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PSEG
*Power LLC*

ND-2011-0058
September 8, 2011

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

Subject: **PSEG Early Site Permit**
**NRC Docket No. 52-043**
**Response to Request for Additional Information, RAI No. 34, Short Term Atmospheric Dispersion Estimates for Accident Releases**

References:
1) PSEG Power, LLC letter to USNRC, Application for Early Site Permit for the PSEG Site, dated May 25, 2010
2) RAI No. 34, SRP Section: 02.03.04 - Short Term Atmospheric Dispersion Estimates for Accident Releases, dated August 10, 2011 (eRAI 5844)

The purpose of this letter is to respond to the request for additional information (RAI) identified in Reference 2 above. This RAI addresses Short Term Atmospheric Dispersion Estimates for Accident Releases, as described in Section 2.3.4. of the Site Safety Analysis Report (SSAR), as submitted in Part 2 of the PSEG Site Early Site Permit Application, Revision 0.

Enclosure 1 provides our response for RAI No. 34, Question No. 02.03.04-2. Our response to RAI No. 34 will require revisions to the SSAR. Enclosure 2 provides proposed revisions to the SSAR. 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.

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NRO

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 8th day of September, 2011.

Sincerely,

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

Enclosure 1: Response to NRC Request for Additional Information, RAI No. 34, Question No. 02.03.04-2, SRP Section: 02.03.04 - Short Term Atmospheric Dispersion Estimates for Accident Releases
Enclosure 2: Proposed Revisions Part 2 – Site Safety Analysis Report (SSAR) Subsections 2.3.2 and 2.3.4
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 Site and Environmental Reviews (w/enclosures)
USNRC Region I, Regional Administrator (w/enclosures)

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ENCLOSURE 1

RESPONSE to RAI No. 34, QUESTION 02.03.04-2

**Response to RAI No. 34, Question 02.03.04-2:**

In Reference 2, the NRC staff asked PSEG for information regarding Short Term Atmospheric Dispersion Estimates for Accident Releases, as described in Section 2.3.4 of the Site Safety Analysis Report (SSAR). The specific request for Question 02.03.04-2 was:

> *10 CFR 100.21(c)(2) requires that site atmospheric dispersion characteristics must be evaluated and dispersion parameters established such that radiological dose consequences of postulated accidents meet the criteria set forth in 10 CFR 50.34(a)(1). RG 1.111, Revision 1, states that for generating long term (annual average) $\chi/Q$ values, spatial and temporal variations of airflow should be considered at sites along and near coasts with significant land-water boundary layer effects on airflow and sea-land breeze circulations. SSAR Section 2.3.2.2.1.2 describes the complex wind patterns at the PSEG site that are caused in part by Delaware Bay breezes and local shoreline breezes.*
>
> *The staff notes that in the PAVAN input/output files that have been provided in a February 25, 2011, response (ML110680201) to RAI 5, Question 02.03.04-1 (ML110280495), adjustments for the potential effects of land-water boundaries on the annual average $\chi/Q$ values generated by PAVAN have not been addressed.*
>
> *Update Section 2.3.4 of the SSAR to include the $\chi/Q$ values that consider and account for the potential effects of land-water boundaries, or provide justification as to why this is not necessary for the PSEG site.*

**PSEG Response to NRC RAI:**

This question addresses PSEG Site Early Site Permit Application (ESPA), Part 2, SSAR Subsections 2.3.2.2.1.2 "On-Site Wind Roses during Three Year Period", and 2.3.4 "Short-Term (Accident) Diffusion Estimates."

As stated in PSEG Site ESPA, SSAR Subsection 2.3.2.2.1.2, "On-Site Wind Roses during Three Year Period", the annual on-site wind rose reflects a complex mix of several minor airflow phenomena. The intended context is that the mix is complex, not the airflows themselves. There are frequent annual site winds from the southeast, which include airflow from over the smooth surface of the Delaware Bay. Sea breeze regimes that are often present at regional sites directly on the Atlantic Ocean generally do not affect the PSEG Site, and there is no evidence of substantial alteration of the synoptic airflow or of closed mesoscale circulations at that site.

