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10 CFR 50.54 (f)

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

Duke Energy Progress, Inc., formerly known as Carolina Power & Light Company

Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325 and 50-324
Renewed License Nos. DPR-71 and DPR-62

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400
Renewed License No. NPF-63

H. B. Robinson Steam Electric Plant, Unit No. 2
Docket No. 50-261
Renewed License No. DPR-23

Subject: 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, ADAMS Accession No. ML12053A340
2. 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*, ADAMS Accession No. ML12333A170
3. NRC Letter, *Endorsement of EPRI Final Draft Report 1025287, "Seismic Evaluation Guidance"*, dated February 15, 2013, ADAMS Accession No. ML12319A074
4. NEI Letter, *Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations*, dated April 9, 2013, ADAMS Accession No. ML13101A379

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5. Duke Energy Letter, *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*, dated April 26, 2013, ADAMS Accession No. ML13121A063
6. 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, ADAMS Accession No. ML13106A331
7. NRC Letter, *Status of 60-Day Response to Issuance of Seismic Evaluation Guidance Related to the Near-Term Task Force Recommendation 2.1, Seismic*, dated August 2, 2013, ADAMS Accession No. ML13161A286

Ladies and Gentlemen:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Reference 1 to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 1 of Reference 1 requested each addressee in the Central and Eastern United States (CEUS) to submit a written response consistent with the requested seismic hazard evaluation information (i.e., items 1 through 7) by September 12, 2013. Reference 2 provides industry guidance for responding to Reference 1. Section 4 of Reference 2 identifies the detailed information to be included in the seismic hazard evaluation submittals. On February 15, 2013, the NRC issued Reference 3, endorsing the industry guidance (i.e., Reference 2).

On April 9, 2013, the Nuclear Energy Institute (NEI) submitted Reference 4 to the NRC, requesting NRC agreement to delay submittal of some of the CEUS seismic hazard evaluation information so that an update to the Electric Power Research Institute (EPRI) (i.e., 2004 and 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 (i.e., items 3a and 3b in Section 4 of Reference 2) be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted to NRC by March 31, 2014.

In Reference 5, Duke Energy provided the 60-day response to the NRC, as required by Reference 1. The response informed the NRC that Duke Energy intended to follow the alternative approach and schedule set forth in Reference 4. In Reference 6 the NRC approved the schedule modification (i.e., Reference 4). Based on the NRC approval of Reference 4, the NRC issued a letter on August 2, 2013 (i.e., Reference 7) and acknowledged the Duke Energy response (i.e., Reference 5) was acceptable.

The enclosures to this letter contain the requested descriptions of subsurface materials and properties and base case velocity profiles for Brunswick Steam Electric Plant, Shearon Harris Nuclear Power Plant, and H. B. Robinson Steam Electric Plant. The geotechnical profile data included as Table 1 of each enclosure is from the plant design record. Table 2 is based on Table 1 for the reactor building control point. The profiles provided in Table 2 and Figure 1 of each enclosure represent a Mean Base Case (Profile 1), a Lower Bound (Profile 2), and an Upper Bound (Profile 3).

This information is being provided for Catawba Nuclear Station, McGuire Nuclear Station, Oconee Nuclear Station, and Crystal River Unit 3 under separate cover letters. 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 Duke Energy will be provided to the NRC in our 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 report, please contact Jeff Thomas, Fukushima Response Support Manager, at (704) 382-3438.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 11, 2013.

Sincerely,



Benjamin C. Waldrep
Vice President, Corporate Governance &
Operation Support

Enclosures:

- Enclosure 1 Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles for Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, Docket Nos. 50-325 and 50-324, Renewed License Nos. DPR-71 and DPR-62
- Enclosure 2 Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles for Shearon Harris Nuclear Power Plant (SHNPP), Unit No. 1, Docket No. 50-400, Renewed License No. NPF-63
- Enclosure 3 Descriptions of Subsurface Materials and Properties and Base Case Velocity Profiles for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, Docket No. 50-261, Renewed License No. DPR-23

xc:

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ENCLOSURE 1

DESCRIPTIONS OF SUBSURFACE MATERIALS

AND

PROPERTIES AND BASE CASE VELOCITY PROFILES

FOR

BRUNSWICK STEAM ELECTRIC PLANT (BSEP), UNIT NOS. 1 AND 2

DOCKET NOS. 50-325 AND 50-324

RENEWED LICENSE NOS. DPR-71 AND DPR-62

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

BRUNSWICK STEAM ELECTRIC PLANT (BSEP)

Brunswick Steam Electric Plant Site Description

The basic information used to create the site geologic profile at the Brunswick Steam Electric Plant is shown in Table 1. This profile was developed using information documented in Reference 1 of this enclosure. As indicated in Reference 1 of this enclosure, the safe shutdown earthquake (SSE) Control Point is at depth 47.83', Elevation -28.33', 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 of this enclosure, the second model assumed linear behavior. These dynamic property models were weighted equally. For dynamic properties of fill, compacted sand, sand, and clay layers, modulus and damping curves were also represented with two models. The first model used soil curves taken from Reference 2 of this enclosure, the second model used soil curves taken from References 3 and 4 of this enclosure. These dynamic property models were weighted equally. To model the profile, rock modulus and damping curves from Reference 2 of this enclosure were paired with soil modulus and damping curves from Reference 2 of this enclosure and linear rock modulus and damping curves were paired with soil modulus and damping curves from References 3 and 4 of this enclosure.

