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Nuclear Development
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PSEG
Power LLC

ND-2010-0092
July 7, 2010

10 CFR 52, Subpart A

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

Subject: **PSEG Power, LLC,**
Submittal of Initial Radionuclide Concentrations Used in Radioactive Transport Analysis in Support of Early Site Permit Application for the PSEG Site
NRC Project Number 771

References: PSEG Power, LLC letter to USNRC, Application for Early Site Permit for the PSEG Site, dated May 25, 2010

PSEG Power, LLC and PSEG Nuclear, LLC (together, "Applicants") submitted an application for an early site permit (ESP) in the referenced letter for a site near Salem, New Jersey.

In addition to the contents of the application, PSEG is providing the following supplemental information in support of the review of the PSEG ESP application. This information confirms previous discussion with the NRC staff regarding acceptance review questions during a conference call held June 28, 2010.

Enclosure 1 provides a revised Table 2.4.13-1, listing the initial concentrations of radionuclides used in the analysis of radionuclide transport due to an inadvertent release of contaminated water to the groundwater at the PSEG Site. This analysis is presented in the Site Safety Analysis Report (SSAR) in subsection 2.4.13.1.4. Enclosure 1 also includes marked up pages of SSAR Section 2.4.13 to reflect the additional information provided in the revised Table 2.4.13-1.

PSEG commits to revise the PSEG Site ESP SSAR Section 2.4.13 to include the information provided in Enclosure 1. The revision will be included in the next periodic update of the PSEG Site SSAR.

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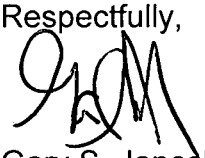
NRO

Regulatory commitments established in this submittal are identified in Enclosure 2. If any additional information is needed, please contact me at (856) 339-7912.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 7th day of July, 2010.

Respectfully,



Gary S. Janosko
Nuclear Development Regulatory Director
PSEG Power, LLC

Enclosure 1: SSAR Section 2.4.13 Revised Pages
Enclosure 2: Summary of Regulatory Commitments

C USNRC, Director, Office of New Reactors/DNRL (w/enclosure – 1 copy)
USNRC, Project Manager, Division of New Reactor Licensing, PSEG Site (w/enclosure – 1 copy)
USNRC, Environmental Project Manager, Division of Site and Environmental Reviews (w/enclosure – 1 copy)
USNRC, Region I, Regional Administrator (w/enclosure – 1 copy)

Enclosure 1

SSAR Section 2.4.13 Revised Pages

Pages
2.4-195
2.4-196
2.4-197
2.4-202
2.4-203
2.4-204
2.4-205

2.4.13.1.2 Accident Scenario

The hypothetical accident scenario involves instantaneous release (NUREG-0800, 15.7.3, III.1.a, 1981) of 80 percent of the contents of a liquid radioactive waste tank into nearby groundwater. This represents the most conservative results of that release on groundwater and potentially affected groundwater receptors.

The final technology and plant layout have not yet been determined. Therefore, the point of release of the hypothetical tank failure is conservatively assumed to occur at the western edge of the proposed power block. The distance along the postulated flow path to the Delaware River (the nearest probable receptor of the contaminated groundwater) is 285 feet (ft.) (Figure 2.4.13-1). The proposed tank size is 30,000 gallons, so a release of 24,000 gallons of liquid radioactive effluent is postulated. Concentrations of radionuclides contained in this hypothetical release are specified as the bounding concentrations for the four DCDs currently under NRC review, as is the 30,000 gallons specified for the tank volume. Table 2.4.13-1 contains the initial list of radionuclides considered and their bounding concentrations. Potential migration of an accidental release into deeper aquifers is discussed in Subsection 2.4.13.1.9.

2.4.13.1.3 Conceptual Model and Hydrogeologic Inputs

The hydrogeologic setting consists of low permeable fill (mainly hydraulic fill materials historically dredged from the Delaware River) placed over more permeable alluvial deposits. It is expected that natural recharge within the fill materials results in vertical migration into the Alluvium which overlie the Kirkwood Formation confining layer. Migration within the alluvial deposits in the new plant location is primarily laterally west toward the Delaware River. The top of the Alluvium aquifer has an elevation ranging from -22 to -35 ft. North America Vertical Datum 1988 (NAVD) through the northern portion of the PSEG Site, and an average thickness of 13 ft. The river immediately adjacent to the site is not dredged and is relatively shallow (7 to 11 ft. deep). This corresponds to an elevation of -7 to -11 ft. NAVD. The discharge of effluent through the Alluvium aquifer to the river most likely occurs at some distance from the shoreline. To support new plant construction, the river bottom will be dredged to an elevation of approximate-15 to -18 ft. NAVD. At these dredging locations, the discharge from the groundwater to the river could be nearer the shoreline than under existing conditions. As a conservative estimate, the migration pathway is assumed to be the distance from the postulated release point to the river shoreline.

