Nuclear Development
244 Chestnut Street, Salem, NJ 08079

PSEG
Power LLC

ND-2012-0064
October, 4, 2012

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, No. Env-10, ESP EIS 4.9 – Radiation Exposure to Construction Workers

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) Env-10, Review Section: ESP EIS 4.9 – Radiation Exposure to Construction Workers, dated August 31, 2012 (eRAI 6738)

The purpose of this letter is to respond to the request for additional information (RAI) identified in Reference 2 above. This RAI addresses ESP EIS 4.9-1 through ESP EIS 4.9-3 for the Environmental Report (ER), as submitted in Part 3 of the PSEG Site Early Site Permit Application, Revision 1.

Enclosure 1 provides our response for RAI No. Env-10, Question Nos. ESP EIS 4.9-1 through ESP EIS 4.9-3 (rRH-07, rRH-08, and rRH-10). Enclosure 2 includes the revisions to the ER resulting from our response to Question No. ESP EIS 4.9-3 (rRH-10). Enclosure 3 provides a CD-ROM containing electronic files requested in RAI Env-10.

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

D079
NRO

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 4th day of October, 2012.

Sincerely,

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

Enclosure 1: Response to NRC Request for Additional Information, RAI No. Env-10, Question No Nos. ESP EIS 4.9-1 through ESP EIS 4.9-3 (rRH-07, rRH-08, and rRH-10), Review Section: ESP EIS 4.9 Radiation Exposure to Construction Workers
Enclosure 2: Proposed Revisions, Part 3 – Environmental Report (ER), Subsection 9.3.2.5 – Summary of the Environmental Assessment
Enclosure 3: CD-ROM containing electronic files requested in RAI Env-10

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)
Oak Ridge National Laboratory

PSEG Letter ND-2012-0064, dated October 4, 2012

ENCLOSURE 1

RESPONSE to RAI No. Env-10

QUESTION Nos.
ESP EIS 4.9-1 (rRH-07)
ESP EIS 4.9-2 (rRH-08)
ESP EIS 4.9-3 (rRH-10)

Response to RAI No. Env-10, Question ESP EIS 4.9-1:

In Reference 2, the NRC staff asked PSEG for information regarding Radiation Exposure to Construction Workers, as described in Section 4.5 of the Environmental Report. The specific request was:

> *rRH-07: Provide the list and location of direct radiation sources on the site and the calculation package for how the dose rates to construction workers from direct radiation sources were calculated.*
>
> *Supporting Information: ER Section 4.5 does not explicitly provide a list and location of the direct radiation sources and how the dose rates to construction workers from direct radiation sources were calculated. This information is needed to evaluate the dose to construction workers from direct sources as described in ESRP 4.5.*

PSEG Response to NRC RAI:

Direct Radiation Sources

The PSEG Site is located north of the Hope Creek Generating Station (HCGS) and the Salem Generating Station (SGS) as shown on Figure 3.1-2 of the Environmental Report (ER). Construction workers on the PSEG Site are exposed to radiation sources associated with HCGS and SGS, which include the following:

- Independent Spent Fuel Storage Installation (ISFSI), which contains spent fuel from HCGS and SGS in dry storage casks
- HCGS Turbine Building, which contains the steam system with a significant N-16 source
- HCGS Auxiliary Building, which contains radwaste processing equipment
- HCGS Containment and Reactor Building, which contains the reactor
- HCGS Condensate Storage Tank (CST), which contains low specific activity water
- Low Level Radwaste Storage Facility (LLRSF), which contains treated radwaste from HCGS and SGS
- SGS Auxiliary Building, which contains radwaste processing equipment
- SGS Units 1 & 2 Containment Buildings, which contain reactors

In addition to the radiation sources associated with HCGS and SGS, if the dual unit AP1000 is constructed, the first unit will be operating while the second unit is under construction. The construction workers are exposed to direct radiation from the first AP1000.

All of the sources associated with HCGS and SGS are located to the south of the proposed new plant site. As described in Subsection 4.5.4 of the ER, the ISFSI is located closest to the new plant site and may become the primary source of direct radiation to construction workers. To estimate the dose rate from the ISFSI, a point 25 m (82.02 ft.) north of the ISFSI pad is selected as the point closest to the ISFSI where a construction worker is positioned for an extended period of time. The approximate distances from this point to the other sources of direct radiation are summarized in Table ESP EIS 4.9-1-1. To calculate the dose rate due to the first unit of the dual unit AP1000, it is assumed that the average distance to the construction workers from the center of the containment for the first unit is 244 m (800 ft.).

