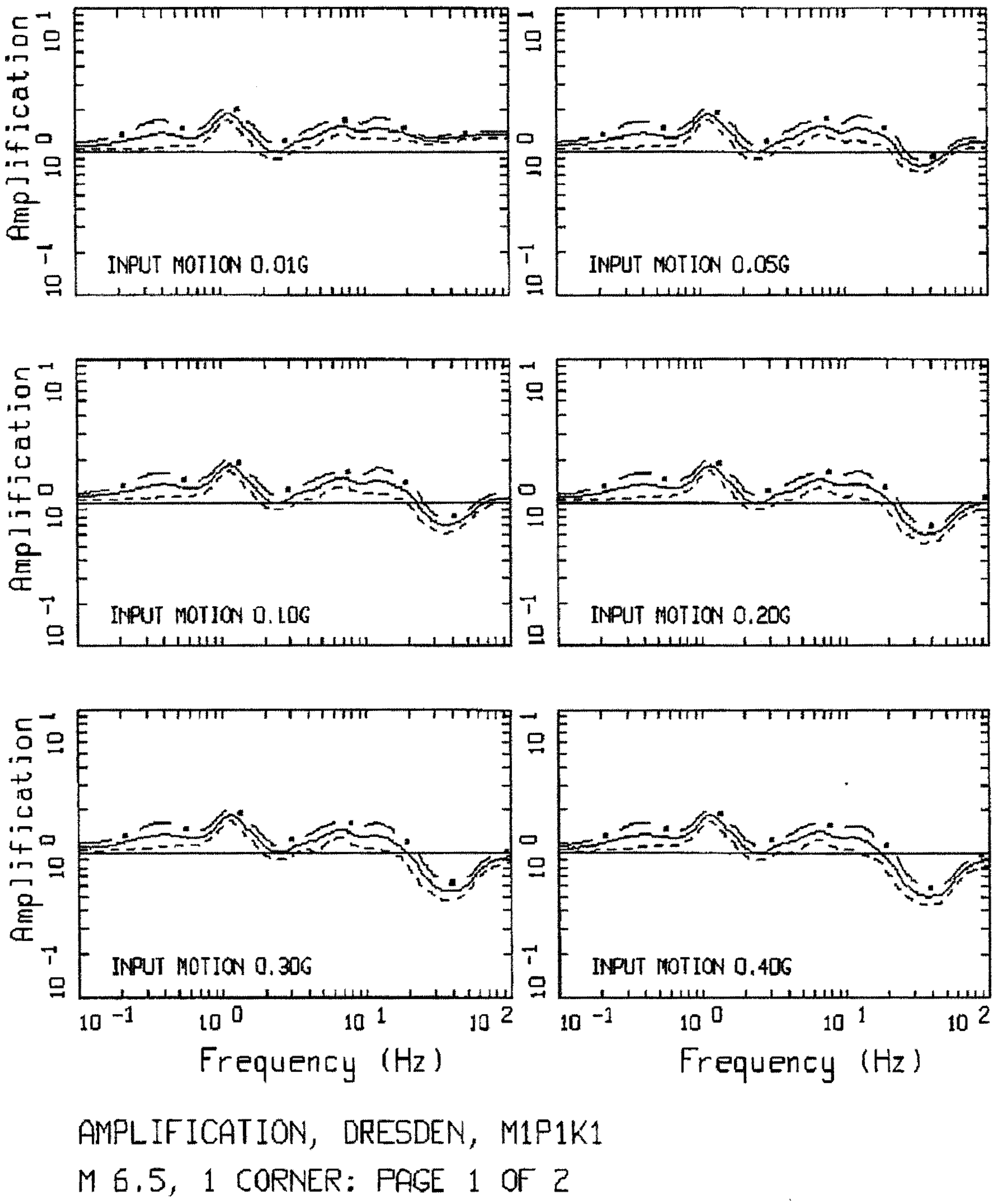
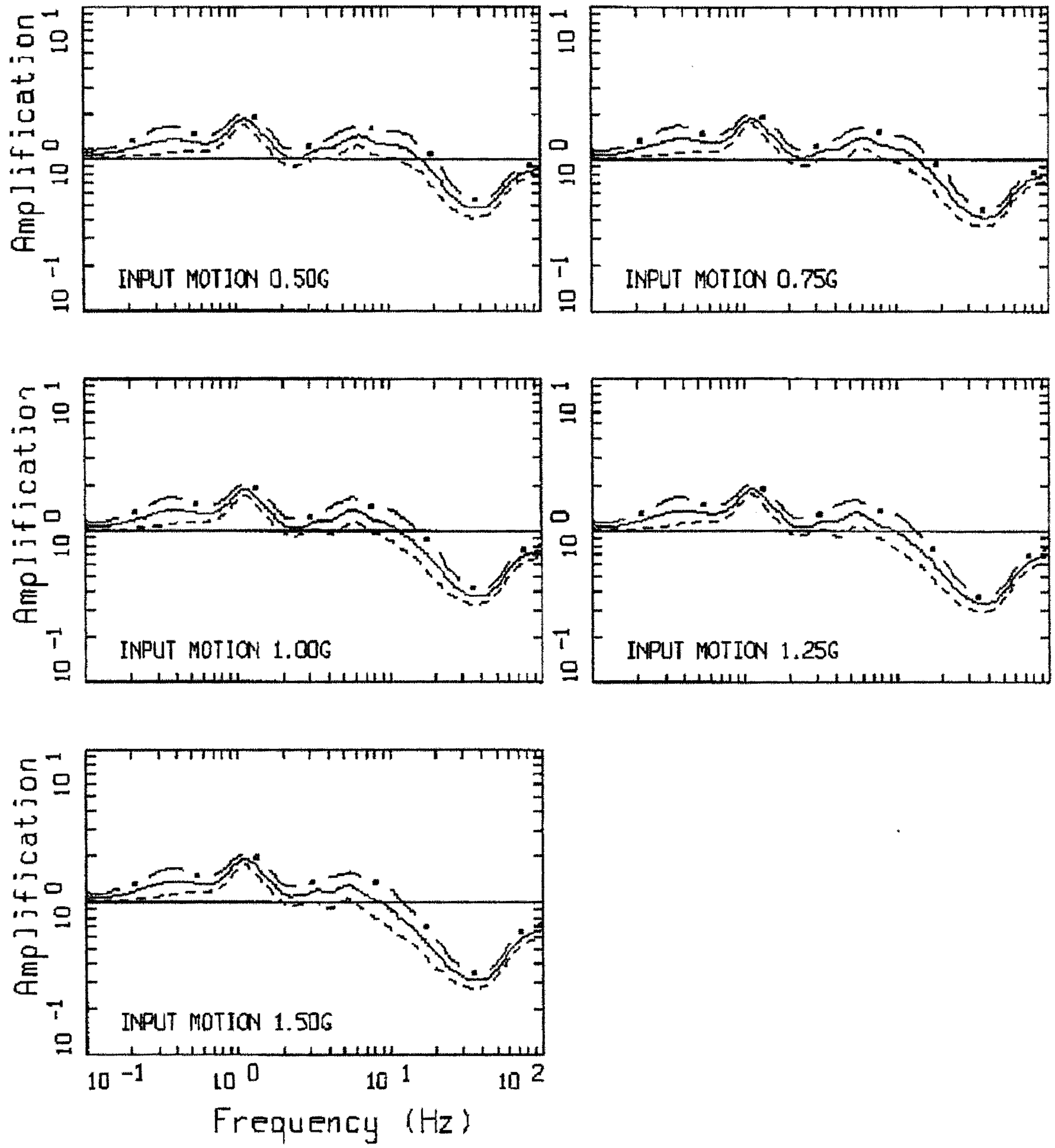


Figure 2.3.6-1: Example suite of amplification factors (5% critical damping pseudo absolute acceleration spectra) developed for the mean base-case profile (P1), EPRI rock modulus reduction and hysteretic damping curves (model M1), and base-case kappa (K1) at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g. **M** 6.5 and single-corner source model (Reference 3) (Reference 15)



AMPLIFICATION, DRESDEN, M1P1K1

M 6.5, 1 CORNER: PAGE 2 OF 2

Figure 2.3.6-1: (Continued)

