



ND-2013-0002
January 11, 2013

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

Subject: **PSEG Early Site Permit Application**
Docket No. 52-043
Response to Request for Additional Information, RAI No. 61, Vibratory
Ground Motion

- References:
- 1) PSEG Power, LLC Letter No, ND-2012-0031 to USNRC, Submittal of Revision 1 of the Early Site Permit Application for the PSEG Site, dated May 21, 2012
 - 2) RAI No. 61, SRP Section: 02.05.02 – Vibratory Ground Motion, dated June 7, 2012 (eRAI 6488)
 - 3) PSEG Power, LLC Letter No, ND-2012-0045 to USNRC, Schedule for Response to Request for Additional Information, RAI No. 61, Vibratory Ground Motion, dated August 21, 2012
 - 4) PSEG Power, LLC Letter No, ND-2012-0057 to USNRC, Response to Request for Additional Information, RAI No. 61, Vibratory Ground Motion, dated October 2, 2012
 - 5) PSEG Power, LLC Letter No, ND-2012-0073 to USNRC, Response to Request for Additional Information, RAI No. 61, Vibratory Ground Motion, dated October 26, 2012
 - 6) PSEG Power, LLC Letter No, ND-2012-0079 to USNRC, Response to Request for Additional Information, RAI No. 61, Vibratory Ground Motion, dated December 20, 2012

DO79
H&O

The purpose of this letter is to provide a response to the request for additional information (RAI) provided in Reference 2 above. This RAI addresses the Vibratory Ground Motion, as described in Subsection 2.5.2 of the Site Safety Analysis Report (SSAR), as submitted in Part 2 of the PSEG Site Early Site Permit Application, Revision 1.

The schedule for the response to Question 02.05.02-10 is provided in Reference 3.

Enclosure 1, which addresses the effects of NUREG-2115 on potential for liquefaction and proposed revisions to SSAR Subsections 2.5.2.5, 2.5.2.6, and 2.5.4, provides our fourth of four planned response submittals for RAI No. 61.

Enclosure 2 includes a CD-ROM containing the proposed revisions to the SSAR, Calculation 360-RAI-061-10, revised SSAR Figures 2.5.2-34 through 2.5.2-37 and 2.5.2-40 through 2.5.2-55, new SSAR Figures 2.5.2-77 through 2.5.2-81, and revised SSAR Figures 2.5.4.7-21 through 2.5.4.7-28 associated with the response to RAI No. 61.

Enclosure 3 includes the new regulatory commitment established in this submittal.

If any additional information is needed, please contact David Robillard, PSEG Nuclear Development Licensing Engineer, at (856) 339-7914.

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

Sincerely,

A handwritten signature in cursive script, appearing to read "James Mallon".

James Mallon
Early Site Permit Manager
Nuclear Development
PSEG Power, LLC

Enclosure 1: Response to NRC Request for Additional Information, RAI No. 61,
Question No. 02.05.02-10, SRP Section: 02.05.02 – Vibratory Ground
Motion

Enclosure 2: CD-ROM containing:

- Proposed Revisions Part 2 - Site Safety Analysis Report (SSAR),
Subsection 2.5.2 – Vibratory Ground Motion and Subsection 2.5.4 –
Stability of Subsurface Materials and Foundations
- Calculation 360-RAI-061-10
- SSAR Figures 2.5.2-34 through 2.5.2-37 and 2.5.2-40 through 2.5.2-55
(revised), 2.5.2-77 through 2.5.2-81 (new), and 2.5.4.7-21 through
2.5.4.7-28 (revised)

Enclosure 3: Summary of Regulatory Commitments

cc: USNRC Project Manager, Division of New Reactor Licensing, PSEG Site
(w/enclosures)
USNRC Environmental Project Manager, Division of New Reactor Licensing
(w/enclosures)
USNRC Region I, Regional Administrator (w/enclosures)

PSEG Letter ND-2013-0002, dated January 11, 2013

ENCLOSURE 1

Response to RAI No. 61

Question No.

