



10 CFR 50.54(f)

RS-13-205
RA-13-075
TMI-13-104

September 12, 2013

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

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Limerick Generating Station, Units 1 and 2
Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Oyster Creek Nuclear Generating Station, Unit 1
Renewed Facility Operating License No. DPR-16
NRC Docket No. 50-219

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Exelon Generation Company, LLC 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

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. NRC Letter, Endorsement of EPRI Final Draft Report 1025287, "Seismic Evaluation Guidance," dated February 15, 2013
3. 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
4. NEI Letter to NRC, Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations, dated April 9, 2013
5. NRC Letter, EPRI Final Draft Report XXXXXX, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations, dated May 7, 2013
6. EPRI 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 in the Central and Eastern United States (CEUS) to submit a written response consistent with the requested seismic hazard evaluation information (items 1 through 7) by September 12, 2013. On February 15, 2013, the NRC issued Reference 2, endorsing the Reference 3 industry guidance for responding to Reference 1. Section 4 of Reference 3 identifies the detailed information to be included in the seismic hazard evaluation submittals.

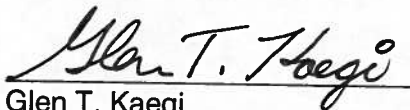
On April 9, 2013, NEI submitted Reference 4 to the NRC, requesting the NRC's agreement to delay submittal of some of the CEUS seismic hazard evaluation information so that an update to the EPRI (2004, 2006) ground motion attenuation model could be completed and used to develop that information. NEI proposed that descriptions of subsurface materials and properties and base case velocity profiles (items 3a and 3b in Section 4 of Reference 3) be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted to the NRC by March 31, 2014. In Reference 5, NRC agreed with this recommendation.

The attachments to this letter contain the requested descriptions of subsurface materials and properties and base case velocity profiles for each of the Exelon Generation Company, LLC (EGC) Stations. The information provided in the attachments to this letter is considered an interim product of seismic hazard development efforts being performed for the industry by EPRI. The complete and final seismic hazard reports for EGC will be provided to the NRC in the EGC seismic hazard submittals by March 31, 2014 in accordance with Reference 5.

This letter contains no new regulatory commitments. If you have any questions regarding this submittal, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 12th day of September 2013.

Respectfully submitted,



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

Attachments:

1. Braidwood Station, Units 1 and 2, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
2. Byron Station, Units 1 and 2, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
3. Clinton Power Station, Unit 1, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
4. Dresden Nuclear Power Station, Units 2 and 3, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
5. LaSalle County Station, Units 1 and 2, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
6. Limerick Generating Station, Units 1 and 2, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles

7. Oyster Creek Nuclear Generating Station, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
8. Peach Bottom Atomic Power Station, Units 2 and 3, Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles
9. Quad Cities Nuclear Power Station, Units 1 and 2, Descriptions of Subsurface Materials and Properties and Base Case Shear Wave Velocity Profiles
10. Three Mile Island Nuclear Station, Unit 1, Descriptions of Subsurface Materials and Properties and Base Case Shear Wave Velocity Profiles

cc: Director, Office of Nuclear Reactor Regulation
Regional Administrator - NRC Region I
Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Senior Resident Inspector - Byron Station
NRC Senior Resident Inspector - Clinton Power Station
NRC Senior Resident Inspector - Dresden Nuclear Power Station
NRC Senior Resident Inspector - LaSalle County Station
NRC Senior Resident Inspector - Limerick Generating Station
NRC Senior Resident Inspector - Oyster Creek Nuclear Generating Station
NRC Senior Resident Inspector - Peach Bottom Atomic Power Station
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station
NRC Senior Resident Inspector - Three Mile Island Nuclear Station, Unit 1
NRC Project Manager, NRR - Braidwood Station
NRC Project Manager, NRR - Byron Station
NRC Project Manager, NRR - Clinton Power Station
NRC Project Manager, NRR - Dresden Nuclear Power Station
NRC Project Manager, NRR - LaSalle County Station
NRC Project Manager, NRR - Limerick Generating Station
NRC Project Manager, NRR - Oyster Creek Nuclear Generating Station
NRC Project Manager, NRR - Peach Bottom Atomic Power Station
NRC Project Manager, NRR - Quad Cities Nuclear Power Station
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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
Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental
Resources
Manager, Bureau of Nuclear Engineering - New Jersey Department of Environmental
Protection
Chairman, Board of County Commissioners of Dauphin County, PA
Chairman, Board of Supervisors of Londonderry Township, PA
Mayor of Lacey Township, Forked River, NJ
S. T. Gray, State of Maryland
R. R. Janati, Chief, Division of Nuclear Safety, Pennsylvania Department of
Environmental Protection, Bureau of Radiation Protection

Attachment 1

Braidwood Station
Units 1 and 2

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Braidwood site description—Rev. 1

The basic information used to create the site geologic profile at the Braidwood Nuclear Generating Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Reference 1, the SSE Control Point is defined at elevation 562 ft, and the profile was modeled up to this elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.

Table 1
 Summary of Geotechnical Profile Data for Braidwood Nuclear Generating Station

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
600 ^a to 579	5-15	Pleistocene Equality Formation, dry silty sand, medium dense	105-110	330	1000	0.41-0.44
	10-15	Pleistocene Equality Formation, wet silty sand, medium dense	125-130	2400	5500-6500	0.41-0.42
579 to 562 ^b	10-25	Pleistocene Wedron Formation, clayey silt to silty clay with sand, gravel, cobbles, and boulders, hard, stiff	130-145	2400	6400	0.38-0.42
562 to 462 ^c	70-105	Pennsylvanian limestone, sandstone, siltstone and coal	113-162	3200	7800-10000	0.38-0.41
462 to 425	37-45	Ordovician Fort Atkinson Formation, limestone and dolomite	164	6800	12000-17000	0.32-0.37
425 to 338	85-90	Ordovician Scales Formation, shale, limestone	155-158	3400	8800-17000	0.32-0.44
338 to 133	165-245	Ordovician Wise Lake and Dunleith Formations, dolomite	162	8700	16400	0.30-0.32
133 to 118	10-20	Ordovician Guttenburg Formation, dolomite	N/A	N/A	N/A	N/A
118 to -37	124-186	Ordovician Platteville Group, dolomite and limestone	N/A	N/A	N/A	N/A
-37 to -384	157-540	Ordovician Ancell Group, dolomitic sandstone and quartzose sandstone	N/A	N/A	N/A	N/A
-384 to -694	285-334	Ordovician Canadian Series, dolomite and sandstone	N/A	N/A	N/A	N/A
-694 to -4234	3300-3800	Cambrian dolomite, shale, and sandstone	N/A	N/A	N/A	N/A
-4234 and below	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. 600 feet MSL, at the top of the Pleistocene Equality Formation.

^b The control points for the SSE and IPEEE HCLPF are at El. 562 ft MSL, which is the elevation of the Reactor Building foundation and the elevation of the rock-till interface.

^c Bottom of the deepest foundation is at El. 523 ft MSL, within the Pennsylvanian bedrock.

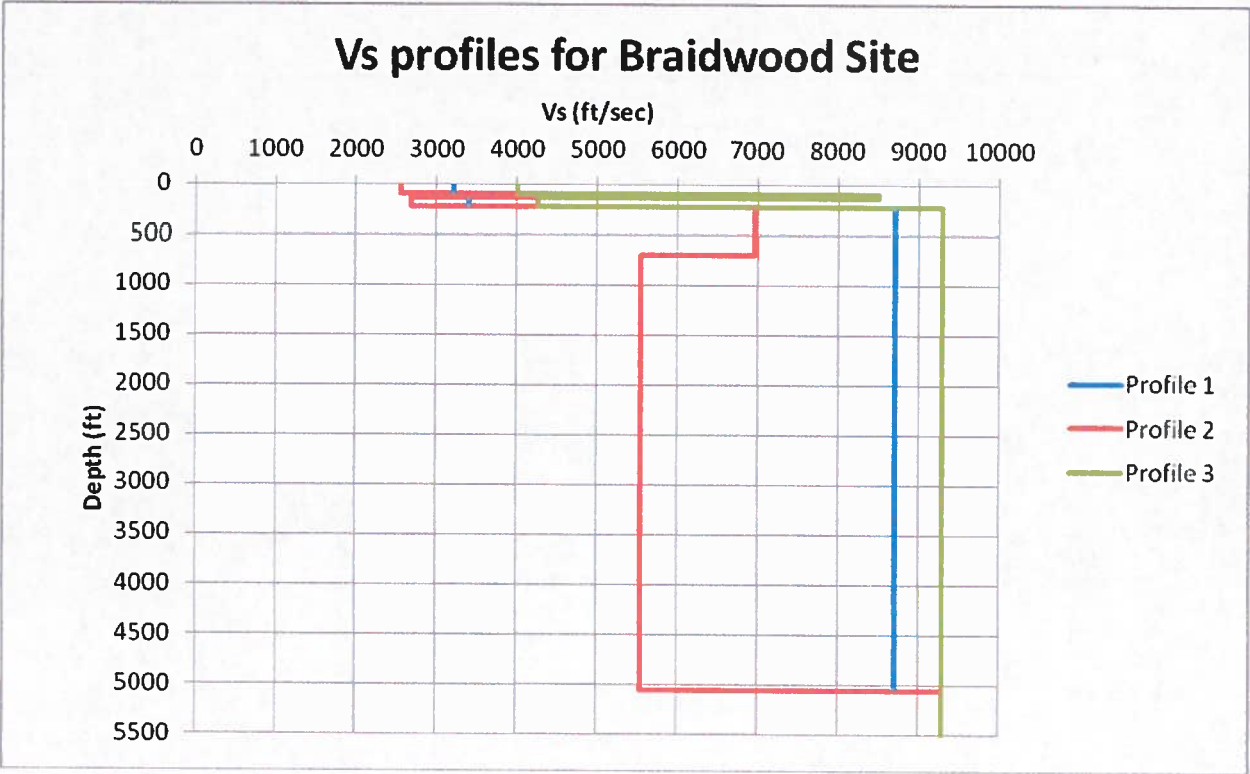


Figure 1. Vs profiles for Braidwood site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Braidwood site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	3200		0	2560		0	4000
10.0	10.0	3200	10.0	10.0	2560	10.0	10.0	4000
10.0	20.0	3200	10.0	20.0	2560	10.0	20.0	4000
10.0	30.0	3200	10.0	30.0	2560	10.0	30.0	4000
10.0	40.0	3200	10.0	40.0	2560	10.0	40.0	4000
10.0	50.0	3200	10.0	50.0	2560	10.0	50.0	4000
10.0	60.0	3200	10.0	60.0	2560	10.0	60.0	4000
10.0	70.0	3200	10.0	70.0	2560	10.0	70.0	4000
10.0	80.0	3200	10.0	80.0	2560	10.0	80.0	4000
10.0	90.0	3200	10.0	90.0	2560	10.0	90.0	4000
10.0	100.0	3200	10.0	100.0	2560	10.0	100.0	4000
10.0	110.0	6800	10.0	110.0	5440	10.0	110.0	8500
10.0	120.0	6800	10.0	120.0	5440	10.0	120.0	8500
7.0	127.0	6800	7.0	127.0	5440	7.0	127.0	8500
10.0	137.0	6800	10.0	137.0	5440	10.0	137.0	8500
7.0	144.0	3400	7.0	144.0	2690	7.0	144.0	4250
10.0	154.0	3400	10.0	154.0	2690	10.0	154.0	4250
10.0	164.0	3400	10.0	164.0	2690	10.0	164.0	4250
10.0	174.0	3400	10.0	174.0	2690	10.0	174.0	4250
10.0	184.0	3400	10.0	184.0	2690	10.0	184.0	4250
10.0	194.0	3400	10.0	194.0	2690	10.0	194.0	4250
10.0	204.0	3400	10.0	204.0	2690	10.0	204.0	4250
10.0	214.0	3400	10.0	214.0	2690	10.0	214.0	4250
10.0	224.0	3400	10.0	224.0	2690	10.0	224.0	4250
6.0	230.0	8700	6.0	230.0	6960	6.0	230.0	9285
10.0	240.0	8700	10.0	240.0	6960	10.0	240.0	9285
10.0	250.0	8700	10.0	250.0	6960	10.0	250.0	9285
25.0	275.0	8700	25.0	275.0	6960	25.0	275.0	9285
25.0	300.0	8700	25.0	300.0	6960	25.0	300.0	9285
25.0	325.0	8700	25.0	325.0	6960	25.0	325.0	9285
25.0	350.0	8700	25.0	350.0	6960	25.0	350.0	9285
25.0	375.0	8700	25.0	375.0	6960	25.0	375.0	9285
25.0	400.0	8700	25.0	400.0	6960	25.0	400.0	9285
25.0	425.0	8700	25.0	425.0	6960	25.0	425.0	9285
25.0	450.0	8700	25.0	450.0	6960	25.0	450.0	9285
25.0	475.0	8700	25.0	475.0	6960	25.0	475.0	9285

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25.0	500.0	8700	25.0	500.0	6960	25.0	500.0	9285
24.4	524.4	8700	24.4	524.4	6960	24.4	524.4	9285
24.4	548.7	8700	24.4	548.7	6960	24.4	548.7	9285
24.4	573.1	8700	24.4	573.1	6960	24.4	573.1	9285
24.4	597.5	8700	24.4	597.5	6960	24.4	597.5	9285
24.4	621.8	8700	24.4	621.8	6960	24.4	621.8	9285
24.4	646.2	8700	24.4	646.2	6960	24.4	646.2	9285
24.4	670.6	8700	24.4	670.6	6960	24.4	670.6	9285
24.4	695.0	8700	24.4	695.0	6960	24.4	695.0	9285
218.3	913.3	8700	218.3	913.3	5541	218.3	913.3	9285
218.3	1131.6	8700	218.3	1131.6	5541	218.3	1131.6	9285
218.3	1350.0	8700	218.3	1350.0	5541	218.3	1350.0	9285
218.3	1568.3	8700	218.3	1568.3	5541	218.3	1568.3	9285
218.3	1786.7	8700	218.3	1786.7	5541	218.3	1786.7	9285
218.3	2005.0	8700	218.3	2005.0	5541	218.3	2005.0	9285
218.3	2223.3	8700	218.3	2223.3	5541	218.3	2223.3	9285
218.3	2441.7	8700	218.3	2441.7	5541	218.3	2441.7	9285
218.3	2660.0	8700	218.3	2660.0	5541	218.3	2660.0	9285
218.3	2878.4	8700	218.3	2878.4	5541	218.3	2878.4	9285
218.3	3096.7	8700	218.3	3096.7	5541	218.3	3096.7	9285
218.3	3315.0	8700	218.3	3315.0	5541	218.3	3315.0	9285
218.3	3533.4	8700	218.3	3533.4	5541	218.3	3533.4	9285
218.3	3751.7	8700	218.3	3751.7	5541	218.3	3751.7	9285
218.3	3970.0	8700	218.3	3970.0	5541	218.3	3970.0	9285
218.3	4188.4	8700	218.3	4188.4	5541	218.3	4188.4	9285
218.3	4406.7	8700	218.3	4406.7	5541	218.3	4406.7	9285
218.3	4625.1	8700	218.3	4625.1	5541	218.3	4625.1	9285
218.3	4843.4	8700	218.3	4843.4	5541	218.3	4843.4	9285
218.3	5061.7	8700	218.3	5061.7	5541	218.3	5061.7	9285
3280.8	8342.6	9285	3280.8	8342.6	9285	3280.8	8342.6	9285

Attachment 2

Byron Station
Units 1 and 2

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Byron site description

The basic information used to create the site geologic profile at the Byron Nuclear Generating Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Table 1, the SSE Control Point is defined at elevation 869 ft, which is the surface of finished grade, and the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.