The 3 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. URS (2012). *Site Geologic Conditions for Brunswick Nuclear Power Plant - Revision 2*, Report dated 12/03/2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Elec. Power Res. Inst., 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.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
BRUNSWICK STEAM ELECTRIC PLANT (BSEP)

Table 1

Summary of Geotechnical Profile Data for Brunswick Steam Electric Plant

Elevation Range (feet)	Soil/Rock Description	Density (pcf)	Shear Wave Velocity (fps)	N Blow Count**
19.5***	Surface	---	---	---
+19.5 – -7	Fill - Confined Compacted Sand	115	750	6 to > 100 blows per foot
-7 – -25	Upper Yorktown - Unconfined Compacted Sand	115	750	Weight of Hammer to 4 blows per foot
-25 – -50	SSE control point - Lower Yorktown - Natural Dense Sand	130	900 - 1400	23 > 100 blows per foot
-50 – -93	Oligocene Sediments - Stiff Clay	145	5500	20 > 100 blows per foot
-93 – -220	Castle Hayne - Limestone	138	4500	---
-220 – -1510	Cretaceous: Peedee Limestone – well consolidated shell limestone that contains varying amounts of clay	130	3000	---
-1510*	Crystalline basemat	165	10000*	---

* Estimated values

** Information sourced from Dynamic Soil Properties Calc by AMEC E&I Inc. Table 1 – Soil Profile. January, 19, 2012.

*** Information sourced from the Updated Final Safety Analysis Report Page. 3-35.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
BRUNSWICK STEAM ELECTRIC PLANT (BSEP)