02.05.02-10, SRP Section: 02.05.02 – Vibratory Ground Motion

Response to RAI No. 61, Question No. 02.05.02-10:

In Reference 2, the NRC staff asked PSEG for information regarding the Vibratory Ground Motion as described in Subsection 2.5.2 of the Site Safety Analysis Report. The specific request for Question No. 02.05.02-10 was:

This request for additional information (RAI) specifically addresses Recommendation 2.1 of the Fukushima Near-Term Task Force recommendations contained in SECY-12-0025, as it pertains to the seismic hazard evaluation. This Recommendation specifies the use of NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities" (CEUS-SSC), in a site probabilistic seismic hazard analysis (PSHA). The NRC staff issued NUREG-2115 in January 2012, marking the completion of approximately four years of collaborative work between NRC, the Department of Energy, and the Electric Power Research Institute.

Consistent with Recommendation 2.1, as well as the need to consider the latest available information in the PSHA for the PSEG proposed reactor site, the NRC staff requests that PSEG Power, LLC and PSEG Nuclear, LLC:

a) Evaluate the potential impacts of the newly released CEUS-SSC model, with potential local and regional refinements as identified in the CEUS-SSC model, on the seismic hazard curves and the site-specific ground motion response spectra (GMRS). For re-calculation of the PSHA, please follow either the cumulative absolute velocity (CAV) filter or minimum magnitude specifications outlined in Attachment 1 to Seismic Enclosure 1 of the March 12, 2012, 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." (ML12053A340)

b) Modify the site-specific GMRS if you determine changes are necessary given the evaluation performed in part a) above.

PSEG Response to NRC RAI:

Applying the Central and Eastern United States Seismic Source Characterization (CEUS-SSC) (NUREG-2115) methodology to the PSEG Site requires revisions of portions of SSAR Subsections 2.5.1, most of 2.5.2, and portions of 2.5.3 and 2.5.4. A sequential program of the work necessary to respond to the RAI is outlined below:

- Compile an updated seismicity catalog for the whole CEUS-SSC study region and for the PSEG Site region.
- Using the updated seismicity catalog, develop the Probabilistic Seismic Hazard Analysis (PSHA) for the PSEG Site by applying the seismic source characterization described in NUREG-2115.

- Conduct deaggregation of hazards and identify magnitudes and distances appropriate to represent rock spectral shapes for site response calculations.
- Develop controlling low frequency and high frequency earthquakes and Uniform Hazard Response Spectra (UHRS).
- Review dynamic soil profiles and modify as necessary.
- Perform site response analysis using the minimum magnitude specifications from Attachment 1 to the March 12, 2011 letter, as specified in the RAI (no cumulative absolute velocity (CAV) filter applied).
- Develop new vertical and horizontal Ground Motion Response Spectra (GMRS).
- Review SSAR Subsections 2.5.1, 2.5.2, 2.5.3, and 2.5.4 and revise as appropriate.

Reference 4 provides information regarding the updated earthquake catalog.

Reference 5 provides information regarding the development of the PSHA using the updated earthquake catalog and the methodology of NUREG-2115.

Reference 6 provides information regarding the development of the new vertical and horizontal GMRS using the PSHA developed using the methodology of NUREG-2115.

The following summarizes the tasks completed for this portion of the RAI No. 61, Question No. 02.05.02-10 response:

- Prepare revised SSAR Subsections 2.5.2.5 and 2.5.2.6.
- Review SSAR Subsection 2.5.4 considering application of NUREG-2115 and perform necessary updates for items where data from EPRI-SOG work was used.
- Prepare revised SSAR Subsections 2.5.4.7, 2.5.4.8, and 2.5.4.9.

Discussion of the above tasks is provided below.

Prepare revised SSAR Subsections 2.5.2.5 and 2.5.2.6

Updated SSAR Subsections 2.5.2.1 through 2.5.2.4 are provided in Reference 6. The information in Subsections 2.5.2.5 and 2.5.2.6 was reviewed for this response and modified to reflect use of the CEUS (NUREG-2115) as a basis for calculating the GMRS.

Review SSAR Subsection 2.5.4

Review of SSAR Subsection 2.5.4 determined that use of NUREG-2115 for seismicity analyses in SSAR Subsection 2.5.2 affects only the values for the GMRS used in Standard Penetration Test (SPT)-based liquefaction screening in Subsection 2.5.4.8.3 and the discussion of the earthquake design basis in Subsection 2.5.4.9. Liquefaction screening using the SPT-based approach uses the GMRS ground acceleration at 100 Hz Peak Ground Acceleration (PGA) as an input to the calculation. As discussed in

Reference 6, the value of GMRS at 100 Hz using the CEUS-SSC (NUREG-2115) is 0.225g, which is greater than the value presented in existing Subsection 2.5.4.8.3 (0.18g). Calculation 360-RAI-061-10 examines the effect of the higher input acceleration on the calculated factors of safety against liquefaction (Reference RAI-61-10-13).