Table 1
 Summary of Geotechnical Profile Data for Byron Nuclear Generating Station

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
N/A	0-8	Pleistocene overburden, clayey silt, clayey sand, and silty sand with some gravel	110-130	330-450	1000-2200	0.44
869 ^a to 772 ^b	30-105	Ordovician Dunleith Formation, slightly to moderately weathered dolomite	147-164	2800-3650	7500-11000	0.37-0.41
772 to 768	3-7	Ordovician Guttenberg Formation, Dolomite	150-157	3000-6000	9500-15250	0.33-0.41
768 to 755	10-15	Ordovician Quimbys Mill Formation, Dolomite	156-166	4500-9500	12000-15250	0.33-0.41
755 to 740	13-24	Ordovician Nachusa Formation, Dolomite	162-168	9500	15500	0.19-0.23
740 to 698	30-46	Ordovician Grand Detour Formation, dolomite	156-177	9500	15500	0.19-0.23
698 to 682	13-26	Ordovician Mifflin Formation, Dolomite	165-166	9500	15500	0.19-0.23
682 to 657	15-31	Ordovician Pecatonica Formation, Dolomite	146-160	9500	15500	0.19-0.23
657 to 655	2-5	Ordovician Glenwood Formation, Harmony Hill Member, shale	116-129	9500	15500	0.19-0.23
655 to 635	17-32	Ordovician Glenwood Formation, Daysville Member, dolomite and sandstone	155-167	9500	15500	0.19-0.23
635 to 408	100-450	Ordovician St. Peter Formation, poorly graded, poorly cemented, friable sandstone	130-132	9500	15500	0.19-0.23
408 to -1622	1500-2500	Cambrian dolomite and sandstone	152-159	11000	18300	0.22
-1622 and below	N/A	Precambrian metamorphic and igneous basement	162	12000	19000	0.18

^a Surface of finish grade is nominally at El. 869 ft MSL in the vicinity of the main power block. This is the control point elevation for the SSE and the IPEEE HCLPF.

^b Bottom of the deepest foundation in the vicinity of the main power block is at El. 792 ft MSL, within the Ordovician Dunleith Formation.

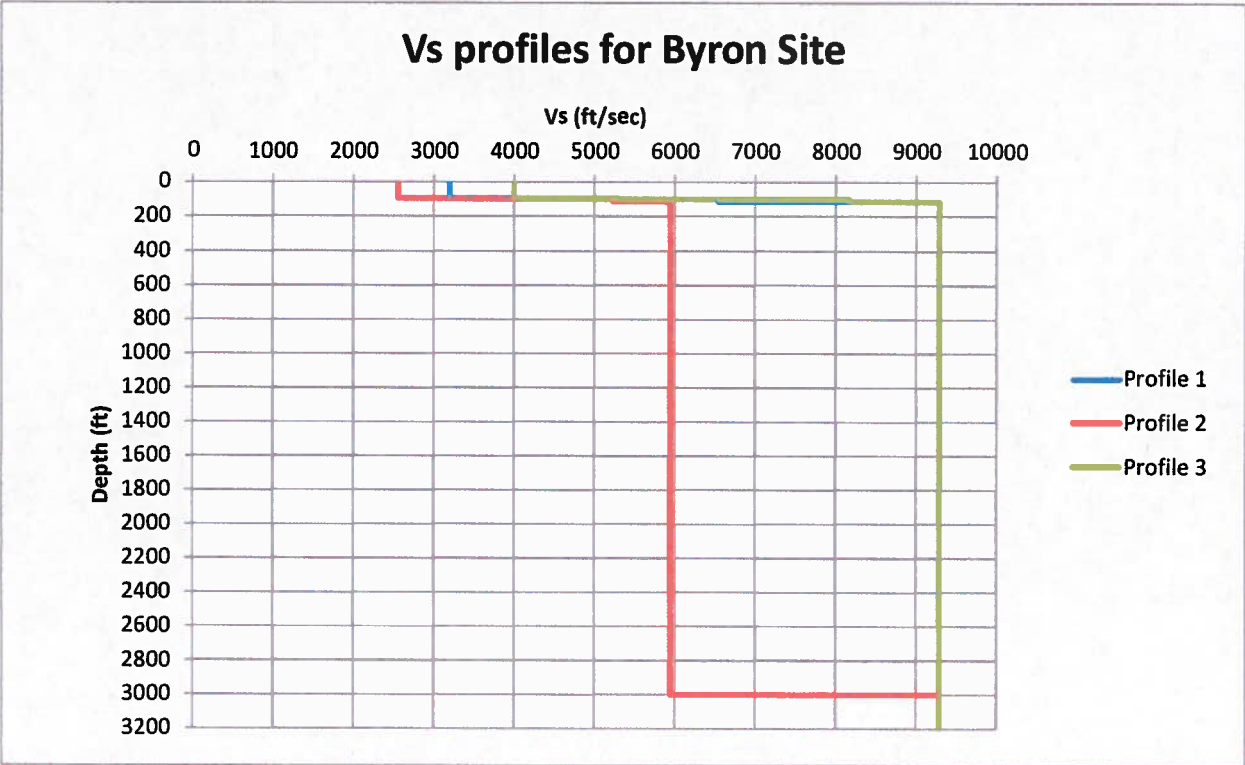


Figure 1. Vs profiles for Byron site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Byron site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	3197		0	2557		0	3996
10.0	10.0	3197	10.0	10.0	2557	10.0	10.0	3996
10.0	20.0	3197	10.0	20.0	2557	10.0	20.0	3996
10.0	30.0	3197	10.0	30.0	2557	10.0	30.0	3996
10.0	40.0	3197	10.0	40.0	2557	10.0	40.0	3996
10.0	50.0	3197	10.0	50.0	2557	10.0	50.0	3996
10.0	60.0	3197	10.0	60.0	2557	10.0	60.0	3996
10.0	70.0	3197	10.0	70.0	2557	10.0	70.0	3996
10.0	80.1	3197	10.0	80.1	2557	10.0	80.1	3996
10.0	90.1	3197	10.0	90.1	2557	10.0	90.1	3996
7.0	97.0	3197	7.0	97.0	2557	7.0	97.0	3996
4.0	101.0	4242	4.0	101.0	3394	4.0	101.0	5303
6.5	107.5	6536	6.5	107.5	5229	6.5	107.5	8170
6.5	114.0	6536	6.5	114.0	5229	6.5	114.0	8170
5.9	120.0	9285	5.9	120.0	5942	5.9	120.0	9285
26.0	146.0	9285	26.0	146.0	5942	26.0	146.0	9285
26.0	172.0	9285	26.0	172.0	5942	26.0	172.0	9285
26.0	198.0	9285	26.0	198.0	5942	26.0	198.0	9285
26.0	224.0	9285	26.0	224.0	5942	26.0	224.0	9285
26.0	250.1	9285	26.0	250.1	5942	26.0	250.1	9285
38.4	288.5	9285	38.4	288.5	5942	38.4	288.5	9285
38.4	326.9	9285	38.4	326.9	5942	38.4	326.9	9285
38.4	365.3	9285	38.4	365.3	5942	38.4	365.3	9285
38.4	403.7	9285	38.4	403.7	5942	38.4	403.7	9285
38.4	442.2	9285	38.4	442.2	5942	38.4	442.2	9285
57.8	500.0	9285	57.8	500.0	5942	57.8	500.0	9285
106.2	606.2	9285	106.2	606.2	5942	106.2	606.2	9285
164.0	770.2	9285	164.0	770.2	5942	164.0	770.2	9285
164.0	934.3	9285	164.0	934.3	5942	164.0	934.3	9285
164.0	1098.3	9285	164.0	1098.3	5942	164.0	1098.3	9285
164.0	1262.4	9285	164.0	1262.4	5942	164.0	1262.4	9285
164.0	1426.4	9285	164.0	1426.4	5942	164.0	1426.4	9285
164.0	1590.4	9285	164.0	1590.4	5942	164.0	1590.4	9285
164.0	1754.5	9285	164.0	1754.5	5942	164.0	1754.5	9285
164.0	1918.5	9285	164.0	1918.5	5942	164.0	1918.5	9285
164.0	2082.6	9285	164.0	2082.6	5942	164.0	2082.6	9285
164.0	2246.6	9285	164.0	2246.6	5942	164.0	2246.6	9285

164.0	2410.7	9285	164.0	2410.7	5942	164.0	2410.7	9285
164.0	2574.7	9285	164.0	2574.7	5942	164.0	2574.7	9285
164.0	2738.7	9285	164.0	2738.7	5942	164.0	2738.7	9285
262.5	3001.2	9285	262.5	3001.2	5942	262.5	3001.2	9285
3280.8	6282.0	9285	3280.8	6282.0	9285	3280.8	6282.0	9285

Attachment 3

Clinton Power Station
Unit 1

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Clinton site description—Rev. 1

The basic information used to create the site geologic profile at the Clinton Power Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Table 1, the SSE Control Point is defined at the surface (elevation 736 ft), and the profile was modeled up to the surface. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally. For dynamic properties of fill and compacted sand layers, modulus and damping curves were also represented with two models. The first model used soil curves taken from Reference 2, the second model used soil curves taken from References 3 and 4. These dynamic property models were weighted equally. To model the profile, rock modulus and damping curves from Reference 2 were paired with soil modulus and damping curves from Reference 2, and linear rock modulus and damping curves were paired with soil modulus and damping curves from References 3 and 4.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.
3. Silva, W.J., N. A. Abrahamson, G.R. Toro, and C. Costantino (1996). *Description and Validation of the Stochastic Ground Motion Model*, Rept. submitted to Brookhaven Natl. Lab., Assoc. Universities Inc., Upton NY 11973, Contract No. 770573.
4. Walling, M.A., W.J., Silva and N.A. Abrahamson (2008). "Nonlinear Site Amplification Factors for Constraining the NGA Models," *Earthquake Spectra*, 24 (1) 243-255.

Table 1
 Summary of Geotechnical Profile Data for Clinton Power Station

Elevations of Layer Boundaries At Containment 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
736 ^a to 732	4-10	Wisconsinan Richland Loess, soft, clayey silt	118-131	641-1354	1680-2875	0.37
732 to 702	20-55	Wisconsinan Wedron Formation, stiff to very stiff clayey sandy silt with lenses of stratified sand, gravel or silt	130-157	641-1354	4800-7300	0.48
702 to 680 ^b	10-22	Illinoian weathered Glasford Formation, clayey silt with sand and gravel	120-160	860-1970	4800-7500	0.48
680 to 577	90-140	Illinoian unaltered Glasford Formation, hard sandy silt till with discontinuous layers of stratified sand, gravel or silt up to 3 ft thick in the uppermost part	140-160	1100-3250	5700-8900	0.46
577 to 560	0-17	Probably-Pre-Illinoian lacustrine deposit of clayey silt (reworked and weathered Pre-Illinoian glacial till)	133-142	1390-2670	7500	0.46-0.47
560 to 510	50-68	Pre-Illinoian silty clay and clayey silt with some sand and gravel	134-162	1560-2800	5270-8230	0.46-0.47
510 to 500	5-15	Pre-Illinoian lacustrine deposits of clayey silt and silty clay with sand and some gravel (reworked glacial till)	126-142	1190-3310	5270-7940	0.40-0.46
500 to 0	300-800	Pennsylvanian limestone, shale, sandstone, coal, and siltstone	160-166	3250-5700	7850-12000	0.29
0 to -500	500-600	Mississippian limestone, with lesser siltstone and shale	N/A	4500-6500	N/A	0.33
-500 to -700	150-250	Devonian shale and limestone	N/A	4500-8500	N/A	0.33
-700 to -1200	450-550	Silurian carbonates, some of which include reef structure	N/A	4500-8500	N/A	0.33
-1200 to -2300	1000-1500	Ordovician dolomite, sandstone, basal sandstone, limestone, and shales	N/A	6500-10500	N/A	0.25-0.33
-2300 to -5300	2900-3100	Cambrian siltstone, shale, sandstone, and dolomite	N/A	6500-10500	N/A	0.25-0.33
-5300 and below	N/A	Precambrian igneous rocks, dominantly granite with associated granodiorite, rhyolite, felsite, or granophyre of closely related composition	N/A	>9200	N/A	0.25

^a Surface of finish grade is nominally at El. 736 ft MSL in the vicinity of the main power block. This is the control point elevation for the SSE and the IPEEE HCLPF.

