

## PSEGSPeRAIPEm Resource

---

**From:** Chowdhury, Prosanta  
**Sent:** Thursday, December 01, 2011 11:30 AM  
**To:** 'PSEGRAIResponses@pseg.com'  
**Cc:** PSEGSPeRAIPEm Resource; 'James.Mallon@pseg.com'; 'David.Robillard@pseg.com'; Segala, John; Silvia, Andrea; Clark, Phyllis; McLellan, Judith; Plaza-Toledo, Meralis; Karas, Rebecca  
**Subject:** PSEG Site ESPA FINAL RAI 42 (eRAI 6160) SRP-02.05.01 (RGS1)  
**Attachments:** PSEG Site ESPA Final RAI 42 (eRAI 6160).pdf

Please find attached RAI 42 for the PSEG Site ESP Application. A draft of the RAI was provided to you on November 14, 2011. You informed via email on November 30, 2011, that you would not need a clarification call involving this specific RAI, and therefore, we are issuing this RAI as final with no changes made to it.

The schedule we have established for review of your application assumes technically correct and complete responses within 30 calendar days of receipt of RAIs; however, you requested via email on November 30, 2011, that due to the number of questions and the complexity of some of the questions, the response duration be 45 days rather than the usual 30 days, and mentioned that you would need the additional time specifically to complete the development of the responses to Questions 02.05.01-3, 02.05.01-4, 02.05.01-7, 02.05.01-11, and 02.05.01-13. After reviewing your request, we concluded that a 45-day response period is acceptable for this RAI. As our standard practice, we will assess any impact the additional response time may have on the review schedule. If this RAI cannot be responded to within 45 calendar days, it is expected that a date for receipt of this information will be provided to the staff within the 30-calendar day period so that the staff can assess how this information will impact the published schedule.

If you have any questions, please contact me.

Prosanta Chowdhury  
Project Manager  
EPR Projects Branch  
Division of New Reactor Licensing  
Office of New Reactors  
301-415-1647

**Hearing Identifier:** PSEG\_Site\_EarlySitePermit\_RAI  
**Email Number:** 88

**Mail Envelope Properties** (320204600EA7B9408FE833FF15E4FF7D7F5A504DC6)

**Subject:** PSEG Site ESPA FINAL RAI 42 (eRAI 6160) SRP-02.05.01 (RGS1)  
**Sent Date:** 12/1/2011 11:29:40 AM  
**Received Date:** 12/1/2011 11:29:41 AM  
**From:** Chowdhury, Prosanta

**Created By:** Prosanta.Chowdhury@nrc.gov

**Recipients:**

"PSEGESPeRAIPEm Resource" <PSEGESPeRAIPEm.Resource@nrc.gov>

Tracking Status: None

"James.Mallon@pseg.com" <James.Mallon@pseg.com>

Tracking Status: None

"David.Robillard@pseg.com" <David.Robillard@pseg.com>

Tracking Status: None

"Segala, John" <John.Segala@nrc.gov>

Tracking Status: None

"Silvia, Andrea" <Andrea.Silvia@nrc.gov>

Tracking Status: None

"Clark, Phyllis" <Phyllis.Clark@nrc.gov>

Tracking Status: None

"McLellan, Judith" <Judith.McLellan@nrc.gov>

Tracking Status: None

"Plaza-Toledo, Meralis" <Meralis.Plaza-Toledo@nrc.gov>

Tracking Status: None

"Karas, Rebecca" <Rebecca.Karas@nrc.gov>

Tracking Status: None

"PSEGRAIResponses@pseg.com" <PSEGRAIResponses@pseg.com>

Tracking Status: None

**Post Office:** HQCLSTR01.nrc.gov

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	1565	12/1/2011 11:29:41 AM
PSEG Site ESPA Final RAI 42 (eRAI 6160).pdf		73995

**Options**

**Priority:** Standard

**Return Notification:** No

**Reply Requested:** No

**Sensitivity:** Normal

**Expiration Date:**

**Recipients Received:**

Request for Additional Information No. 42

Application Revision 0

FINAL

12/01/2011

PSEG Site ESP

PSEG Power LLC, PSEG Nuclear LLC

Docket No. 52-043

SRP Section: 02.05.01 - Basic Geologic and Seismic Information

Application Section: 2.5.1

QUESTIONS for Geosciences and Geotechnical Engineering Branch 1 (RGS1)

02.05.01-1

SSAR Subsection 2.5.1.1.1.3, "Piedmont Physiographic Province," describes drainages (including the Potomac, Susquehanna, and Delaware Rivers) near the "fall line" (or Fall Zone) that have complex longitudinal profiles and show right stepping bends. However, SSAR Subsection 2.5.1.1.1.3 does not discuss whether the bends in the river drainages are related to uplift or whether they are related to tectonic or non-tectonic processes. SSAR Subsection 2.5.1.1.2.7, "Cenozoic Passive Margin Development," states that variations in subsidence have formed local arches and basins (e.g., the South New Jersey Arch and the Salisbury Embayment) within the Coastal Plain; that the Coastal Plain is being loaded isostatically by fluvial deposition; and that the Fall Zone is a topographic escarpment dominantly controlled by lithologic contrasts. These statements in SSAR Subsection 2.5.1.1.2.7 suggest that the Fall Zone is non-tectonic in character but does not include any specific references.