The PSEG Site is located on a man-made island in the Delaware River. It is located at a point where the river gradually widens into the Delaware Bay. From the site northward, the river is less than five kilometers (three miles) wide. South of the site, the river opens up into the bay, which eventually empties into the Atlantic Ocean,

approximately 52 miles to the south-southeast of the PSEG Site. Since this site is not located on the coastline of a large body of water, such as an ocean or the Great Lakes, it should not be considered a coastal location. The site is not subject to the frequent sea-breeze mesoscale circulations that arise from the differential heating of the land and water surfaces and are commonly observed at coastal locations.

The meteorological characteristics of the air flowing over the site from the waters of the Delaware Bay to the south-southeast are not significantly altered by passing over the site. The PSEG Site is located on a small, marshy and flat island. Airflows originating from directions other than south-southeast are not significantly affected because of their short over-water fetch. The present meteorological tower allows adequate and representative measurements of airflows and atmospheric stability, which are required to simulate atmospheric dispersion in the region. Stagnation conditions are not frequent in the site region.

Summarizing, the meteorological data used to determine the short-term diffusion estimates were measured by the on-site meteorological tower, which adequately measures site airflows. Those flows include winds from across the Delaware Bay. The site is not an ocean coastal location and no spatial or temporal circulations of airflow are expected due to land-water boundary sea breeze effects. Therefore, no changes are necessary to the X/Q and D/Q values provided in Subsection 2.3.4 of the SSAR.

Additional discussion of the site meteorological dispersion conditions will be added to SSAR Subsection 2.3.2.2.1.2. A reference to the discussion in Subsection 2.3.2.2.1.2 is also being added to Subsection 2.3.4.1.

**Associated PSEG Site ESP Application Revisions:**

SSAR Subsections 2.3.2.2.1.2 and 2.3.4.1 will be updated as specified in Enclosure 2 of this document.

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# ENCLOSURE 2

## Proposed Revisions
## Part 2 – Site Safety Analysis Report (SSAR)

## Subsection 2.3.2 Local Meteorology
## Subsection 2.3.4 Short-Term (Accident) Diffusion Estimates

**Marked Up Pages**
**2.3-29**
**2.3-38**

The on-site annual dominant wind direction from the northwest reflects flow over the site region of air masses that originate within large surface high pressure systems over the continental interior. The on-site annual frequent wind direction from the southeast reflects Delaware Bay breezes that flow from the southeast along the length of that bay (Reference 2.3.2-1).

On-site winds from directions other than the two dominant directions northwest and southeast, appear to be due to a complex mix of several minor phenomena including: flows around transient storm systems, local shoreline breezes, and flow around the southwest perimeter of the Atlantic Ocean high pressure system.

The winter wind rose (Figure 2.3-25) shows more frequent flow from the northwest than any other season. It verifies that during winter, modified continental polar air masses streaming over the Appalachian Mountains towards the Atlantic Ocean shoreline dominate the site regional airflow.

The spring season wind rose (Figure 2.3-26) shows a high frequency of continental polar air mass intrusion from the northwest, like the winter wind rose. It also indicates an even higher frequency of flow from the southeast. That bimodal distribution is an indicator of two phenomena. First, it indicates that the spring season is transitional between winter and summer synoptic regimes in the region, and that modified continental polar air masses continue to occasionally penetrate to New Jersey during the year. Second, it indicates the high frequency of Delaware Bay breezes during spring.

The summer season wind rose (Figure 2.3-27), in addition to characteristic prevalent flows from the northwest (of modified continental polar air masses) and southeast (Delaware Bay breeze), also indicates somewhat larger frequencies of flows from the minor directions.

The autumn season wind rose (Figure 2.3-28), reflects the characteristic prevalent northwest (modified continental polar air mass) and southeast (Delaware Bay breeze) flows.

No calms are detected during the three years of on-site monitoring because of the sensitivity of the on-site sonic wind sensor and the open exposure of the flat terrain and Delaware Bay at the site.

INSERT 1

2.3.2.2.1.3 On-Site Wind Roses during 32 Year Period

Figures 2.3-29 through 2.3-34 present annual and seasonal wind roses for the 33 ft. level of the on-site primary tower for the 32 year period of record 1977 through 2008.

Comparison of three year (Figure 2.3-12, 2006-2008) and 32 year (Figure 2.3-29, 1977-2008) annual mean wind roses shows very similar distributions, verifying that the three years of data used for $\chi/Q$ and dose calculations are representative of longer term climatological conditions at the PSEG Site.