^b Bottom of the deepest foundation in the vicinity of the main power block is at El. 693 ft MSL, within the weathered Glasford Formation. Beneath the main power block, the native soils were excavated down to El. 680 ft MSL to the surface of the unaltered Glasford Formation. Type B structural fill is placed between El. 680 ft MSL and the bottom of the foundations. The structural backfill is described in UFSAR Section 2.5.4.5.1.5 [1].

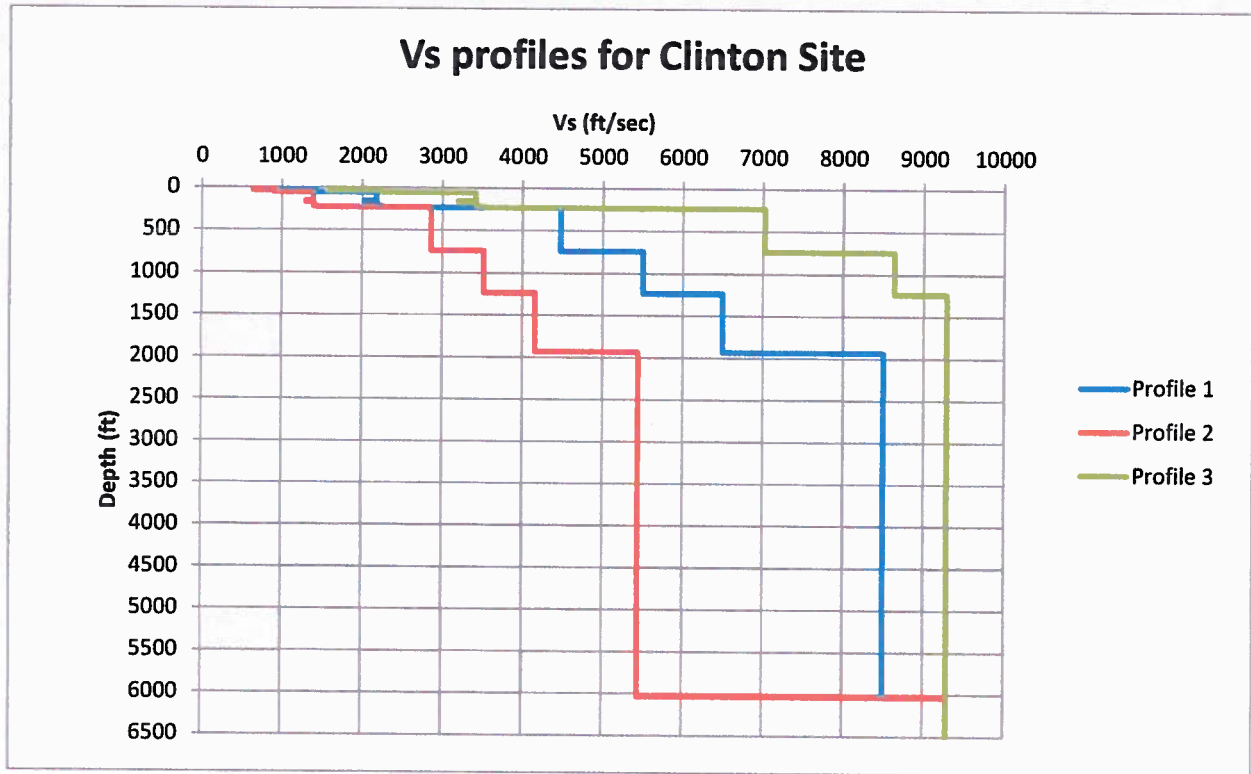


Figure 1. Vs profiles for Clinton site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Clinton site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs (ft/s)	thickness(ft)	depth (ft)	Vs (ft/s)	thickness(ft)	depth (ft)	Vs (ft/s)
	0	997		0	638		0	1566
4.0	4.0	997	4.0	4.0	638	4.0	4.0	1566
5.0	9.0	997	5.0	9.0	638	5.0	9.0	1566
5.0	14.0	997	5.0	14.0	638	5.0	14.0	1566
5.0	19.0	997	5.0	19.0	638	5.0	19.0	1566
1.0	20.0	997	1.0	20.0	638	1.0	20.0	1566
4.0	24.0	997	4.0	24.0	638	4.0	24.0	1566
5.0	29.0	997	5.0	29.0	638	5.0	29.0	1566
5.0	34.0	997	5.0	34.0	638	5.0	34.0	1566
4.4	38.4	1415	4.4	38.4	906	4.4	38.4	2221
4.4	42.8	1415	4.4	42.8	906	4.4	42.8	2221
4.4	47.2	1415	4.4	47.2	906	4.4	47.2	2221
2.8	50.0	1415	2.8	50.0	906	2.8	50.0	2221
1.6	51.6	1415	1.6	51.6	906	1.6	51.6	2221
4.4	56.0	1415	4.4	56.0	906	4.4	56.0	2221
10.3	66.3	2175	10.3	66.3	1392	10.3	66.3	3415
10.3	76.6	2175	10.3	76.6	1392	10.3	76.6	3415
10.3	86.9	2175	10.3	86.9	1392	10.3	86.9	3415
10.3	97.2	2175	10.3	97.2	1392	10.3	97.2	3415
10.3	107.5	2175	10.3	107.5	1392	10.3	107.5	3415
10.3	117.8	2175	10.3	117.8	1392	10.3	117.8	3415
2.2	120.0	2175	2.2	120.0	1392	2.2	120.0	3415
8.1	128.1	2175	8.1	128.1	1392	8.1	128.1	3415
10.3	138.4	2175	10.3	138.4	1392	10.3	138.4	3415
10.3	148.7	2175	10.3	148.7	1392	10.3	148.7	3415
10.3	159.0	2175	10.3	159.0	1392	10.3	159.0	3415
8.5	167.5	2030	8.5	167.5	1299	8.5	167.5	3187
8.5	176.0	2030	8.5	176.0	1299	8.5	176.0	3187
10.0	186.0	2180	10.0	186.0	1395	10.0	186.0	3422
10.0	196.0	2180	10.0	196.0	1395	10.0	196.0	3422
10.0	206.0	2180	10.0	206.0	1395	10.0	206.0	3422
10.0	216.0	2180	10.0	216.0	1395	10.0	216.0	3422
10.0	226.0	2180	10.0	226.0	1395	10.0	226.0	3422
10.0	236.0	2250	10.0	236.0	1440	10.0	236.0	3532
14.0	250.0	4475	14.0	250.0	2864	14.0	250.0	7025
25.0	275.0	4475	25.0	275.0	2864	25.0	275.0	7025

25.0	300.0	4475	25.0	300.0	2864	25.0	300.0	7025
25.0	325.0	4475	25.0	325.0	2864	25.0	325.0	7025
25.0	350.0	4475	25.0	350.0	2864	25.0	350.0	7025
25.0	375.0	4475	25.0	375.0	2864	25.0	375.0	7025
25.0	400.0	4475	25.0	400.0	2864	25.0	400.0	7025
25.0	425.0	4475	25.0	425.0	2864	25.0	425.0	7025
25.0	450.0	4475	25.0	450.0	2864	25.0	450.0	7025
25.0	475.0	4475	25.0	475.0	2864	25.0	475.0	7025
25.0	500.0	4475	25.0	500.0	2864	25.0	500.0	7025
118.0	618.0	4475	118.0	618.0	2864	118.0	618.0	7025
118.0	736.0	4475	118.0	736.0	2864	118.0	736.0	7025
250.0	985.9	5500	250.0	985.9	3520	250.0	985.9	8635
250.0	1235.9	5500	250.0	1235.9	3520	250.0	1235.9	8635
233.3	1469.3	6500	233.3	1469.3	4160	233.3	1469.3	9285
233.3	1702.6	6500	233.3	1702.6	4160	233.3	1702.6	9285
233.3	1935.9	6500	233.3	1935.9	4160	233.3	1935.9	9285
275.0	2210.9	8500	275.0	2210.9	5440	275.0	2210.9	9285
275.0	2485.9	8500	275.0	2485.9	5440	275.0	2485.9	9285
275.0	2760.9	8500	275.0	2760.9	5440	275.0	2760.9	9285
275.0	3035.8	8500	275.0	3035.8	5440	275.0	3035.8	9285
300.0	3335.8	8500	300.0	3335.8	5440	300.0	3335.8	9285
300.0	3635.8	8500	300.0	3635.8	5440	300.0	3635.8	9285
300.0	3935.8	8500	300.0	3935.8	5440	300.0	3935.8	9285
300.0	4235.8	8500	300.0	4235.8	5440	300.0	4235.8	9285
300.0	4535.8	8500	300.0	4535.8	5440	300.0	4535.8	9285
300.0	4835.8	8500	300.0	4835.8	5440	300.0	4835.8	9285
300.0	5135.7	8500	300.0	5135.7	5440	300.0	5135.7	9285
300.0	5435.7	8500	300.0	5435.7	5440	300.0	5435.7	9285
300.0	5735.7	8500	300.0	5735.7	5440	300.0	5735.7	9285
300.0	6035.7	8500	300.0	6035.7	5440	300.0	6035.7	9285
3280.8	9316.5	9285	3280.8	9316.5	9285	3280.8	9316.5	9285

Attachment 4

Dresden Nuclear Power Station
Units 2& 3

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Dresden site description

The basic information used to create the site geologic profile at the Dresden Generating Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Table 1, the SSE Control Point is defined at elevation 515 ft, and the profile was modeled up to this elevation. For dynamic properties of soft rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally. The six base-case shear-wave velocity profiles used to model amplification at the site are shown in Figures 1A (for Profiles 1, 2, and 3) and 1B (for Profiles 4, 5, and 6). Profiles 1 through 6 are weighted 0.2, 0.15, 0.15, 0.2, 0.15, and 0.15, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Tables 2A (for Profiles 1, 2, and 3) and 2B (for Profiles 4, 5, and 6).

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.

Table 1
 Summary of Geotechnical Profile Data for Dresden Generating Station

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.