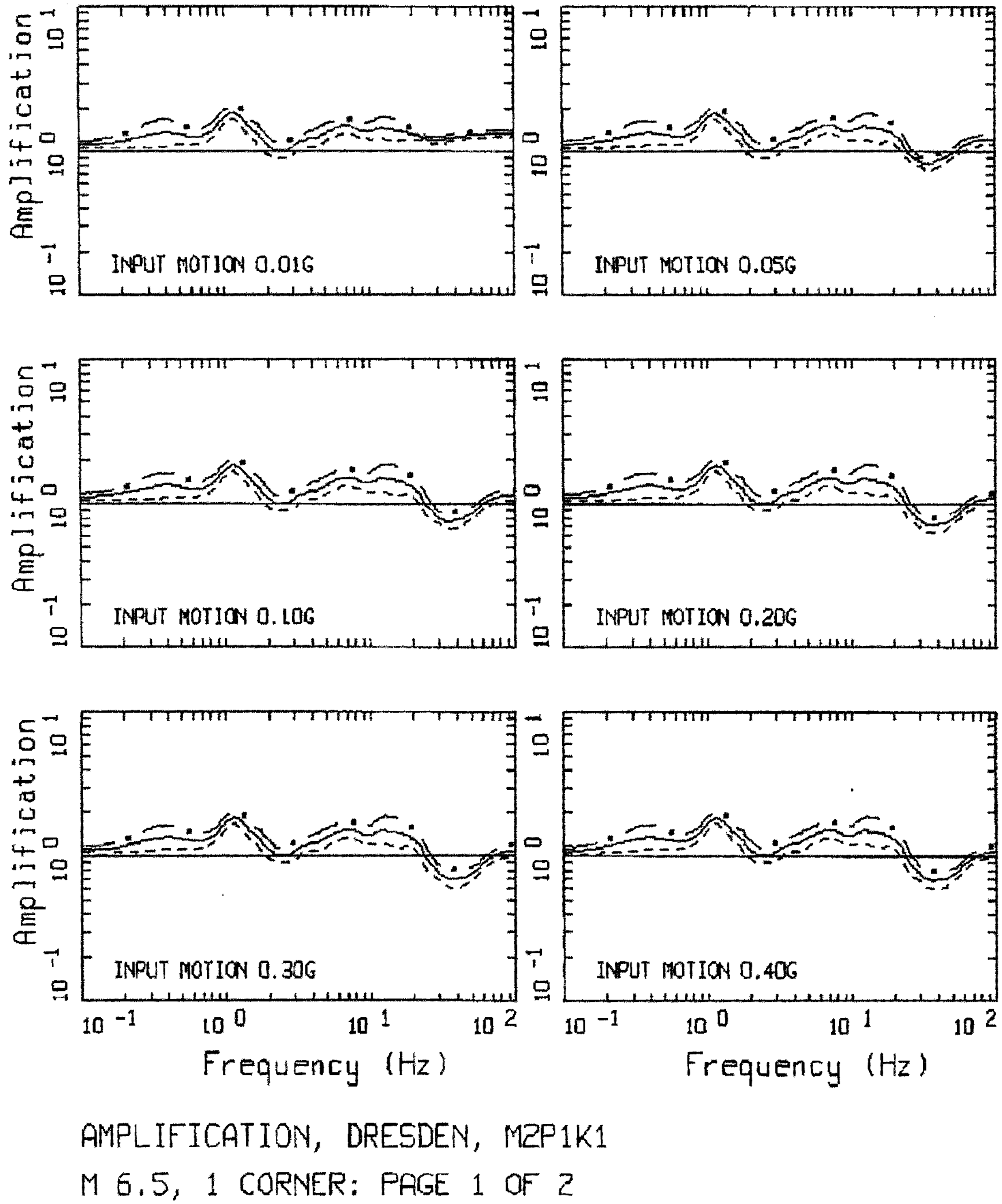
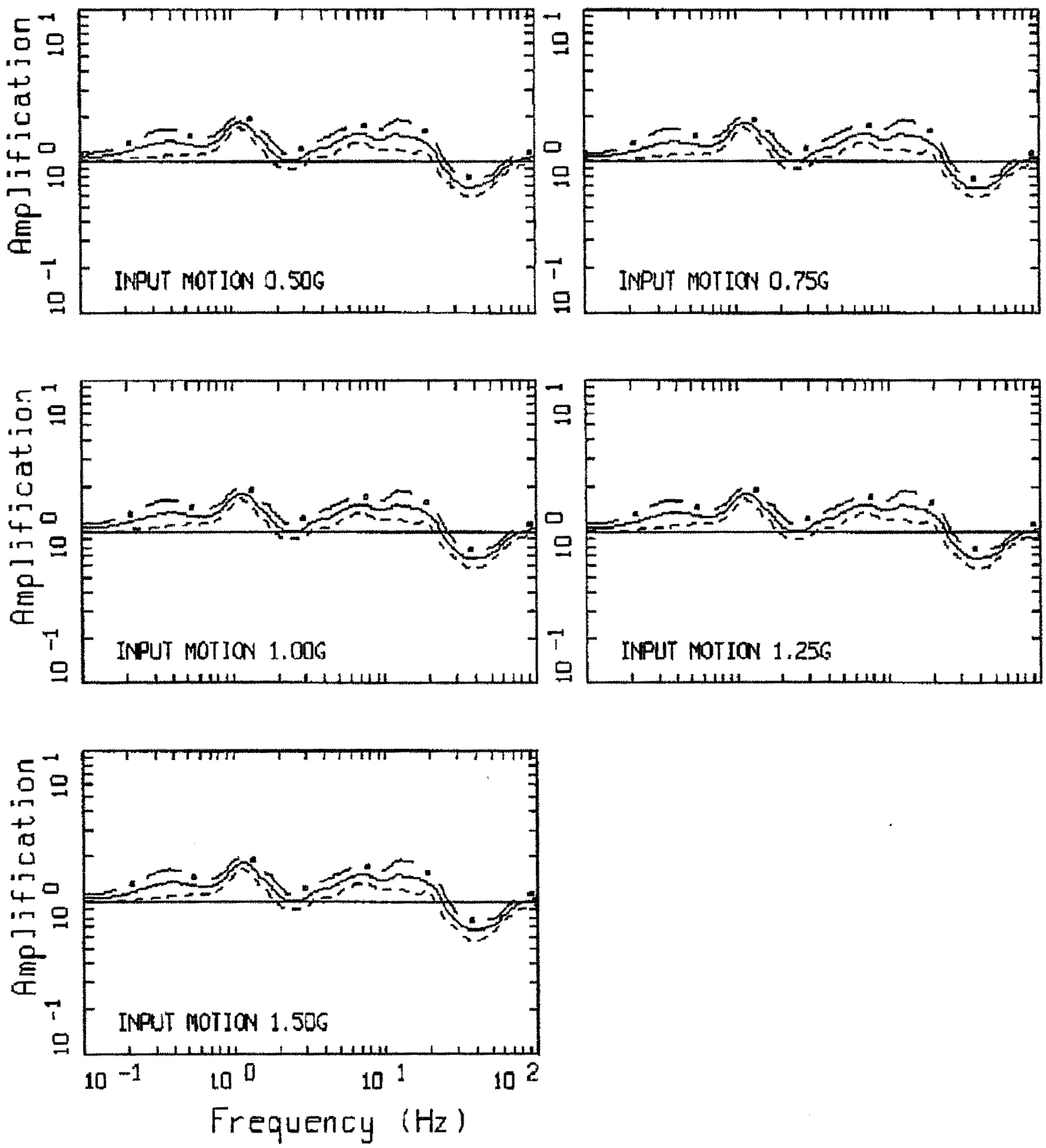


Figure 2.3.6-2: Example suite of amplification factors (5% critical damping pseudo absolute acceleration spectra) developed for the mean base-case profile (P1), linear site response (model M2), and base-case kappa (K1) at eleven loading levels of hard rock median peak acceleration values from 0.01g to 1.50g. **M** 6.5 and single-corner source model (Reference 3) (Reference 15)



AMPLIFICATION, DRESDEN, M2P1K1

M 6.5, 1 CORNER: PAGE 2 OF 2

Figure 2.3.6-2: (Continued)

2.3.7 Control Point Seismic Hazard Curves

The procedure to develop probabilistic site-specific control point hazard curves used in the present analysis follows the methodology described in Section B-6.0 of the SPID (Reference 3). This procedure (referred to as Method 3) computes a site-specific control point hazard curve for a broad range of spectral accelerations given the site-specific bedrock hazard curve and site-specific estimates of soil or soft-rock response and associated uncertainties. This process is repeated for each of the seven spectral frequencies for which ground motion equations are available. The dynamic response of the materials below the control point was represented by the frequency- and amplitude-dependent amplification functions (median values and standard deviations) developed and described in the previous section. The resulting control point mean hazard curves for Dresden station are shown in Figure 2.3.7-1 for the seven spectral frequencies for which ground motion equations are defined. Tabulated values of mean and fractile seismic hazard curves and site response amplification functions are provided in Appendix A.

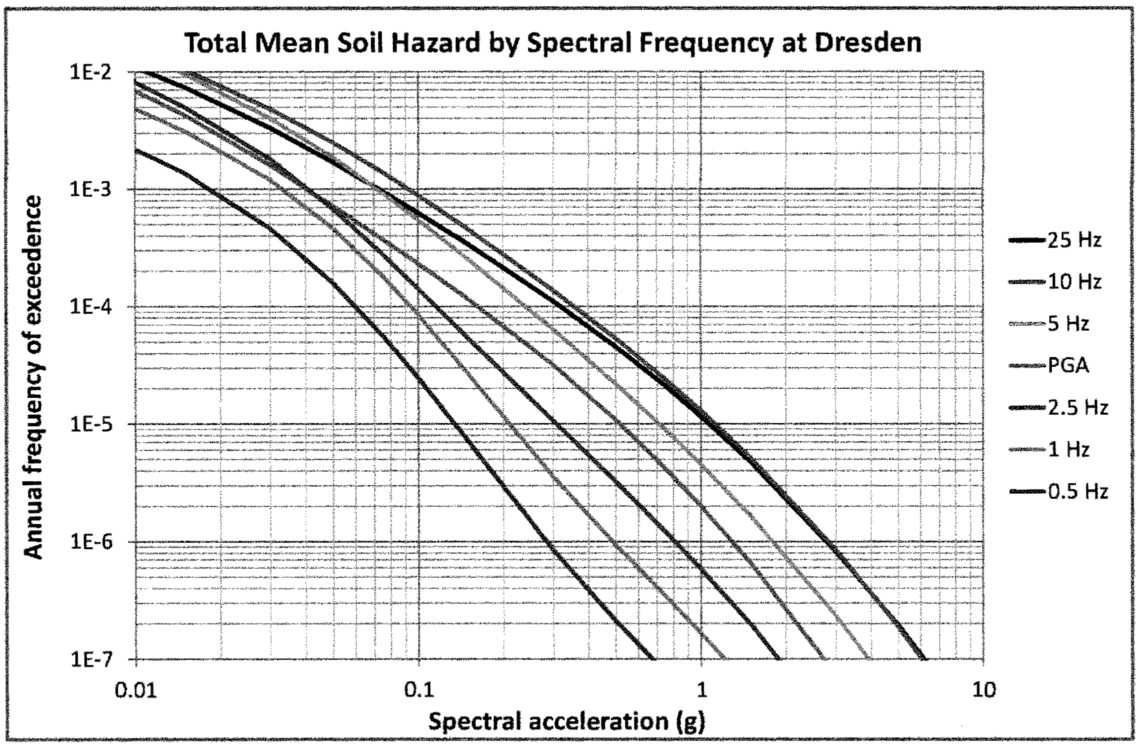


Figure 2.3.7-1: Control point mean hazard curves for spectral frequencies of 0.5, 1, 2.5, 5, 10, 25 and 100 Hz (PGA) at Dresden station (5% of critical damping)