Dose Rates to Construction Workers

As described in ER Subsection 4.5.4, the contribution of direct radiation sources to the construction worker dose rates is broken into three components: ISFSI direct radiation, HCGS and SGS direct radiation, and AP1000 direct radiation. The following is a summary of the approach used to estimate each direct radiation component. The annual dose is based on 2400 hrs per year, which is 40 hrs per week for 50 weeks, with 20% overtime.

ISFSI Direct: The dose rate from the ISFSI is based on the assumption that the dose rate at the ISFSI fence, which is 10 m (32.8 ft.) from the ISFSI pad, is limited to 100 millirem per year (mrem/yr). This provides an estimate of the maximum future contribution of the ISFSI to the direct dose. An MCNP model for the fully loaded ISFSI, which includes the contribution of direct and scattered neutron and gamma radiation, is used to estimate the dose rate as a function of distance from the ISFSI. The contribution of the ISFSI to the annual worker dose is 10.3 mrem.

HCGS and SGS Direct: HCGS and SGS are operating plants so the dose rate contribution is based on measured radiation levels. A thermoluminescent dosimeter (TLD) located north of the current PSEG Site indicates that the annual dose is 2.2 mrem above background. It is assumed that this dose is due to the HCGS and SGS direct radiation sources, and conservatively includes the casks that are currently on the ISFSI. Based on this assumption, the contribution of the HCGS and SGS sources to the annual worker dose is 0.6 mrem.

AP1000 Direct: The direct dose rate due to an operating AP1000 is expected to be primarily from the reactor containment. The DCD for the AP1000 indicates the radiation shielding is adequate to reduce the dose rate to 0.25 mrem/hr outside the containment wall. By assuming that the dose rate drops off as the square of the distance from the center of the containment and that the average distance to construction workers is 800 ft, the contribution of the AP1000 to the annual worker dose is 4.9 mrem.

The calculation package for the doses to construction workers is provided in Enclosure 3.

Associated PSEG Site ESP Application Revisions:

None.

Table ESP EIS 4.9-1-1
Direct Radiation Sources for the PSEG Site

Source Description	Distance from the Construction Workers (ft.)
ISFSI	82
HCGS Turbine Building	1100
HCGS Auxiliary Building	1100
HCGS Containment Reactor Building	1500
HCGS CST	1500
LLRSF	1500
SGS Auxiliary Building	2900
SGS Containment Building	2900
AP1000 Unit 1	800 (from containment center)

Response to RAI No. ENV-10, Question ESP EIS 4.9-2:

In Reference 2, the NRC staff asked PSEG for information regarding Radiation Exposure to Construction Workers, as described in Section 4.5 of the Environmental Report. The specific request was:

> *rRH-08: Provide the calculation package for the number and locations of construction worker who would be exposed to the radiation sources at the site and the amount of time per year that they would spend at those locations.*
>
> *Supporting Information: ER Section 4.5 does not explicitly provide the calculations performed to determine the dose to construction workers. This information is needed to evaluate the dose to construction workers as described in ESRP 4.5.*

PSEG Response to NRC RAI:

The number of workers involved in the construction of the new unit(s) at the PSEG Site varies over the construction period. Since the number of construction workers varies depending on the technology, the number of construction workers is identified as an item in the Plant Parameter Envelope (PPE). Table 1.3-1 of the Site Safety Analysis Report contains the PPE. PPE Item 18.4.1 is the number of construction workers, and has a range of 3950 to 4100 personnel. As described in ER Subsection 4.5.5, the maximum workforce of 4100 personnel is used to calculate the annual collective dose to the construction workforce.

The collective annual dose to the construction workforce is determined by first estimating the annual dose to a single construction worker and then multiplying by the number of people in the workforce. The construction workers are exposed to various sources of radiation, including direct radiation and effluent releases from both the existing HCGS and SGS, and from a new unit on the PSEG Site if the dual unit AP1000 is selected. The location of the worker is different for each dose component in order to establish a bounding annual dose rate for each source of radiation. The exposure period is 2400 hours, which is based on a 40 hour work week, 50 work weeks in a year, and 20% overtime. The inclusion of overtime in the exposure period is to demonstrate that overtime scheduling will not lead to annual doses exceeding the regulatory limits.

The method used to calculate the contribution of each radiation source to the annual worker dose, including the location of the worker, is described in ER Subsection 4.5.4. The contribution of each source to the annual worker dose and the annual collective dose to the construction workforce based on a workforce of 4100 people are in ER Table 4.5-1.