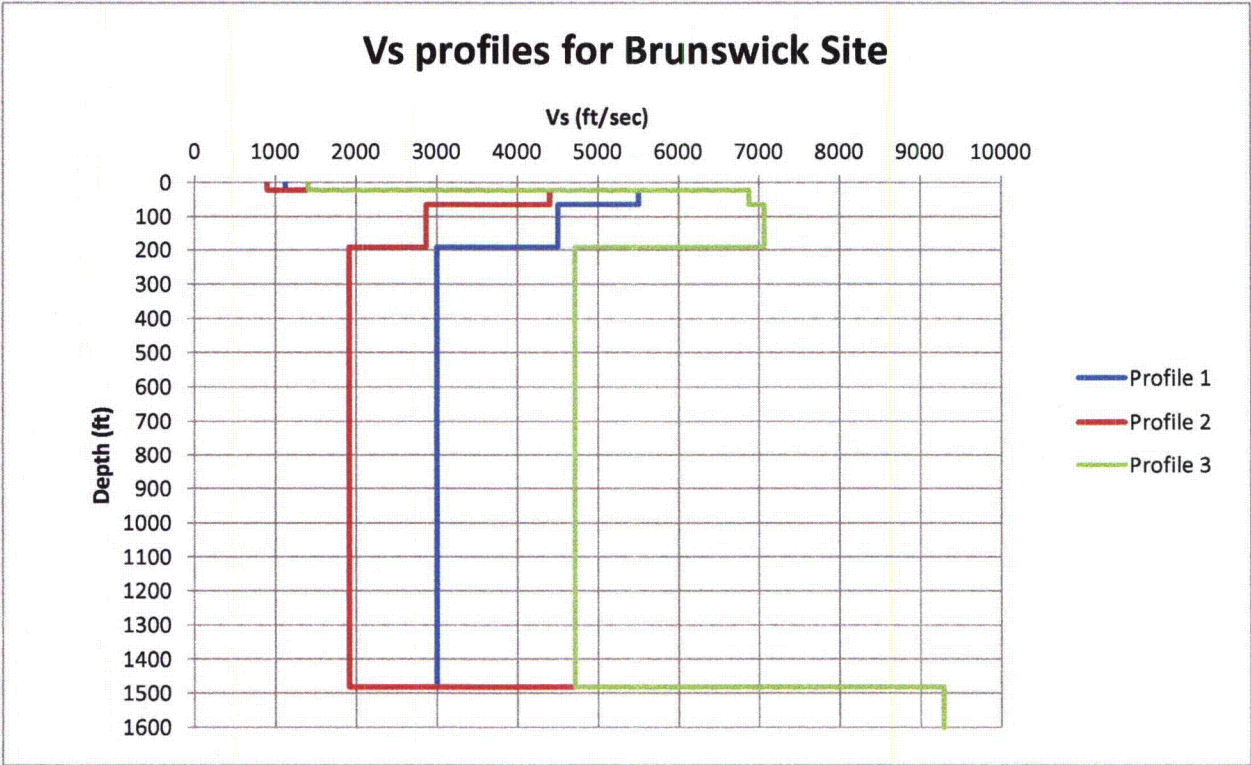


Figure 1. Vs profiles for Brunswick Steam Electric Plant site

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

BRUNSWICK STEAM ELECTRIC PLANT (BSEP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Brunswick 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	1122		0	898		0	1403
5.0	5.0	1122	5.0	5.0	898	5.0	5.0	1403
5.0	10.0	1122	5.0	10.0	898	5.0	10.0	1403
5.0	15.0	1122	5.0	15.0	898	5.0	15.0	1403
5.0	20.0	1122	5.0	20.0	898	5.0	20.0	1403
1.7	21.7	1122	1.7	21.7	898	1.7	21.7	1403
4.0	25.7	5500	4.0	25.7	4400	4.0	25.7	6875
5.0	30.7	5500	5.0	30.7	4400	5.0	30.7	6875
5.0	35.7	5500	5.0	35.7	4400	5.0	35.7	6875
5.0	40.7	5500	5.0	40.7	4400	5.0	40.7	6875
5.0	45.7	5500	5.0	45.7	4400	5.0	45.7	6875
5.0	50.7	5500	5.0	50.7	4400	5.0	50.7	6875
4.0	54.7	5500	4.0	54.7	4400	4.0	54.7	6875
5.0	59.7	5500	5.0	59.7	4400	5.0	59.7	6875
5.0	64.7	5500	5.0	64.7	4400	5.0	64.7	6875
27.7	92.3	4500	27.7	92.3	2866	27.7	92.3	7065
27.7	120.0	4500	27.7	120.0	2866	27.7	120.0	7065
35.8	155.8	4500	35.8	155.8	2866	35.8	155.8	7065
35.8	191.7	4500	35.8	191.7	2866	35.8	191.7	7065
19.4	211.1	3000	19.4	211.1	1911	19.4	211.1	4710
19.4	230.5	3000	19.4	230.5	1911	19.4	230.5	4710
19.4	250.0	3000	19.4	250.0	1911	19.4	250.0	4710
25.0	275.0	3000	25.0	275.0	1911	25.0	275.0	4710
25.0	300.0	3000	25.0	300.0	1911	25.0	300.0	4710
25.0	325.0	3000	25.0	325.0	1911	25.0	325.0	4710
25.0	350.0	3000	25.0	350.0	1911	25.0	350.0	4710
25.0	375.0	3000	25.0	375.0	1911	25.0	375.0	4710
25.0	400.0	3000	25.0	400.0	1911	25.0	400.0	4710
25.0	425.0	3000	25.0	425.0	1911	25.0	425.0	4710
25.0	450.0	3000	25.0	450.0	1911	25.0	450.0	4710
25.0	475.0	3000	25.0	475.0	1911	25.0	475.0	4710
25.0	500.0	3000	25.0	500.0	1911	25.0	500.0	4710

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

BRUNSWICK STEAM ELECTRIC PLANT (BSEP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Brunswick 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)
32.7	532.7	3000	32.7	532.7	1911	32.7	532.7	4710
32.7	565.4	3000	32.7	565.4	1911	32.7	565.4	4710
32.7	598.1	3000	32.7	598.1	1911	32.7	598.1	4710
32.7	630.9	3000	32.7	630.9	1911	32.7	630.9	4710
32.7	663.6	3000	32.7	663.6	1911	32.7	663.6	4710
32.7	696.3	3000	32.7	696.3	1911	32.7	696.3	4710
32.7	729.0	3000	32.7	729.0	1911	32.7	729.0	4710
32.7	761.7	3000	32.7	761.7	1911	32.7	761.7	4710
32.7	794.5	3000	32.7	794.5	1911	32.7	794.5	4710
32.7	827.2	3000	32.7	827.2	1911	32.7	827.2	4710
32.7	859.9	3000	32.7	859.9	1911	32.7	859.9	4710
32.7	892.6	3000	32.7	892.6	1911	32.7	892.6	4710
32.7	925.3	3000	32.7	925.3	1911	32.7	925.3	4710
32.7	958.1	3000	32.7	958.1	1911	32.7	958.1	4710
32.7	990.8	3000	32.7	990.8	1911	32.7	990.8	4710
32.7	1023.5	3000	32.7	1023.5	1911	32.7	1023.5	4710
32.7	1056.2	3000	32.7	1056.2	1911	32.7	1056.2	4710
32.7	1088.9	3000	32.7	1088.9	1911	32.7	1088.9	4710
32.7	1121.7	3000	32.7	1121.7	1911	32.7	1121.7	4710
32.7	1154.4	3000	32.7	1154.4	1911	32.7	1154.4	4710
32.7	1187.1	3000	32.7	1187.1	1911	32.7	1187.1	4710
32.7	1219.8	3000	32.7	1219.8	1911	32.7	1219.8	4710
32.7	1252.5	3000	32.7	1252.5	1911	32.7	1252.5	4710
32.7	1285.3	3000	32.7	1285.3	1911	32.7	1285.3	4710
32.7	1318.0	3000	32.7	1318.0	1911	32.7	1318.0	4710
32.7	1350.7	3000	32.7	1350.7	1911	32.7	1350.7	4710
32.7	1383.4	3000	32.7	1383.4	1911	32.7	1383.4	4710
32.7	1416.1	3000	32.7	1416.1	1911	32.7	1416.1	4710
32.7	1448.9	3000	32.7	1448.9	1911	32.7	1448.9	4710
32.7	1481.6	3000	32.7	1481.6	1911	32.7	1481.6	4710
3280.8	4762.4	9285	3280.8	4762.4	9285	3280.8	4762.4	9285