While structural fill with potentially higher hydraulic conductivity may be placed as foundation support material, the migration pathway between the power block and the river will remain within the lower permeability Alluvium. This evaluation assumes that the release occurs at the western boundary of the proposed power block, a distance of 285 ft. from the Delaware River, because a reactor technology has not been selected, nor the specific building layout determined (Figure 2.4.13-1). Also, conservatively, the release is assumed to occur directly into the Alluvium aquifer, and no time for decay is provided by the vertical migration through the hydraulic fills or the structural fill to the aquifer.

Water-level data have been collected from the observation wells installed for this ESPA at the new plant location (Subsection 2.4.12.1.3). Calculated horizontal hydraulic gradients, based on these water-level measurements and the interpreted probable migration pathway, indicate an

average gradient along the projected migration pathway of 0.00042 feet per foot (ft/ft), and a maximum gradient of 0.00235 ft/ft.

Slug test analyses of monitoring wells installed in the Alluvium at the new plant location suggest an average hydraulic conductivity of 3.8 feet per day (ft/day), and a maximum of 8 ft/day.

Considering an effective porosity of 0.20, the estimated average groundwater velocity along the postulated migration pathway of the release to the Delaware River is 0.00788 ft/day (2.9 feet per year [ft/yr]). Maximum groundwater velocity is estimated as 0.094 ft/day (34 ft/yr).

2.4.13.1.4 Radionuclide Transport Analysis

The analysis of an accidental release to groundwater is based on a conceptual model of a catastrophic release of a volume of radionuclide-contaminated water from a containment vessel or tank (assuming a release of 80 percent of the total vessel volume). This release instantly displaces an equal volume of groundwater in the underlying Alluvium aquifer. The release then proceeds to migrate at the estimated groundwater flow velocity to a potential receptor location. At the new plant location, and depending on the exact location of the hypothetical release, the potential receptors consist of the Delaware River to the west and the wetland area to the east. While wetlands are present to the north of the new plant location, and HCGS is immediately to the south, plots of alluvial aquifer water levels collected throughout 2009 indicate that groundwater beneath the new plant location does not migrate in these directions, based on groundwater contours.

If an accidental release occurs in the power block area, migration in the alluvium easterly toward the marsh is postulated as possible. However, this migration pathway is longer in length and therefore duration. The release would have to seep upwards through 30 to 40 ft. of hydraulic fills and sediments with low permeability to discharge to the wetlands. These wetlands are tidally-influenced, so any release is diluted by the tidal ebb and flow. This migration scenario is considered less probable and of longer duration than migration from the western edge of the power block area, hence less conservative, and is not considered further in this analysis.

Table 2.4.13-1

This accidental release screening analysis is conducted in three stages, with the results compared to 10 CFR Part 20 ECLs. First, the list of potentially released radionuclides contains a number with very short half-lives, which are excluded (thus limiting the number of radionuclides for further consideration); constituents with initial concentrations equal to or less than their respective ECLs are also deleted. Given the setting and the hypothetical release location, this screening step decreases the number of radionuclides that need to be considered further. Second, a conservative assumption of decrease in activity/concentration due to radioactive decay and advective transport only is applied. Finally, if contaminated groundwater discharges to surface-water, dilution of radionuclides in groundwater takes place in the surface-water discharge in proportion to their relative flow rates. For large surface-water flows, such as flows in the Delaware River, this dilution is large.

The analysis is conducted for the estimated average groundwater flow velocity, and also for a reasonable worst-case estimated maximum groundwater velocity (minimum travel time).

Some of the radionuclides may decay to other radionuclides of concern. Other radionuclides are parents (have no other contributing species, so initial concentrations simply decay), and their

decay products are termed progeny or daughter products. Decay of parent compounds follows simple first-order decay kinetics, while the equations governing the time-dependent concentrations of progeny are more complex and require solution of sequential differential equations. Further, a parent compound may branch off into more than one progeny.