In order for the staff to fully evaluate features in the vicinity of the "fall line" (or Fall Zone) and to fully understand the tectonic or non-tectonic origin of these features, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide references to support the interpretation that the primary influence on the development of uplifts and embayments near the Fall Zone is related to variations in subsidence. Please also provide references to support that development of the Fall Zone is primarily due to lithologic contrasts rather than faulting. In addition, please discuss the existing evidence that faulting along the Fall Zone may be at least a secondary effect for development of this zone.

02.05.01-2

SSAR Figure 2.5.1-10 shows two squared symbols with different colors that the legend defines as "feature identified at only one location" and refers to SSAR References 2.5.1-40 and 2.5.1-173. Reference 2.5.1-173 refers to an index of faults of Cretaceous and Cenozoic age in the eastern US, while Reference 2.5.1-40 is related to data for Quaternary faults and tectonic features in the central and eastern US. The staff notes that no particular features are mentioned for these two icons and, in addition, Figure 2.5.1-10 shows Quaternary faults with a different symbol.

In order for the staff to assess the tectonic and structural features within the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please indicate what particular structures are associated with the squared icons labeled as "feature identified at only one location".

#### 02.05.01-3

SSAR Subsection 2.5.1.1.4, "Regional Tectonic Setting," states that no structures identified in the site region since 1986 indicate a need to alter the treatment of seismogenic potential as accomplished by EPRI in 1986. SSAR Subsection 2.5.1.1.4.2 describes principal tectonic structures in the site region but does not include a discussion of the concepts presented by Sykes and others (2008) related to the Peekskill-Stamford seismic boundary.

In order for the staff to fully evaluate the regional tectonic setting of the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide additional information regarding potential seismic hazard related to the northwest-trending Peekskill-Stamford seismic boundary.

#### 02.05.01-4

SSAR Subsection 2.5.1.1.4.2.4.1, "The Hypothesized Fault of Pazzaglia (1993)," describes a fault proposed in 1993 by Pazzaglia that may affect Quaternary sediments along the Fall Zone in MD. SSAR Subsection 2.5.1.1.4.2.4.1 states that "no indicators of faulting" were found by field and aerial reconnaissance performed for the PSEG site and concludes that this feature, if it exists, is not a capable tectonic structure. This postulated structure is projected into the site vicinity, as shown in SSAR Figures 2.5.1-16 and 2.5.3-1. The staff notes that other researchers, some of whom are cited by the applicant, have also postulated Quaternary faulting along the Fall Zone or beneath Coastal Plain sediments at various other Atlantic coast locations (e.g., Mixon and Newall, 1977; Prowell, 1983; Mixon and Powars, 1984; Newell, 1985; Benson, 1990; Pazzaglia and Gardner, 1944; McLaurin and Harris, 2001).

In order for the staff to fully evaluate Quaternary deformation within the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information,"

- 1) please provide information on what field data were specifically used to conclude that the proposed fault of Pazzaglia (1993), if it exists, is not a capable tectonic structure since it projects into the site vicinity.
- 2) please discuss the interpretations by other researchers who have postulated the existence of Quaternary faulting along the Fall Zone or beneath Coastal Plain sediments at various other Atlantic coast locations and discuss whether these other interpretations were considered in evaluating potential faulting associated with the proposed fault of Pazzaglia.

#### 02.05.01-5

In regard to the River Bend Trend and the projected extension of the Stafford Fault of Marple (2004) along the Fall Line into the site vicinity (as shown in FSAR Figures 2.5.1-16 and 2.5.3-1), SSAR Subsection 2.5.1.1.4.2.4.3, "River Bend Trend/Stafford Fault of Marple (2004)," states that the river bends, which Marple (2004) proposed to be related to faulting along the northeast-striking, Tertiary age Stafford Fault, likely represent the migration of the rivers from older entrenched channels in resistant Piedmont rocks to lower-gradient meandering streams flowing across less-competent Coastal Plain sediments.

In order for the staff to fully evaluate the potential for Quaternary faulting in the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please describe any field locations that were visited to examine exposed Quaternary stratigraphic units and to document the conclusion that the River Bend Trend, noted in the site vicinity, is not related to Quaternary faulting. In addition, please provide more complete references to support the interpretation that the River Bend Trend is not related to Quaternary faulting.