ENCLOSURE 2

DESCRIPTIONS OF SUBSURFACE MATERIALS

AND

PROPERTIES AND BASE CASE VELOCITY PROFILES

FOR

SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP), UNIT 1

DOCKET NOS. 50-400

RENEWED LICENSE NO. NPF-63

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Shearon Harris Nuclear Power Plant Site Description

The basic information used to create the site geologic profile at the Shearon Harris Nuclear Power Plant is shown in Table 1. This profile was developed using information documented in Reference 1 of this enclosure. As indicated in Table 1, the safe shutdown earthquake (SSE) Control Point is defined at the top of “sound bedrock,” and site amplifications correspond to that location. For dynamic properties, modulus and damping curves for rock layers were represented with two models. The first model used rock curves taken from Reference 2 of this enclosure, the second model assumed linear behavior. These dynamic property models were weighted equally.

The 3 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. URS (2012). *Site Geologic Conditions for Shearon Harris Nuclear Generating Station—Revision 1*, Letter Report PE-HNP-A07-12267 dated September 21, 2012, transmitted by letter from B. Alumbaugh to C. Albers dated September 25, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Elec. Power Res. Inst., Palo Alto, CA, Rept. TR-102293, Vol. 1—5.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Table 1

Summary of Geotechnical Profile Data for Shearon Harris Nuclear Power Plant ⁽¹⁾

Depth Range (feet)	Soil/Rock Description	Density (pcf) ⁽²⁾	Shear Wave Velocity (fps)	Compressional Wave Velocity (fps)	Poisson's ratio
0-8	Residual Soil	130	500 ⁽³⁾	1500	0.44
8-16	Weathered and Fractured Rock	160	2500	5500	0.37
Below 16	Sound Bedrock (SSE Control Point)	160	5600	12000	0.35

Note: Estimated depth to crystalline basement rocks at the site is approximately 5000 ft

Note: On Page 2.5-189 of the Shearon Harris Advanced Reactor Units 2 and 3 Combined Construction and Operating License Application, it is assumed that the crystalline basement is the point at which the generic Central and Eastern United States hard rock conditions are encountered and a shear wave velocity of 7600 fps is estimated.

Note: The base case profile used in "Seismic Hazard Results Using the USGS 2008 Seismic Source Model: Brunswick, Crystal River, Harris, and Robinson Nuclear Sites" estimates a shear wave velocity of 9200 fps at a depth of 7000 ft.

(1) Reference Table 2.5.2-3 SHNPP Final Safety Analysis Report (FSAR)

(2) Reference Table 3.7.1-2 SHNPP FSAR

(3) This value was assumed on the basis of previous experience under similar conditions.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

