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PNP 2013-069

September 11, 2013

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

SUBJECT: Palisades Nuclear Plant 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

Palisades Nuclear Plant
Docket No. 50-255
License No. DPR-20

- 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 Number ML12056A046)
 2. NRC letter, *Endorsement of EPRI Final Draft Report 1025287, "Seismic Evaluation Guidance,"* dated February 15, 2013 (ADAMS Accession Number ML12319A074)
 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*, dated February 2013 (ADAMS Accession Number ML12333A170)
 4. NEI letter, *Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations*, dated April 9, 2013 (ADAMS Accession Number ML13101A345)
 5. NRC letter, *Electric Power Research Institute Final Draft Report XXXXXX, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations*, dated May 7, 2013 (ADAMS Accession Number ML13106A331)
 6. Entergy Nuclear Operations, Inc. letter, PNP 2013-33, *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 Number ML13116A341)

Dear Sir or Madam:

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 the seismic evaluation in Reference 1. Section 4 of Reference 3 identifies the detailed information to be included in the seismic hazard evaluation submittals.

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) (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, the NRC agreed with this recommendation. Reference 6 contained an Entergy Nuclear Operations, Inc. commitment to follow the approach described in Reference 4.

The attachment to this letter contains the requested descriptions of subsurface materials and properties and base case velocity profiles for Palisades Nuclear Plant (PNP). The information provided in the attachment 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 report(s) for PNP will be provided to the NRC in our seismic hazard submittal by March 31, 2014 in accordance with Reference 5.

This letter contains no new commitments and no revised commitments.

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

Sincerely,



ajv/jse

Attachment: Palisades Nuclear Plant Descriptions of Subsurface Materials and Properties, and Base Case Velocity Profiles

cc: Office Director, NRR, USNRC
Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

Attachment

Palisades Nuclear Plant Descriptions of Subsurface Materials and Properties, and Base Case Velocity Profiles

The basic information used to create the site geologic profile at the Palisades Nuclear Plant is shown in Table 1. This profile was developed using information documented in Reference 1. The safe shutdown earthquake (SSE) control point was taken to be at the top of “Brown dune sand, very compact”, and the profile was modeled up to this location. For dynamic properties of sand, silt, clay, and till 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.

Six base-case shear-wave velocity (V_s) profiles were used to model amplification at the site, and these are shown in Figures 1A and 1B. Profiles 1, 2, and 3 assume that hard rock is at a depth of 148 feet, and Profiles 4, 5, and 6 assume that hard rock is at a depth of 3238 feet. The six profiles are weighted 0.2, 0.15, 0.15, 0.2, 0.15, and 0.15, respectively. Thicknesses, depths, and V_s corresponding to Profiles 1, 2, and 3 are shown in Table 2A, and thicknesses, depths, and V_s corresponding to Profiles 4, 5, and 6 are shown in Table 2B. Two sets of soil columns extending to two different depths were used to bound the uncertainty in the depth to hard rock, and to incorporate uncertainties in the properties of the shale underlying the site where direct measurements of V_s were not available.

References

1. *Site Geologic Conditions for Palisades Nuclear Power Plant*, dated May 31, 2012, transmitted by Entergy Nuclear Operations, Inc. to Electric Power Research Institute in July, 2012.
2. Electric Power Research Institute Technical Report TR-102293, *Guidelines for Determining Design Basis Ground Motions*, Volumes 1-5, 1993.
3. Silva, W., N. Abrahamson, G. Toro, and C. Costantino, *Description and Validation of the Stochastic Ground Motion Model*, Pacific Engineering and Analysis, prepared for Brookhaven National Laboratory, Contract No. 770573, November 15, 1996 (ADAMS Accession No. ML042310562).
4. Walling, M.A., W.J., Silva and N.A. Abrahamson, “Nonlinear Site Amplification Factors for Constraining the NGA Models,” *Earthquake Spectra*, Volume 24, 243-255, February 2008.
5. Palisades Nuclear Plant Final Safety Analysis Report (FSAR), Revision 30.
6. GEI Consultants, Inc. soils report for Palisades Nuclear Plant Individual Plant Examination of External Events (IPEEE), Revision 1, March 21, 1994.