#### 02.05.01-6

SSAR Subsection 2.5.1.1.4.2.4.4 describes the National Zoo Faults in Washington, D.C. and states that these faults are "probably Tertiary in age." In order for the staff to fully evaluate the potential for Quaternary faulting in the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide references and/or field data to document the conclusion that the National Zoo Faults are probably Tertiary in age.

#### 02.05.01-7

SSAR Subsection 2.5.1.1.4.2.5.11, "Ramapo Fault," discusses the Ramapo fault and references work by Sykes et al. (2008) that labels the Ramapo fault as Mesozoic in age and work by Ratcliffe (1982 and 1990) that indicates Quaternary units are not offset by the Ramapo fault. FSAR Subsection 2.5.1.1.4.2.5.11 also states that some researchers have proposed Quaternary age displacement along the Ramapo fault (e.g., Aggrawal and Sykes, 1978) but that field evidence contradicts Quaternary activity on the Ramapo fault. The staff notes that Newman et al. (1987) proposed evidence for graben-like downfaulting and radiocarbon dates that may suggest more recent movement on the Ramapo fault

In order for the staff to fully understand the fault history of the Ramapo fault and the seismic hazard for the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide a discussion of data related to interpretations that the Ramapo fault may have experienced post-Mesozoic activity.

02.05.01-8

SSAR Figure 2.5.1-17 is a map of potential Quaternary features in the PSEG site region. The figure shows three square to rectangular shaded areas associated with the Central Virginia seismic zone, the Lancaster seismic zone and offset glaciated features. However, the staff notes that there is no explanation of these shaded areas provided in the legend for SSAR Figure 2.5.1-17.

In order for the staff to fully evaluate the Quaternary tectonic setting in the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please clarify the significance of the three shaded areas on SSAR Figure 2.5.1-17.

02.05.01-9

SSAR Subsection 2.5.1.1.4.2.5 states that Crone and Wheeler (2000) reported one Class A tectonic feature in the site region (associated with the Central Virginia seismic zone) that shows "potential evidence for Quaternary activity." This statement implies that there is some question as to whether or not the feature is Quaternary in age and is inconsistent with the definition of a Class A feature as defined in Crone and Wheeler (2000).

In order for the staff to fully evaluate the seismic hazard for the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please clarify in SSAR Section 2.5.1.1.4.2.5 the definition of a Class A tectonic feature to be consistent with the descriptions of this feature provided in SSAR 2.5.1.1.4.2.5.1 and with Crone and Wheeler (2000).

02.05.01-10

SSAR Subsection 2.5.1.1.4.2.5.4, "Everona-Mountain Run Fault Zone," cites Manspeizer et al. (1989) (SSAR Reference 2.5.1-117) who interpreted the Everona segment of the fault zone to offset Pleistocene (2.6 Ma to 10,000 yrs) gravels by about 5 ft in a reverse motion sense. SSAR Subsection 2.5.1.1.4.2.5.4 describes field analysis conducted along the Mountain Run fault zone in support of the North Anna ESP application.

In order for the staff to fully evaluate the Quaternary tectonic setting and seismic hazard in the site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please describe field investigations specifically associated with the Everona segment of the Everona-Mountain Run fault zone. Please explain whether field assessments of the Everona fault segment were used to conclude that the Everona-Mountain Run fault zone is not a capable tectonic source and describe any evidence that supports or contradicts the findings of Manspeizer et al. (1989).

02.05.01-11

SSAR Subsection 2.5.1.1.4.2.5.5, "New Castle County Faults," states that based on aerial and field reconnaissance, no evidence of disrupted topography or Quaternary deformation along lineaments was identified in satellite imagery or above any of the faults mapped in basement; however those images were not included in the SSAR.

In order for the staff to understand the basis for the conclusion that no Quaternary deformation was identified at the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide images used to conclude that there is no evidence of surface deformation. Also, please explain the specific topographic features used to draw the conclusion that there is no Quaternary deformation at the site region.

#### 02.05.01-12

SSAR Subsection 2.5.1.1.4.2.5.13, "Dobb's Ferry Fault Zone," states that the best estimate for timing of displacement along the Dobb's Ferry fault zone (i.e., Paleozoic or younger) is based on the oldest rock deformed. However, no field relationships are described to suggest a possible age for youngest displacement along the fault zone.

In order for the staff to fully evaluate the seismic hazard associated with the Dobb's Ferry fault zone (including the minimum age for most recent displacement along the fault zone), and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide information on observed field relationships to clarify the age of the youngest rock unit deformed by the Dobb's Ferry fault zone.

#### 02.05.01-13

SSAR Subsection 2.5.1.1.4.2.5.17, "East Coast Fault System," describes the hypothetical nature of the proposed northern segment of the East Coast fault system (ECFS) and states that its existence is based only on "a variety of anomalous river characteristics" and that no coincidence with faulting has been demonstrated.