2.4 CONTROL POINT RESPONSE SPECTRA

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

The 1E-4 and 1E-5 UHRS, along with a design factor (DF), are used to compute the GMRS at the control point using the criteria in Regulatory Guide 1.208 (Reference 18). Table 2.4-1 shows the UHRS and GMRS accelerations for a range of spectral frequencies.

Table 2.4-1: UHRS and GMRS for Dresden, 5% of critical damping (Reference 15)

Freq. (Hz)	10^{-4} UHRS (g)	10^{-5} UHRS (g)	GMRS (g)
100	1.63E-01	5.17E-01	2.46E-01
90	1.63E-01	5.22E-01	2.48E-01
80	1.65E-01	5.29E-01	2.51E-01
70	1.67E-01	5.42E-01	2.57E-01
60	1.74E-01	5.69E-01	2.69E-01
50	1.89E-01	6.26E-01	2.96E-01
40	2.14E-01	7.18E-01	3.38E-01
35	2.33E-01	7.83E-01	3.69E-01
30	2.66E-01	8.95E-01	4.22E-01
25	3.19E-01	1.07E+00	5.04E-01
20	3.70E-01	1.22E+00	5.77E-01
15	3.83E-01	1.24E+00	5.87E-01
12.5	3.80E-01	1.21E+00	5.77E-01
10	3.56E-01	1.12E+00	5.34E-01
9	3.34E-01	1.04E+00	4.99E-01
8	3.14E-01	9.70E-01	4.65E-01
7	2.93E-01	8.98E-01	4.31E-01
6	2.67E-01	8.08E-01	3.89E-01
5	2.39E-01	7.12E-01	3.43E-01
4	1.90E-01	5.48E-01	2.66E-01
3.5	1.65E-01	4.65E-01	2.27E-01
3	1.38E-01	3.80E-01	1.86E-01
2.5	1.16E-01	3.09E-01	1.52E-01
2	1.10E-01	2.83E-01	1.41E-01
1.5	1.05E-01	2.55E-01	1.28E-01
1.25	1.03E-01	2.41E-01	1.22E-01
1	9.43E-02	2.11E-01	1.08E-01

Table 2.4-1: (Continued)

Freq. (Hz)	10^{-4} UHRS (g)	10^{-5} UHRS (g)	GMRS (g)
0.9	9.00E-02	2.01E-01	1.03E-01
0.8	8.49E-02	1.90E-01	9.71E-02
0.7	7.66E-02	1.72E-01	8.78E-02
0.6	6.83E-02	1.53E-01	7.82E-02
0.5	5.99E-02	1.35E-01	6.87E-02
0.4	4.80E-02	1.08E-01	5.49E-02
0.35	4.20E-02	9.42E-02	4.81E-02
0.3	3.60E-02	8.07E-02	4.12E-02
0.25	3.00E-02	6.73E-02	3.43E-02
0.2	2.40E-02	5.38E-02	2.75E-02
0.15	1.80E-02	4.04E-02	2.06E-02
0.125	1.50E-02	3.36E-02	1.72E-02
0.1	1.20E-02	2.69E-02	1.37E-02

The 1E-4 and 1E-5 UHRS are used to compute the GMRS at the control point and are shown in Figure 2.4-1.

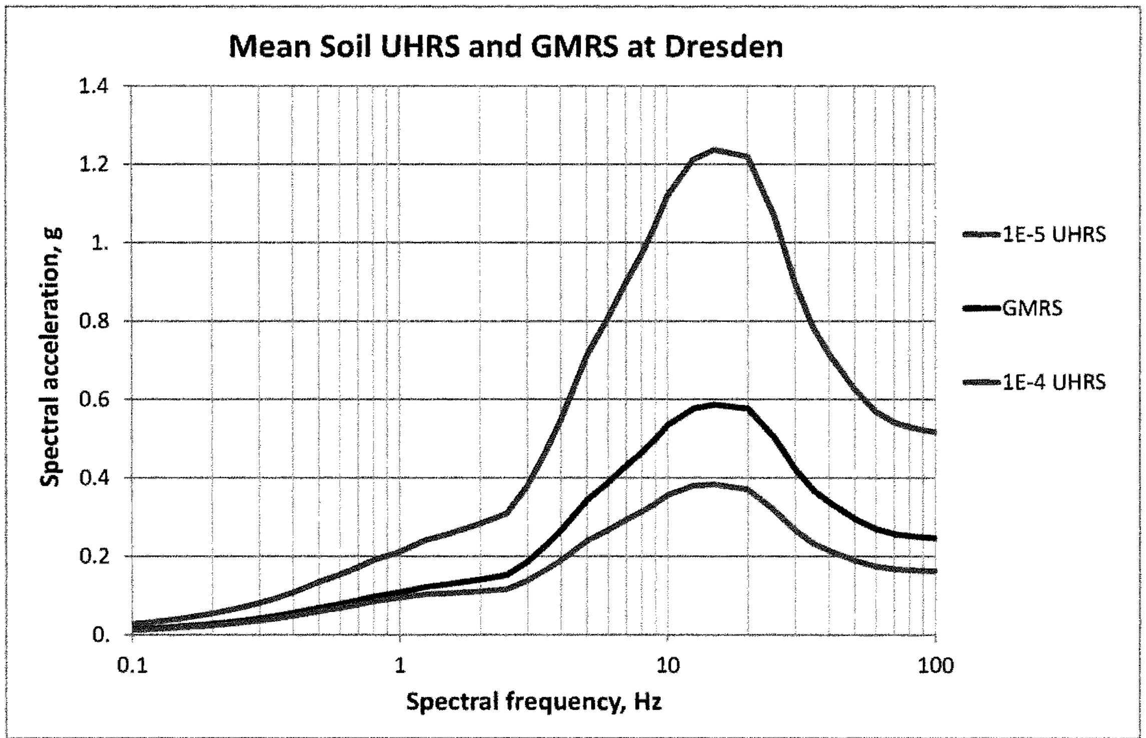


Figure 2.4-1: Plots of 1E-4 and 1E-5 UHRS and GMRS at control point for Dresden, 5% critical damping (Reference 15)

3

Plant Design Basis Ground Motion

The design basis for Dresden station is identified in the Updated Final Safety Analysis Report (Reference 10). The SSE for the site was based on the seismology report in Volume III, Section 4 of the Dresden Unit 2 PDAR. An earthquake having a MMI VII was considered the maximum anticipated seismic event for the site. A safe shutdown earthquake having a ground acceleration of 0.2g was selected based on the seismological reviews.

3.1 SSE Description of Spectral Shape

The input motions used to create the seismic design of Dresden station are based on the Housner ground response spectrum and the north-south component of the El Centro earthquake of May 18, 1940. The Dresden design basis SSE ground spectrum is the Housner spectrum normalized to a peak ground acceleration (PGA) of 0.2g. Equipment analyzed using the response spectrum method used the Housner design spectra. The El Centro 1940 earthquake, N-S component anchored to 0.10g was used to perform time history analysis of selected structures and equipment and to generate the in-structure response spectra. The SSE is defined by multiplying the OBE acceleration by a factor of two resulting in a horizontal direction PGA value of 0.20g. Table 3.1-1 shows the spectral acceleration values as a function of frequency for the 5% damped horizontal SSE. The SSE is plotted in Figure 3.1-1. (Reference 10)

Table 3.1-1: Dresden Safe Shutdown Earthquake ground response spectrum, 5% critical damping (Reference 24)

Frequency (Hz)	Spectral Acceleration (g)
1.14	0.200
1.25	0.220
1.43	0.246
1.67	0.270
2.00	0.290
2.50	0.310
3.33	0.328
4.00	0.332
4.44	0.332
5.00	0.330
6.67	0.320
10.0	0.300
11.1	0.292
12.5	0.284
14.3	0.276

Table 3.1-1: (Continued)

Frequency (Hz)	Spectral Acceleration (g)
16.7	0.266
20.0	0.256
25.0	0.246
28.6	0.240
33.3	0.234
40.0	0.226
50.0	0.218
66.7	0.21
100	0.20