Table 1

Summary of Geotechnical Profile Data for Palisades Nuclear Plant

Depth Range (feet) ^a	Soil/Rock Description	Density (pcf) ^e	Shear Wave Velocity (fps) ^f	Compressional Wave Velocity (fps) ^h	Poisson's Ratio ^g
	Deepest structure foundation elevation – 564' (portion of auxiliary building)	---	---	---	---
^b	Ground surface elevation (589' mean sea level)	---	---	---	---
0-100 ^c	Brown dune sand	115	---	---	---
100-125 ^d	Brown dune sand, very compact	130	750	---	0.30 to 0.48
125-148	Grey fine-grained sand with trace of Silt	127	900	5400	0.48
148-170	Grey stiff clay	135	1000	5400	0.48
170-248	Gray very stiff gravelly sandy clay (glacial till)	140	1600	6700	0.48
248+	Black massive shale (top 10 feet weathered)	170	9500	10000	---

Notes: Embedment depth for containment building is approximately 14 to 21 feet below plant grade at 589 ft. Water table varies between elevations 580 ft and 585 ft.

- ^a Boring log for hole nearest containment building (boring no. 21 - see FSAR Figure 2-12 for variation in layer depth, use in conjunction with FSAR Figures 2-10, 2-11, and 2-13)
- ^b Control point was defined as being at the ground surface, in the free field (elevation 575 ft to 600 ft)
- ^c Dune sand from depth 0 ft to 100 ft was removed prior to plant construction
- ^d Plant grade for the area of the containment building is at depth 100 ft and at elevation 589 ft
- ^e Estimated densities (Reference 6)
- ^f Estimated shear wave velocities (Reference 6)
- ^g Estimated Poisson's ratios (Reference 6), (0.30 for dune sand above the water table))
- ^h See FSAR Figure 2-15