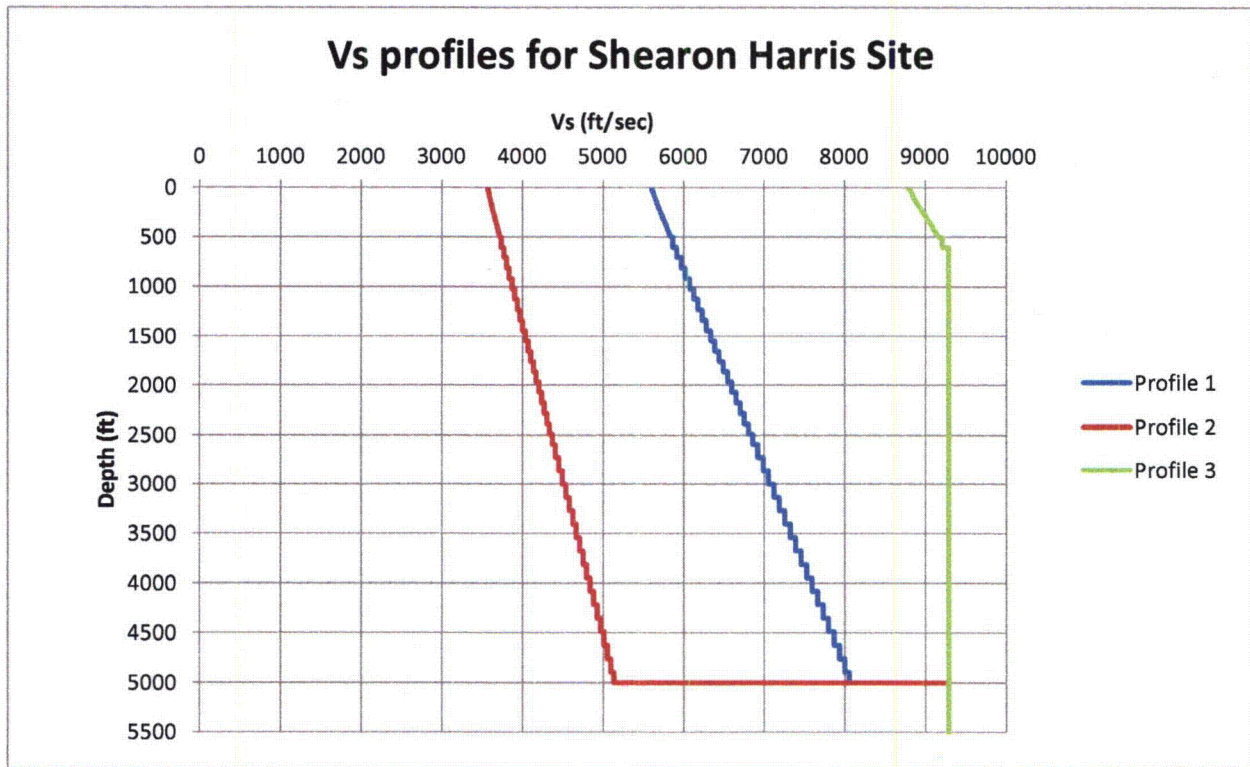


Figure 1. Vs profiles for Shearon Harris Nuclear Power Plant site

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Shearon Harris 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	5600		0	3567		0	8792
5.0	5.0	5600	5.0	5.0	3567	5.0	5.0	8792
5.0	10.0	5601	5.0	10.0	3568	5.0	10.0	8794
5.0	15.0	5603	5.0	15.0	3569	5.0	15.0	8797
5.0	20.0	5606	5.0	20.0	3571	5.0	20.0	8801
5.0	25.0	5608	5.0	25.0	3573	5.0	25.0	8805
5.0	30.0	5611	5.0	30.0	3574	5.0	30.0	8809
5.0	35.0	5613	5.0	35.0	3576	5.0	35.0	8813
5.0	40.0	5616	5.0	40.0	3577	5.0	40.0	8817
5.0	45.0	5618	5.0	45.0	3579	5.0	45.0	8821
5.0	50.0	5621	5.0	50.0	3581	5.0	50.0	8825
5.0	55.0	5623	5.0	55.0	3582	5.0	55.0	8829
5.0	60.0	5626	5.0	60.0	3584	5.0	60.0	8833
5.0	65.0	5628	5.0	65.0	3585	5.0	65.0	8837
3.0	68.0	5630	3.0	68.0	3586	3.0	68.0	8839
6.0	74.0	5631	6.0	74.0	3587	6.0	74.0	8841
6.0	80.0	5632	6.0	80.0	3588	6.0	80.0	8843
6.0	86.0	5634	6.0	86.0	3589	6.0	86.0	8845
6.0	92.0	5635	6.0	92.0	3589	6.0	92.0	8847
7.0	99.0	5639	7.0	99.0	3592	7.0	99.0	8852
7.0	106.0	5642	7.0	106.0	3594	7.0	106.0	8858
7.0	113.0	5645	7.0	113.0	3596	7.0	113.0	8863
7.0	120.0	5649	7.0	120.0	3598	7.0	120.0	8869
6.0	126.0	5652	6.0	126.0	3600	6.0	126.0	8874
4.0	130.0	5654	4.0	130.0	3602	4.0	130.0	8877
5.0	135.0	5657	5.0	135.0	3603	5.0	135.0	8881
5.0	140.0	5659	5.0	140.0	3605	5.0	140.0	8885
5.0	145.0	5662	5.0	145.0	3606	5.0	145.0	8889
5.0	150.0	5664	5.0	150.0	3608	5.0	150.0	8892
5.0	155.0	5667	5.0	155.0	3610	5.0	155.0	8896
5.0	160.0	5669	5.0	160.0	3611	5.0	160.0	8900
4.0	164.0	5671	4.0	164.0	3612	4.0	164.0	8903