Input parameters necessary for modeling the radioactive decay of radionuclides include first-order decay rates (or half-lives), initial concentrations, and duration of decay. First-order decay rates are obtained from Table E.1 of NUREG/CR-5512, *Residual Radioactive Contamination from Decommissioning*. Equations (Eq.) governing the decay of radionuclides are developed and presented in Appendix B of NUREG/CR-5512. Results are presented in Tables 2.4.13-2 through 2.4.13-5. for the Chart of Nuclides (Reference 2.4.13-4)

The advective mean groundwater velocity is assumed to follow Darcy's Law.

$$V = Ki/n_e \qquad \text{(Equation 2.4.13-1)}$$

(Reference 2.4.13-3)

where: V = mean groundwater velocity
K = aquifer hydraulic conductivity
i = aquifer hydraulic gradient
n_e = effective porosity

with consistent units.

The duration of travel, t, for a particular radionuclide is given by:

$$t = (L/V) \qquad \text{(Equation 2.4.13-2)}$$

where: L = the distance from the release to the receptor
V = the mean groundwater velocity

with consistent units.

First-order radioactive decay of a parent is governed by the equation:

$$C_{P1} = C_{P0} \exp(-\lambda_1 t) \qquad \text{(Equation 2.4.13-3)}$$

where: C_{P1} = parent radionuclide concentration at time t
C_{P0} = parent radionuclide concentration at time zero
exp = exponential function base e (2.718281828...)
λ_1 = first-order decay rate of parent

with consistent units.

If decay rates are expressed in terms of half-lives ($t_{1/2}$), λ is obtained from Equation 2.4.13-4 by substituting $C_{p1} = 0.5C_{p0}$ and $t = t_{1/2}$ and solving for λ as:

2.4.13-2 Harleman, D.R.F., "One-Dimensional Models," in "Estuarine Modeling: An Assessment, Capabilities and Limitations for Resource Management and Pollution Control," by Tracor, Inc., for the Water Quality Office, Environmental Protection Agency, February 1971.

2.4.13-3 Kresic, N., "Hydrogeology and Groundwater Modeling," 2nd edition, CRC Press, Boca Raton, Florida, 2007.

2.4.13-4 Parrington, J.R., et.al., "Nuclides and Isotopes," 15th. edition, General Electric, 1996

Table 2.4.13-1
Initial Concentrations of Radionuclides

Radio-nuclide	Progeny	Bounding (uCi/cc)	Half-life (days)[a]
Sr-90	Y-90	1.26E-04	10,600
Ru-106	Rh-106	5.41E-05	368
Cs-134		2.00E+00	753
Cs-137	Ba-137m	1.20E+00	11,000
Pu-241	Am-241	6.90E-06	5260
Cm-242		1.90E-06	163
	Pu-238 -> U-234	2.00E-07	32,000
Cm-244		1.00E-07	6610
	Pu-240	2.80E-08	2,390,000
Fe-55		1.80E-02	986
Co-60		7.21E-03	1930
H-3		3.40E+00	4510

a) Half-lives from Table E.1 NUREG/CR-5512

Replace with new table 2.4-13-1

Table 2.4.13-1 (Sheet 1 of 3)
Initial Concentrations of Radionuclides

Radio-nuclide	Progeny	Bounding (uCi/cc)	Half-life (d)[(a)]	Analysis (uCi/cc)
Br-82		3.50E-03	1.47E+00	*
Br-83		3.20E-02	9.96E-02	*
Br-84		1.70E-02	2.21E-02	*
Br-85		2.00E-03	1.99E-03	*
Rb-86m		3.00E-07	6.94E-04	*
Rb-86		1.10E-02	1.87E+01	*
Rb-88		1.50E+00	1.24E-02	*
Rb-89		6.90E-02	1.06E-02	*
Sr-89		1.53E-03	5.05E+01	*
Sr-90	Y-90	1.26E-04	1.06E+04	1.26E-04
Sr-91		2.10E-03	3.96E-01	*
Sr-92		1.59E-03	1.13E-01	*
Y-90		1.80E-04	2.67E+00	*
Y-91m		5.20E-04	3.45E-02	*
Y-91		6.01E-04	5.85E+01	*
Y-92		1.23E-03	1.48E-01	*
Y-93		2.04E-03	4.21E-01	*
Zr-95		1.60E-04	6.40E+01	*
Zr-97		6.70E-05	7.04E-01	*
Nb-95		1.80E-04	3.52E+01	*
Mo-99		2.10E-01	2.75E+00	*
Mo-101		5.00E-03	1.01E-02	*
Tc-99m		1.10E-01	2.51E-01	*
Ru-103		2.91E-04	3.93E+01	*
Ru-105		9.50E-05	1.85E-01	*
Ru-106	Rh-106	5.41E-05	3.68E+02	5.41E-05
Rh-103m		2.91E-04	3.90E-02	*
Rh-105		4.40E-05	1.47E+00	*
Rh-106		5.41E-05	3.46E-04	*
Ag-110m		1.74E-05	2.50E+02	*
Ag-110		1.10E-08	2.85E-04	*
Sb-125		8.00E-07	1.01E+03	**
Sb-127		5.00E-06	3.85E+00	*,**
Sb-129		6.80E-06	1.85E-01	*
Te-125m		1.90E-04	5.80E+01	*
Te-127m		7.50E-04	1.09E+02	*
Te-127		2.20E-03	3.90E-01	*
Te-129m		5.80E-03	3.36E+01	*
Te-129		2.40E-03	4.83E-02	*
Te-131m		6.30E-03	1.25E+00	*
Te-131		2.60E-03	1.74E-02	*
Te-132		7.00E-02	3.26E+00	*