The results of the calculation, summarized in Table RAI-61-10-14, show an increase in the numbers of samples with factors of safety less than or equal to 1.1 from 3 to 17, and an increase in the numbers of samples with factors of safety greater than 1.1 but less than 1.4 from 9 to 15. The total number of samples reviewed is 257. Distribution of the samples with low factors of safety within the Vincentown Formation, the formation at and below the level of the competent layer, is illustrated on Figures RAI-61-10-66 and RAI-61-10-67. The SPT-based screening calculation results indicate the potentially liquefiable soils in the Vincentown Formation are isolated zones surrounded by denser materials, not a continuous layer.

In the response to RAI 64, Question 02.05.04-22, consideration of the effects of overconsolidation ratio and coefficient of lateral earth pressure at rest resulted in preparation of several RAI figures illustrating the results. SSAR Subsection 2.5.4.7 is revised to update the appropriate text, tables, and figures from the RAI 64, Question 02.05.04-22 response.

References:

RAI-61-10-13 AMEC Environment and Infrastructure, Inc., PSEG2-924, Calculation RAI-360-061-10, Rev. 2, "Updated SPT-based Liquefaction Screening Based on GMRS from NUREG-2115 (CEUS SSC) Site Seismicity Analysis", January, 2013

Associated PSEG Site ESP Application Revisions:

Enclosure 2 contains proposed revisions to SSAR Subsections 2.5.2.5 and 2.5.2.6. SSAR Tables 2.5.2-17 through 2.5.2-24 are revised. SSAR Figures 2.5.2-34 through 2.5.2-55 are revised, except SSAR Figures 2.5.2-38 and 2.5.2-39 are no longer used. SSAR Figures 2.5.2-77 through 2.5.2-81 are added. Two versions of the SSAR markups are provided; a blackline version that shows additions (in red) and deletions (strikethrough), and a hidden version (deletions hidden) to enhance readability.

Enclosure 2 also contains proposed revisions to SSAR Subsections 2.5.4.7.5, 2.5.4.8.3, and 2.5.4.9, Tables 2.5.4.7-5 and 2.5.4.8-2, and SSAR Figures 2.5.4.7-21 through 2.5.4.7-28.