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Shearon Harris 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)
5.0	169.0	5672	5.0	169.0	3613	5.0	169.0	8905
5.0	174.0	5675	5.0	174.0	3615	5.0	174.0	8909
5.0	179.0	5677	5.0	179.0	3616	5.0	179.0	8913
5.0	184.0	5680	5.0	184.0	3618	5.0	184.0	8917
5.0	189.0	5682	5.0	189.0	3620	5.0	189.0	8921
5.0	194.0	5685	5.0	194.0	3621	5.0	194.0	8925
5.0	199.0	5687	5.0	199.0	3623	5.0	199.0	8929
5.0	204.0	5690	5.0	204.0	3624	5.0	204.0	8933
5.0	209.0	5692	5.0	209.0	3626	5.0	209.0	8937
5.0	214.0	5695	5.0	214.0	3628	5.0	214.0	8941
5.0	219.0	5697	5.0	219.0	3629	5.0	219.0	8945
5.0	224.0	5700	5.0	224.0	3631	5.0	224.0	8949
5.0	229.0	5702	5.0	229.0	3632	5.0	229.0	8953
5.0	234.0	5705	5.0	234.0	3634	5.0	234.0	8956
5.0	239.0	5707	5.0	239.0	3636	5.0	239.0	8960
5.0	244.0	5710	5.0	244.0	3637	5.0	244.0	8964
6.0	250.0	5713	6.0	250.0	3639	6.0	250.0	8969
6.3	256.3	5716	6.3	256.3	3641	6.3	256.3	8974
6.3	262.7	5719	6.3	262.7	3643	6.3	262.7	8979
6.3	269.0	5722	6.3	269.0	3645	6.3	269.0	8984
10.0	279.0	5727	10.0	279.0	3648	10.0	279.0	8992
10.0	289.0	5732	10.0	289.0	3651	10.0	289.0	9000
10.0	299.0	5737	10.0	299.0	3655	10.0	299.0	9007
10.0	309.0	5742	10.0	309.0	3658	10.0	309.0	9015
10.0	319.0	5747	10.0	319.0	3661	10.0	319.0	9023
12.0	331.0	5753	12.0	331.0	3665	12.0	331.0	9033
10.0	341.0	5758	10.0	341.0	3668	10.0	341.0	9040
10.0	351.0	5763	10.0	351.0	3671	10.0	351.0	9048
10.0	361.0	5768	10.0	361.0	3674	10.0	361.0	9056
10.0	371.0	5773	10.0	371.0	3678	10.0	371.0	9064
10.0	381.0	5778	10.0	381.0	3681	10.0	381.0	9072
12.0	393.0	5784	12.0	393.0	3685	12.0	393.0	9081
7.0	400.0	5788	7.0	400.0	3687	7.0	400.0	9087

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Shearon Harris 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)
10.0	410.0	5790	10.0	410.0	3688	10.0	410.0	9091
10.0	420.0	5795	10.0	420.0	3692	10.0	420.0	9099
10.0	430.0	5800	10.0	430.0	3695	10.0	430.0	9106
10.0	440.0	5805	10.0	440.0	3698	10.0	440.0	9114
10.0	450.0	5810	10.0	450.0	3701	10.0	450.0	9122
10.0	460.0	5815	10.0	460.0	3704	10.0	460.0	9130
10.0	470.0	5820	10.0	470.0	3707	10.0	470.0	9138
10.0	480.0	5825	10.0	480.0	3711	10.0	480.0	9146
10.0	490.0	5830	10.0	490.0	3714	10.0	490.0	9153
10.0	500.0	5837	10.0	500.0	3718	10.0	500.0	9164
104.7	604.7	5863	104.7	604.7	3735	104.7	604.7	9205
104.7	709.5	5916	104.7	709.5	3768	104.7	709.5	9285
104.7	814.2	5968	104.7	814.2	3802	104.7	814.2	9285
104.7	919.0	6020	104.7	919.0	3835	104.7	919.0	9285
104.7	1023.7	6073	104.7	1023.7	3868	104.7	1023.7	9285
104.7	1128.4	6125	104.7	1128.4	3902	104.7	1128.4	9285
104.7	1233.2	6177	104.7	1233.2	3935	104.7	1233.2	9285
104.7	1337.9	6230	104.7	1337.9	3968	104.7	1337.9	9285
104.7	1442.7	6282	104.7	1442.7	4002	104.7	1442.7	9285
104.7	1547.4	6335	104.7	1547.4	4035	104.7	1547.4	9285
104.7	1652.2	6387	104.7	1652.2	4068	104.7	1652.2	9285
104.7	1756.9	6439	104.7	1756.9	4102	104.7	1756.9	9285
104.7	1861.7	6492	104.7	1861.7	4135	104.7	1861.7	9285
104.7	1966.4	6544	104.7	1966.4	4169	104.7	1966.4	9285
104.7	2071.1	6596	104.7	2071.1	4202	104.7	2071.1	9285
104.7	2175.9	6649	104.7	2175.9	4235	104.7	2175.9	9285
104.7	2280.6	6701	104.7	2280.6	4269	104.7	2280.6	9285
104.7	2385.4	6754	104.7	2385.4	4302	104.7	2385.4	9285
104.7	2490.1	6806	104.7	2490.1	4335	104.7	2490.1	9285
104.7	2594.9	6858	104.7	2594.9	4369	104.7	2594.9	9285
135.2	2730.1	6918	135.2	2730.1	4407	135.2	2730.1	9285
135.2	2865.3	6986	135.2	2865.3	4450	135.2	2865.3	9285
135.2	3000.6	7054	135.2	3000.6	4493	135.2	3000.6	9285

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

SHEARON HARRIS NUCLEAR POWER PLANT (SHNPP)