Figure 1A

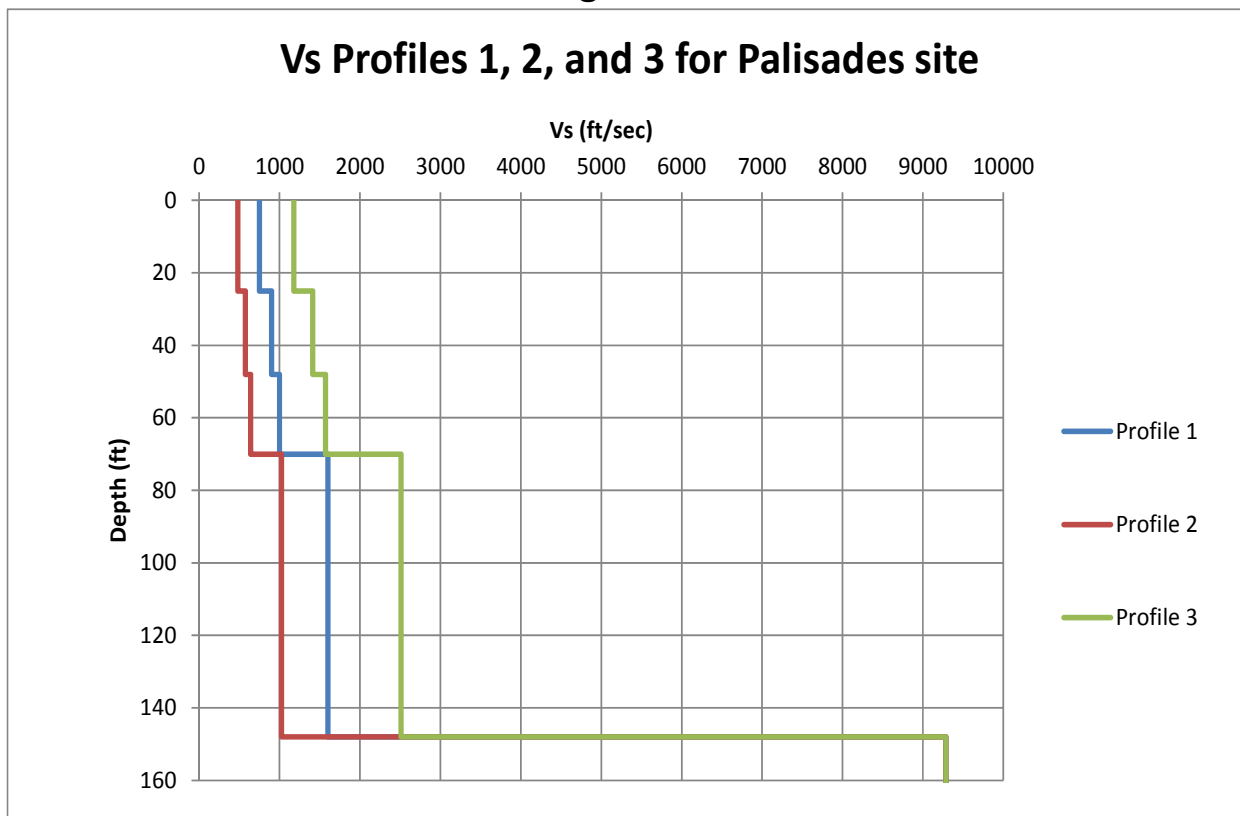


Figure 1B

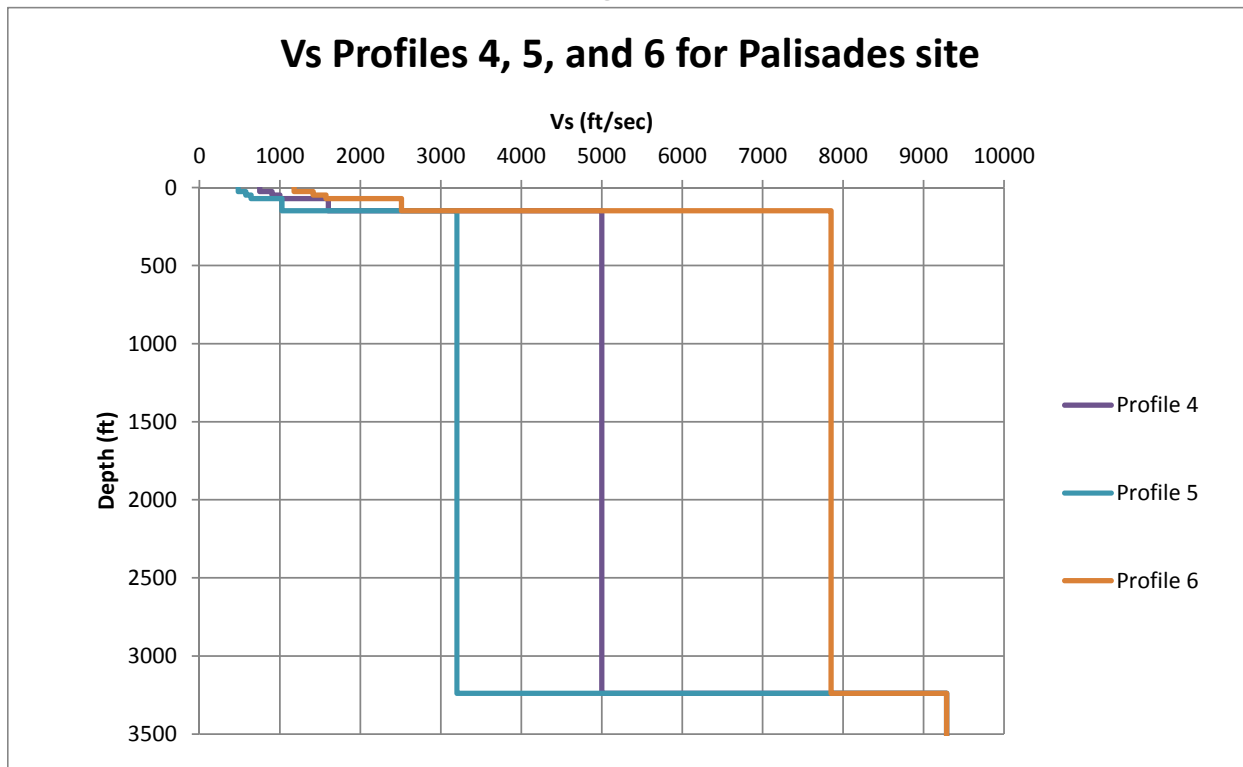


Table 2A

Layer Thicknesses, Depths, and Vs for Profiles 1, 2, and 3 for Palisades Nuclear Plant