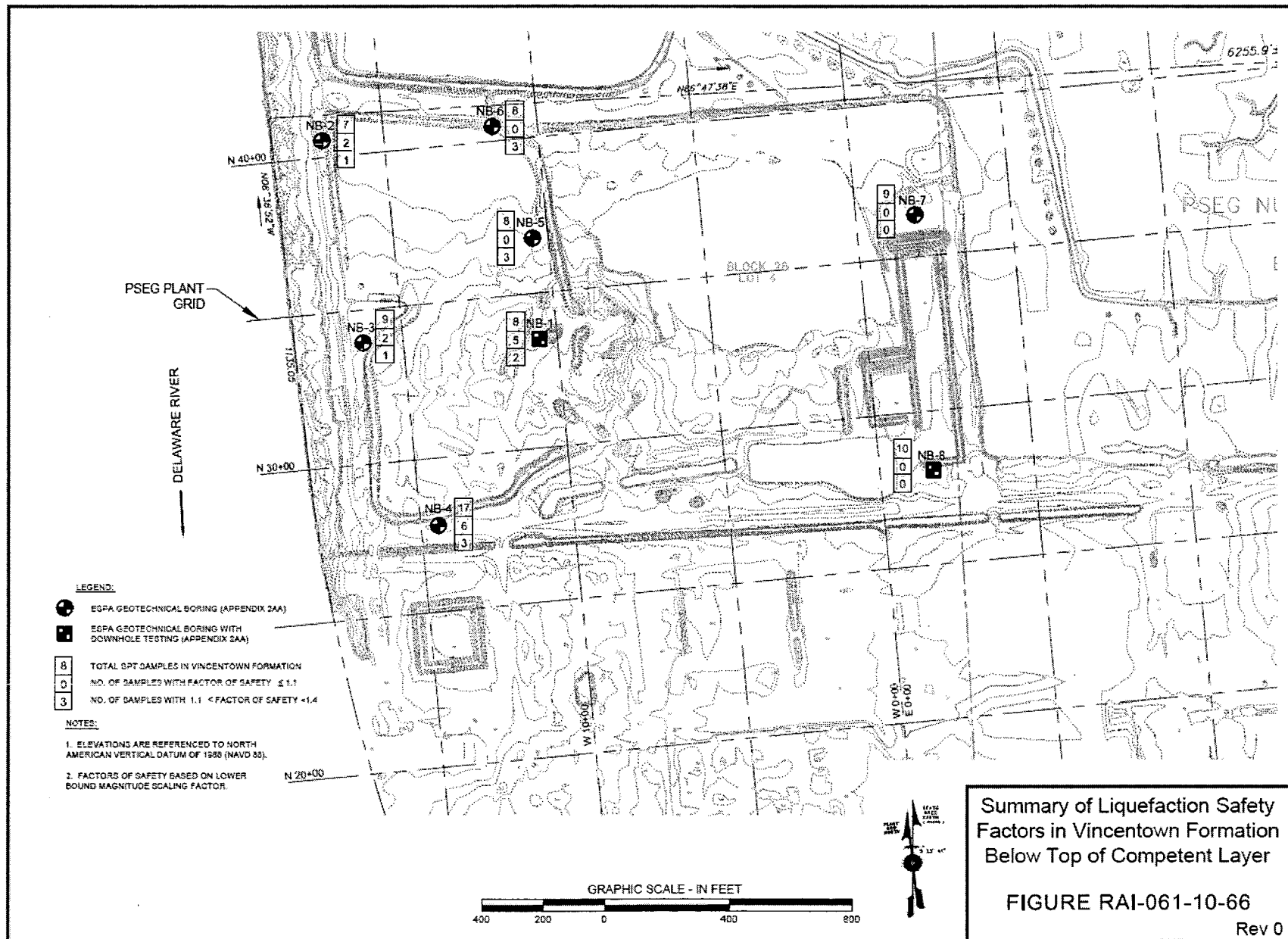
Table RAI-61-10-14

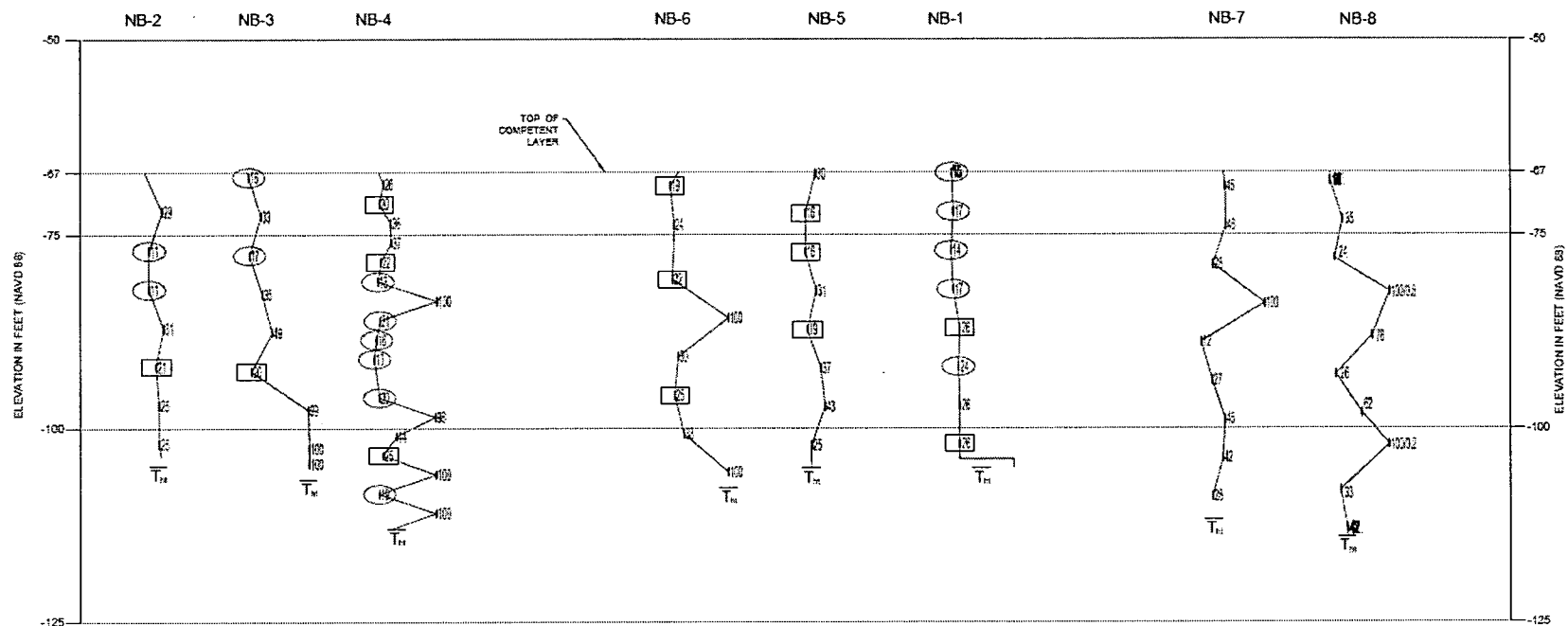
Summary of Liquefaction Safety Factors (FS) for each Geologic Formation