The calculation package for the doses to construction workers is provided in Enclosure 3.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. Env-10, Question ESP EIS 4.9-3:

In Reference 2, the NRC staff asked PSEG for information regarding Alternative Sites, as discussed in Section 9.3 of the Environmental Report. The specific request was:

> *rRH-10: Provide additional information of how the radiological health impacts were evaluated as a part of the comparison of the proposed and alternative sites.*
>
> *Supporting Information: ER Section 9.3.2 does not explicitly address the radiological health impacts in a comparison of the proposed and alternative sites. An evaluation of the radiological health effects based on available reconnaissance level information (e.g., survey of nearby residents, demographic information of the population within a 50- mi. radius, etc.) for the alternative sites is needed for the comparison of the proposed and alternative sites as described in ESRP 9.3. In particular, explain how such reconnaissance level environmental and health impact information was used to predict site-specific impacts, and how the impacts were assembled for a site-to-site comparison.*

PSEG Response to NRC RAI:

The numerical scoring criteria used to evaluate Candidate Sites and select the Proposed Site include six site characteristics that influence the significance of radiological health impacts at the sites. These site characteristics are summarized below:

- Proximity to Population Centers (Characteristic No. 1a) – Candidate Sites are evaluated based on the distance from the middle of the power block area to the nearest population center (defined in 10 CFR 100 as a densely populated area with at least 25,000 residents). Sites with greater distances receive higher numerical scores. Greater distances tend to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

- Population Density (Characteristic No. 1b) – Candidate Sites are evaluated based on the population density (number of persons per square mile) within a 3-mile radius around the middle of the power block area. Sites with lower population densities receive higher numerical scores. Lower population densities tend to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

- Exclusion Area Feasibility (Characteristic No. 1c) – Candidate Sites are evaluated based on the geographic features (residences, roads, waterways, etc.) included within the exclusion area boundary (EAB) and the extent to which the EAB extended beyond the site property boundary. Sites with better EAB

characteristics receive higher numerical scores. Better EAB characteristics tend to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

- Emergency Planning Zone Feasibility (Characteristic No. 1d) – Candidate Sites are evaluated based on the distance to the nearest population center and whether the population center is downwind of the site. Sites with population centers that are at greater distances and not downwind receive higher numerical scores. In addition, other factors relevant to emergency planning, such as the availability of adequate transportation routes and the absence of populations with special needs, are considered qualitatively during the identification of Potential Sites and the selection of Candidate Sites. All of these factors tend to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

- River Flow (Characteristic No. 10b) – Candidate Sites are evaluated based on the 7-day, 10-year low flow (7Q10) value in the river that provides make-up water and receives wastewater discharges. Sites with higher 7Q10 values receive higher numerical scores. Higher river flows tend to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

- Potential to Impact Water Quality (Characteristic No. 10d) – Candidate Sites are evaluated based on the potential for adverse impacts on the quality of ground water and surface water. Sites with a lower potential to degrade water quality receive higher numerical scores. Lower potential to degrade water quality tends to minimize potential radiological health risks associated with exposure of the public to routine and non-routine radiological releases during operation of the new unit.

Available reconnaissance level information is used to evaluate the site characteristics listed above. Population data provided by the U.S. Census Bureau in a Geographic Information System (GIS) database is used to determine the proximity to population centers and the population density in the area around each site. Information from aerial photographs, topographic maps, and field reconnaissance is used to evaluate conditions in the potential Exclusion Area and Emergency Planning Zone for each site. River flow data from the U.S. Geological Survey monitoring station nearest to each site is used to determine the applicable 7Q10 value. State water quality regulations and GIS databases of ground water protection areas are used to identify sensitive water resources in each site area.

All of the above characteristics are fully considered in the numerical evaluation that resulted in the selection of the Proposed Site and Alternative Sites. If these characteristics are separated from the other site characteristics used in the evaluation, the combined scores related to radiological health impacts provide additional support for

the selection of the PSEG Site (Site 7-4 in the site selection study) as the Proposed Site. Table ESP EIS 4.9-3-1 (provided in Enclosure 3) provides the numerical scores developed in the site selection study for the six characteristics related to radiological health impacts, along with the reason for each score and the source of information used to develop the score. This table provides a direct comparison of the PSEG Site (Site 7-4) and the Alternative Sites with regard to the site characteristics relevant to radiological health impacts.