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	750		0	480		0	1177
5.0	5.0	750	5.0	5.0	480	5.0	5.0	1177
5.0	10.0	750	5.0	10.0	480	5.0	10.0	1177
5.0	15.0	750	5.0	15.0	480	5.0	15.0	1177
5.0	20.0	750	5.0	20.0	480	5.0	20.0	1177
5.0	25.0	750	5.0	25.0	480	5.0	25.0	1177
3.0	28.0	900	3.0	28.0	576	3.0	28.0	1413
5.0	33.0	900	5.0	33.0	576	5.0	33.0	1413
5.0	38.0	900	5.0	38.0	576	5.0	38.0	1413
5.0	43.0	900	5.0	43.0	576	5.0	43.0	1413
5.0	48.0	900	5.0	48.0	576	5.0	48.0	1413
2.0	50.0	1000	2.0	50.0	640	2.0	50.0	1570
5.0	55.0	1000	5.0	55.0	640	5.0	55.0	1570
5.0	60.0	1000	5.0	60.0	640	5.0	60.0	1570
5.0	65.0	1000	5.0	65.0	640	5.0	65.0	1570
5.0	70.0	1000	5.0	70.0	640	5.0	70.0	1570
5.0	75.0	1600	5.0	75.0	1024	5.0	75.0	2512
5.0	80.0	1600	5.0	80.0	1024	5.0	80.0	2512
5.0	85.0	1600	5.0	85.0	1024	5.0	85.0	2512
5.0	90.0	1600	5.0	90.0	1024	5.0	90.0	2512
5.0	95.0	1600	5.0	95.0	1024	5.0	95.0	2512
5.0	100.0	1600	5.0	100.0	1024	5.0	100.0	2512
5.0	105.0	1600	5.0	105.0	1024	5.0	105.0	2512
5.0	110.0	1600	5.0	110.0	1024	5.0	110.0	2512
5.0	115.0	1600	5.0	115.0	1024	5.0	115.0	2512
5.0	120.0	1600	5.0	120.0	1024	5.0	120.0	2512
5.0	125.0	1600	5.0	125.0	1024	5.0	125.0	2512
5.0	130.0	1600	5.0	130.0	1024	5.0	130.0	2512
5.0	135.0	1600	5.0	135.0	1024	5.0	135.0	2512
5.0	140.0	1600	5.0	140.0	1024	5.0	140.0	2512
5.0	145.0	1600	5.0	145.0	1024	5.0	145.0	2512
3.0	148.0	1600	3.0	148.0	1024	3.0	148.0	2512
20.4	168.4	9285	20.4	168.4	9285	20.4	168.4	9285

Table 2B

Layer Thicknesses, Depths, and Vs for Profiles 4, 5, and 6 for Palisades Nuclear Plant