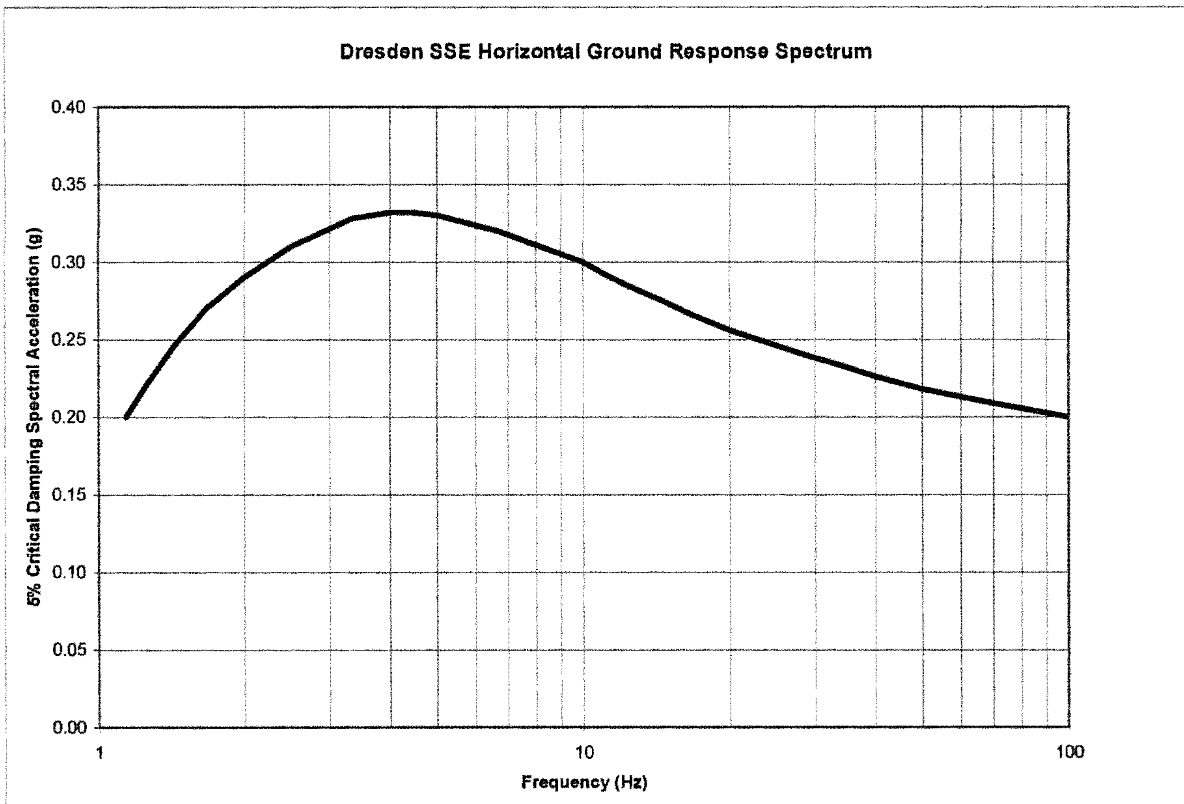


Figure 3.1-1: Dresden SSE horizontal ground response spectrum, 5% critical damping

3.2 CONTROL POINT ELEVATION

Dresden was designed and constructed before the concept of control point was defined, and the UFSAR (Reference 10) does not provide specific definition of the SSE control point. Therefore, the SPID (Reference 3) Section 2.4.2 criteria were used to determine the appropriate control point elevation. The Dresden site has a thin layer of topsoil overlaying the bedrock layer. This thin layer was removed before founding the Dresden safety-related structures. For rock sites, the SPID (Reference 3) guidance recommends to define the control point at the top of the rock. Therefore, the control point is elevation 515 feet MSL, which is the approximate top of the bedrock in the vicinity of the main power block.

4 Screening Evaluation

Following completion of the seismic hazard reevaluation, as requested in the 50.54(f) letter (Reference 1), a screening process is required to determine if a risk evaluation is needed. The horizontal GMRS determined from the hazard reevaluation is used to characterize the amplitude of the new seismic hazard at each of the nuclear power plant sites. The screening evaluation compares the GMRS with the established plant-level seismic capacity, in accordance with the SPID, Section 3 (Reference 3).

4.1 Risk Evaluation Screening (1 to 10 Hz)

In the 1 Hz to 10 Hz part of the response spectrum, the GMRS exceeds the SSE. Therefore, Dresden station screens in for a risk evaluation.

Further, in accordance with the screening requirements in the ESEP Guidance (Reference 4), Dresden Station will perform "Augmented Approach" near-term seismic evaluations. The ESEP will be performed as an interim assessment for Dresden station. See Section 5.1 for further details on the ESEP.

4.2 High Frequency Screening (> 10 Hz)

The GMRS exceeds the SSE in the range above 10 Hz. Therefore, high frequency exceedances can be addressed in the risk evaluation discussed in Section 4.1.

Section 3.4 of the SPID (Reference 3) discusses high-frequency exceedances. It discusses the impact of high-frequency ground motion on plant components and identifies the component groups that are sensitive to high-frequency vibration. A two-phase test program is described, which is currently ongoing, that will develop data to support the high-frequency evaluation.

The SPID concludes that high-frequency vibration is not damaging, in general, to components with strain- or stress-based failure modes, based on EPRI Report NP-7498 (Reference 27). But components, such as relays, subject to electrical functionality failure modes have unknown acceleration sensitivity for frequencies above 16 Hz.

EPRI Report 1015108 (Reference 25) provides evidence that supports the conclusion that high-frequency motions are not damaging to the majority of nuclear plant components, excluding relays and other electrical devices whose output signals may be affected by high-frequency vibration. EPRI Report 1015109 (Reference 26) provides guidance for identifying and evaluating potentially high-frequency sensitive components. Guidance from these documents is considered in the SPID (Reference 3) report for identifying components that are sensitive to high-frequency vibration. Component types listed in Table 2-1 of the EPRI Report 3002000706 (Reference 36) will require high-frequency evaluation. Those component types are:

- Electro-mechanical relays
- Circuit breakers
- Control switches
- Process switches and sensors
- Electro-mechanical contactors
- Auxiliary contacts
- Transfer switches
- Potentiometers

4.3 Spent Fuel Pool Evaluation Screening (1 to 10 Hz)

In the 1 Hz to 10 Hz part of the response spectrum, the GMRS exceeds the SSE. Therefore, a spent fuel pool evaluation will be performed.

5 Interim Actions

Based on the screening evaluation outcome described in Section 4, the GMRS exceeds the SSE at frequencies from 1 Hz to 10 Hz and greater than 10 Hz. Therefore, Dresden station screens in for a risk evaluation in response to the 50.54(f) letter request for information (Reference 1). Prior to completion of the risk evaluation, Dresden station will implement certain interim actions to ensure continued and improved seismic safety of the plant, namely execution of the Expedited Seismic Evaluation Process (ESEP).

5.1 Expedited Seismic Evaluation Process

Based on the screening evaluation, the expedited seismic evaluation described in EPRI Report 3002000704 (Reference 4) will be performed as proposed in a letter to the NRC dated April 9, 2013 (Reference 6) and agreed to by the NRC in the letter dated May 7, 2013 (Reference 29).

The ESEP addresses the 50.54(f) letter (Reference 1) request for "interim evaluations and actions taken or planned to address the higher seismic hazard relative to the design basis, as appropriate, prior to completion of the risk evaluation." Specifically, the ESEP focuses initial industry efforts on short term evaluations that will lead to prompt modifications to some of the most important components that could improve plant seismic safety.

5.2 Interim Evaluation of Seismic Hazard

Consistent with the NRC letter dated February 20, 2014 (Reference 32), the seismic hazard reevaluations presented herein are distinct from the current design and licensing bases of Dresden station. Therefore, the results do not call into question the operability or functionality of SSCs and are not reportable pursuant to 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors" (Reference 37), and 10 CFR 50.73, "Licensee event report system" (Reference 38).

The NRC letter also requests that licensees provide an interim evaluation or actions to demonstrate that the plant can cope with the reevaluated hazard while the expedited approach and risk evaluations are conducted. In response to that request, NEI letter dated March 12, 2014 (Reference 33), provides seismic core damage risk estimates using the updated seismic hazards for the operating nuclear plants in the Central and Eastern United States. These risk estimates continue to support the following conclusions of the NRC GI-199 Safety/Risk Assessment (Reference 34):

> Overall seismic core damage risk estimates are consistent with the Commission's Safety Goal Policy Statement because they are within the subsidiary objective of 10^{-4}/year for core damage frequency. The GI-199 Safety/Risk Assessment, based in part on information from the U. S. Nuclear Regulatory Commission's (NRC's)

Individual Plant Examination of External Events (IPEEE) program, indicates that no concern exists regarding adequate protection and that the current seismic design of operating reactors provides a safety margin to withstand potential earthquakes exceeding the original design basis.

Dresden station is included in the March 12, 2014 risk estimates (Reference 33). Using the methodology described in the NEI letter, all plants were shown to be below 10^{-4}/year; thus, the above conclusions apply.