The total scores from Table ESP EIS 4.9-3-1 are summarized below:

Site	Unweighted Score	Weighted Score
7-4 (PSEG Site)	22	169
7-2 and 7-3	17	133
7-1	16	122
4-1	15	116

It can be seen that the PSEG Site has significantly higher scores for the characteristics related to radiological health impacts, both with and without the application of importance weighting factors. There is no indication that any of the Alternative Sites are preferable to the PSEG Site with regard to radiological health impacts.

The numerical scoring summarized in Table ESP EIS 4.9-3-1 represents an appropriate evaluation of the significance of potential radiological health impacts at the Proposed Site and Alternative Sites based on available reconnaissance level information.

Associated PSEG Site ESP Application Revisions:

ER Subsection 9.3.2.5 will be updated as specified in Enclosure 2 of this document.

PSEG Letter ND-2012-0064, dated October 4, 2012

ENCLOSURE 2

Proposed Revisions
Part 3 – Environmental Report (ER)
Subsection 9.3.2.5 – Summary of the Environmental Assessment

Marked-up Pages
9.3-69

for every resource category except Land Use associated with transmission facilities, Historical / Archaeological Resources, and Transportation. The impacts in these three categories are MODERATE. All of the Alternative Sites have at least a MODERATE impact in these same categories, and Site 4-1 has a MODERATE to LARGE impact in Historical / Archaeological Resources, while Site 7-3 has a MODERATE to LARGE impact in Transportation. In addition, each of the Alternative Sites has a MODERATE or MODERATE to LARGE impact in at least three categories where the PSEG Site has a SMALL impact. These differences in the impact ratings reflect real differences in site characteristics that would be expected to result in more severe construction-related impacts at the Alternative Sites.

DELETE Per Question ESP EIS 4.9-3

ADD Insert A here per Question ESP EIS 4.9-3

summarizes the expected environmental impacts of pro
e sites and at the PSEG Site. It can be seen that operation impacts at the PSEG
LL for every resource category, whereas each of the Alternative Sites has a
or MODERATE to LARGE impact in at least one category. Again, these differences in the impact ratings reflect real differences in site characteristics that would be expected to result in more severe operation-related impacts at the Alternative Sites.

Potential impacts related to human health (due to both radiological and non-radiological releases), postulated accidents, and the uranium fuel cycle are not explicitly evaluated for the Alternative Sites, because they are not site selection factors that would likely impact the siting decision. A detailed evaluation of these effects requires detailed site-specific information (e.g. meteorological data) that is not available to PSEG. None of the Alternative Sites currently have operating nuclear facilities, therefore, potential radiological exposures due to existing facilities would be lower at the Alternative Sites compared to the PSEG Site. However, since human health impacts are dependent on population density near the proposed facility, the low population density near the PSEG Site should lessen potential health effects. Subsections 9.3.2.1.6.1, 9.3.2.2.6.1, 9.3.2.3.6.1, and 9.3.2.4.6.1, show that each of the Alternative Sites has a significant number of existing residences within 0.5 mi. of the site boundaries. As discussed in Subsection 2.1.2, the PSEG Site has no residences closer than 2.8 mi. from the site. Therefore, with regard to nearby residences, the PSEG Site has a distinct advantage compared with the Alternative Sites.

Based on the information summarized above, none of the Alternative Sites are environmentally preferable to the PSEG Site.

9.3.3 CONCLUSIONS

The PSEG Site was selected as the Proposed Site on the basis of a comprehensive site selection study. The site selection study included computerized GIS screening of a large and diverse Region of Interest, identification of seven Candidate Areas and eleven Potential Sites, evaluation of the Potential Sites to select five Candidate Sites, and numerical scoring of the Candidate Sites. The numerical scores and other objective evaluations indicate that Site 7-4, now known as the PSEG Site, is the most favorable site for the new plant. Site 7-4 had the highest total score for all evaluation factors together and the highest score for those evaluation factors specifically related to environmental acceptability.

The environmental impacts for all of the Alternative Sites were evaluated to determine that none of the Alternative Sites are environmentally preferable to the PSEG Site, and therefore none are obviously superior to the PSEG Site.