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	750		0	480		0	1177
5.0	5.0	750	5.0	5.0	480	5.0	5.0	1177
5.0	10.0	750	5.0	10.0	480	5.0	10.0	1177
5.0	15.0	750	5.0	15.0	480	5.0	15.0	1177
5.0	20.0	750	5.0	20.0	480	5.0	20.0	1177
5.0	25.0	750	5.0	25.0	480	5.0	25.0	1177
3.0	28.0	900	3.0	28.0	576	3.0	28.0	1413
5.0	33.0	900	5.0	33.0	576	5.0	33.0	1413
5.0	38.0	900	5.0	38.0	576	5.0	38.0	1413
5.0	43.0	900	5.0	43.0	576	5.0	43.0	1413
5.0	48.0	900	5.0	48.0	576	5.0	48.0	1413
2.0	50.0	1000	2.0	50.0	640	2.0	50.0	1570
5.0	55.0	1000	5.0	55.0	640	5.0	55.0	1570
5.0	60.0	1000	5.0	60.0	640	5.0	60.0	1570
5.0	65.0	1000	5.0	65.0	640	5.0	65.0	1570
5.0	70.0	1000	5.0	70.0	640	5.0	70.0	1570
5.0	75.0	1600	5.0	75.0	1024	5.0	75.0	2512
5.0	80.0	1600	5.0	80.0	1024	5.0	80.0	2512
5.0	85.0	1600	5.0	85.0	1024	5.0	85.0	2512
5.0	90.0	1600	5.0	90.0	1024	5.0	90.0	2512
5.0	95.0	1600	5.0	95.0	1024	5.0	95.0	2512
5.0	100.0	1600	5.0	100.0	1024	5.0	100.0	2512
5.0	105.0	1600	5.0	105.0	1024	5.0	105.0	2512
5.0	110.0	1600	5.0	110.0	1024	5.0	110.0	2512
5.0	115.0	1600	5.0	115.0	1024	5.0	115.0	2512
5.0	120.0	1600	5.0	120.0	1024	5.0	120.0	2512
5.0	125.0	1600	5.0	125.0	1024	5.0	125.0	2512
5.0	130.0	1600	5.0	130.0	1024	5.0	130.0	2512
5.0	135.0	1600	5.0	135.0	1024	5.0	135.0	2512
5.0	140.0	1600	5.0	140.0	1024	5.0	140.0	2512
5.0	145.0	1600	5.0	145.0	1024	5.0	145.0	2512
3.0	148.0	1600	3.0	148.0	1024	3.0	148.0	2512
20.4	168.4	5000	20.4	168.4	3200	20.4	168.4	7850
20.4	188.8	5000	20.4	188.8	3200	20.4	188.8	7850
20.4	209.2	5000	20.4	209.2	3200	20.4	209.2	7850
20.4	229.6	5000	20.4	229.6	3200	20.4	229.6	7850
20.4	250.0	5000	20.4	250.0	3200	20.4	250.0	7850
22.6	272.6	5000	22.6	272.6	3200	22.6	272.6	7850

22.6	295.2	5000	22.6	295.2	3200	22.6	295.2	7850
22.6	317.8	5000	22.6	317.8	3200	22.6	317.8	7850
22.6	340.5	5000	22.6	340.5	3200	22.6	340.5	7850
22.6	363.1	5000	22.6	363.1	3200	22.6	363.1	7850
22.6	385.7	5000	22.6	385.7	3200	22.6	385.7	7850
22.6	408.3	5000	22.6	408.3	3200	22.6	408.3	7850
22.6	430.9	5000	22.6	430.9	3200	22.6	430.9	7850
22.6	453.5	5000	22.6	453.5	3200	22.6	453.5	7850
22.6	476.1	5000	22.6	476.1	3200	22.6	476.1	7850
23.9	500.0	5000	23.9	500.0	3200	23.9	500.0	7850
152.1	652.1	5000	152.1	652.1	3200	152.1	652.1	7850
152.1	804.2	5000	152.1	804.2	3200	152.1	804.2	7850
164.0	968.2	5000	164.0	968.2	3200	164.0	968.2	7850
164.0	1132.3	5000	164.0	1132.3	3200	164.0	1132.3	7850
164.0	1296.3	5000	164.0	1296.3	3200	164.0	1296.3	7850
164.0	1460.3	5000	164.0	1460.3	3200	164.0	1460.3	7850
164.0	1624.4	5000	164.0	1624.4	3200	164.0	1624.4	7850
164.0	1788.4	5000	164.0	1788.4	3200	164.0	1788.4	7850
164.0	1952.5	5000	164.0	1952.5	3200	164.0	1952.5	7850
164.0	2116.5	5000	164.0	2116.5	3200	164.0	2116.5	7850
164.0	2280.6	5000	164.0	2280.6	3200	164.0	2280.6	7850
164.0	2444.6	5000	164.0	2444.6	3200	164.0	2444.6	7850
164.0	2608.6	5000	164.0	2608.6	3200	164.0	2608.6	7850
164.0	2772.7	5000	164.0	2772.7	3200	164.0	2772.7	7850
164.0	2936.7	5000	164.0	2936.7	3200	164.0	2936.7	7850
301.8	3238.6	5000	301.8	3238.6	3200	301.8	3238.6	7850
3280.8	6519.4	9285	3280.8	6519.4	9285	3280.8	6519.4	9285