Comparison of three year (Figures 2.3-25 through 2.3-28, 2006-2008) and 32 year (Figure 2.3-30, 1977-2008) seasonal mean wind roses also shows very similar distributions. Those similarities also support the conclusion that the three years of data used for $\chi/Q$ and radiological dose calculations are representative of longer term climatological conditions at the new plant site.

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As stated above, the annual on-site wind rose reflects a complex mix of several minor airflow phenomena. The mix is complex, but not the airflows themselves. There are frequent annual site winds from the southeast, which include airflow from over the smooth surface of the Delaware Bay. The bay acts as a relatively low-friction path for airflow from the southeast directional sector.

While the PSEG Site is located on the shore of the Delaware River, the river "valley" is extremely flat and open in this area. The types of channeled airflows that are typically associated with deep "v-shaped" river valleys do not occur, because the marshy land areas bordering the water are only slightly higher than the river level in the region.

The PSEG Site is not located on the coastline of a large body of water, such as the Atlantic Ocean or the Great Lakes, and is not considered a coastal location. Therefore, the PSEG Site is not subject to the frequent sea-breeze mesoscale circulations that arise from the differential heating of the land and water surfaces and are commonly observed at coastal locations. Such closed sea-breeze mesoscale circulations do not occur at the PSEG Site, and recirculation of airflow during periods of prolonged atmospheric stagnation seldom occurs.

Summarizing, the on-site meteorological tower provides representative measurements of PSEG Site airflows and atmospheric stability, and of the meteorological conditions under which effluents are released. The site is not an ocean coastal location. No spatial or temporal circulations of airflow are expected due to land-water boundary sea breeze effects.

INSERT 1
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percent target is 33 ft. dew point temperature during 2006 and 2008. The 33-ft. dew point temperature sensor failed during several periods. Together those periods caused annual data recovery to be 83.9 percent during 2006 and 79.2 percent during 2008, and therefore less than the 90 percent target.

The 33-ft. dew point temperature sensor failed on October 19, 2008, which caused a 90 percent data recovery goal to not be met for the dew point parameter during the year 2008. However, that dew point sensor failure occurred after the June 2008 equipment upgrade which included installation of a 33-ft. relative humidity sensor. The new redundant intruments enabled PSEG to meet the 90 percent data recovery goal. The 33-ft. dew point sensor was subsequently replaced in 2009.

On-site dew point temperature measurements recorded during the three-year period 2006-2008 are not used for any purpose that is affected by the missing observations.

## 2.3.4 SHORT-TERM (ACCIDENT) DIFFUSION ESTIMATES

### 2.3.4.1 Basis

The consequence of a design basis accident in terms of personnel exposure is a function of the atmospheric dispersion conditions at the site of the potential release. Atmospheric dispersion consists of two components: 1) atmospheric transport due to organized or mean airflow within the atmosphere and 2) atmospheric diffusion due to disorganized or random air motions. Atmospheric diffusion conditions are represented by atmospheric dispersion factor ($\chi/Q$) values.

The magnitude of the atmospheric diffusion is a function of the wind speed, wind direction and atmospheric stability class. The more unstable the atmospheric characteristics, the more rapid the atmospheric dispersion. The lower the alphabetic atmospheric class designation (Class A) in RG 1.145 *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Revision 1, 1982, (Re-issued February 1983), the more unstable the atmosphere, the more rapid the atmospheric dispersion. Thus, the atmospheric class designations in RG 1.145 run from most rapid atmospheric dispersion (Class A) to least rapid atmospheric dispersion (Class G).

For accident analysis, the $\chi/Q$ calculations are based on the theory that material released to the atmosphere is normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the point of release and all distances for which $\chi/Q$ values are calculated.

To evaluate potential health effects for the new plant on the PSEG Site, a design basis accident is postulated to predict upper-limit concentrations and doses that might occur in the event of a containment release to the atmosphere.

RG 4.7, *General Site Suitability Criteria for Nuclear Power Stations*, Revision 2, 1998, states that for site approval, each applicant should collect at least one year's worth of meteorological information that is representative of the site conditions for calculating radiation doses resulting from the release of fission products as a consequence of a postulated accident.

A straight-line trajectory approach is appropriate for the meteorological conditions at the PSEG Site as described in Subsection 2.3.2.2.1.2.

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# 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 2.3.2.2.1.2 and 2.3.4.1 to incorporate the changes in Enclosure 2 in response to NRC RAI No. 34. | This revision will be included in the next update of the PSEG Site ESP application SSAR. | Yes | No |