5.3 SEISMIC WALKDOWN INSIGHTS

In response to NTTF Recommendation 2.3, the 50.54(f) letter (Reference 1) requested licensees to perform seismic walkdowns in order to, in the context of seismic response: 1) verify that the current plant configuration is consistent with the licensing basis, 2) verify the adequacy of current strategies, monitoring, and maintenance programs, and 3) identify degraded, nonconforming, or unanalyzed conditions. Seismic walkdown guidance (EPRI 1025286, Reference 21) was developed and endorsed by the NRC as a means for all plants to provide a uniform and acceptable industry response to NTTF 2.3 seismic walkdowns.

Seismic walkdowns in response to NTTF 2.3 for Dresden station have been performed as documented in References 12 and 13. The seismic walkdowns for Dresden station determined that no adverse anchorage conditions, no adverse seismic spatial interactions, and no other adverse seismic conditions existed for equipment examined during the walkdowns. Any potentially degraded, non-conforming, or unanalyzed conditions identified during the seismic walkdown program were assessed in accordance with the plant corrective action program, and were identified as being minor issues.

Plant improvements and "outliers" identified in the Dresden station seismic Individual Plant Examination of External Events (IPEEE) (References 11 and 20) were reviewed as part of the seismic walkdowns (References 12 and 13). Plant improvements were identified in Sections 3 and 7 of the IPEEE (Reference 11). Table G-1 of Appendix G of the seismic walkdown reports (12 and 13) lists the plant improvements, the IPEEE proposed resolution, the actual resolution, and resolution date. The seismic walkdown reports confirmed that no open items exist from the seismic portion of the IPEEE program (References 12 and 13).

5.4 BEYOND-DESIGN-BASIS SEISMIC INSIGHTS

A beyond-design-basis seismic margin assessment (SMA) was performed for the seismic portion of the Dresden station IPEEE using the EPRI SMA methodology, EPRI NP-6041-SL (Reference 9) with the enhancements identified in NUREG-1407 (Reference 22), where applicable (References 11 and 20). Dresden is a focused scope 0.3g peak ground acceleration (PGA) plant per NUREG-1407 (Reference 22). The review level earthquake (RLE) was a NUREG/CR-0098 (Reference 31) rock spectrum anchored to 0.3g PGA (References 11 and 20).

The majority of components on the IPEEE Success Path Equipment List (SPEL) had capacities greater than or equal to the RLE (0.3g PGA), which demonstrates seismic capacity beyond the design basis. However, there were some items with HCLPFs less than the RLE. The controlling High Confidence of a Low Probability of Failure (HCLPF) component capacity reported was 0.2g PGA (References 11 and 20). Therefore, the IPEEE HCLPF spectrum (IHS) is a NUREG/CR-0098 (Reference 31) rock spectrum anchored to 0.2g PGA.

The Dresden station IPEEE SMA did not identify any overall seismic concerns. The IPEEE submittal report (Attachment 1 of Reference 20) concludes that Dresden plant has reasonable margin with respect to its design basis earthquake based on experience with actual industrial facilities in moderate to severe earthquakes.

6 Conclusions

In accordance with the 50.54(f) letter (Reference 1), a seismic hazard and screening evaluation was performed for the Dresden Generating Station. This reevaluation followed the SPID guidance (Reference 3) in order to develop a GMRS for the site. The GMRS was developed solely for the purpose of screening for additional evaluation requirements in accordance with the SPID (Reference 3). The new GMRS represents a beyond-design-basis seismic demand and does not constitute a change in the plant design or licensing basis.

The screening evaluation comparison demonstrates that the GMRS exceeds the SSE in the 1 Hz to 10 Hz range of the response spectrum and also above 10 Hz. Based on the screening evaluation, Dresden station screens in for a risk evaluation and a spent fuel pool integrity evaluation. The risk evaluation process can also evaluate components for high frequency exceedances (> 10 Hz). The risk evaluation schedule will be in accordance with NRC prioritization and the NEI letter dated April 9, 2013 (Reference 6) as endorsed by the NRC in the letter to NEI dated May 7, 2013 (Reference 29).

The near-term ESEP interim evaluations will also be performed following the ESEP guidance (Reference 4). This is an interim action to establish beyond-design-basis safety margin prior to completion of the risk evaluation. ESEP evaluation will be performed and modifications (if required) will be implemented on a schedule in accordance with the NEI letter dated April 9, 2013 (Reference 6) as endorsed by the NRC in the letter to NEI dated May 7, 2013 (Reference 29).

7 References

1. NRC Letter (E. J. Leeds) to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident,* March 2012

2. NRC Regulations Title 10, Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities"

3. EPRI Technical Report 1025287, *Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*, dated February 2013

4. EPRI Technical Report 3002000704, *Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*, dated May 2013

5. NRC Regulations Title 10, Code of Federal Regulations, Part 100, "Reactor Site Criteria"

6. NEI Letter (A. R. Pietrangelo) to the NRC, *Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations,* April 9, 2013

7. EPRI Technical Report 1021097 (NUREG-2115), *Central and Eastern United States Seismic Source Characterization for Nuclear Facilities*, dated January 2012

8. EPRI Technical Report 3002000717, *EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project*, dated June 2013

9. EPRI NP-6041-SL, *A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)*, dated August 1991

10. Dresden Power Station Updated Final Safety Analysis Report (UFSAR), Revision 10, June 2013

11. Exelon, Dresden Nuclear Power Station Units 2 and 3, *Individual Plant Examination of External Events for Severe Accident Vulnerabilities*, December 30, 1997

12. Seismic Walkdown Report in Response to the 50.54(f) Information Request Regarding Fukushima Near-Term Task Force Recommendation 2.3: Seismic for the Dresden Generating Station Unit 2, Exelon Correspondence No. RS-12-167, Enclosure 1, November 27, 2012

13. Seismic Walkdown Report in Response to the 50.54(f) Information Request Regarding Fukushima Near-Term Task Force Recommendation 2.3: Seismic for the Dresden Generating Station Unit 3, Exelon Correspondence No. RS-12-167, Enclosure 2, November 27, 2012

14. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1,* Simpson Gumpertz & Heger Report No. 128018-R-01, dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012

15. EPRI RSM-121313-031, LCI Report: *Dresden Seismic Hazard and Screening Report*, December 23, 2013

16. Dames & Moore, *Dresden Unit 1 ISFSI Pad Study*, Calc No. DRE98-0096, Attachment B

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

19. General Electric Company, *Dresden Plant Design Analysis Report (PDAR), Volume III, Site and Environs*

20. ComEd PSLTR #00-0068, *Request for Additional Information Regarding Individual Plant Examination of External Events*, March 30, 2000

21. EPRI Technical Report 1025286, *Seismic Walkdown Guidance for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic*, June 2012

22. NRC NUREG-1407, *Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities*, April 1991

23. Exelon Generation Company letter to the NRC, *Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Seismic Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, RS-13-102, dated April 29, 2013

24. TDBD-DQ-1, *Topical Design Basis Document Quad Cities Units 1 & 2 and Dresden Units 2 & 3 Structural Design Criteria*, Revision 1, April 2000

25. EPRI Report 1015108, *Program on Technology Innovation: The Effects of High-Frequency Ground Motion on Structures, Components and Equipment in Nuclear Power Plants*, June 2007

26. EPRI Report 1015109, *Program on Technology Innovation: Seismic Screening of Components Sensitive to High-Frequency Vibratory Motions*, October 2007

27. EPRI NP-7498, *Industry Approach to Severe Accident Policy Implementation*, November, 1991

28. Attachment 4 to Letter from Glen T. Kaegi of Exelon to U.S. Nuclear Regulatory Commission, *Dresden Nuclear Power Station, Units 2 and 3, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles*, dated September 12, 2013 (Exelon correspondence numbers RS-13-205, RA-13-075, and TMI-13-104)

29. NRC (E. Leeds) Letter to NEI (J. Pollock), ML 13106A331, Electric Power Research Institute Final Draft Report XXXXXX, *Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic, as an Acceptable Alternative to the March 12, 2013, Information Request for Seismic Reevaluations*, dated May 7, 2013

30. NRC Letter, Endorsement of EPRI Final Draft Report 1025287, *Seismic Evaluation Guidance*, dated February 15, 2013

31. NRC NUREG/CR-0098, *Development of Criteria for Seismic Review of Selected Nuclear Power Plants*, May 1978

32. NRC Letter (E. J. Leeds) to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, *Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident,* dated February 20, 2014

33. NEI Letter (A. R. Pietrangelo) to the NRC, *Seismic Risk Evaluations for Plants in the Central and Eastern United States,* March 12, 2014

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35. E-mail from R. Kassawara (EPRI) to J. Clark (Exelon) dated February 27, 2014, Subject: Amp Tables

36. EPRI Report 3002000706, *High Frequency Program, Phase 1 Seismic Test Summary*, September 2013

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38. Title 10 Code of Federal Regulations Part 50 Section 73, "Licensee event report system"