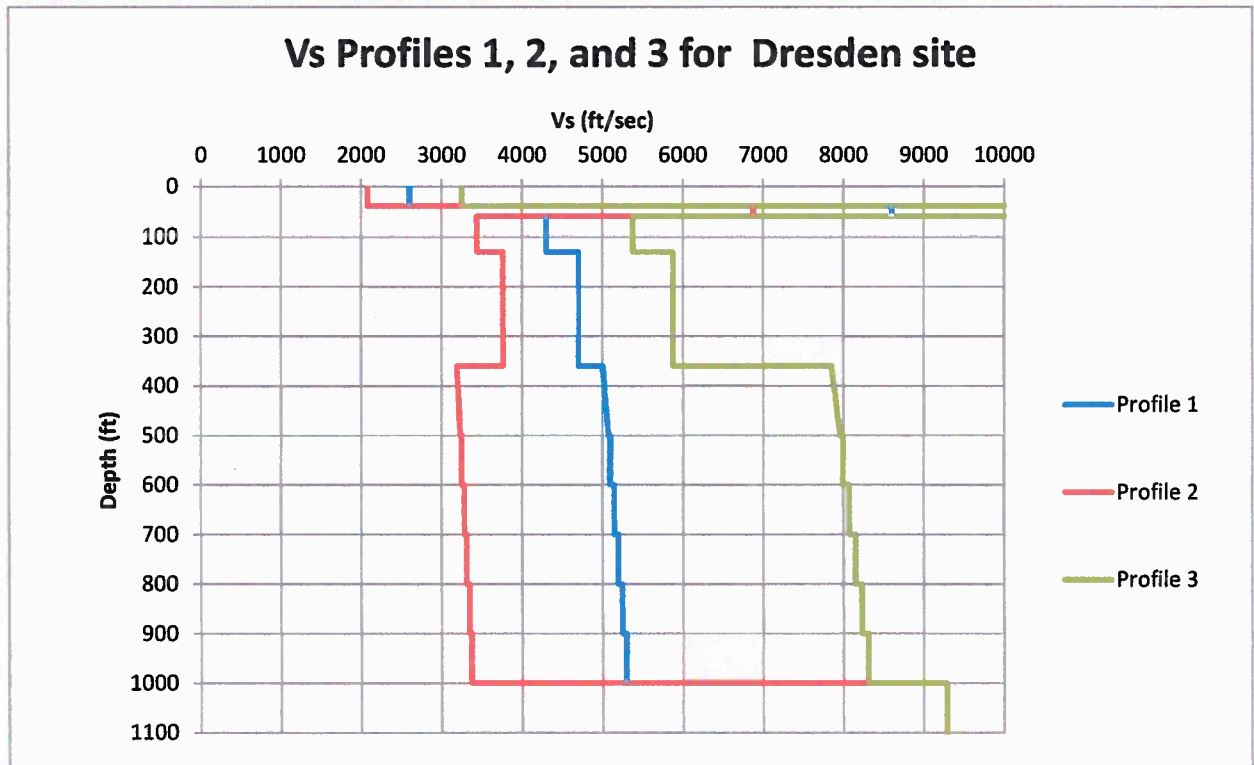


Figure 1A. Vs for Profiles 1, 2, and 3 for Dresden site

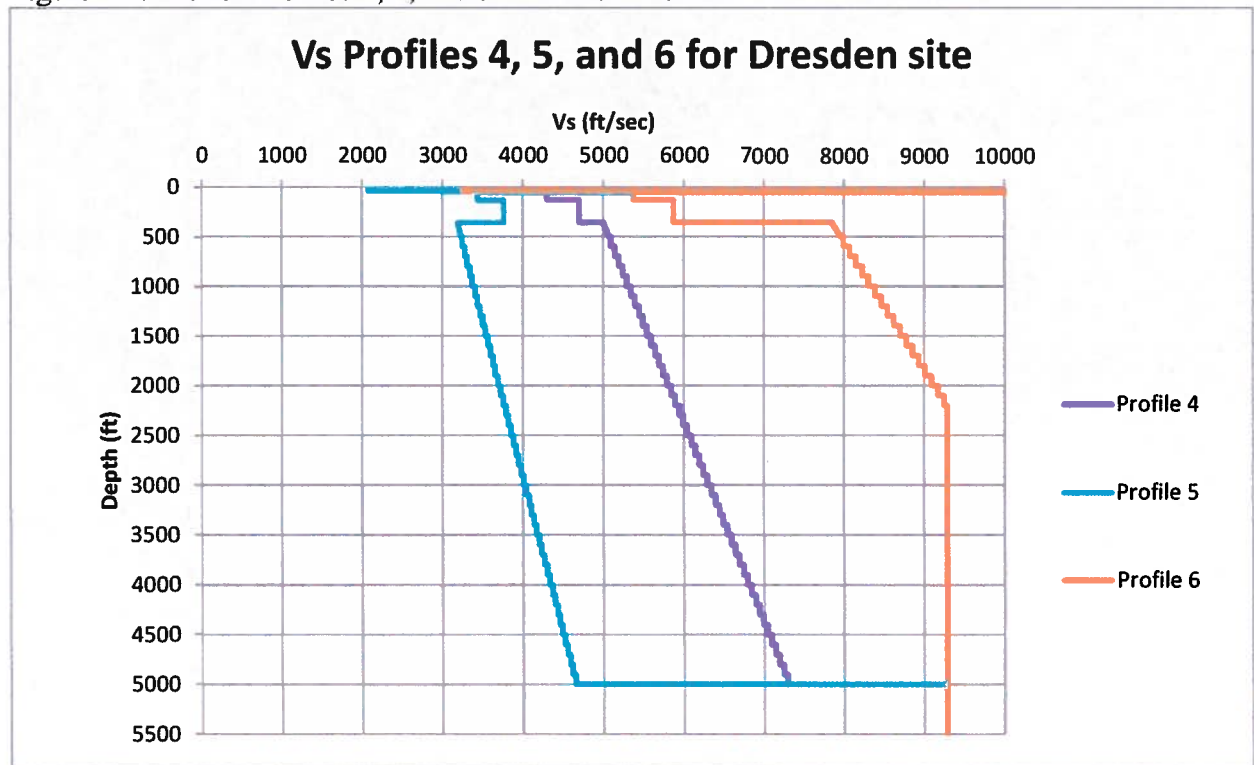


Figure 1B. Vs for Profiles 4, 5, and 6 for Dresden site

Table 2A
 Layer thicknesses, depths, and Vs for Profiles 1, 2, and 3 for Dresden site

Profile 1			Profile 2			Profile 3		
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
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

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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

Table 2B
 Layer thicknesses, depths, and Vs for Profiles 4, 5, and 6 for Dresden site

Profile 4			Profile 5			Profile 6		
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
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

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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
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

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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
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

Attachment 5

LaSalle County Station
Units 1 & 2

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

LaSalle site description

The basic information used to create the site geologic profile at the LaSalle County Nuclear Generating Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Table 1, the SSE Control Point is defined at the surface (elevation 710 ft), and the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally. For dynamic properties of fill and compacted sand layers, modulus and damping curves were also represented with two models. The first model used soil curves taken from Reference 2, the second model used soil curves taken from References 3 and 4. These dynamic property models were weighted equally. To model the profile, rock modulus and damping curves from Reference 2 were paired with soil modulus and damping curves from Reference 2, and linear rock modulus and damping curves were paired with soil modulus and damping curves from References 3 and 4.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.
3. Silva, W.J., N. A. Abrahamson, G.R. Toro, and C. Costantino (1996). *Description and Validation of the Stochastic Ground Motion Model*, Rept. submitted to Brookhaven Natl. Lab., Assoc. Universities Inc., Upton NY 11973, Contract No. 770573.
4. Walling, M.A., W.J., Silva and N.A. Abrahamson (2008). "Nonlinear Site Amplification Factors for Constraining the NGA Models," *Earthquake Spectra*, 24 (1) 243-255.

Table 1
 Summary of Geotechnical Profile Data for LaSalle County Nuclear Generating Station

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
710 ^a to 600 ^b	90-140	Pleistocene Wisconsinan Wedron Formation, stiff to hard silty clay with some sand and gravel	129-139	400-1100	1100	0.38-0.46
600 to 540	45-60	Pleistocene Wisconsinan Wedron Formation, very dense, very hard to hard clayey silt with some sand and gravel	134-153	1640-1750	5000-5680	0.41-0.49
540 to 395	145-175	Pennsylvanian Carbondale Formation, shale, limestone, sandstone, siltstone, and coal	135-177	4800	9400-10700	0.1-0.37
395 to 370	25	Pennsylvanian Spoon Formation, shale, limestone, sandstone, siltstone, and coal	150	4800	9800	0.34
370 to 300	50-100	Ordovician Platteville Group, dolomite	150	4800	9800	0.34
300 to 50	235-250	Ordovician Ancell Group, sandstone	150	4800	9800	0.34
50 to -3690	3740	Ordovician and Cambrian dolomite and sandstone	155	11000	18300	0.22
-3690 and below	N/A	Precambrian igneous and metamorphic rocks	162	12000	19000	0.18

^a Surface of finish grade is nominally at El. 710 ft MSL in the vicinity of the main power block. This is the control point elevation for the SSE.

^b Bottom of the deepest foundation is at El. 656 ft MSL, within the Wedron Formation.

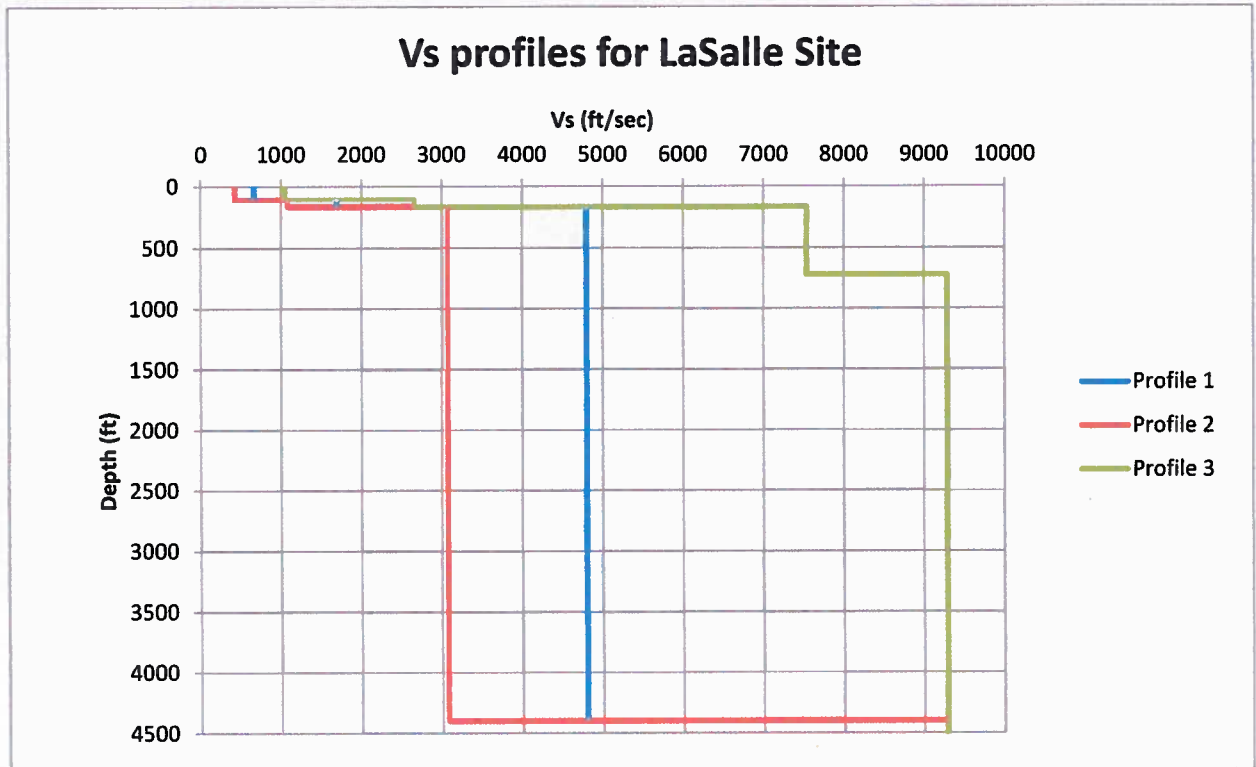


Figure 1. Vs profiles for LaSalle site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, LaSalle site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	663		0	424		0	1041
5.5	5.5	663	5.5	5.5	424	5.5	5.5	1041
5.5	11.0	663	5.5	11.0	424	5.5	11.0	1041
5.5	16.5	663	5.5	16.5	424	5.5	16.5	1041
5.5	22.0	663	5.5	22.0	424	5.5	22.0	1041
5.5	27.6	663	5.5	27.6	424	5.5	27.6	1041
5.5	33.1	663	5.5	33.1	424	5.5	33.1	1041
5.5	38.6	663	5.5	38.6	424	5.5	38.6	1041
5.5	44.1	663	5.5	44.1	424	5.5	44.1	1041
5.5	49.6	663	5.5	49.6	424	5.5	49.6	1041
5.5	55.1	663	5.5	55.1	424	5.5	55.1	1041
5.5	60.6	663	5.5	60.6	424	5.5	60.6	1041
5.5	66.1	663	5.5	66.1	424	5.5	66.1	1041
5.5	71.7	663	5.5	71.7	424	5.5	71.7	1041
5.5	77.2	663	5.5	77.2	424	5.5	77.2	1041
5.5	82.7	663	5.5	82.7	424	5.5	82.7	1041
5.5	88.2	663	5.5	88.2	424	5.5	88.2	1041
5.5	93.7	663	5.5	93.7	424	5.5	93.7	1041
5.5	99.2	663	5.5	99.2	424	5.5	99.2	1041
5.5	104.7	663	5.5	104.7	424	5.5	104.7	1041
5.5	110.2	663	5.5	110.2	424	5.5	110.2	1041
6.0	116.2	1694	6.0	116.2	1084	6.0	116.2	2660
6.0	122.2	1694	6.0	122.2	1084	6.0	122.2	2660
6.0	128.2	1694	6.0	128.2	1084	6.0	128.2	2660
6.0	134.3	1694	6.0	134.3	1084	6.0	134.3	2660
6.0	140.3	1694	6.0	140.3	1084	6.0	140.3	2660
6.0	146.3	1694	6.0	146.3	1084	6.0	146.3	2660
6.0	152.3	1694	6.0	152.3	1084	6.0	152.3	2660
6.0	158.3	1694	6.0	158.3	1084	6.0	158.3	2660
6.0	164.3	1694	6.0	164.3	1084	6.0	164.3	2660
6.0	170.3	1694	6.0	170.3	1084	6.0	170.3	2660
29.0	199.3	4800	29.0	199.3	3072	29.0	199.3	7536
29.0	228.3	4800	29.0	228.3	3072	29.0	228.3	7536
29.0	257.3	4800	29.0	257.3	3072	29.0	257.3	7536
29.0	286.3	4800	29.0	286.3	3072	29.0	286.3	7536
29.0	315.3	4800	29.0	315.3	3072	29.0	315.3	7536
184.7	500.0	4800	184.7	500.0	3072	184.7	500.0	7536

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223.8	723.8	4800	223.8	723.8	3072	223.8	723.8	7536
204.2	928.0	4800	204.2	928.0	3072	204.2	928.0	9285
204.2	1132.2	4800	204.2	1132.2	3072	204.2	1132.2	9285
204.2	1336.4	4800	204.2	1336.4	3072	204.2	1336.4	9285
204.2	1540.7	4800	204.2	1540.7	3072	204.2	1540.7	9285
204.2	1744.9	4800	204.2	1744.9	3072	204.2	1744.9	9285
204.2	1949.1	4800	204.2	1949.1	3072	204.2	1949.1	9285
204.2	2153.4	4800	204.2	2153.4	3072	204.2	2153.4	9285
204.2	2357.6	4800	204.2	2357.6	3072	204.2	2357.6	9285
204.2	2561.8	4800	204.2	2561.8	3072	204.2	2561.8	9285
204.2	2766.1	4800	204.2	2766.1	3072	204.2	2766.1	9285
204.2	2970.3	4800	204.2	2970.3	3072	204.2	2970.3	9285
204.2	3174.5	4800	204.2	3174.5	3072	204.2	3174.5	9285
204.2	3378.8	4800	204.2	3378.8	3072	204.2	3378.8	9285
204.2	3583.0	4800	204.2	3583.0	3072	204.2	3583.0	9285
204.2	3787.2	4800	204.2	3787.2	3072	204.2	3787.2	9285
204.2	3991.5	4800	204.2	3991.5	3072	204.2	3991.5	9285
204.2	4195.7	4800	204.2	4195.7	3072	204.2	4195.7	9285
204.2	4399.9	4800	204.2	4399.9	3072	204.2	4399.9	9285
3280.8	7680.8	9285	3280.8	7680.8	9285	3280.8	7680.8	9285

Attachment 6

Limerick Generating Station
Units 1 & 2

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Limerick site description

The basic information used to create the site geologic profile at the Limerick Nuclear Power Plant is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Reference 1, the SSE Control Point is taken to be at the top of Triassic lithofacies, elevation 204', and the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. Simpson, Gumpertz and Heger (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet*, Rept. 128018-R-01, Rev. 1, July 17, 2012, Section 7 "Limerick."
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1—5.