In order for the staff to fully evaluate the potential for Quaternary deformation in the PSEG site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please describe the observed field relationships used to conclude that the ECFS is not a zone of Quaternary faulting in the PSEG site region.

#### 02.05.01-14

SSAR Subsection 2.5.1.1.6.1, "Site Regional Gravity Field and FSAR," states that portions of the low gravity anomaly located east of the PSEG site have been shown by seismic reflection to be associated with synrift sediments within a Mesozoic extensional basin. SSAR Subsection 2.5.1.1.6.3, "Discussion and Synthesis of Regional Gravity and Magnetic Fields," suggests that basins other than the Buena Basin may occur east of the site, but stated that the existence of these basins has not been proven. That statement (in SSAR Subsection 2.5.1.1.6.3) would appear to be in disagreement with the statement

in Subsection 2.5.1.1.6.1 indicating seismic reflection data showed a Mesozoic extensional basin east of the site. It is not clear based on reviewing SSAR Figures 2.5.1-20c and 2.5.1-23 if the gravity low identified to the east of the PSEG site and described in SSAR Subsection 2.5.1.1.6.1 is associated with the Buena Basin, or if is considered a separate basin.

In order for the staff to fully evaluate the gravity and magnetic features within the PSEG site region, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please clarify why the extensional basin (if other than the Buena Basin) suggested by seismic reflection at the location of the low gravity anomaly (located east of the PSEG site) is not indicated on the regional gravity field map (SSAR Figure 2.5.1-20c). Please clarify if the Mesozoic Basin feature identified in the seismic reflection data (discussed in SSAR Subsection 2.5.1.1.6.1) represents the Buena Basin, or another basin.

#### 02.05.01-15

SSAR Figure 2.5.1-40 is a structural contour map showing the top of the foundation bearing unit, the Vincentown formation. The legend states that the contour interval equals 2 feet. However, Figure 2.5.1-40 does not include contour values on the map.

In order for the staff to fully evaluate the vertical variation across the top of the foundation-bearing unit, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provided an updated SSAR Figure 2.5.1-40 that clearly identifies contour values on the map.

#### 02.05.01-16

Multiple sections in the SSAR (including SSAR Subsections 2.5.1.1.4.2.5.5, 2.5.1.2.2.1.1, and 2.5.1.2.4) reference investigations for the Summit Site. However, it is not clear to the staff the significance of the Summit Site to the PSEG site.

In order for the staff to fully evaluate conclusions made by the applicant related to the regional and site geology, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide a discussion of the Summit Site, the investigations that were performed for this site and the extent to which these investigations contributed to the PSEG site characterization.

#### 02.05.01-17

SSAR Subsection 2.5.1.2.5.1, "Dynamic Behavior During Prior Earthquakes," states that no field investigations (i.e., regional studies by Amick et al., 1990; review of aerial photography, both historic and recent; excavation mapping at the existing Hope Creek unit) have revealed the presence of earthquake-induced liquefaction features. SSAR Subsection 2.5.1.2.5.1 also states that physical properties of the soils at the proposed PSEG plant location are discussed in FSAR Section 2.5.4.7, "Response of Soil and



Rock to Dynamic Loading.” SSAR Section 2.5.4.7 (specifically Section 2.5.4.7.3, “Effects of Prior Earthquakes on Site”) indicates that there is little exposure for evaluating the presence of liquefaction features such as sand blows or fissures. However, these sections do not discuss the susceptibility of materials surrounding the PSEG site to earthquake-induced liquefaction, and what, if any, field investigations were conducted for the PSEG ESP Site to assess the presence of liquefaction features.

In order for the staff to fully understand and evaluate the seismic hazard at the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please provide a discussion of the materials surrounding the PSEG site that may be susceptible to earthquake-induced liquefaction. In addition, please describe any field investigations conducted for the ESP Site specifically to assess the presence or absence of liquefaction features in the site region, site vicinity, site area, and site location.

02.05.01-18

SSAR Subsection 2.5.1.2.5.2, “Zones of Mineralization, Alteration, Weathering, Structural Weakness,” states that karst terrain associated with dissolution of marble in the Cockeysville Formation (greater than 444 Ma) occurs about 20 mi northwest of the site in the Piedmont region of Delaware. Subsection 2.5.1.2.5.2 indicates that karst is not a hazard in the PSEG site area, or at the PSEG site. However, the SSAR does not state whether the Cockeysville Formation underlies the PSEG site at depth.

In order for the staff to fully evaluate the potential for karst development at the PSEG site, and in compliance with 10 CFR 100.23 and in conformance to NUREG 0800, Standard Review Plan, Section 2.5.1, "Basic Geologic and Seismic Information," please clarify whether the Cockeysville Formation underlies the site at depth.