A
Additional Tables

Table A-1a: Mean and fractile seismic hazard curves for 100 Hz (PGA) at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	6.90E-02	3.37E-02	4.98E-02	6.93E-02	8.85E-02	9.93E-02
0.001	4.98E-02	2.07E-02	3.28E-02	4.90E-02	6.73E-02	8.00E-02
0.005	1.38E-02	5.12E-03	7.89E-03	1.25E-02	1.87E-02	2.80E-02
0.01	6.87E-03	2.25E-03	3.47E-03	6.00E-03	9.51E-03	1.57E-02
0.015	4.26E-03	1.27E-03	1.92E-03	3.52E-03	6.09E-03	1.07E-02
0.03	1.60E-03	3.73E-04	5.66E-04	1.13E-03	2.32E-03	4.98E-03
0.05	7.21E-04	1.32E-04	2.16E-04	4.63E-04	1.05E-03	2.35E-03
0.075	3.75E-04	6.00E-05	1.02E-04	2.32E-04	5.66E-04	1.20E-03
0.1	2.32E-04	3.42E-05	6.09E-05	1.42E-04	3.57E-04	7.45E-04
0.15	1.16E-04	1.51E-05	2.84E-05	7.03E-05	1.82E-04	3.73E-04
0.3	3.19E-05	2.92E-06	6.45E-06	1.87E-05	5.12E-05	1.05E-04
0.5	1.08E-05	6.64E-07	1.67E-06	6.00E-06	1.82E-05	3.68E-05
0.75	4.17E-06	1.62E-07	4.77E-07	2.10E-06	7.13E-06	1.49E-05
1.	2.00E-06	5.20E-08	1.77E-07	9.11E-07	3.47E-06	7.45E-06
1.5	6.53E-07	8.72E-09	3.73E-08	2.46E-07	1.13E-06	2.57E-06
3.	7.38E-08	2.92E-10	1.60E-09	1.72E-08	1.16E-07	3.23E-07
5.	1.15E-08	1.11E-10	1.79E-10	1.62E-09	1.55E-08	5.12E-08
7.5	2.18E-09	9.11E-11	1.11E-10	2.64E-10	2.53E-09	9.79E-09
10.	6.06E-10	8.12E-11	9.37E-11	1.23E-10	6.73E-10	2.72E-09

Table A-1b: Mean and fractile seismic hazard curves for 25 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	7.52E-02	4.37E-02	5.66E-02	7.55E-02	9.37E-02	9.93E-02
0.001	5.84E-02	2.88E-02	4.07E-02	5.83E-02	7.66E-02	8.85E-02
0.005	2.01E-02	8.00E-03	1.16E-02	1.84E-02	2.76E-02	3.95E-02
0.01	1.10E-02	3.90E-03	5.75E-03	9.65E-03	1.53E-02	2.32E-02
0.015	7.33E-03	2.35E-03	3.52E-03	6.26E-03	1.05E-02	1.62E-02
0.03	3.30E-03	7.89E-04	1.25E-03	2.60E-03	5.12E-03	8.35E-03
0.05	1.69E-03	3.01E-04	5.20E-04	1.21E-03	2.68E-03	4.77E-03
0.075	9.57E-04	1.46E-04	2.60E-04	6.54E-04	1.51E-03	2.80E-03
0.1	6.28E-04	9.11E-05	1.64E-04	4.19E-04	9.93E-04	1.84E-03
0.15	3.39E-04	4.77E-05	8.72E-05	2.19E-04	5.42E-04	1.01E-03
0.3	1.11E-04	1.53E-05	2.84E-05	7.13E-05	1.82E-04	3.33E-04
0.5	4.55E-05	5.91E-06	1.13E-05	2.92E-05	7.55E-05	1.36E-04
0.75	2.10E-05	2.53E-06	4.98E-06	1.32E-05	3.57E-05	6.45E-05
1.	1.16E-05	1.29E-06	2.64E-06	7.13E-06	2.01E-05	3.68E-05
1.5	4.73E-06	4.43E-07	9.51E-07	2.76E-06	8.35E-06	1.55E-05
3.	8.24E-07	4.70E-08	1.16E-07	4.13E-07	1.46E-06	2.96E-06
5.	1.91E-07	5.66E-09	1.74E-08	8.23E-08	3.37E-07	7.34E-07
7.5	5.38E-08	8.23E-10	3.05E-09	1.98E-08	9.37E-08	2.19E-07
10.	2.08E-08	2.32E-10	8.12E-10	6.54E-09	3.52E-08	8.98E-08

Table A-1c: Mean and fractile seismic hazard curves for 10 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	8.48E-02	5.83E-02	6.64E-02	8.47E-02	9.93E-02	9.93E-02
0.001	7.18E-02	4.50E-02	5.35E-02	7.13E-02	8.98E-02	9.93E-02
0.005	2.83E-02	1.34E-02	1.79E-02	2.72E-02	3.84E-02	4.83E-02
0.01	1.54E-02	6.73E-03	9.24E-03	1.44E-02	2.13E-02	2.80E-02
0.015	1.04E-02	4.25E-03	5.91E-03	9.51E-03	1.44E-02	1.95E-02
0.03	4.81E-03	1.69E-03	2.42E-03	4.25E-03	7.03E-03	1.01E-02
0.05	2.49E-03	7.77E-04	1.13E-03	2.04E-03	3.73E-03	5.83E-03
0.075	1.38E-03	3.90E-04	5.75E-04	1.08E-03	2.07E-03	3.52E-03
0.1	8.85E-04	2.29E-04	3.52E-04	6.73E-04	1.32E-03	2.32E-03
0.15	4.57E-04	1.07E-04	1.69E-04	3.42E-04	6.93E-04	1.21E-03
0.3	1.37E-04	2.72E-05	4.70E-05	1.02E-04	2.16E-04	3.68E-04
0.5	5.33E-05	9.11E-06	1.69E-05	3.95E-05	8.72E-05	1.46E-04
0.75	2.38E-05	3.47E-06	6.93E-06	1.72E-05	3.95E-05	6.64E-05
1.	1.29E-05	1.64E-06	3.37E-06	9.11E-06	2.19E-05	3.73E-05
1.5	5.11E-06	4.83E-07	1.08E-06	3.37E-06	8.98E-06	1.57E-05
3.	8.49E-07	3.63E-08	1.01E-07	4.50E-07	1.53E-06	3.01E-06
5.	1.87E-07	3.37E-09	1.16E-08	7.77E-08	3.37E-07	7.34E-07
7.5	4.94E-08	4.37E-10	1.67E-09	1.57E-08	8.60E-08	2.10E-07
10.	1.78E-08	1.49E-10	4.19E-10	4.63E-09	2.96E-08	7.77E-08

Table A-1d: Mean and fractile seismic hazard curves for 5 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	8.62E-02	6.00E-02	6.73E-02	8.60E-02	9.93E-02	9.93E-02
0.001	7.40E-02	4.56E-02	5.58E-02	7.34E-02	9.24E-02	9.93E-02
0.005	2.88E-02	1.32E-02	1.77E-02	2.76E-02	4.07E-02	4.77E-02
0.01	1.48E-02	6.45E-03	8.98E-03	1.40E-02	2.10E-02	2.57E-02
0.015	9.49E-03	3.95E-03	5.66E-03	8.98E-03	1.34E-02	1.67E-02
0.03	3.99E-03	1.46E-03	2.13E-03	3.63E-03	5.83E-03	7.77E-03
0.05	1.85E-03	6.00E-04	8.85E-04	1.57E-03	2.76E-03	4.13E-03
0.075	9.26E-04	2.76E-04	4.13E-04	7.45E-04	1.34E-03	2.25E-03
0.1	5.48E-04	1.55E-04	2.35E-04	4.31E-04	7.89E-04	1.38E-03
0.15	2.53E-04	6.54E-05	1.02E-04	1.95E-04	3.73E-04	6.54E-04
0.3	6.36E-05	1.40E-05	2.39E-05	4.98E-05	1.01E-04	1.62E-04
0.5	2.19E-05	4.25E-06	7.66E-06	1.72E-05	3.57E-05	5.58E-05
0.75	8.92E-06	1.46E-06	2.84E-06	6.83E-06	1.46E-05	2.39E-05
1.	4.53E-06	6.45E-07	1.31E-06	3.33E-06	7.55E-06	1.25E-05
1.5	1.64E-06	1.79E-07	3.90E-07	1.11E-06	2.80E-06	4.90E-06
3.	2.34E-07	1.29E-08	3.33E-08	1.27E-07	4.07E-07	8.12E-07
5.	4.60E-08	1.27E-09	3.84E-09	1.92E-08	7.77E-08	1.82E-07
7.5	1.11E-08	2.19E-10	6.00E-10	3.52E-09	1.79E-08	4.70E-08
10.	3.75E-09	1.15E-10	1.95E-10	9.79E-10	5.66E-09	1.64E-08

Table A-1e: Mean and fractile seismic hazard curves for 2.5 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	7.82E-02	5.05E-02	6.00E-02	7.77E-02	9.65E-02	9.93E-02
0.001	6.07E-02	3.37E-02	4.19E-02	5.91E-02	8.00E-02	9.24E-02
0.005	1.75E-02	7.89E-03	1.07E-02	1.64E-02	2.49E-02	3.05E-02
0.01	8.16E-03	3.42E-03	4.83E-03	7.66E-03	1.15E-02	1.46E-02
0.015	4.97E-03	1.90E-03	2.76E-03	4.63E-03	7.23E-03	9.24E-03
0.03	1.80E-03	5.27E-04	8.00E-04	1.51E-03	2.80E-03	4.07E-03
0.05	6.84E-04	1.67E-04	2.64E-04	5.20E-04	1.07E-03	1.79E-03
0.075	2.79E-04	6.17E-05	1.01E-04	2.04E-04	4.31E-04	7.77E-04
0.1	1.42E-04	2.96E-05	4.98E-05	1.02E-04	2.22E-04	3.95E-04
0.15	5.38E-05	1.04E-05	1.79E-05	3.90E-05	8.72E-05	1.49E-04
0.3	1.07E-05	1.55E-06	3.01E-06	7.45E-06	1.79E-05	3.09E-05
0.5	3.25E-06	3.33E-07	7.23E-07	2.10E-06	5.58E-06	1.01E-05
0.75	1.22E-06	8.72E-08	2.10E-07	7.03E-07	2.10E-06	4.07E-06
1.	5.86E-07	3.09E-08	8.12E-08	3.09E-07	1.02E-06	2.07E-06
1.5	1.97E-07	6.17E-09	1.87E-08	8.72E-08	3.42E-07	7.55E-07
3.	2.44E-08	3.23E-10	1.08E-09	7.13E-09	3.95E-08	1.05E-07
5.	4.20E-09	1.11E-10	1.64E-10	8.60E-10	6.09E-09	1.90E-08
7.5	8.89E-10	9.11E-11	1.11E-10	1.95E-10	1.18E-09	4.01E-09
10.	2.70E-10	8.12E-11	9.24E-11	1.15E-10	3.79E-10	1.29E-09