Table 1
 Summary of Geotechnical Profile Data for Limerick Nuclear Power Plant [1]

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) ^e	Compressional Wave Velocity (fps) ^e	Poisson's ratio
214 ^a to 204	0-10	Cretaceous stiff clayey silt, sandy silt, and silty fine sand with some gravel-sized rock fragments	126-141	UFSAR: N/A ISFSI: 875-1000	UFSAR: N/A ISFSI: 1800	N/A
204 ^b to -7800 ^c	8004	Triassic Brunswick lithofacies, hard siltstone, sandstone and shale	140-162	UFSAR: 5800-6100 ISFSI: 1900-5000	UFSAR: 7700-20000 ^d ISFSI: 3500-8000	0.30-033
-7800 and below	N/A	Paleozoic and Precambrian basement rocks	N/A	N/A	N/A	N/A

^a Finish grade elevation is nominally 217 ft MSL around the main power block. The elevation shown in the table represents original grade before excavation and backfill. Type I Fill was used for site grading around the main power block. UFSAR Section 2.5.4.2.2.5 states that the dynamic properties of Type I Fill have not been measured. The density is assumed to be 140 pcf in the design evaluations.

^b The SSE and IPEEE HCLPF control point elevations are at the top of bedrock, at El. 204 ft MSL.

^c Bottom of the deepest foundation is at El. 174 ft MSL, within the unweathered Brunswick lithofacies.

^d UFSAR Section 2.5.4.2.1 indicates that the variation in compressional wave velocities in the immediate vicinity of the power block is significantly less than that over the entire site. The unbiased one-standard-deviation range is estimated to be 10950-12810 fps in the power block area.

^e The ISFSI geotechnical investigation and UFSAR provide significantly different ranges for the bedrock shear wave velocity and compressional wave velocity. Consequently, the reported values from each reference are reported separately.

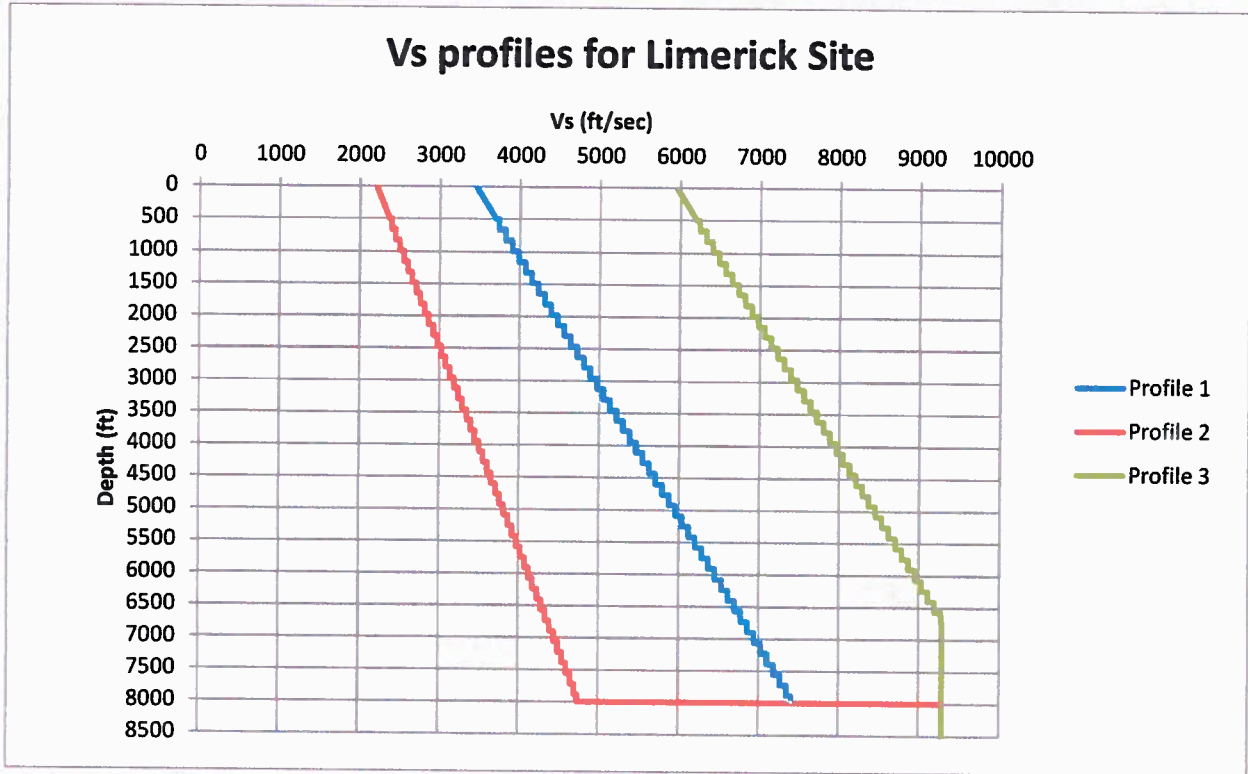


Figure 1. Vs profiles for Limerick site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Limerick site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	3452		0	2209		0	5952
10.0	10.0	3452	10.0	10.0	2209	10.0	10.0	5952
10.0	20.0	3457	10.0	20.0	2213	10.0	20.0	5957
10.0	30.0	3462	10.0	30.0	2216	10.0	30.0	5962
10.0	40.0	3467	10.0	40.0	2219	10.0	40.0	5967
10.0	50.0	3472	10.0	50.0	2222	10.0	50.0	5972
10.0	60.0	3477	10.0	60.0	2225	10.0	60.0	5977
10.0	70.0	3482	10.0	70.0	2229	10.0	70.0	5982
10.0	80.0	3487	10.0	80.0	2232	10.0	80.0	5987
10.0	90.0	3492	10.0	90.0	2235	10.0	90.0	5992
10.0	100.0	3497	10.0	100.0	2238	10.0	100.0	5997
10.0	110.0	3502	10.0	110.0	2241	10.0	110.0	6002
10.0	120.0	3507	10.0	120.0	2245	10.0	120.0	6007
10.0	130.0	3512	10.0	130.0	2248	10.0	130.0	6012
10.0	140.0	3517	10.0	140.0	2251	10.0	140.0	6017
10.0	150.0	3522	10.0	150.0	2254	10.0	150.0	6022
10.0	160.0	3527	10.0	160.0	2257	10.0	160.0	6027
10.0	170.0	3532	10.0	170.0	2261	10.0	170.0	6032
10.0	180.0	3537	10.0	180.0	2264	10.0	180.0	6037
10.0	190.0	3542	10.0	190.0	2267	10.0	190.0	6042
10.0	200.0	3547	10.0	200.0	2270	10.0	200.0	6047
10.0	210.0	3552	10.0	210.0	2273	10.0	210.0	6052
10.0	220.0	3557	10.0	220.0	2277	10.0	220.0	6057
10.0	230.0	3562	10.0	230.0	2280	10.0	230.0	6062
10.0	240.0	3567	10.0	240.0	2283	10.0	240.0	6067
10.0	250.0	3572	10.0	250.0	2286	10.0	250.0	6072
10.0	260.0	3577	10.0	260.0	2289	10.0	260.0	6077
10.0	270.0	3582	10.0	270.0	2293	10.0	270.0	6082
10.0	280.0	3587	10.0	280.0	2296	10.0	280.0	6087
10.0	290.0	3592	10.0	290.0	2299	10.0	290.0	6092
10.0	300.0	3597	10.0	300.0	2302	10.0	300.0	6097
10.0	310.0	3602	10.0	310.0	2305	10.0	310.0	6102
10.0	320.0	3607	10.0	320.0	2309	10.0	320.0	6107
10.0	330.0	3612	10.0	330.0	2312	10.0	330.0	6112
10.0	340.0	3617	10.0	340.0	2315	10.0	340.0	6117
10.0	350.0	3622	10.0	350.0	2318	10.0	350.0	6122
10.0	360.0	3627	10.0	360.0	2321	10.0	360.0	6127

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10.0	370.0	3632	10.0	370.0	2325	10.0	370.0	6132
10.0	380.0	3637	10.0	380.0	2328	10.0	380.0	6137
10.0	390.0	3642	10.0	390.0	2331	10.0	390.0	6142
10.0	400.0	3647	10.0	400.0	2334	10.0	400.0	6147
10.0	410.0	3652	10.0	410.0	2337	10.0	410.0	6152
10.0	420.0	3657	10.0	420.0	2341	10.0	420.0	6157
10.0	430.0	3662	10.0	430.0	2344	10.0	430.0	6162
10.0	440.0	3667	10.0	440.0	2347	10.0	440.0	6167
10.0	450.0	3672	10.0	450.0	2350	10.0	450.0	6172
10.0	460.0	3677	10.0	460.0	2353	10.0	460.0	6177
10.0	470.0	3682	10.0	470.0	2357	10.0	470.0	6182
10.0	480.0	3687	10.0	480.0	2360	10.0	480.0	6187
10.0	490.0	3692	10.0	490.0	2363	10.0	490.0	6192
10.0	500.0	3695	10.0	500.0	2365	10.0	500.0	6197
164.0	664.0	3741	164.0	664.0	2394	164.0	664.0	6241
164.0	828.1	3823	164.0	828.1	2447	164.0	828.1	6323
164.0	992.1	3905	164.0	992.1	2499	164.0	992.1	6405
164.0	1156.1	3987	164.0	1156.1	2552	164.0	1156.1	6487
164.0	1320.2	4069	164.0	1320.2	2604	164.0	1320.2	6569
164.0	1484.2	4151	164.0	1484.2	2657	164.0	1484.2	6651
164.0	1648.3	4233	164.0	1648.3	2709	164.0	1648.3	6733
164.0	1812.3	4315	164.0	1812.3	2762	164.0	1812.3	6815
164.0	1976.4	4397	164.0	1976.4	2814	164.0	1976.4	6897
164.0	2140.4	4479	164.0	2140.4	2867	164.0	2140.4	6979
164.0	2304.4	4561	164.0	2304.4	2919	164.0	2304.4	7061
164.0	2468.5	4643	164.0	2468.5	2972	164.0	2468.5	7143
164.0	2632.5	4725	164.0	2632.5	3024	164.0	2632.5	7225
164.0	2796.6	4807	164.0	2796.6	3077	164.0	2796.6	7307
164.0	2960.6	4889	164.0	2960.6	3129	164.0	2960.6	7389
164.0	3124.6	4971	164.0	3124.6	3182	164.0	3124.6	7471
164.0	3288.7	5053	164.0	3288.7	3234	164.0	3288.7	7553
164.0	3452.7	5135	164.0	3452.7	3287	164.0	3452.7	7635
164.0	3616.8	5217	164.0	3616.8	3339	164.0	3616.8	7717
164.0	3780.8	5299	164.0	3780.8	3391	164.0	3780.8	7799
164.0	3944.9	5381	164.0	3944.9	3444	164.0	3944.9	7881
164.0	4108.9	5463	164.0	4108.9	3496	164.0	4108.9	7963
164.0	4272.9	5545	164.0	4272.9	3549	164.0	4272.9	8045
164.0	4437.0	5627	164.0	4437.0	3601	164.0	4437.0	8127
164.0	4601.0	5709	164.0	4601.0	3654	164.0	4601.0	8209
164.0	4765.1	5791	164.0	4765.1	3706	164.0	4765.1	8291
164.0	4929.1	5873	164.0	4929.1	3759	164.0	4929.1	8373

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164.0	5093.1	5955	164.0	5093.1	3811	164.0	5093.1	8455
164.0	5257.2	6037	164.0	5257.2	3864	164.0	5257.2	8537
164.0	5421.2	6119	164.0	5421.2	3916	164.0	5421.2	8619
164.0	5585.3	6201	164.0	5585.3	3969	164.0	5585.3	8701
164.0	5749.3	6283	164.0	5749.3	4021	164.0	5749.3	8783
164.0	5913.4	6365	164.0	5913.4	4074	164.0	5913.4	8865
164.0	6077.4	6448	164.0	6077.4	4126	164.0	6077.4	8947
164.0	6241.4	6530	164.0	6241.4	4179	164.0	6241.4	9029
164.0	6405.5	6612	164.0	6405.5	4231	164.0	6405.5	9111
164.0	6569.5	6694	164.0	6569.5	4284	164.0	6569.5	9193
164.0	6733.6	6776	164.0	6733.6	4336	164.0	6733.6	9275
164.0	6897.6	6858	164.0	6897.6	4389	164.0	6897.6	9285
164.0	7061.6	6940	164.0	7061.6	4441	164.0	7061.6	9285
164.0	7225.7	7022	164.0	7225.7	4494	164.0	7225.7	9285
164.0	7389.7	7104	164.0	7389.7	4546	164.0	7389.7	9285
164.0	7553.8	7186	164.0	7553.8	4599	164.0	7553.8	9285
164.0	7717.8	7268	164.0	7717.8	4651	164.0	7717.8	9285
164.0	7881.9	7350	164.0	7881.9	4704	164.0	7881.9	9285
117.7	7999.6	7409	117.7	7999.6	4742	117.7	7999.6	9285
3280.8	11280.4	9285	3280.8	11280.4	9285	3280.8	11280.4	9285

Attachment 7

Oyster Creek Nuclear Generating Station Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles

Oyster Creek site description

The basic information used to create the site geologic profile at the Oyster Creek Nuclear Power Plant is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Reference 1, the SSE Control Point is not well-defined. As a result, the profile was modeled up to an elevation where the best-estimate shear-wave velocity exceeds 1000 fps, which occurs in the Cohansey Formation (see Table 1). For dynamic properties of sand and sediment layers, modulus and damping curves were represented with two models. The first model used soil curves taken from Reference 2, the second model used soil curves taken from References 3 and 4. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. Simpson, Gumpertz and Heger (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet*, Rept. 128018-R-01, Rev. 1, July 17, 2012, Section 8 "Oyster Creek."
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1—5.
3. Silva, W.J., N. A. Abrahamson, G.R. Toro, and C. Costantino (1996). *Description and Validation of the Stochastic Ground Motion Model*, Rept. submitted to Brookhaven Natl. Lab., Assoc. Universities Inc., Upton NY 11973, Contract No. 770573.
4. Walling, M.A., W.J., Silva and N.A. Abrahamson (2008). "Nonlinear Site Amplification Factors for Constraining the NGA Models," *Earthquake Spectra*, 24 (1) 243-255.