Table 2.4.13-1 (Sheet 2 of 3)
Initial Concentrations of Radionuclides

Radio-nuclide	Progeny	Bounding (uCi/cc)	Half-life (d)[(a)]	Analysis (uCi/cc)
Te-133m		4.30E-03	3.85E-02	*
Te-134		7.60E-03	2.90E-02	*
I-129		4.60E-08	5.73E+09	**
I-130		5.00E-02	5.15E-01	*
I-131		7.40E-01	8.04E+00	*
I-132		3.70E-01	9.58E-02	*
I-133		1.30E+00	8.67E-01	*
I-134		2.40E-01	3.65E-02	*
I-135		7.90E-01	2.75E-01	*
Cs-132		2.20E-03	6.48E+00	*
Cs-134		2.00E+00	7.53E+02	2.00E+00
Cs-135m		2.40E-03	3.68E-02	*
Cs-136		1.00E+06	1.31E+01	*
Cs-137	Ba-137m	1.20E+00	1.10E+04	1.20E+00
Cs-138		3.70E-01	2.24E-02	*
Ba-137m		8.00E+00	1.77E-03	*
Ba-139		2.20E-02	5.74E-02	*
Ba-140		3.90E-03	1.27E+01	*
La-140		3.90E-03	1.68E+00	*
La-141		5.30E-05	1.64E-01	*
La-142		3.10E-05	6.42E-02	*
Ce-141		4.20E-04	3.25E+01	*
Ce-143		1.20E-04	1.38E+00	*
Ce-144		1.20E-04	2.84E+02	*
Pr-143		8.80E-05	1.36E+01	*
Pr-144		2.90E-03	1.20E-02	*
Pm-147		1.30E-05	9.58E+02	**
Nd-147		3.40E-05	1.10E+01	*
Eu-154		1.20E-06	3.21E+03	**
Np-239		2.04E-02	2.36E+00	*
Pu-238	U-234	2.00E-07	3.20E+04	2.00E-07
Pu-239		2.00E-08	8.79E+06	*
Pu-240		2.80E-08	2.39E+06	2.80E-08
Pu-241	Am-241	6.90E-06	5.26E+03	6.90E-06
Am-241		7.80E-09	1.58E+05	**
Cm-242		1.90E-06	1.63E+02	1.90E-06
Cm-244		1.00E-07	6.61E+03	1.00E-07
Na-24		3.70E-02	6.25E-01	*
P-32		2.07E-03	1.43E+01	*
Cr-51		8.11E-02	2.77E+01	*
Mn-54		1.70E-02	3.13E+02	*
Mn-56		4.00E-02	1.07E-01	*
Fe-55		1.80E-02	9.86E+02	1.80E-02

Table 2.4.13-1 (Sheet 3 of 3)
Initial Concentrations of Radionuclides

Radio-nuclide	Progeny	Bounding (uCi/cc)	Half-life (d)[(a)]	Analysis (uCi/cc)
Fe-59		4.50E-04	4.45E+01	*
Co-58		3.30E-03	7.08E+01	*
Co-60		7.21E-03	1.93E+03	7.21E-03
Ni-63		1.80E-05	3.51E+04	**
Cu-64		1.92E-02	5.29E-01	*
Zn-65		3.60E-03	2.44E+02	*
W-187		1.80E-03	9.96E-01	*
H-3		3.40E+00	4.15E+03	3.40E+00

a) Half-lives from Table E.1 NUREG/CR-5512 or Chart of Nuclides
* Eliminated because half life is less than one year
** Eliminated because activity is below ECL

Enclosure 2

SUMMARY OF REGULATORY COMMITMENTS
(PSEG Letter to USNRC No. ND-2010-0092, dated July 7, 2010)

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 commits to revise the PSEG Site ESP application Site Safety Analysis Report Section 2.4.13 to include the initial concentrations of radionuclides used in the radionuclide transport analysis.	This revision will be included in the next periodic update of the PSEG Site ESP application SSAR.	Yes	No