Table A-1f: Mean and fractile seismic hazard curves for 1 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	5.86E-02	2.84E-02	3.84E-02	5.83E-02	7.89E-02	9.11E-02
0.001	3.94E-02	1.60E-02	2.35E-02	3.79E-02	5.50E-02	6.73E-02
0.005	9.84E-03	3.52E-03	5.35E-03	9.11E-03	1.42E-02	1.87E-02
0.01	4.85E-03	1.40E-03	2.32E-03	4.43E-03	7.34E-03	9.79E-03
0.015	3.10E-03	7.03E-04	1.25E-03	2.72E-03	4.98E-03	6.83E-03
0.03	1.21E-03	1.64E-04	3.23E-04	8.72E-04	2.13E-03	3.37E-03
0.05	4.68E-04	4.56E-05	9.24E-05	2.80E-04	8.23E-04	1.53E-03
0.075	1.83E-04	1.46E-05	3.05E-05	9.65E-05	3.09E-04	6.45E-04
0.1	8.57E-05	6.26E-06	1.32E-05	4.19E-05	1.38E-04	3.09E-04
0.15	2.68E-05	1.79E-06	3.90E-06	1.27E-05	4.25E-05	9.65E-05
0.3	3.59E-06	1.84E-07	4.50E-07	1.60E-06	6.00E-06	1.36E-05
0.5	9.42E-07	3.05E-08	8.47E-08	3.68E-07	1.55E-06	3.84E-06
0.75	3.44E-07	6.45E-09	2.10E-08	1.10E-07	5.50E-07	1.49E-06
1.	1.67E-07	2.01E-09	7.23E-09	4.50E-08	2.57E-07	7.55E-07
1.5	5.74E-08	4.07E-10	1.46E-09	1.13E-08	8.12E-08	2.68E-07
3.	7.63E-09	1.11E-10	1.46E-10	8.23E-10	8.35E-09	3.52E-08
5.	1.41E-09	9.11E-11	1.11E-10	1.60E-10	1.23E-09	6.17E-09
7.5	3.23E-10	8.12E-11	9.11E-11	1.11E-10	2.84E-10	1.34E-09
10.	1.05E-10	8.12E-11	9.11E-11	1.11E-10	1.40E-10	4.56E-10

Table A-1g: Mean and fractile seismic hazard curves for 0.5 Hz at Dresden, 5% of critical damping (Reference 15)

AMPS(g)	MEAN	0.05	0.16	0.50	0.84	0.95
0.0005	2.89E-02	1.32E-02	1.90E-02	2.76E-02	3.84E-02	4.77E-02
0.001	1.68E-02	7.23E-03	1.05E-02	1.60E-02	2.29E-02	2.96E-02
0.005	4.23E-03	1.16E-03	1.98E-03	3.84E-03	6.45E-03	8.60E-03
0.01	2.18E-03	3.33E-04	6.73E-04	1.79E-03	3.73E-03	5.35E-03
0.015	1.36E-03	1.36E-04	3.05E-04	9.65E-04	2.49E-03	3.90E-03
0.03	4.66E-04	2.25E-05	5.66E-05	2.29E-04	8.72E-04	1.72E-03
0.05	1.59E-04	4.98E-06	1.29E-05	5.83E-05	2.64E-04	6.64E-04
0.075	5.64E-05	1.40E-06	3.63E-06	1.72E-05	8.60E-05	2.42E-04
0.1	2.48E-05	5.42E-07	1.42E-06	6.73E-06	3.57E-05	1.07E-04
0.15	7.16E-06	1.34E-07	3.68E-07	1.74E-06	1.02E-05	3.09E-05
0.3	8.49E-07	1.01E-08	3.33E-08	1.74E-07	1.21E-06	3.90E-06
0.5	2.12E-07	1.31E-09	4.83E-09	3.23E-08	2.60E-07	1.08E-06
0.75	7.64E-08	2.76E-10	9.93E-10	8.12E-09	7.89E-08	4.07E-07
1.	3.71E-08	1.34E-10	3.42E-10	2.84E-09	3.33E-08	1.95E-07
1.5	1.29E-08	1.07E-10	1.29E-10	6.45E-10	8.98E-09	6.54E-08
3.	1.74E-09	8.12E-11	9.11E-11	1.18E-10	7.66E-10	7.45E-09
5.	3.28E-10	8.12E-11	9.11E-11	1.11E-10	1.64E-10	1.23E-09
7.5	7.57E-11	8.12E-11	9.11E-11	1.11E-10	1.11E-10	3.01E-10
10.	2.47E-11	8.12E-11	9.11E-11	1.11E-10	1.11E-10	1.49E-10

Table A-2a: Amplification functions for Dresden (Reference 15)

100 Hz (PGA)	Median AF	Sigma ln(AF)	25 Hz	Median AF	Sigma ln(AF)	10 Hz	Median AF	Sigma ln(AF)	5 Hz	Median AF	Sigma ln(AF)
1.00E-02	1.22E+00	6.93E-02	1.30E-02	1.12E+00	7.06E-02	1.90E-02	1.27E+00	1.48E-01	2.09E-02	1.32E+00	1.14E-01
4.95E-02	1.09E+00	8.88E-02	1.02E-01	9.14E-01	1.41E-01	9.99E-02	1.26E+00	1.66E-01	8.24E-02	1.32E+00	1.17E-01
9.64E-02	1.02E+00	9.23E-02	2.13E-01	8.63E-01	1.60E-01	1.85E-01	1.25E+00	1.70E-01	1.44E-01	1.31E+00	1.18E-01
1.94E-01	9.63E-01	9.54E-02	4.43E-01	8.14E-01	1.72E-01	3.56E-01	1.23E+00	1.74E-01	2.65E-01	1.30E+00	1.19E-01
2.92E-01	9.29E-01	9.75E-02	6.76E-01	7.83E-01	1.78E-01	5.23E-01	1.22E+00	1.77E-01	3.84E-01	1.29E+00	1.21E-01
3.91E-01	9.06E-01	9.89E-02	9.09E-01	7.60E-01	1.83E-01	6.90E-01	1.20E+00	1.79E-01	5.02E-01	1.29E+00	1.23E-01
4.93E-01	8.87E-01	9.98E-02	1.15E+00	7.39E-01	1.86E-01	8.61E-01	1.19E+00	1.81E-01	6.22E-01	1.28E+00	1.25E-01
7.41E-01	8.53E-01	1.01E-01	1.73E+00	7.00E-01	1.91E-01	1.27E+00	1.17E+00	1.87E-01	9.13E-01	1.27E+00	1.31E-01
1.01E+00	8.26E-01	1.01E-01	2.36E+00	6.69E-01	1.92E-01	1.72E+00	1.14E+00	1.92E-01	1.22E+00	1.26E+00	1.39E-01
1.28E+00	8.05E-01	1.02E-01	3.01E+00	6.45E-01	1.92E-01	2.17E+00	1.11E+00	1.96E-01	1.54E+00	1.25E+00	1.46E-01
1.55E+00	7.88E-01	1.02E-01	3.63E+00	6.26E-01	1.91E-01	2.61E+00	1.08E+00	1.98E-01	1.85E+00	1.24E+00	1.49E-01
2.5 Hz	Median AF	Sigma ln(AF)	1 Hz	Median AF	Sigma ln(AF)	0.5 Hz	Median AF	Sigma ln(AF)			
2.18E-02	1.07E+00	1.14E-01	1.27E-02	1.50E+00	1.43E-01	8.25E-03	1.37E+00	1.43E-01			
7.05E-02	1.06E+00	1.14E-01	3.43E-02	1.48E+00	1.38E-01	1.96E-02	1.37E+00	1.37E-01			
1.18E-01	1.06E+00	1.13E-01	5.51E-02	1.48E+00	1.36E-01	3.02E-02	1.37E+00	1.35E-01			
2.12E-01	1.06E+00	1.12E-01	9.63E-02	1.48E+00	1.34E-01	5.11E-02	1.37E+00	1.34E-01			
3.04E-01	1.06E+00	1.11E-01	1.36E-01	1.48E+00	1.33E-01	7.10E-02	1.37E+00	1.34E-01			
3.94E-01	1.06E+00	1.11E-01	1.75E-01	1.48E+00	1.31E-01	9.06E-02	1.37E+00	1.34E-01			
4.86E-01	1.06E+00	1.11E-01	2.14E-01	1.48E+00	1.30E-01	1.10E-01	1.37E+00	1.34E-01			
7.09E-01	1.06E+00	1.12E-01	3.10E-01	1.48E+00	1.29E-01	1.58E-01	1.37E+00	1.34E-01			
9.47E-01	1.06E+00	1.15E-01	4.12E-01	1.48E+00	1.28E-01	2.09E-01	1.38E+00	1.34E-01			
1.19E+00	1.06E+00	1.20E-01	5.18E-01	1.48E+00	1.27E-01	2.62E-01	1.38E+00	1.35E-01			
1.43E+00	1.06E+00	1.24E-01	6.19E-01	1.48E+00	1.27E-01	3.12E-01	1.38E+00	1.35E-01			

Tables A-2b1 and A-2b2 are tabular versions of the typical amplification factors provided in Figures 2.3.6-1 and 2.3.6-2. Values are provided for two input motion levels at approximately 10^{-4} and 10^{-5} mean annual frequency of exceedance. These tables concentrate on the frequency range of 0.5 Hz to 25 Hz, with values up to 100 Hz included, with a single value at 0.1 Hz included for completeness. These factors are unverified and are provided for information only. The figures should be considered the governing information.