Table 1

Summary of Geotechnical Profile Data for Oyster Creek Nuclear Power Plant

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
23 ^a to 20	17-18	Late Pleistocene Cape May Formation, medium density fine Sand	120	270-360	Saturated: 5000-5200 ^c Not saturated: 1400 ^c	0.39
20 to 13				520-690		
13 to 5				570-760		
5 to -3	16-17	Late Pleistocene to Late Miocene Upper Clay, alternating clay, silt, and fine sand	115	640-845	5200-5900	0.49
-3 to -11				700-930		
-11 to -20	65-66	Late Miocene Cohansey Formation, dense fine to coarse sand	125	810-1070	5200-5900	0.49
-20 to -29 ^b				860-1130		
-29 to -32				1020-1350		
-32 to -39				1100-1460		
-39 to -45				1000-1320		
-45 to -55				980-1300		
-55 to -57				1100-1450		
-57 to -63				1230-1630		
-63 to -71				1260-1670		
-71 to -77				1220-1610		
-77 to -85	8	Lower Clay, alternating clay, silt, and fine sand	125	1030-1360	5200-5900	N/A
-85 to -330	245	Kirkwood Formation, dense fine to medium sand	125	1350-1780	5200-5900	N/A
-330 to N/A	3700	Quaternary, Tertiary and Cretaceous sediments	N/A	N/A	N/A	N/A
N/A	N/A	Precambrian, early Paleozoic and Triassic rocks	N/A	N/A	N/A	N/A

^a Finish grade elevation is nominally 23 ft MSL.

^b Bottom of the deepest foundation is at El. -29 ft MSL, within Cohansey Formation.

^c Section 5 of Geomatrix [9] reports different compressional wave velocities for saturated and not-saturated soils. At the time of a 1989 geotechnical investigation by Weston Geophysical Corporation, the soils below a depth of 15 ft were found to be saturated, and those above were not saturated [9]. The ISFSI geotechnical investigation [11] found groundwater at depths between 10 and 13 ft.

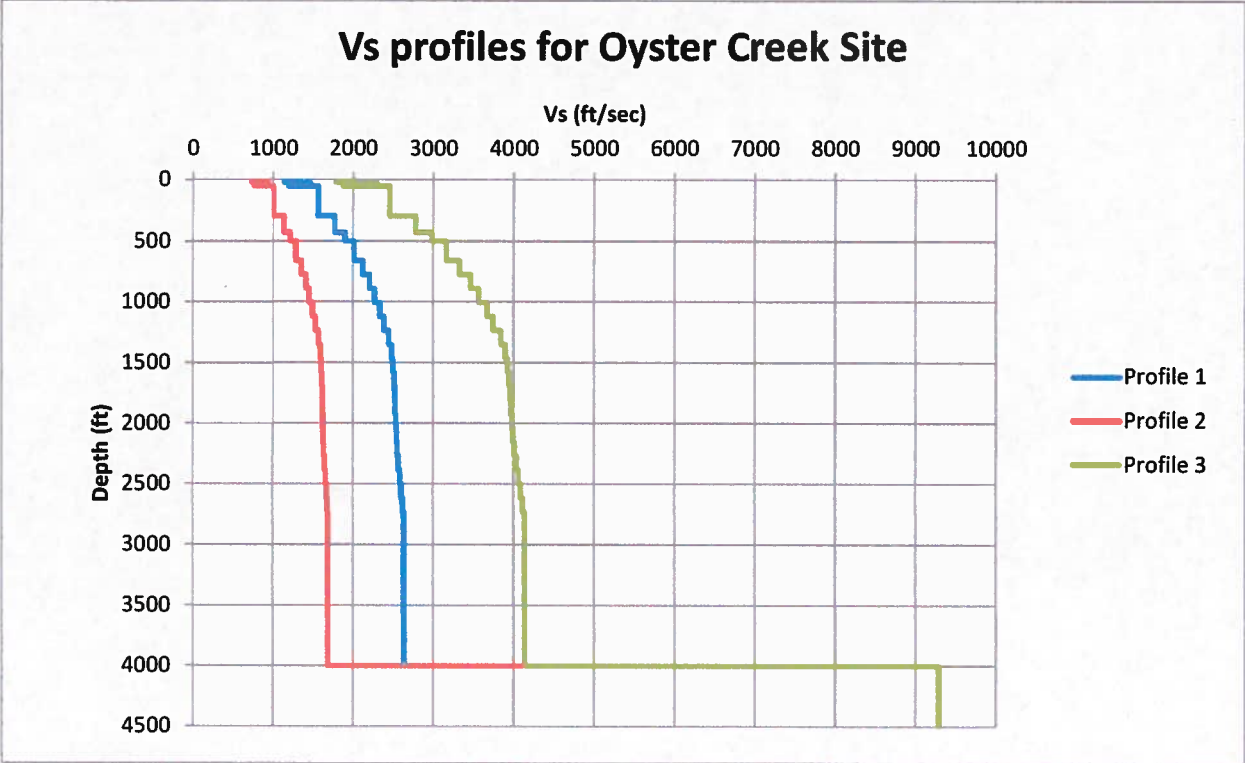


Figure 1. Vs profiles for Oyster Creek site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Oyster Creek site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	1185		0	758		0	1861
3.0	3.0	1185	3.0	3.0	758	3.0	3.0	1861
3.5	6.5	1280	3.5	6.5	819	3.5	6.5	2009
3.5	10.0	1280	3.5	10.0	819	3.5	10.0	2009
6.0	16.0	1160	6.0	16.0	742	6.0	16.0	1821
4.0	20.0	1140	4.0	20.0	730	4.0	20.0	1790
6.0	26.0	1140	6.0	26.0	730	6.0	26.0	1790
2.0	28.0	1275	2.0	28.0	816	2.0	28.0	2002
6.0	34.0	1430	6.0	34.0	915	6.0	34.0	2245
4.0	38.0	1465	4.0	38.0	938	4.0	38.0	2300
4.0	42.0	1465	4.0	42.0	938	4.0	42.0	2300
6.0	48.0	1415	6.0	48.0	906	6.0	48.0	2222
2.0	50.0	1195	2.0	50.0	765	2.0	50.0	1876
6.0	56.0	1195	6.0	56.0	765	6.0	56.0	1876
6.4	62.4	1565	6.4	62.4	1002	6.4	62.4	2457
6.4	68.8	1565	6.4	68.8	1002	6.4	68.8	2457
6.4	75.2	1565	6.4	75.2	1002	6.4	75.2	2457
6.4	81.6	1565	6.4	81.6	1002	6.4	81.6	2457
6.4	88.0	1565	6.4	88.0	1002	6.4	88.0	2457
6.4	94.4	1565	6.4	94.4	1002	6.4	94.4	2457
6.4	100.8	1565	6.4	100.8	1002	6.4	100.8	2457
6.4	107.2	1565	6.4	107.2	1002	6.4	107.2	2457
6.4	113.6	1565	6.4	113.6	1002	6.4	113.6	2457
6.4	120.0	1565	6.4	120.0	1002	6.4	120.0	2457
6.5	126.5	1565	6.5	126.5	1002	6.5	126.5	2457
6.5	133.0	1565	6.5	133.0	1002	6.5	133.0	2457
6.5	139.5	1565	6.5	139.5	1002	6.5	139.5	2457
6.5	146.0	1565	6.5	146.0	1002	6.5	146.0	2457
6.5	152.5	1565	6.5	152.5	1002	6.5	152.5	2457
6.5	159.0	1565	6.5	159.0	1002	6.5	159.0	2457
6.5	165.5	1565	6.5	165.5	1002	6.5	165.5	2457
6.5	172.0	1565	6.5	172.0	1002	6.5	172.0	2457
6.5	178.5	1565	6.5	178.5	1002	6.5	178.5	2457
6.5	185.0	1565	6.5	185.0	1002	6.5	185.0	2457
6.5	191.5	1565	6.5	191.5	1002	6.5	191.5	2457
6.5	198.0	1565	6.5	198.0	1002	6.5	198.0	2457
6.5	204.5	1565	6.5	204.5	1002	6.5	204.5	2457

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6.5	211.0	1565	6.5	211.0	1002	6.5	211.0	2457
6.5	217.5	1565	6.5	217.5	1002	6.5	217.5	2457
6.5	224.0	1565	6.5	224.0	1002	6.5	224.0	2457
6.5	230.5	1565	6.5	230.5	1002	6.5	230.5	2457
6.5	237.0	1565	6.5	237.0	1002	6.5	237.0	2457
6.5	243.5	1565	6.5	243.5	1002	6.5	243.5	2457
6.5	250.0	1565	6.5	250.0	1002	6.5	250.0	2457
6.4	256.4	1565	6.4	256.4	1002	6.4	256.4	2457
6.4	262.7	1565	6.4	262.7	1002	6.4	262.7	2457
6.4	269.1	1565	6.4	269.1	1002	6.4	269.1	2457
6.4	275.5	1565	6.4	275.5	1002	6.4	275.5	2457
6.4	281.9	1565	6.4	281.9	1002	6.4	281.9	2457
6.4	288.2	1565	6.4	288.2	1002	6.4	288.2	2457
6.4	294.6	1565	6.4	294.6	1002	6.4	294.6	2457
6.4	301.0	1565	6.4	301.0	1002	6.4	301.0	2457
15.9	316.9	1773	15.9	316.9	1135	15.9	316.9	2784
114.8	431.7	1773	114.8	431.7	1135	114.8	431.7	2784
68.2	500.0	1901	68.2	500.0	1217	68.2	500.0	2985
161.4	661.4	2014	161.4	661.4	1289	161.4	661.4	3162
114.8	776.2	2120	114.8	776.2	1357	114.8	776.2	3329
114.8	891.0	2209	114.8	891.0	1414	114.8	891.0	3469
114.8	1005.8	2271	114.8	1005.8	1453	114.8	1005.8	3565
114.8	1120.7	2339	114.8	1120.7	1497	114.8	1120.7	3673
114.8	1235.5	2387	114.8	1235.5	1528	114.8	1235.5	3748
114.8	1350.3	2449	114.8	1350.3	1567	114.8	1350.3	3845
114.8	1465.2	2483	114.8	1465.2	1589	114.8	1465.2	3899
114.8	1580.0	2500	114.8	1580.0	1600	114.8	1580.0	3926
114.8	1694.8	2514	114.8	1694.8	1609	114.8	1694.8	3947
114.8	1809.6	2521	114.8	1809.6	1613	114.8	1809.6	3958
114.8	1924.5	2528	114.8	1924.5	1618	114.8	1924.5	3969
114.8	2039.3	2535	114.8	2039.3	1622	114.8	2039.3	3979
114.8	2154.1	2541	114.8	2154.1	1627	114.8	2154.1	3990
114.8	2269.0	2552	114.8	2269.0	1633	114.8	2269.0	4006
114.8	2383.8	2569	114.8	2383.8	1644	114.8	2383.8	4033
114.8	2498.6	2586	114.8	2498.6	1655	114.8	2498.6	4060
114.8	2613.5	2603	114.8	2613.5	1666	114.8	2613.5	4087
114.8	2728.3	2620	114.8	2728.3	1677	114.8	2728.3	4114
85.1	2813.4	2634	85.1	2813.4	1686	85.1	2813.4	4135
1186.4	3999.8	2634	1186.4	3999.8	1686	1186.4	3999.8	4135
3280.8	7280.6	9285	3280.8	7280.6	9285	3280.8	7280.6	9285

Attachment 8

Peach Bottom Atomic Power Station
Units 2 & 3

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Peach Bottom site description

The basic information used to create the site geologic profile at the Peach Bottom Nuclear Power Plant is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Reference 1, the SSE Control Point is taken to be the top of moderately weathered schist, and the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. Simpson, Gumpertz and Heger (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet*, Rept. 128018-R-01, Rev. 1, July 17, 2012, Section 9 "Peach Bottom."
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1—5.

Table 1
 Summary of Geotechnical Profile Data for Peach Bottom Nuclear Power Plant

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) ^d	Compressional Wave Velocity (fps)	Poisson's ratio
N/A	0-40	Residual soil overburden derived from weathering underlying Peters Creek Schist, compact sandy silt and silty sand with gravel	110-150	N/A	2000	0.33
N/A	10-50	Early Paleozoic or Precambrian Peters Creek Schist, highly weathered metamorphosed sedimentary rock	135-145	N/A	<7000	0.30
136 ^b to 116	0-40	Early Paleozoic or Precambrian Peters Creek Schist, moderately weathered metamorphosed sedimentary rock	150-175	N/A	7000	0.30
116 and below ^c	N/A	Early Paleozoic or Precambrian Peters Creek Schist, unweathered metamorphosed sedimentary rock	160-170	N/A	>16000	0.28

^a Residual soil overburden and highly weathered bedrock was excavated from the areas surrounding the main power block.

^b Finish grade elevation is nominally 136 ft MSL on the west side of the main power block, and 117 ft MSL on the east. The control point elevation for the SSE and IPEEE HCLPF is at El. 136 ft MSL.

^c Bottom of the deepest foundation is at El. 88 ft MSL, within the unweathered Peters Creek Schist.

^d The documentation reviewed during this study does not contain shear wave velocity data.