Table 2								
Layer thicknesses, depths, and Vs for 3 profiles, Shearon Harris 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)
135.2	3135.8	7121	135.2	3135.8	4536	135.2	3135.8	9285
135.2	3271.1	7189	135.2	3271.1	4579	135.2	3271.1	9285
135.2	3406.3	7256	135.2	3406.3	4622	135.2	3406.3	9285
135.2	3541.6	7324	135.2	3541.6	4665	135.2	3541.6	9285
135.2	3676.8	7392	135.2	3676.8	4708	135.2	3676.8	9285
135.2	3812.0	7459	135.2	3812.0	4752	135.2	3812.0	9285
135.2	3947.3	7527	135.2	3947.3	4795	135.2	3947.3	9285
135.2	4082.5	7594	135.2	4082.5	4838	135.2	4082.5	9285
135.2	4217.8	7662	135.2	4217.8	4881	135.2	4217.8	9285
135.2	4353.0	7730	135.2	4353.0	4924	135.2	4353.0	9285
135.2	4488.3	7797	135.2	4488.3	4967	135.2	4488.3	9285
135.2	4623.5	7865	135.2	4623.5	5010	135.2	4623.5	9285
135.2	4758.7	7933	135.2	4758.7	5053	135.2	4758.7	9285
135.2	4894.0	8000	135.2	4894.0	5096	135.2	4894.0	9285
105.8	4999.7	8053	105.8	4999.7	5130	105.8	4999.7	9285
3280.8	8280.6	9285	3280.8	8280.6	9285	3280.8	8280.6	9285

ENCLOSURE 3

DESCRIPTIONS OF SUBSURFACE MATERIALS

AND

PROPERTIES AND BASE CASE VELOCITY PROFILES

FOR

H. B. ROBINSON STEAM ELECTIC PLANT (HBRSEP), UNIT NO. 2

DOCKET NOS. 50-261

RENEWED LICENSE NO. DPR-23

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

H. B. ROBINSON STEAM ELECTRIC PLANT (HBRSEP)

H. B. Robinson Steam Electric Plant Site Description

The basic information used to create the site geologic profile at the H. B. Robinson Steam Electric Plant is shown in Table 1. This profile was developed using information documented in Reference 1 of this enclosure. As indicated in Reference 1 of this enclosure, the safe shutdown earthquake (SSE) is defined at the ground surface elevation, so the profile up to the ground surface has been modeled for site amplification. For dynamic properties of sand, gravel, clay, sandstone, and mudstone layers, modulus and damping curves were represented with two models. The first model used soil curves taken from Reference 2 of this enclosure, the second model used soil curves taken from Reference 3 of this enclosure and Reference 4 of this enclosure. These dynamic property models were weighted equally.

The 3 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. URS (2012). *Site Geologic Conditions for H.B Robinson Steam Electric Plant, Unit 2*, Letter Report PE-RNP-A07-12128 dated July 9, 2012, transmitted by letter from B. Alumbaugh to C. Albers dated July 9, 2012.
2. EPRI (1993). *Guidelines for Determining Design Basis Ground Motions*, Elec. Power Res. Inst., 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.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

H. B. ROBINSON STEAM ELECTRIC PLANT (HBRSEP)

Table 1

Summary of Geotechnical Profile Data for H. B. Robinson Steam Electric Plant

Depth* Range (feet)	Soil/Rock Description	Density (pcf)	Shear Wave Velocity (fps)	Compressional Wave Velocity (fps)	Assumed Poisson's ratio
0 to 56	Recent Alluvium (Sand and Gravel)	125	1000**	1500	0.33
56 to 460	Cretaceous Middendorf (Sands, Silty and Sandy Clay, Sandstone and Mudstone)	130	3600	7200	0.33
> 460	Pre-Cambrian Crystalline (Granite, Gneiss, Phyllite Schist)	170	11200	17500	0.15

* Measured from EL. 226 ft.

** The original soil profile data obtained from Figure 2.5.1-2 of the HBRSEP Unit 2 Updated Final Safety Analysis Report (UFSAR) has been adjusted based on recommendations of MACTEC in EC54720-Z00 Attachment A. Figure 2.5.1-2 had a shear wave velocity of 750 fps for the first 30ft of soil (measured from EL. 226 ft); whereas, MACTEC suggested an adjusted value of 1000 fps for the first 70ft of soil (measured from EL. 240 ft). All other soil profile data in Table 2 remains the same as given in Figure 2.5.1-2 of the UFSAR.

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1
H. B. ROBINSON STEAM ELECTRIC PLANT (HBRSEP)