Table A-2b1: Median AFs and sigmas for Model 1, Profile 1, for 2 PGA levels (Reference 35)

M1P1K1	Rock PGA=0.194			M1P1K1	PGA=0.741		
Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)	Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)
100.0	0.196	1.008	0.088	100.0	0.591	0.799	0.099
87.1	0.197	0.989	0.089	87.1	0.594	0.776	0.099
75.9	0.199	0.955	0.089	75.9	0.598	0.738	0.100
66.1	0.202	0.889	0.090	66.1	0.604	0.668	0.101
57.5	0.208	0.784	0.092	57.5	0.614	0.564	0.104
50.1	0.219	0.688	0.102	50.1	0.634	0.477	0.111
43.7	0.236	0.627	0.118	43.7	0.662	0.421	0.118
38.0	0.252	0.608	0.126	38.0	0.701	0.412	0.124
33.1	0.269	0.613	0.135	33.1	0.747	0.421	0.140
28.8	0.296	0.673	0.149	28.8	0.806	0.462	0.169
25.1	0.337	0.761	0.192	25.1	0.887	0.511	0.197
21.9	0.403	0.953	0.220	21.9	1.016	0.625	0.249
19.1	0.456	1.094	0.158	19.1	1.157	0.733	0.246
16.6	0.485	1.210	0.171	16.6	1.275	0.851	0.193
14.5	0.498	1.299	0.207	14.5	1.369	0.969	0.200
12.6	0.505	1.354	0.212	12.6	1.451	1.067	0.219
11.0	0.494	1.359	0.191	11.0	1.512	1.152	0.208
9.5	0.460	1.322	0.163	9.5	1.479	1.190	0.190
8.3	0.436	1.358	0.155	8.3	1.391	1.225	0.175
7.2	0.436	1.449	0.147	7.2	1.373	1.302	0.185
6.3	0.410	1.450	0.130	6.3	1.372	1.394	0.168
5.5	0.374	1.386	0.133	5.5	1.274	1.366	0.160
4.8	0.338	1.279	0.159	4.8	1.140	1.257	0.177
4.2	0.309	1.207	0.144	4.2	1.026	1.174	0.171
3.6	0.293	1.173	0.110	3.6	0.978	1.157	0.123
3.2	0.262	1.115	0.122	3.2	0.891	1.125	0.102
2.8	0.229	1.025	0.120	2.8	0.787	1.052	0.118
2.4	0.208	1.012	0.118	2.4	0.712	1.037	0.119
2.1	0.196	1.048	0.124	2.1	0.660	1.061	0.119
1.8	0.202	1.205	0.154	1.8	0.667	1.205	0.143
1.6	0.201	1.386	0.133	1.6	0.663	1.389	0.132
1.4	0.199	1.594	0.136	1.4	0.652	1.596	0.130
1.2	0.198	1.803	0.105	1.2	0.649	1.814	0.101
1.0	0.176	1.774	0.095	1.0	0.579	1.803	0.087

Table A-2b1: (Continued)

M1P1K1	Rock PGA=0.194			M1P1K1	PGA=0.741		
Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)	Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)
0.91	0.139	1.540	0.113	0.91	0.457	1.574	0.111
0.79	0.111	1.354	0.112	0.79	0.360	1.381	0.113
0.69	0.093	1.273	0.113	0.69	0.298	1.294	0.113
0.60	0.080	1.265	0.120	0.60	0.255	1.281	0.118
0.52	0.070	1.294	0.142	0.52	0.220	1.306	0.139
0.46	0.060	1.329	0.173	0.46	0.187	1.339	0.170
0.10	0.002	1.119	0.053	0.10	0.006	1.109	0.052

Table A-2b2: Median AFs and sigmas for Model 2, Profile 1, for 2 PGA levels (Reference 35)

M2P1K1	PGA=0.194			M2P1K1	PGA=0.741		
Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)	Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)
100.0	0.216	1.113	0.086	100.0	0.788	1.064	0.088
87.1	0.218	1.094	0.086	87.1	0.796	1.040	0.088
75.9	0.221	1.060	0.086	75.9	0.808	0.998	0.088
66.1	0.225	0.993	0.085	66.1	0.831	0.919	0.087
57.5	0.235	0.887	0.082	57.5	0.877	0.805	0.084
50.1	0.254	0.796	0.092	50.1	0.963	0.725	0.099
43.7	0.279	0.741	0.125	43.7	1.076	0.685	0.139
38.0	0.297	0.717	0.140	38.0	1.145	0.673	0.155
33.1	0.317	0.723	0.119	33.1	1.220	0.688	0.131
28.8	0.352	0.801	0.115	28.8	1.351	0.774	0.127
25.1	0.411	0.926	0.159	25.1	1.569	0.905	0.171
21.9	0.495	1.171	0.170	21.9	1.884	1.159	0.178
19.1	0.559	1.340	0.149	19.1	2.111	1.336	0.150
16.6	0.568	1.416	0.212	16.6	2.119	1.416	0.213
14.5	0.562	1.467	0.227	14.5	2.073	1.467	0.229
12.6	0.558	1.495	0.224	12.6	2.033	1.495	0.226
11.0	0.527	1.449	0.190	11.0	1.903	1.449	0.191
9.5	0.484	1.393	0.147	9.5	1.729	1.392	0.149
8.3	0.462	1.439	0.138	8.3	1.633	1.438	0.138
7.2	0.458	1.524	0.121	7.2	1.608	1.523	0.122
6.3	0.423	1.498	0.135	6.3	1.474	1.498	0.135
5.5	0.385	1.425	0.129	5.5	1.329	1.425	0.130
4.8	0.346	1.308	0.152	4.8	1.187	1.309	0.152
4.2	0.317	1.237	0.142	4.2	1.081	1.237	0.142
3.6	0.297	1.192	0.110	3.6	1.008	1.192	0.110
3.2	0.264	1.125	0.132	3.2	0.891	1.125	0.132
2.8	0.229	1.027	0.123	2.8	0.768	1.028	0.123
2.4	0.209	1.013	0.122	2.4	0.696	1.014	0.121
2.1	0.197	1.051	0.128	2.1	0.653	1.051	0.128

Table A-2b2: (Continued)

M2P1K1	PGA=0.194			M2P1K1	PGA=0.741		
Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)	Freq. (Hz)	Soil_SA	med. AF	sigma ln(AF)
1.8	0.203	1.212	0.158	1.8	0.670	1.211	0.157
1.6	0.202	1.391	0.132	1.6	0.663	1.388	0.131
1.4	0.200	1.599	0.138	1.4	0.652	1.594	0.136
1.2	0.199	1.806	0.106	1.2	0.644	1.798	0.104
1.0	0.176	1.772	0.097	1.0	0.566	1.764	0.096
0.91	0.139	1.536	0.113	0.91	0.445	1.533	0.111
0.79	0.111	1.350	0.111	0.79	0.352	1.350	0.109
0.69	0.093	1.270	0.113	0.69	0.292	1.271	0.111
0.60	0.080	1.263	0.121	0.60	0.251	1.264	0.119
0.52	0.070	1.293	0.144	0.52	0.218	1.293	0.142
0.46	0.060	1.329	0.175	0.46	0.185	1.329	0.173
0.10	0.002	1.119	0.053	0.10	0.006	1.106	0.053

Enclosure 2

SUMMARY OF REGULATORY COMMITMENTS

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE OR "OUTAGE"	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	PROGRAMMATIC (Yes/No)
1. Dresden Nuclear Power Station, Units 2 and 3, will perform a Risk Evaluation including a High Frequency Confirmation evaluation.	As determined by NRC prioritization following submittal of all nuclear power plant Seismic Hazard Re-evaluations, but no later than December 31, 2019.	Yes	No
2. Dresden Nuclear Power Station, Units 2 and 3, will perform a Spent Fuel Pool evaluation in accordance with EPRI Report 1025287, Section 7.	As determined by NRC prioritization following submittal of all nuclear power plant Seismic Hazard Re-evaluations, but no later than December 31, 2019.	Yes	No
3. Dresden Nuclear Power Station, Units 2 and 3, will prepare an Expedited Seismic Evaluation Process (ESEP) Report in accordance with EPRI Report 3002000704.	December 31, 2014	Yes	No