INSERT 'A' FOR ER SUBSECTION 9.3.2.5

However, the site selection study performed by PSEG in 2008 and 2009 included the numerical evaluation of several site characteristics that influence the significance of both radiological and non-radiological health impacts at the Proposed Site and Alternative Sites. The relevant site characteristics are listed below along with the type of health impacts they influence:

- Population Density (radiological and non-radiological)
- River Flow (radiological and non-radiological)
- Potential to Impact Water Quality (radiological and non-radiological)
- Proximity to Population Centers (radiological only)
- Exclusion Area Feasibility (radiological only)
- Emergency Planning Zone Feasibility (radiological only)
- Hazardous Material Contamination (non-radiological only)
- Length of New Transmission Lines (non-radiological only)
- Noise Impacts (non-radiological only)

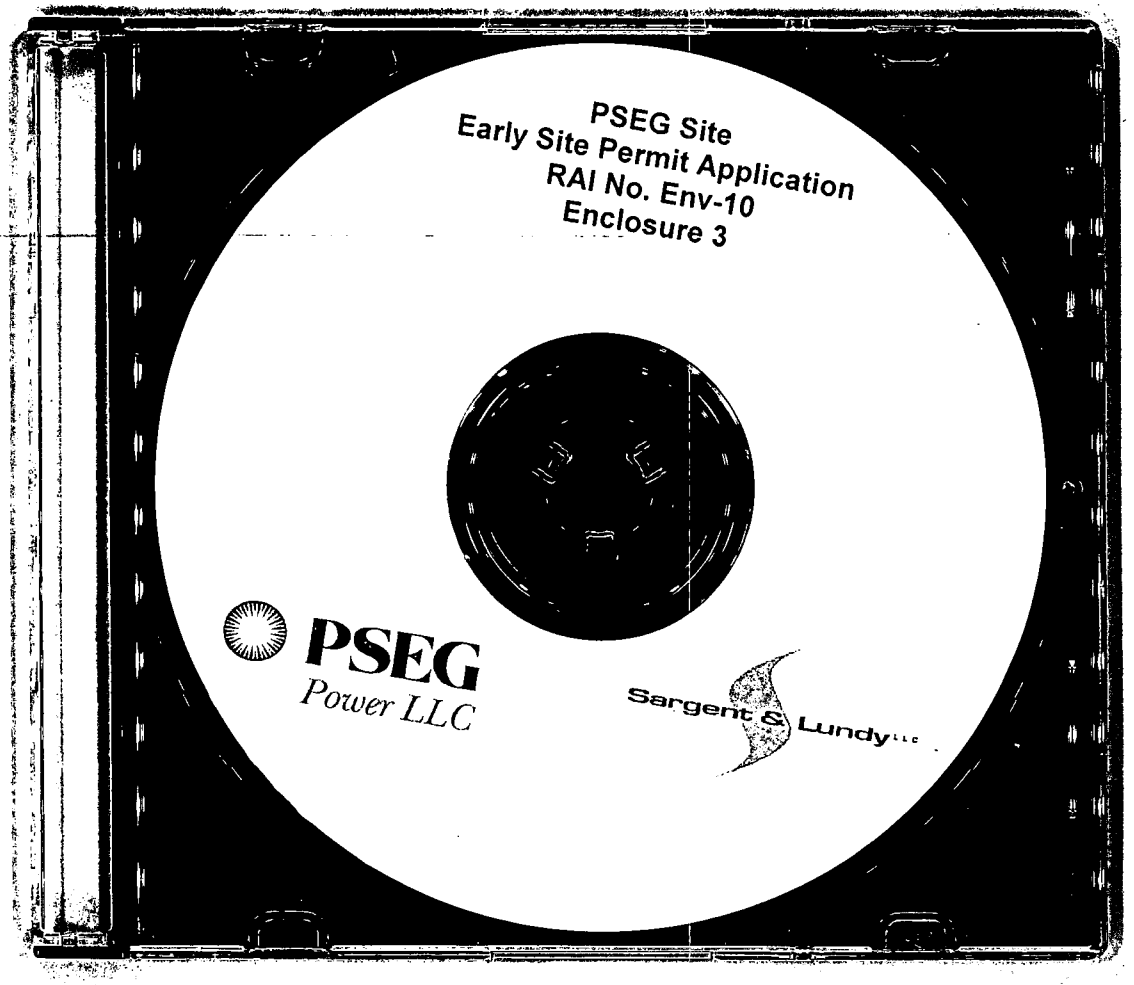
All of these characteristics are fully considered in the numerical evaluation that resulted in the selection of the PSEG Site as the Proposed Site. The PSEG Site has significant advantages with regard to many of these characteristics. There is no indication that any of the Alternative Sites are preferable to the PSEG Site with regard to radiological or non-radiological health impacts.

A detailed evaluation of radiological health impacts requires

PSEG Letter ND-2012-0064, dated October 4, 2012

ENCLOSURE 3

CD-ROM containing electronic files requested in RAI Env-10


PSEG Site
Early Site Permit Application
RAI No. Env-10
Enclosure 3
PSEG
Power LLC
Sargent & Lundy LLC