Formation No.	Formation Name	Safety Factor ^{(a), (b)}			Distribution of Safety Factors		
		Minimum	Maximum	Average	FS≤1.1	1.1<FS<1.4	1.4≥FS
4	Vincentown	0.8	10.0	3.6	15	13	48
5	Hornerstown	1.0	8.1	3.7	1	2	30
6	Navesink	2.8	21.4	8.1	0	0	44
7	Mount Laurel	1.4	11.6	9.0	0	0	90
8	Wenonah	0.9	2.4	1.7	1	0	1
9	Mashalltown	1.5	7.5	4.5	0	0	5
10	Englishtown	2.6	2.6	3.2	0	0	1
11	Woodbury	NL	NL	NL	0	0	0
12	Merchantville	NL	NL	NL	0	0	0
13	Magothy	6.1	6.7	6.5	0	0	3
14	Potomac	5.8	6.0	6.0	0	0	3
Total =					17	15	225

a) NL = Non-liquefiable silts and clays (USCS designations CL, CH, ML, MH, CL-ML, CH-MH).

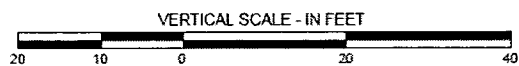
b) Safety factors based on lower bound Magnitude Scaling Factor.





- LEGEND:**
- SAMPLE WITH FACTOR OF SAFETY ≤ 1.1
 - SAMPLE WITH $1.1 < \text{FACTOR OF SAFETY} < 1.4$
 - N/7 STANDARD PENETRATION TEST (SPT) N-VALUE
 - T_{ht} TOP OF HORNERSTOWN FORMATION

- NOTES:**
1. MATERIALS ABOVE TOP OF COMPETENT LAYER WILL BE REMOVED.
 2. FACTORS OF SAFETY BASED ON LOWER BOUND MAGNITUDE SCALING FACTOR.



Vertical Distribution of
Liquefaction Safety Factors
(Vincentown Formation)