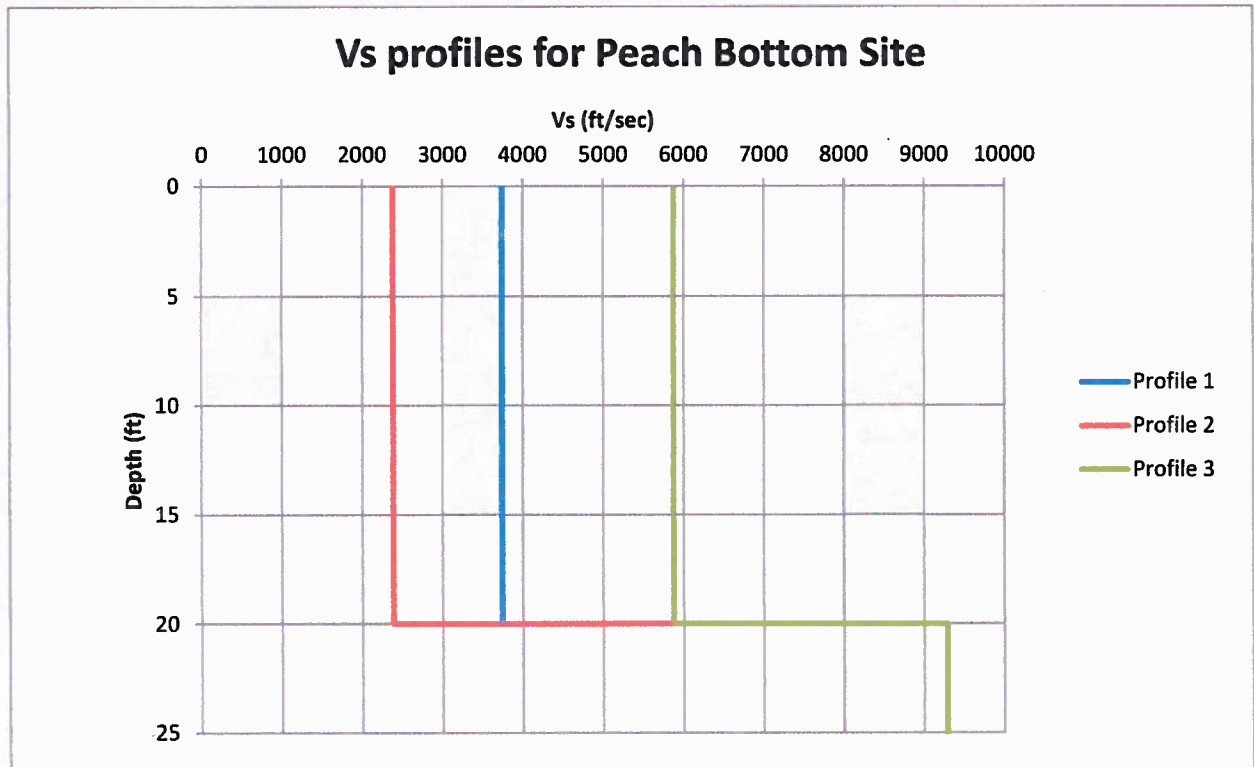


Figure 1. Vs profiles for Peach Bottom site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Peach Bottom site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	3741		0	2383		0	5874
5.0	5.0	3741	5.0	5.0	2383	5.0	5.0	5874
5.0	10.0	3741	5.0	10.0	2383	5.0	10.0	5874
5.0	15.0	3741	5.0	15.0	2383	5.0	15.0	5874
5.0	20.0	3741	5.0	20.0	2383	5.0	20.0	5874
3280.8	3300.8	9285	3280.8	3300.8	9285	3280.8	3300.8	9285

Attachment 9

Quad Cities Nuclear Power Station
Units 1 & 2

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Quad Cities site description

The basic information used to create the site geologic profile at the Quad Cities Generating Station is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Table 1, the SSE Control Point is defined at elevation 550 ft), and the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. SGH (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet—Revision 1*, Simpson Gumpertz & Heger Rept. No. 128018-R-01 dated July 17, 2012, transmitted by letter from J. Clark to J. Hamel on July 18, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.

Table 1
 Summary of Geotechnical Profile Data for Quad Cities Generating Station

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
595 ^a to 550	45-55	Pleistocene glacial till, outwash and lacustrine deposits, unconsolidated fine sand to coarse gravels containing some cobbles and boulders	N/A	N/A	N/A	N/A
550 ^b to 530 ^c	10-20	Silurian Niagaran Formation, dolomite exhibiting extensive voids and cavities due to solution ^d	150-170	2000-7500	8100-14000	0.12-0.37
530 to 510	15-30	Silurian Niagaran Formation, dolomite exhibiting relatively infrequent voids and cavities due to solution ^d	150-170	5000-9000	9300-14000	0.12-0.37
510 to 470	5-40	Silurian Niagaran Formation, dolomite exhibiting voids and cavities due to solution ^d	150-170	2000-6200	8800-10700	0.12-0.37
470 to 300	170-250	Silurian Niagaran and Alexandrian Formations, dolomite and dolomitic limestone with varying degrees of porosity	150-170	5000-9000	9300-14000	0.12-0.37
300 to -2700	3000	Ordovician and Cambrian sedimentary rocks, dolomite, shale, sandstone, and siltstone	N/A	N/A	N/A	N/A
-2700 and below	N/A	Precambrian crystalline basement, granite and granodiorite	N/A	N/A	N/A	N/A

^a Finish grade elevation is nominally 595 ft MSL.

^b The IPEEE HCLPF and SSE control point elevations are at the top of bedrock, which is at El. 550 ft MSL.

^c Bottom of the deepest foundation is at El. 539 ft MSL, within the upper Niagaran Formation, which exhibits extensive voids and cavities. This cavity-bearing portion of this upper zone was largely removed during excavation and backfilled with concrete prior to placing the structure foundations.

^d See Section 10.2.1 for a brief description of a grouting program that was implemented to improve the structural properties of the upper bedrock. More detail is provided in UFSAR Appendix 2A [8].

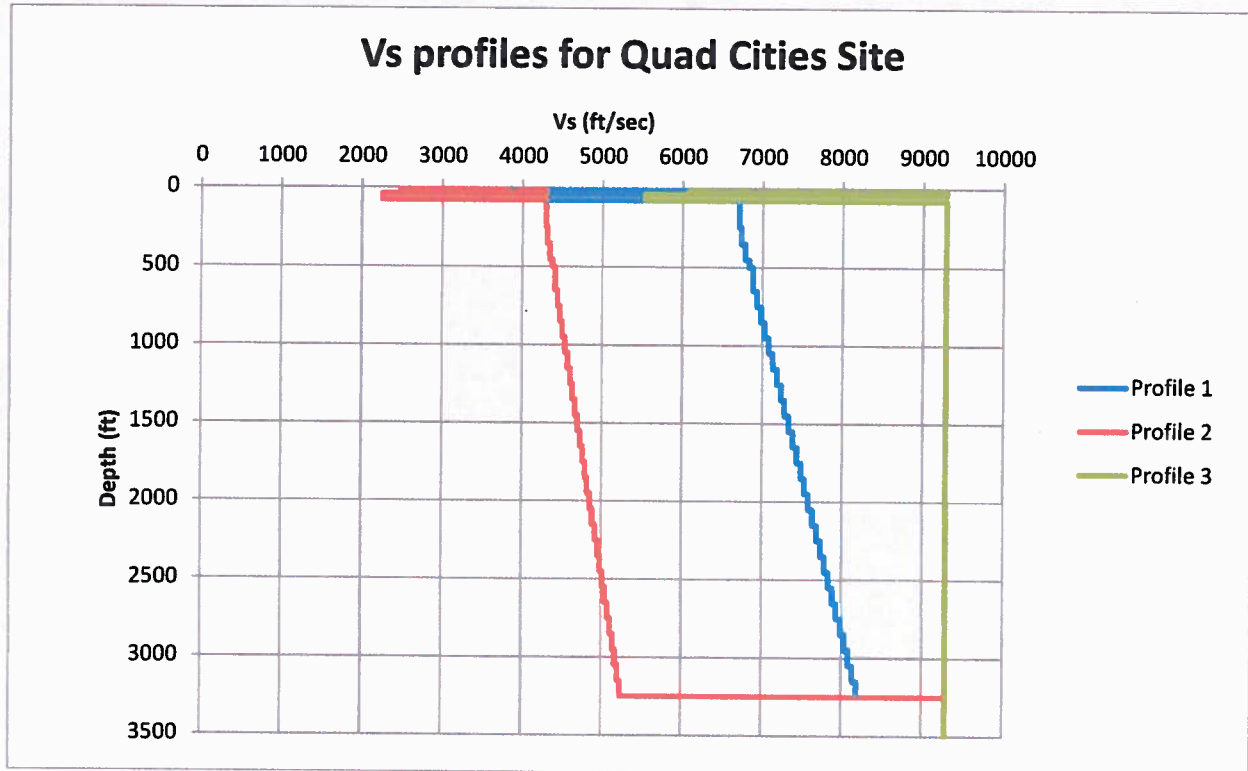


Figure 1. Vs profiles for Quad Cities site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Quad Cities site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	3873		0	2479		0	6080
6.7	6.7	3873	6.7	6.7	2479	6.7	6.7	6080
6.7	13.3	3873	6.7	13.3	2479	6.7	13.3	6080
6.7	20.0	3873	6.7	20.0	2479	6.7	20.0	6080
5.0	25.0	6708	5.0	25.0	4293	5.0	25.0	9285
8.3	33.3	6708	8.3	33.3	4293	8.3	33.3	9285
6.7	40.0	6708	6.7	40.0	4293	6.7	40.0	9285
6.7	46.6	3521	6.7	46.6	2254	6.7	46.6	5528
3.4	50.0	3521	3.4	50.0	2254	3.4	50.0	5528
9.9	59.9	3521	9.9	59.9	2254	9.9	59.9	5528
6.7	66.6	3521	6.7	66.6	2254	6.7	66.6	5528
6.7	73.3	3521	6.7	73.3	2254	6.7	73.3	5528
6.7	79.9	3521	6.7	79.9	2254	6.7	79.9	5528
40.1	120.0	6708	40.1	120.0	4293	40.1	120.0	9285
44.9	164.9	6708	44.9	164.9	4293	44.9	164.9	9285
85.0	249.9	6708	85.0	249.9	4293	85.0	249.9	9285
100.0	349.9	6733	100.0	349.9	4309	100.0	349.9	9285
100.0	449.9	6783	100.0	449.9	4341	100.0	449.9	9285
50.1	500.0	6833	50.1	500.0	4373	50.1	500.0	9285
150.1	650.0	6883	150.1	650.0	4405	150.1	650.0	9285
100.0	750.0	6933	100.0	750.0	4437	100.0	750.0	9285
100.0	850.0	6983	100.0	850.0	4469	100.0	850.0	9285
100.0	950.0	7033	100.0	950.0	4501	100.0	950.0	9285
100.0	1050.0	7083	100.0	1050.0	4533	100.0	1050.0	9285
100.0	1150.0	7133	100.0	1150.0	4565	100.0	1150.0	9285
100.0	1250.0	7183	100.0	1250.0	4597	100.0	1250.0	9285
100.0	1350.0	7233	100.0	1350.0	4629	100.0	1350.0	9285
100.0	1450.0	7283	100.0	1450.0	4661	100.0	1450.0	9285
100.0	1550.0	7333	100.0	1550.0	4693	100.0	1550.0	9285
100.0	1650.0	7383	100.0	1650.0	4725	100.0	1650.0	9285
100.0	1750.0	7433	100.0	1750.0	4757	100.0	1750.0	9285
100.0	1850.0	7483	100.0	1850.0	4789	100.0	1850.0	9285
100.0	1950.0	7533	100.0	1950.0	4821	100.0	1950.0	9285
100.0	2050.0	7583	100.0	2050.0	4853	100.0	2050.0	9285
100.0	2150.0	7633	100.0	2150.0	4885	100.0	2150.0	9285
100.0	2250.0	7683	100.0	2250.0	4917	100.0	2250.0	9285
100.0	2350.0	7733	100.0	2350.0	4949	100.0	2350.0	9285

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100.0	2450.0	7783	100.0	2450.0	4981	100.0	2450.0	9285
100.0	2550.0	7833	100.0	2550.0	5013	100.0	2550.0	9285
100.0	2650.0	7883	100.0	2650.0	5045	100.0	2650.0	9285
100.0	2750.0	7933	100.0	2750.0	5077	100.0	2750.0	9285
100.0	2850.0	7983	100.0	2850.0	5109	100.0	2850.0	9285
100.0	2950.0	8033	100.0	2950.0	5141	100.0	2950.0	9285
100.0	3050.0	8083	100.0	3050.0	5173	100.0	3050.0	9285
100.0	3150.0	8133	100.0	3150.0	5205	100.0	3150.0	9285
100.0	3250.0	8183	100.0	3250.0	5237	100.0	3250.0	9285
3280.8	6530.9	9285	3280.8	6530.9	9285	3280.8	6530.9	9285

Attachment 10

**Three Mile Island Nuclear Station
Unit 1**

**Descriptions of Subsurface
Materials and Properties
and
Base Case Velocity Profiles**

Three Mile Island site description

The basic information used to create the site geologic profile at the Three Mile Island Nuclear Power Plant is shown in Table 1. This profile was developed using information documented in Reference 1. As indicated in Reference 1, the SSE Control Point was judged to be at the surface of bedrock, elevation 280 ft. As a result, the profile was modeled up to that elevation. For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 2, the second model assumed linear behavior. These dynamic property models were weighted equally.

The three base-case shear-wave velocity profiles used to model amplification at the site are shown in Figure 1. Profiles 1, 2, and 3 are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities (V_s) corresponding to each profile are shown in Table 2.

References

1. Simpson, Gumpertz and Heger (2012). *Review of Existing Site Response Parameter Data for the Exelon Nuclear Fleet*, Rept. 128018-R-01, Rev. 1, July 17, 2012, Section 11 "Three Mile Island."
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Electric Power Research Institute, Palo Alto, CA, Rept. TR-102293, Vol. 1-5.