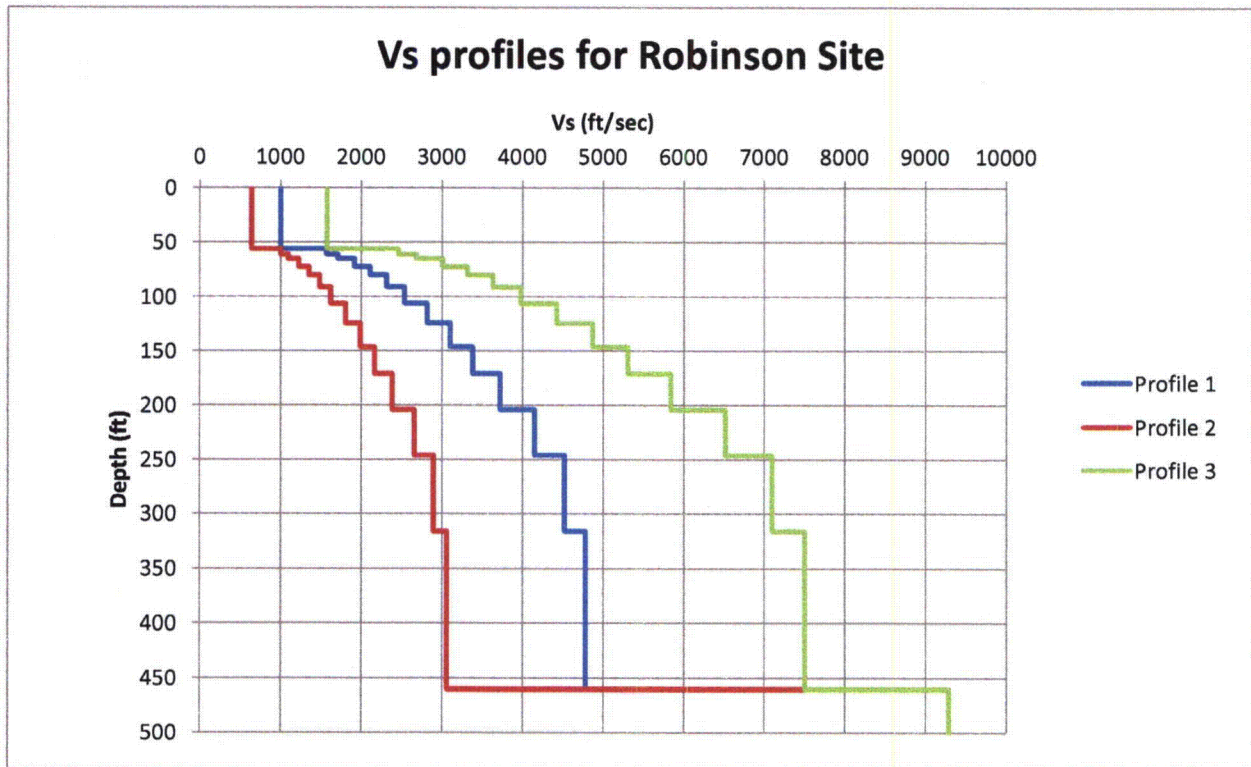


Figure 1. Vs profiles for H. B. Robinson Steam Electric Plant site

RESPONSE REGARDING THE SEISMIC ASPECTS OF RECOMMENDATION 2.1

H. B. ROBINSON STEAM ELECTRIC PLANT (HBRSEP)

Table 2

Layer thicknesses, depths, and Vs for 3 profiles, Robinson 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	1000		0	640		0	1570
5.6	5.6	1000	5.6	5.6	640	5.6	5.6	1570
5.6	11.2	1000	5.6	11.2	640	5.6	11.2	1570
5.6	16.8	1000	5.6	16.8	640	5.6	16.8	1570
5.6	22.4	1000	5.6	22.4	640	5.6	22.4	1570
5.6	28.1	1000	5.6	28.1	640	5.6	28.1	1570
5.6	33.7	1000	5.6	33.7	640	5.6	33.7	1570
5.6	39.3	1000	5.6	39.3	640	5.6	39.3	1570
5.6	44.9	1000	5.6	44.9	640	5.6	44.9	1570
5.6	50.5	1000	5.6	50.5	640	5.6	50.5	1570
5.6	56.1	1000	5.6	56.1	640	5.6	56.1	1570
5.0	61.1	1566	5.0	61.1	1002	5.0	61.1	2458
4.0	65.1	1706	4.0	65.1	1092	4.0	65.1	2679
7.4	72.5	1914	7.4	72.5	1225	7.4	72.5	3005
7.5	80.1	2110	7.5	80.1	1350	7.5	80.1	3312
11.0	91.0	2312	11.0	91.0	1480	11.0	91.0	3630
15.0	106.0	2531	15.0	106.0	1620	15.0	106.0	3974
18.0	124.0	2815	18.0	124.0	1802	18.0	124.0	4420
22.0	146.1	3100	22.0	146.1	1984	22.0	146.1	4867
25.0	171.1	3380	25.0	171.1	2163	25.0	171.1	5306
33.0	204.1	3720	33.0	204.1	2381	33.0	204.1	5840
42.0	246.1	4150	42.0	246.1	2656	42.0	246.1	6515
35.0	281.1	4520	35.0	281.1	2893	35.0	281.1	7096
35.0	316.1	4520	35.0	316.1	2893	35.0	316.1	7096
33.3	349.4	4780	33.3	349.4	3059	33.3	349.4	7504
33.3	382.7	4780	33.3	382.7	3059	33.3	382.7	7504
33.3	416.1	4780	33.3	416.1	3059	33.3	416.1	7504
44.0	460.1	4780	44.0	460.1	3059	44.0	460.1	7504
3280.8	3740.9	9285	3280.8	3740.9	9285	3280.8	3740.9	9285