FIGURE RAI-061-10-67

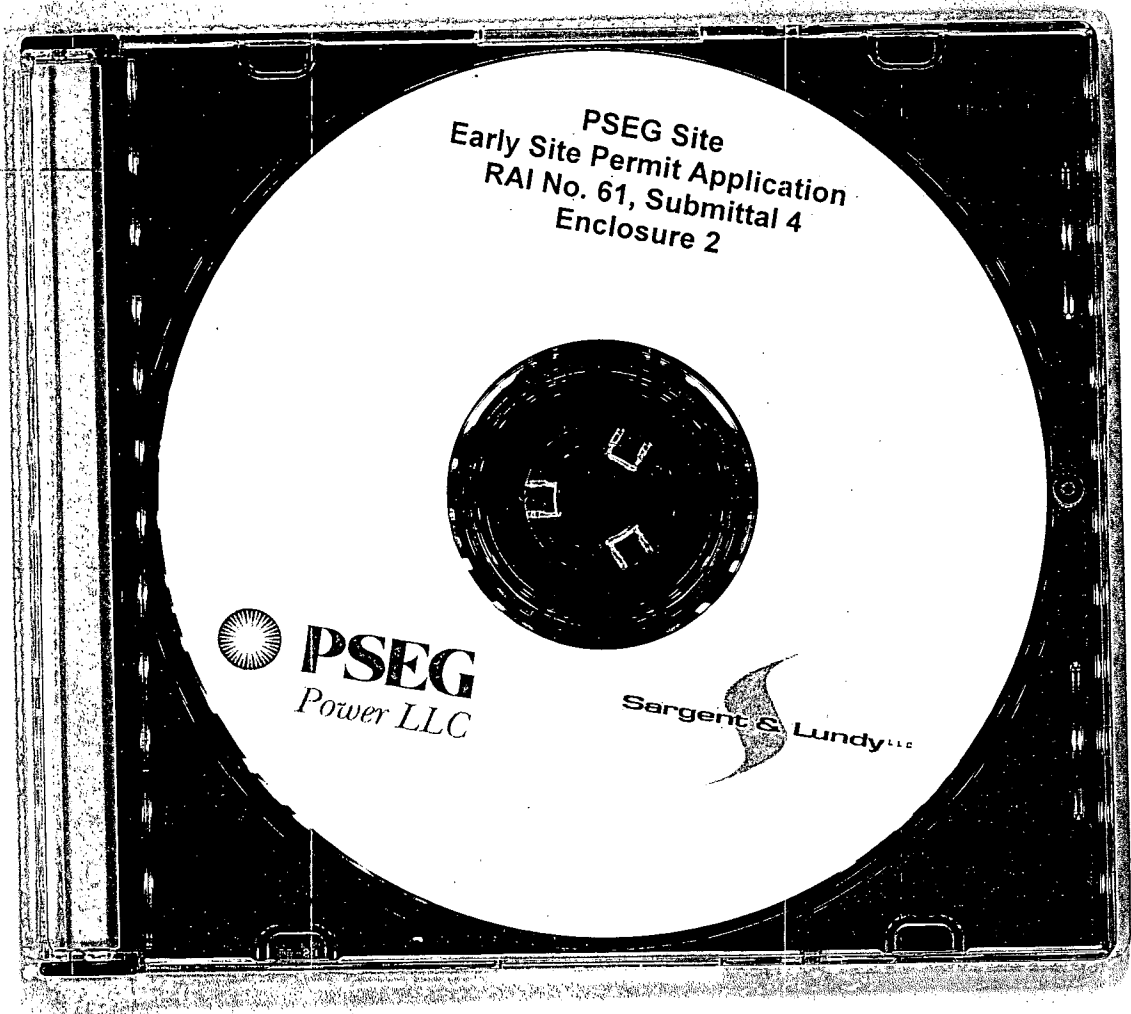
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PSEG Letter ND-2013-0002, dated January 11, 2013

ENCLOSURE 2

CD-ROM containing:

- **Proposed Revisions Part 2 - Site Safety Analysis Report (SSAR)
Subsection 2.5.2 – Vibratory Ground Motion**
- **Proposed Revisions Part 2 – Site Safety Analysis Report (SSAR)
Subsection 2.5.4 – Stability of Subsurface Materials and Foundations**
- **360-RAI-061-10, “Updated SPT-based Liquefaction Screening Based
on GMRS from NUREG-2115 (CEUS SSC) Site Seismicity Analysis”**
- **SSAR Figures 2.5.2-34 through 2.5.2-37 and 2.5.2-40 through 2.5.2-55
(revised), 2.5.2-77 through 2.5.2-81 (new) and Figures 2.5.4.7-21
through 2.5.4.7-28 (revised)**



PSEG Letter ND-2013-0002, dated January 11, 2013

ENCLOSURE 3

Summary of Regulatory Commitments

ENCLOSURE 3

SUMMARY OF REGULATORY COMMITMENTS

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

COMMITMENT	COMMITTED DATE	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	Programmatic (Yes/No)
PSEG will revise SSAR Subsections 2.5.2.5 and 2.5.2.6, 2.5.4.7 through 2.5.4.9, and SSAR Figures 2.5.2-34 through 2.5.2-37 and 2.5.2-40 through 2.5.2-55 (revised), 2.5.2-77 through 2.5.2-81 (new) and Figures 2.5.4.7-21 through 2.5.4.7-28 (revised) to incorporate the changes in Enclosure 2 in response to NRC RAI No. 61.	This revision will be included in a future update of the PSEG ESP application.	Yes	No