Table 1
 Summary of Geotechnical Profile Data for Three Mile Island Nuclear Power Plant

Elevations of Layer Boundaries At Reactor Building (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
304 ^a to 298	6	Loose to medium dense fine silty sand and gravel to very stiff clayey silt	125-147	N/A	1000-2300	N/A
298 to 280	18	Medium dense to very dense coarse sand and gravel with some boulders and cobbles	125-147	N/A	2300-3800	N/A
280 ^b to -15700 ^c	15980-16000	Triassic Gettysburg Formation, sandstone, medium-hard to hard shaley siltstone, and shaley claystone	N/A	N/A	8000-12000 ^d	N/A
-15700 and below	N/A	Basement rock	N/A	N/A	N/A	N/A

^a Finish grade elevation is nominally 304 ft MSL.

^b The SSE control point elevation is at the top of bedrock at EL. 280 ft MSL.

^c Bottom of the deepest foundation is at El. 268 ft MSL, near the surface of the Gettysburg Formation.

^d Gettysburg Formation wave velocities were measured near the surface of the bedrock. The wave velocities are expected to increase with depth, but the degree and rate at which they do so is uncertain.

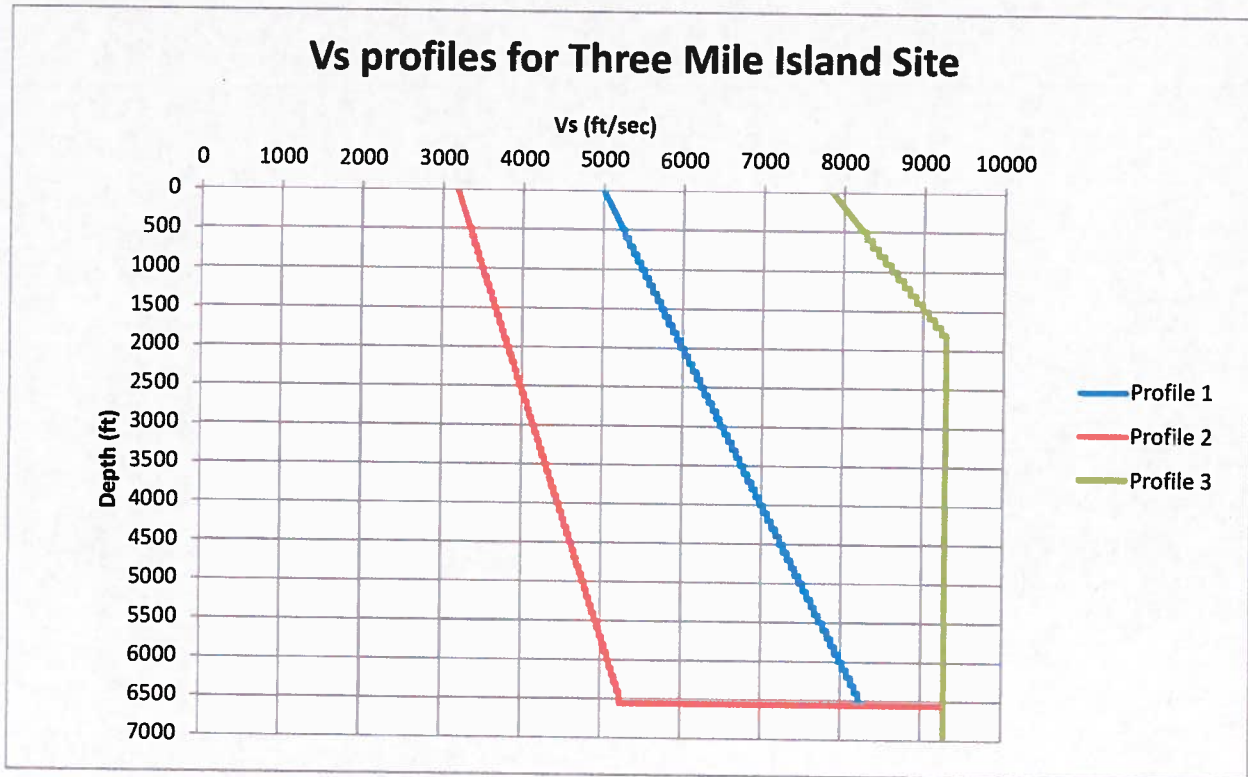


Figure 1. Vs profiles for Three Mile Island site

Table 2
 Layer thicknesses, depths, and Vs for 3 profiles, Three Mile Island site

Profile 1			Profile 2			Profile 3		
thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)	thickness(ft)	depth (ft)	Vs(ft/s)
	0	5002		0	3186		0	7854
10.0	10.0	5002	10.0	10.0	3186	10.0	10.0	7854
10.0	20.0	5007	10.0	20.0	3190	10.0	20.0	7861
10.0	30.0	5012	10.0	30.0	3193	10.0	30.0	7869
10.0	40.0	5017	10.0	40.0	3196	10.0	40.0	7877
10.0	50.0	5022	10.0	50.0	3199	10.0	50.0	7885
10.0	60.0	5027	10.0	60.0	3202	10.0	60.0	7893
10.0	70.0	5032	10.0	70.0	3206	10.0	70.0	7901
10.0	80.0	5037	10.0	80.0	3209	10.0	80.0	7908
10.0	90.0	5042	10.0	90.0	3212	10.0	90.0	7916
10.0	100.0	5047	10.0	100.0	3215	10.0	100.0	7924
10.0	110.0	5052	10.0	110.0	3218	10.0	110.0	7932
10.0	120.0	5057	10.0	120.0	3221	10.0	120.0	7940
10.0	130.0	5062	10.0	130.0	3225	10.0	130.0	7948
10.0	140.0	5067	10.0	140.0	3228	10.0	140.0	7956
10.0	150.0	5072	10.0	150.0	3231	10.0	150.0	7963
10.0	160.0	5077	10.0	160.0	3234	10.0	160.0	7971
10.0	170.0	5082	10.0	170.0	3237	10.0	170.0	7979
10.0	180.0	5087	10.0	180.0	3241	10.0	180.0	7987
10.0	190.0	5092	10.0	190.0	3244	10.0	190.0	7995
10.0	200.0	5097	10.0	200.0	3247	10.0	200.0	8003
10.0	210.0	5102	10.0	210.0	3250	10.0	210.0	8011
10.0	220.0	5107	10.0	220.0	3253	10.0	220.0	8018
10.0	230.0	5112	10.0	230.0	3256	10.0	230.0	8026
10.0	240.0	5117	10.0	240.0	3260	10.0	240.0	8034
10.0	250.0	5122	10.0	250.0	3263	10.0	250.0	8042
10.0	260.0	5127	10.0	260.0	3266	10.0	260.0	8050
10.0	270.0	5132	10.0	270.0	3269	10.0	270.0	8058
10.0	280.0	5137	10.0	280.0	3272	10.0	280.0	8065
10.0	290.0	5142	10.0	290.0	3276	10.0	290.0	8073
10.0	300.0	5147	10.0	300.0	3279	10.0	300.0	8081
10.0	310.0	5152	10.0	310.0	3282	10.0	310.0	8089
10.0	320.0	5157	10.0	320.0	3285	10.0	320.0	8097
10.0	330.0	5162	10.0	330.0	3288	10.0	330.0	8105
10.0	340.0	5167	10.0	340.0	3292	10.0	340.0	8113
10.0	350.0	5172	10.0	350.0	3295	10.0	350.0	8120
10.0	360.0	5177	10.0	360.0	3298	10.0	360.0	8128

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10.0	370.0	5182	10.0	370.0	3301	10.0	370.0	8136
10.0	380.0	5187	10.0	380.0	3304	10.0	380.0	8144
10.0	390.0	5192	10.0	390.0	3307	10.0	390.0	8152
10.0	400.0	5197	10.0	400.0	3311	10.0	400.0	8160
10.0	410.0	5202	10.0	410.0	3314	10.0	410.0	8168
10.0	420.0	5207	10.0	420.0	3317	10.0	420.0	8175
10.0	430.0	5212	10.0	430.0	3320	10.0	430.0	8183
10.0	440.0	5217	10.0	440.0	3323	10.0	440.0	8191
10.0	450.0	5222	10.0	450.0	3327	10.0	450.0	8199
10.0	460.0	5227	10.0	460.0	3330	10.0	460.0	8207
10.0	470.0	5232	10.0	470.0	3333	10.0	470.0	8215
10.0	480.0	5237	10.0	480.0	3336	10.0	480.0	8222
10.0	490.0	5242	10.0	490.0	3339	10.0	490.0	8230
10.0	500.0	5247	10.0	500.0	3342	10.0	500.0	8238
100.0	600.0	5274	100.0	600.0	3360	100.0	600.0	8281
100.0	700.0	5324	100.0	700.0	3392	100.0	700.0	8359
100.0	800.0	5374	100.0	800.0	3423	100.0	800.0	8438
100.0	900.0	5424	100.0	900.0	3455	100.0	900.0	8516
100.0	1000.0	5474	100.0	1000.0	3487	100.0	1000.0	8595
100.0	1100.0	5524	100.0	1100.0	3519	100.0	1100.0	8673
100.0	1200.0	5574	100.0	1200.0	3551	100.0	1200.0	8752
100.0	1300.0	5624	100.0	1300.0	3583	100.0	1300.0	8830
100.0	1400.0	5674	100.0	1400.0	3615	100.0	1400.0	8909
100.0	1499.9	5724	100.0	1499.9	3646	100.0	1499.9	8987
100.0	1599.9	5774	100.0	1599.9	3678	100.0	1599.9	9066
100.0	1699.9	5824	100.0	1699.9	3710	100.0	1699.9	9144
100.0	1799.9	5874	100.0	1799.9	3742	100.0	1799.9	9223
100.0	1899.9	5924	100.0	1899.9	3774	100.0	1899.9	9285
100.0	1999.9	5974	100.0	1999.9	3806	100.0	1999.9	9285
100.0	2099.9	6024	100.0	2099.9	3838	100.0	2099.9	9285
100.0	2199.9	6074	100.0	2199.9	3869	100.0	2199.9	9285
100.0	2299.9	6124	100.0	2299.9	3901	100.0	2299.9	9285
100.0	2399.9	6174	100.0	2399.9	3933	100.0	2399.9	9285
100.0	2499.9	6224	100.0	2499.9	3965	100.0	2499.9	9285
100.0	2599.9	6274	100.0	2599.9	3997	100.0	2599.9	9285
100.0	2699.9	6324	100.0	2699.9	4029	100.0	2699.9	9285
100.0	2799.9	6374	100.0	2799.9	4060	100.0	2799.9	9285
100.0	2899.9	6424	100.0	2899.9	4092	100.0	2899.9	9285
100.0	2999.9	6474	100.0	2999.9	4124	100.0	2999.9	9285
100.0	3099.9	6524	100.0	3099.9	4156	100.0	3099.9	9285
100.0	3199.9	6574	100.0	3199.9	4188	100.0	3199.9	9285

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100.0	3299.9	6624	100.0	3299.9	4220	100.0	3299.9	9285
100.0	3399.9	6674	100.0	3399.9	4252	100.0	3399.9	9285
100.0	3499.9	6724	100.0	3499.9	4283	100.0	3499.9	9285
100.0	3599.9	6774	100.0	3599.9	4315	100.0	3599.9	9285
100.0	3699.9	6824	100.0	3699.9	4347	100.0	3699.9	9285
100.0	3799.9	6874	100.0	3799.9	4379	100.0	3799.9	9285
100.0	3899.9	6924	100.0	3899.9	4411	100.0	3899.9	9285
100.0	3999.9	6974	100.0	3999.9	4443	100.0	3999.9	9285
100.0	4099.9	7024	100.0	4099.9	4475	100.0	4099.9	9285
100.0	4199.9	7074	100.0	4199.9	4506	100.0	4199.9	9285
100.0	4299.9	7124	100.0	4299.9	4538	100.0	4299.9	9285
100.0	4399.8	7174	100.0	4399.8	4570	100.0	4399.8	9285
100.0	4499.8	7224	100.0	4499.8	4602	100.0	4499.8	9285
100.0	4599.8	7274	100.0	4599.8	4634	100.0	4599.8	9285
100.0	4699.8	7324	100.0	4699.8	4666	100.0	4699.8	9285
100.0	4799.8	7374	100.0	4799.8	4698	100.0	4799.8	9285
100.0	4899.8	7424	100.0	4899.8	4729	100.0	4899.8	9285
100.0	4999.8	7474	100.0	4999.8	4761	100.0	4999.8	9285
100.0	5099.8	7524	100.0	5099.8	4793	100.0	5099.8	9285
100.0	5199.8	7574	100.0	5199.8	4825	100.0	5199.8	9285
100.0	5299.8	7624	100.0	5299.8	4857	100.0	5299.8	9285
100.0	5399.8	7674	100.0	5399.8	4889	100.0	5399.8	9285
100.0	5499.8	7724	100.0	5499.8	4920	100.0	5499.8	9285
100.0	5599.8	7774	100.0	5599.8	4952	100.0	5599.8	9285
100.0	5699.8	7824	100.0	5699.8	4984	100.0	5699.8	9285
100.0	5799.8	7874	100.0	5799.8	5016	100.0	5799.8	9285
100.0	5899.8	7924	100.0	5899.8	5048	100.0	5899.8	9285
100.0	5999.8	7975	100.0	5999.8	5080	100.0	5999.8	9285
100.0	6099.8	8025	100.0	6099.8	5112	100.0	6099.8	9285
100.0	6199.8	8075	100.0	6199.8	5143	100.0	6199.8	9285
100.0	6299.8	8125	100.0	6299.8	5175	100.0	6299.8	9285
100.0	6399.8	8175	100.0	6399.8	5207	100.0	6399.8	9285
100.0	6499.8	8225	100.0	6499.8	5239	100.0	6499.8	9285
61.4	6561.2	8235	61.4	6561.2	5246	61.4	6561.2	9285
3280.8	9842.0	9285	3280.8	9842.0	9285	3280.8	9842.0	9285